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Electronic Medical Records: An Empirical Study of South African Health Workers' Attitudes, Use and Perceptions of Impacts

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A dissertation presented in fulfilment of the requirements

for the degree of Master of Commerce by Research in the field of Information Systems

Faculty of Commerce, Law and Management

University of the Witwatersrand, Johannesburg

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Supervisor – Jason Cohen

February 2014

Dedications

This dissertation is dedicated to my mother and father who have always believed in me and continue to push me to reach for the stars. I am grateful for the life you have given me and the opportunities you have provided. I live to make you proud. May God grant you joy, peace and good health. I love you.

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Declaration

This research report is submitted to the University of the Witwatersrand, Johannesburg in fulfilment of the requirements for the degree of Master of Commerce in Information Systems.

I declare that the work presented in this research report is my own unaided work, except where acknowledged in the text. I have not submitted this material, either in part or in whole, for any degree at this or any other institution.

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Tinashe Katsande Date

Abstract

Successful implementation of electronic medical record systems (EMRs) can result in many benefits. However, the adoption and use of EMRs by health workers is often problematic. Understanding the perceptions and attitudes of health workers towards the use of these systems is therefore important. This study has contributed by examining (a) perceptions of health workers towards the characteristics of EMR systems, (b) perceptions of the impacts of EMR use on healthcare delivery and other workplace outcomes (i.e. individual work performance and job satisfaction), (c) their intentions to continue using EMRs.

The DeLone and McLean Information System Success model and the Information Systems Continuance model were used to underpin the study and to hypothesize inter-relationships amongst these perceptions and attitudes.

The empirical context of the study was Tygerberg Hospital in Cape Town, South Africa. A survey was carried out and 142 responses were obtained from the nurses at the hospital. Results showed that system characteristics, namely, system quality, information quality and service quality were significant predictors of user satisfaction, which in turn was found to be a significant predictor of EMR use. Satisfaction together with perceptions of individual impacts and healthcare impacts was found to lead to continuance intention. Users reported statistically significantly higher levels of job satisfaction than non-users. Healthcare impact perceptions was positively associated with job satisfaction.

Based on the results of the study, it is recommended that decision makers, policy makers and EMR vendors pay close attention to the service quality and the system quality of EMRs as these are the key determinants of user satisfaction. It is also recommended that managers ensure that all healthcare workers be given access to and encouraged to use EMRs to perform their work related task as EMR users have been shown to have higher levels of job satisfaction than non-users.

Key words:

Electronic Medical Records, EMR, use, perceived impacts, individual impacts, healthcare impacts, DeLone and McLean, Bhattacherjee, ISC, information systems continuance, Information systems success, continuance intention, job satisfaction.

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Chapter 1 Introduction

1.1 Foreword

Paper based information systems have become inadequate for dealing with the complexities of information management in healthcare and a need for more efficient computerised systems has become apparent (Chaudhry, Jerome, Shinyi, Maglione *et al.* 2006). In order to cater for the complex information management needs by healthcare institutions, various kinds of clinical information systems have therefore been created and implemented. The functionalities, capabilities and purposes of these clinical information systems vary.

Information systems in healthcare focus on the administration of healthcare institutions as well as clinical and healthcare delivery processes. This dissertation focuses on the latter, specifically Electronic Medical Record (EMR) systems. The study will discuss the use of EMRs and the perceived impacts of EMRs on healthcare delivery and on healthcare workers.

1.2 Background to the study

The paper-based medical records often used today emerged in the 19th century in the form of a highly personalised lab notebook, which clinicians used to record and keep track of their patients' medical encounters (Shortliffe 1999). This then evolved into a formal and defined medical record for every patient. The efforts to move from paper-based information processing towards computer-based information processing then gave birth to the Electronic Medical Record (EMR) (Haux 2006). Lenhart, Honess, Covington and Johnson (2000, pg. 110) define an EMR as "an intra-office electronic software and hardware system that captures the essential components of a patient's medical encounter". The functionalities of an EMR include but are not limited to data capturing (Wagner and Hogan 1996; Lenhart, Honess, Covington and Johnson 2000; Miller and Sim 2004; Moody, Slocumb, Berg and Jackson 2004), information processing (Haux 2006), patient chart viewing, analysis and reporting, prescription ordering, patient monitoring and communication between clinicians (Miller and Sim 2004). Thus a more complete definition of an EMR useful for this study is:

> *A computer based information system used by healthcare workers in a particular institution to capture, process, analyse, view and communicate both the medical and administrative information of their patients.*

The term healthcare worker, for the purpose of this study, shall refer to doctors, nurses, pharmacists, medical students practicing at the hospital, and administrative workers who typically engage in much of these above activities. Literature however shows that nurses are the largest group of users of Clinical Information Systems (CIS) amongst healthcare workers (Garcia-Smith and Effken 2013). Studying their attitudes, use and perceptions of EMR impacts is therefore important.

EMR systems have the potential to provide healthcare with many desired benefits (Fraser, Biondich, Moodley, Choi *et al.* 2005; Wasserman 2011; Schenarts and Schenarts 2012). These benefits could transform healthcare by providing more efficient means of practice, resulting in improved patient care (Wang, Middleton, Prosser, Bardon *et al.* 2003). The impacts that EMRs potentially present are such that some governments have seen fit to provide incentives in an attempt to encourage healthcare institutions to implement EMR systems (Schenarts and Schenarts 2012).

Potential benefits of EMRs include the following (Shortliffe 1999; Lenhart *et al.* 2000; Wang *et al.* 2003; Miller and Sim 2004; Moody *et al.* 2004; Hillestad, Bigeiow, Bower, Girosi *et al.* 2005; Diamond, French, Gronkiewicz and Borkgren 2010; Clayton, Smith, Fullerton, Burke *et al.* 2010):

- improved patient file and chart availability,
- improved data management,
- improved legibility of patient files and charts,
- improved communication between practitioners,
- improved disease prevention and management measures,
- improved patient monitoring,
- improved support and better availability of information for clinical trials and clinical research,
- reduced workload for healthcare practitioners ,
- financial gains through cost savings and increased revenue.

These benefits, for the purposes of this study, are categorised into five areas of impact as shown in Table 1-1 below.

Table 1-1: EMR Benefits

Area of Impact	Benefit
Documentation	• Improved patient file and chart availability • Improved data management • Improved legibility of patient files and charts
Communication	• Better communication between practitioners
Workload	• Reduced workload for healthcare practitioners
Research	• Improved disease prevention • Better availability of information for clinical trials and clinical research
Patient Care	• Improved management measures • Improved patient monitoring • Improved support

Successful implementation and the adoption of EMRs can result in the above mentioned benefits being realised (Kralewski, Dowd, Cole-Adeniyi, Gans *et al.* 2008). However, implementation of EMRs and their subsequent adoption by health workers is problematic with many barriers. For example, there are high initial costs of implementation (Wang *et al.* 2003; Miller and Sim 2004; Hillestad *et al.* 2005; Diamond *et al.* 2010), uncertainty of financial returns, time costs (Miller and Sim 2004), and attitudes and perceptions of users (Littlejohns, Wyatt and Garvican 2003; Miller and Sim 2004).

While the above mentioned studies show that EMRs have positive impacts on healthcare delivery there is evidence to support the contrary. Schenarts and Schenarts (2012) point out how EMRs have a negative impact on the education of future healthcare practitioners. They also show how there are discrepancies in the literature on the impacts of EMRs on healthcare delivery.

Other concerns with EMRs include those of privacy and confidentiality (Shortliffe 1999; Clayton *et al.* 2010). Barrows and Clayton (1996) in their study, however, point out that there are many measures which can be taken to ensure that patient records are safe and secure, and that access is restricted to authorised personnel. Current users of EMRs also raise concerns over the challenges they face with regards to

data capturing, as EMRs seem not to be as flexible as the paper-based medical record (Lenhart *et al.* 2000; Lærum, Ellingsen and Faxvaag 2001; Moody *et al.* 2004). Unsurprisingly, these challenges have resulted in varying perceptions and attitudes amongst clinicians about the impacts of EMRs, and moreover create challenges or problems in achieving the extended use of EMR and in ensuring that the benefits are realised.

1.3 Theoretical Basis for the Study

This study draws on DeLone and McLean's (2010) updated Information Systems Success Model (ISSM) and Bhattacherjee's (2001) Information Systems Continuance (ISC) model to develop a conceptual model. In addition, this study also draws on the works of Lenhart *et al.* (2000), Moody *et al.* (2004) as well as other studies on the use and impacts of EMRs to build the conceptual model.

The Information Systems Success Model (DeLone and McLean, 2003) describes the factors and process which ultimately defines the extent to which an Information Systems impacts the organisation within it is implemented. The model theorises that system, information and service quality have an effect on the user's satisfaction as well as their usage of the system. Use of the system and satisfaction with the system then determine the extent to which the information system is successful and has a positive net benefit.

The Information Systems Continuance Model (Bhattacherjee, 2001) explains that an individual's intention to continue using a system results from the feelings and perceptions experienced in the use of the system. The model comprises of four variables being confirmation of expectation, perceived usefulness, satisfaction, and continuance intention with the latter being the dependent variable. The model shows how these variables affect each other and in turn how they influence an individual's intention to continue using a system. Continuance intention is a very important outcome as it ultimately determines the long term success of an information system (Bhattacherjee, 2001).

1.4 Problem Statement and Research Questions

As shown above EMRs are said to present a wealth of benefits over paper-based medical records. However, it is unclear as to whether these benefits are being realised in the public sector of developing contexts such as South Africa. EMRs

seem not to be having as much of an impact on healthcare delivery as they are intended to. This may be attributed to users of the system experiencing certain inconveniences with regards to using the system (Moody *et al.* 2004). Users then opt for using an alternative means to complete their tasks, usually bypassing the EMR system. The result of this is that while a functional EMR system is in place and use is mandatory, it is not used in its entirety. This then limits the extent to which the system can impact the standard of healthcare delivery. According to the Information Systems Continuance model the extent to which a user perceives a system to be useful has an effect on their satisfaction with that system as well as their intention to use that system (Bhattacherjee, 2001). This therefore presents another problem in that if users are not realising the benefits or impacts of EMRs, their intention to continue using EMRs is likely to reduce. This presents a problem where limited usage of the system results in the benefits of the system not being realised. This then leads to users being further discouraged from using the system as they do not see its usefulness, benefit or impact. To address the above mentioned problems this study will seek to answer the following research questions:

To tackle the problem of lack of usage, this study seeks to draw on the *DeLone and McLean IS Success Model* and the *Information Systems Continuance Model* to answer the following research question:

1. *What are the relative effects of the factors "System Quality", "Information Quality" and "Service Quality" as well as the "Confirmation of Expectation" and "Satisfaction", on healthcare workers' use of EMRs?*

To tackle the problem of unclear perceived impacts on healthcare delivery this study seeks to answer the research question:

2. *What are the perceptions of healthcare workers regarding the impacts of EMR use on healthcare delivery and other workplace outcomes (i.e. individual work performance and job satisfaction)?*

To address the problem of unrealised impacts affecting continuance intention this study will seek to answer the research question:

3. *To what extent do the healthcare delivery impacts of an EMR affect the extent to which users of the system intend to continue using it?*

1.4.1 Aim of study

In answering the above questions, the aim of this study is to examine and reveal:

(1) the factors affecting the use of EMRs
(2) perceptions of healthcare workers regarding the impacts of EMR use on healthcare delivery and other workplace outcomes (i.e. individual work performance and job satisfaction)
(3) healthcare workers' intention to continue using EMRs.

This study was conducted in a healthcare facility that has adopted and implemented an EMR system known as Clinicom Patient Information System. This revealed the nature and extent of the perceived impacts being realised from the use of EMRs. As noted above EMRs have benefits which are intended to positively impact healthcare delivery. This study will attempt to uncover, from the users' perspectives, whether or not the healthcare facilities that make use of these EMR systems realise these benefits and impacts.

1.4.2 Objectives of the study

This study will attempt to determine the factors that affect the use of an EMR. The study will then attempt to reveal the extent to which the use of EMRs has an impact on healthcare delivery as perceived by healthcare workers, and in turn the effect of the perceived impacts on intentions to continue using the EMR system. The proposed model will be used to test the above mentioned relationships. The model integrates the updated DeLone and McLean IS Success Model (2010) and the Information Systems Continuance (ISC) model by Bhattacherjee (2001).

The proposed study extends the works of Garcia-Smith and Effken (2013) and draws on the DeLone and McLean IS Success Model and the ISC Model (Bhattacherjee, 2001) to test relationships between the factors using regression analysis. As this is a descriptive and correlational study, descriptive statistics such as mean and percentages will be used to summarise the perceptions of healthcare workers towards the impacts on healthcare delivery outcomes, while correlation tests and a regression analysis will be used to analyse the relationships between the system characteristics, use, confirmation of expectations, user satisfaction with the EMR system, the impacts of the EMR system on healthcare delivery, the users' intention to continue using the system and the users' job satisfaction.

1.5 Importance and Contribution of the study

The current study is of importance to healthcare institutions, healthcare workers and patients. It will provide healthcare institutions with information on the important factors that affect the use of an EMR system. Knowing the factors that potentially affect the use of EMRs may also assist healthcare institutions that are in their implementation phase to increase chances of adoption. It will provide guidance on those factors that may influence the usage of EMRs so they can be taken into consideration during implementation, thereby improving on the inconveniences and costs that come about as a result of failed implementation and resistance from users. The information provided by this study will also be of use to institutions currently using EMRs as it may assist them to ensure the continued use of EMR systems. Ensuring the appropriate use of EMR systems will improve the extent to which EMR systems impacts healthcare delivery. Therefore this study will attempt to provide healthcare institutions with information that could potentially assist in making decisions that will improve healthcare delivery. Improved healthcare delivery should see patients benefiting as well.

Healthcare workers that make use of EMRs will also benefit in that this study will highlight the factors that potentially affect their use of EMRs. This will allow for institutions to address the issues that hamper the use of EMRs potentially leading to higher usage of EMRs by healthcare workers. Healthcare workers therefore benefit as the use of EMRs will allow them to carry out their duties more efficiently and increase their productivity as shown in the list of benefits identified previously. This study also examines how the use of EMRs potentially affects healthcare workers' job satisfaction. This may also be very beneficial to healthcare workers if the use of EMRs is found to have a potential effect on job satisfaction.

1.6 Structure and Organisation of the Research Report

This research report is structured and organised into six chapters. The outline is as follows:

Chapter 1 – Introduction

This chapter presented the background of the study. The theories and models on which this study draws were identified. Furthermore, the aims and objectives of the

study were stated and finally the importance and contribution of the study were highlighted.

Chapter 2 – Literature Review

This chapter will discuss prior literature related to the topic of EMRs use and impacts as well as further literature relevant to the current study. The connection between prior literature and the current study will be illustrated and the gap in the literature which presents an opportunity for this study will be exposed. The conceptual model will then be presented and the hypotheses derived.

Chapter 3 – Research Methods

Research methodologies used for this study will be explained and justified in this chapter. The data collection strategy that was employed will be discussed in detail. The sample will be described and the instrument used for data collection will be presented. The rigorous process taken to refine the instrument will then be described. Furthermore, the credibility and ethical considerations of the study will be discussed. The analysis strategy is also presented.

Chapter 4 – Research Findings

This chapter will illustrate how the research data were analysed and report the findings of the research. It will report tests for reliability and validity, and results of tests of the research model and hypotheses.

Chapter 5 – Discussion of Findings

This chapter will discuss the study's findings, explaining the meaning of the findings in relation to each of the research hypotheses and the possible implications of the findings.

Chapter 6 – Summary and Conclusions

This chapter summarises and concludes the study. The limitations of the study, suggestions for future research and contributions the study has made to academia and practice will be discussed.

Chapter 2 Literature Review

2.1 Introduction

This chapter will discuss the literature related to the current study. The focus will be on literature pertaining to healthcare workers' perceptions of the use and impacts of EMRs on healthcare delivery. This chapter aims to expose the gaps in this literature, which provides the motivation for the subsequent development of this study's research model. The underpinnings of the research model are followed by the development of the model and its associated hypotheses.

2.2 Background and overview of EMRs

As stated in the previous chapter, this study defines EMRs as a computer based information system used by healthcare workers in a particular institution to capture, process, analyse, view and communicate both the medical and administrative information of their patients. EMRs are not only an electronic version of paper-based medical records (Wasserman 2011), they have evolved over the years to provide healthcare workers a number of functions. These functions are presented below.

2.2.1 Functions of EMRs

While functionalities of EMRs may vary depending on the vendor or brand (Lærum *et al.* 2001), the main functionalities of an EMR may include but are not limited to the following.

2.2.1.1 Documentation

EMR systems enable the capturing, processing and viewing of all the details related to a patient's medical encounter (Miller and Sim 2004). This collection of administrative and medical information resembles or is an electronic version of a paper-based patient file.

2.2.1.2 Ordering

EMRs allow for the electronic ordering of prescriptions, referrals, laboratory and radiology tests (Miller and Sim 2004). More advanced systems allow the progress of the orders to be tracked (Miller and Sim 2004).

2.2.1.3 Communication

EMRs allow for the exchange of information between physicians and/or hospital departments. This involves information and documentation such as laboratory,

imaging and radiology results to be sent electronically to the user who ordered them (Hogan and Kissam 2010). EMRs also enable users to communicate through messaging (Miller and Sim 2004).

2.2.1.4 Decision Support

EMRs provide users with information that supports their decision making and allows them to make better informed decisions (Hogan and Kissam 2010). Some examples include warnings given by the system when a user attempts to prescribe a drug that a patient is allergic to, warnings against incompatible drugs, and reminders that assist the user to efficiently monitor patients (Hogan and Kissam 2010).

2.2.1.5 Reporting

EMRs produce reports that aid healthcare institutions and governments in the decision making process (Hogan and Kissam 2010). For example EMRs can be used to produce a report to identify diabetic patients (Tu, Manuel, Lam, Kavanagh *et al.* 2011).

Through the above functionalities, EMRs are intended to provide for a number of benefits.

2.2.2 Benefits of EMRs

The above mentioned functionalities of EMRs are intended to provide the following benefits: improved decision support, improved access to information, financial improvements, time improvements and patient monitoring improvements. These are briefly explained below.

2.2.2.1 Decision Support

The decision support functionality allows practitioners to make better decisions in relation to the care they provide to patients (Hatton, Schmidt and Jelen 2012). Information relating to drug allergies and drug-drug interactions is provided in order to enable practitioners to make better informed decisions as well as reminders that aid with patient monitoring (Hogan and Kissam 2010).

2.2.2.2 Access to Information

EMRs, through efficient documentation, enable access to patient information. Through the use of EMRs accurate, legible and well-structured patient information can be retrieved timeously (Miller and Sim 2004; Hatton *et al.* 2012). This can further translate into improved patient care (Hatton *et al.* 2012).

2.2.2.3 Financial Improvements

By efficiently keeping track of the services that have been rendered to patients and capturing the charges accordingly, EMRs can help with cost savings and revenue increases (Hatton *et al.* 2012). EMRs may also be integrated with billing systems so as to improve the billing of patients and lead to financial benefits (Miller and Sim 2004). EMRs also allow for the identification of patients in need of care through data mining thereby increasing revenue (Hatton *et al.* 2012).

2.2.2.4 Time Improvements

Through improved communication and access to information, EMRs enable practitioners to save time and therefore provide care to patients timeously (Hatton *et al.* 2012). Where practitioners would have had to use scribbled notes to communicate, or physically retrieve hard copy patient files they are able to do this electronically, saving valuable time (Miller and Sim 2004; Hatton *et al.* 2012).

2.2.2.5 Patient Monitoring Improvements

Through the use of reminders, warnings, reports and decision support, EMRs improve the efficiency with which patients are monitored (Hogan and Kissam 2010). These features also allow for better disease prevention and management (Lenhart *et al.* 2000).

2.2.3 Unintended consequences

Unfortunately, there are unintended or unanticipated consequences that come about as a result of EMR use. Listed below are some of the unintended consequences that may result from EMR use.

2.2.3.1 Data capturing

Data capturing has proved to be problematic with EMRs in certain instances. Most practitioners prefer capturing data at the bedside as they find it to be more convenient, but system setup and terminal locations may not cater for this (Moody *et al.* 2004). EMR systems have also in some instance increased the time it takes to capture data thereby negatively impacting patient care (Ayatollahi, Bath and Goodacre 2010).

2.2.3.2 Workarounds

As shown above with data capturing, practitioners sometimes find certain aspects of EMRs that they do not like or find inconvenient. They then create or find ways

around these inconveniences so as to avoid encountering them (Ash, Berg and Coiera 2004). These workarounds can however undermine the integrity of system and may result in further consequences and inconveniences.

2.2.3.3 Impact on education

Literature shows that EMRs have negatively affected the manner in which junior practitioners learn from their seniors (Schenarts and Schenarts 2012). EMRs have significantly changed the way in which teachers and learners interact in healthcare institutions. By providing large volumes of information and simplifying the decision making process, EMRs have been said to hamper the critical thinking process that learners would otherwise witness and experience (Schenarts and Schenarts 2012).

2.2.3.4 Communication with Patient

EMRs in some instances impair the manner in which physicians communicate with their patient (Makoul, Curry and Tang 2001). The fixed position of computers can limit the extent to which a physician can move around so as to be positioned appropriately towards the patient.

2.3 Contextualising the Literature Review

As shown in the previous chapter, this study is focused on (1) the factors that potentially influence the use of EMRs, (2) the perceived impacts of EMRs on outcomes such as documentation, workload, healthcare delivery, patient care and job satisfaction, and (3) the potential link between these perceived impacts and continuance intentions. The purpose of this literature review will be to source and understand past literature into these three topics so as to gain a clearer picture of the research field and reveal gaps.

Computer-based provider order entry (CPOE) systems, Hospital/Health Information Systems (HIS), Electronic Patient Records (EPR), Electronic Health Records (EHR), Electronic Medical Records and Clinical Information Systems (CIS) and Patient Information Systems (PIS) are some of the common names for the information systems that exist in healthcare. With the exception of CPOE, the definitions of these systems in literature vary to the extent that in some instances these terms are used interchangeably to mean the same technology (Häyrinen, Saranto and Nykänen 2008).

Some literature describes the difference between an EMR and an EHR as the latter is often used to refer to systems that are shared across institutions while the former is institution specific (Wasserman 2011). However, other studies indicate that EHRs can be shared or non-shared (Hovenga, Garde and Heard 2005) which then blurs the difference between EMRs and EHRs if not nullifies it. In essence these are closely related technologies and thus this literature review will discuss literature on these technologies alike. Therefore, any study focused on a technology that captures, processes, views, analyses, and communicates medical and administrative information of patients will be considered relevant for the current review.

A literature search was conducted on Google Scholar search engine as well as the Science Direct and EBSCOhost online academic databases accessed through the Wits library website. The following search strings were used to query the search engine and online databases:

- electronic medical records
- electronic health records
- electronic patient records
- clinical information systems
- health information systems
- hospital information systems
- patient information systems

The above phrases were used in conjunction with the following in order to source the required relevant literature:

- use
- impacts
- continuance intention
- job satisfaction
- DeLone and McLean
- Bhattacherjee
- information systems continuance
- information systems success model

Date filters were used to restrict the search to find recent articles. The "cited by" link on Google Scholar was also utilised in order to find out which articles had cited some of the articles that were found during the search. Lastly, the reference lists of the articles found during the search were scrutinised in order to find any articles that may not have showed up during the online search. The articles that were found to be relevant to the current study are reviewed next.

2.4 Past Studies on EMR usage

There are two aspects of usage that are evident in the literature. On the one hand there is usage at an organisational level and on the other usage at an individual level. This study is concerned with the latter. However statistics and literature on the former will be reviewed and briefly discussed where considered relevant.

Past studies have found EMR usage behaviours to vary , with some studies finding high usage (Hogan and Kissam 2010) while others have found low usage of EMRs by healthcare workers within institutions that have implemented EMR systems (Lenhart *et al.* 2000; Lærum *et al.* 2001). This variation in usage patterns can be attributed to factors such as the quality of the system in question, the quality of the information it produces (Lærum *et al.* 2001) and the quality of the service or support that is available for that system (DeLone and McLean 2003). Different systems would therefore inspire different usage behaviour patterns from users as they vary in functionality depending on the vendor (Lærum *et al.* 2001). The variation can also be attributed to the factors, for example social or cultural factors, that define the context or setting in which the system is in place (Venkatesh, Morris, Gordon and Davis 2003). Studies that found low usage of EMRs are discussed next.

2.4.1 Low Usage

Studies have reported low usage of EMR systems, showing that not only are entire healthcare institutions choosing not to implement EMRs (Lenhart *et al.* 2000; Loomis, Ries, Saywell and Thakker 2002; Valdes, Kibbe, Tolleson, Kunik *et al.* 2004), but where they have chosen to implement them, usage is not wide spread (Lærum *et al.* 2001). Studies that found low usage of EMRs are discussed below.

In terms of the number of healthcare institutions that have implemented EMRs and are using them as an organisation, usage has been found to be low (Lenhart *et al.* 2000; Loomis *et al.* 2002). The number of healthcare institutions that had

implemented EMRs was shown to be in the range of 5% to 10% in the year 2002 in the United States of America (Loomis *et al.* 2002).

Lenhart *et al.* (2000) conducted a study on EMR use in family practice residencies in the United States (US) and found low usage with 80% of 379 programs reporting never having used EMRs and 3% having discontinued their use. 17% of the programs were using EMRs but only 2% were completely paperless. For the 80% that had never used EMRs, the main factors that got in the way of implementing EMRs were the costs associated with the systems as well as not having the adequate hardware required to run the systems. The main challenges faced by those that were using EMRs were the time it took to capture data, which perhaps explains why most of them also used paper-based records along with EMRs. Time taken to capture data was also one of the reasons given for discontinuing the use of EMRs by those who no longer had EMRs. System inadequacy, sponsors deciding against EMRs and the loss of financial support were the other reasons given for discontinuing EMRs.

A study by Loomis *et al.* (2002) surveyed members of the Indiana Academy of Family Physicians and found that of the 618 physicians that responded, only 89 (14.4%) had implemented EMRs. The study compared the perceptions of EMR users versus those of non-users and found the following. Both EMR users and non-users seemed interested in the idea of an EMR system that would connect the different physician practices so as to enable the exchange of patient data. Generally users of EMRs had a more positive attitude towards EMR systems and their capabilities. Non-users had the following perceptions of EMRs. Firstly, they saw less of a need for EMRs. They also expressed concerns with regards to data entry. They were not as confident in the level of security and confidentiality provided by EMR systems. Finally they found the cost of EMRs to be too expensive.

Lærum *et al.* (2001) explored the use of three EMR systems by doctors in Norwegian hospitals that had implemented EMRs. They found that although implementation was widespread, doctors did not use the EMRs to complete all the tasks of which the EMR system was capable. Generally only 2 out of a possible 15 functions were used and these mainly involved the reading of patient records. They concluded that the systems were not being used extensively. The reasons for the low levels of use were

said to be the lack of available computers, and the preferred flexibility of paper-based records over the EMR. The study also pointed out that while the respondents were generally computer literate, they may have lacked training in the use of EMRs.

2.4.2 High Usage

Lærum *et al.'s* (2001) study showed that 77% of the 72 hospitals in Norway had purchased a licence for EMRs. The study went on to show that practitioners were not extensively using the system, despite the widespread implementation amongst organisations. This is an indication of the high levels of EMR implementation and low levels of usage within the organisation.

Hogan and Kissam (2010) report on the usage behaviour of 2758 office-based physicians. They found high usage of EMRs in the United States amongst physicians for taking clinical notes, writing prescriptions, some aspects of physician order entry, viewing lab and imaging results but less so for decision support and public health reporting. Between 75% and 85% of the physicians reported making use of information exchange related functionalities with the exception of sending lab orders electronically, sending radiology orders electronically and allowing patients to view their records online which were only used by 64.1%, 62.3% and 27.6% of the physicians respectively. Finally the study also reports an average of 56.1% of physicians making use of public health reporting related functions. On the whole, this study found very high and extensive use of EMR amongst physicians. This could possibly be due to the fact that these are office-based physicians and their environment is very different to that of a larger health institution such as a hospital.

Hogan and Kissam (2010) refer to the meaningful use concept adopted by the US Department of Health and Human Services as the basis on which providers will be compensated for EMR use. In an attempt to improve healthcare delivery and reap the promised benefits of EMRs, the US government as well as other governments offer incentives to healthcare providers in order to entice them to meaningfully use EMRs (Abramson, Patel, Malhotra, Pfoh *et al.* 2012). Table 2-1 on the next page contains a list summarising the meaningful use criteria.

Table 2-1: Meaningful Use Criteria

Criteria
Record patient demographics (sex, race, ethnicity, date of birth, preferred language, and in the case of hospitals, date and preliminary cause in the event of death)
Record vital signs and chart changes (height, weight, blood pressure, body mass index, growth charts for children)
Maintain up-to-date problem lists of current and active diagnoses
Maintain active medication list
Maintain active medication allergy list
Record smoking status for patients 13 years of age or older
For individual professionals, provide patients with clinical summaries for each office visit; for hospitals, provide an electronic copy of hospital discharge instructions on request.
On request, provide patients with an electronic copy of their health information (including diagnostic-test results, problem list, medication lists, medication allergies, and for hospitals, discharge summary and procedures)
Generate and transmit permissible prescriptions electronically (does not apply to hospitals)
Computer provider order entry (CPOE) for medical orders
Implement drug-drug and drug-allergy interaction checks
Implement capability to electronically exchange key clinical information among providers and patient-authorised entities
Implement one clinical decision support rule and ability to track compliance with the rule
Implement systems to protect privacy and security patients data in the EHR
Report clinical quality measures to CMS or states

Source: (Blumenthal and Tavenner 2010).

2.4.3 Factors affecting Use

Literature shows variations in the usage patterns of EMRs both at an organisational and individual level. The focus of numerous studies has therefore been on the factors that affect the use of EMRs. Some of the main factors that have been shown by the literature as having an effect on the use of EMRs include; user characteristics such as age, gender, computer literacy and user speciality (Moody *et al.* 2004; Ayatollahi *et al.* 2010; Melas, Zampetakis, Dimopoulou and Moustakis 2011); system characteristics such as perceived ease of use, perceived usefulness and access to information that can be grouped into system quality, information quality and service quality (DeLone and McLean 2003; Ayatollahi *et al.* 2010; Bleich and Slack 2010; Altavilla, Thornton and Almodovar 2011; Melas *et al.* 2011; Garcia-Smith and Effken 2013); environmental characteristics such as subjective norms, IT training, IT support and location of the computers; and finally the individual, organisational and patient care impacts of the system (Ayatollahi *et al.* 2010). On an organisational level, cost was shown to be the major reason for not purchasing EMRs (Loomis *et al.* 2002; Valdes *et al.* 2004). Both users and non-users of EMRs thought that EMRs

were too expensive (Loomis *et al.* 2002). Table 2-2 below, summarises the literature relating to the factors affecting EMR use.

Table 2-2: Summary of EMR Use Studies

Author(s)	Title	Methodology	Findings
Ayatollahi, Bath and Goodacre (2010)	Factors influencing the use of IT in the emergency department: A qualitative study	Qualitative	User characteristics, system characteristics, environmental characteristics and the impact of the technology can influence the use of an EMR system in the emergency department.
Bleich and Slack (2010)	Reflections on electronic medical records: when doctors will use them and when they will not	Review	The extent to which doctors see a system as being helpful in assisting them to provide care to patients affects their use of the system.
Garcia-Smith and Effken (2013)	Development and initial evaluation of the Clinical Information Systems Success Model (CISSM)	Quantitative	Information quality and social influence are predictors of Clinical Information System (CIS) use dependency, System performance is not a predictor of use dependency.
Hogan and Kissam (2010)	Measuring Meaningful Use	Quantitative	75-85% of physicians that had electronic health records made use of the functions of EHRs that met the meaningful use criteria.
Ilie, Courtney and Van Slyke (2007)	Paper versus Electronic: Challenges Associated with Physicians' Usage of Electronic Medical Records.	Qualitative	Physicians preferred paper charts to EMRs and only used EMRs because usage was mandatory. In the event that usage was voluntary physicians would use paper charts instead.
Lærum, Ellingsen and Faxvaag (2001)	Doctors' use of electronic medical records systems in hospitals: cross sectional survey	Quantitative	Implementation of EMRs was widespread in Norway, with 53 out of 72 hospitals having purchased an EMR licence. However, doctors did not use EMRs extensively, only using a fraction of the functions that the EMRs were capable of.
Lenhart, Honess, Covington and Johnson (2000)	An Analysis of Trends, Perceptions, and Use Patterns of Electronic Medical Records Among US Family Practice Residency Programs	Quantitative	EMR usage was found to be low: out 329 programs, only 55 were users of EMRs. However, based on the responses, usage was expected to rise from 17% to 47%.
Melas, Zampetakis, Dimopoulou and Moustakis (2011)	Modelling the acceptance of clinical information systems among hospital medical staff: An extended TAM model	Quantitative	Perceived usefulness and perceived ease of use are determinants of intention to use. The external factors ICT feature demands and ICT knowledge affected perceived usefulness and perceived ease of use respectively, with the former being a negative relationship.
Otieno, Toyama, Asonuma, Kanai-Pak and Naitoh (2007)	Nurses' views on the use, quality and user satisfaction with electronic medical records: questionnaire development	Quantitative	The quality of an EMR system, being the information quality and the system quality, and the extent of use of that system are positively related to user satisfaction.
Valdes, Kibbe, Tolleson, Kunik and Petersen (2004)	Barriers to proliferation of electronic medical records	Quantitative	23.5% of 5517 members of the American Academy of Family Physicians (AAFP) reported that they were users of EMR/EHR systems. Cost was found to be the major reason why physicians chose not to purchase EMR/EHRs.

2.5 Past Literature on EMR impacts

Several studies have researched the actual effects of EMRs on healthcare delivery (Makoul *et al.* 2001; Adams, Mann and Bauchner 2003; Vollmer, O'Connor, Heumann, Frazier *et al.* 2004; Salazar, Best and Hiestand 2011; Tu *et al.* 2011; Varroud-Vial 2011; Schenarts and Schenarts 2012; Teufel Ii, Kazley, Ebeling and Basco Jr 2012; Xue, Liang, Wu, Gong *et al.* 2012) while others have studied the perceived impacts of EMRs (Marshall and Chin 1998; Miller and Sim 2004; Moody *et al.* 2004; de Veer and Francke 2010; Vishwanath, Singh and Winkelstein 2010; Garcia-Smith and Effken 2013). This study focuses on the perceived impacts of EMRs by healthcare workers. This is because individual perceptions are considered the more proximal determinants of their usage behaviours.

In a number of studies, EMRs have been found to positively affect certain areas of healthcare delivery and therefore improved patient care (Marshall and Chin 1998; Adams *et al.* 2003; Wang *et al.* 2003; Moody *et al.* 2004; de Veer and Francke 2010; Tu *et al.* 2011; Xue *et al.* 2012), while in others they have been found to have the opposite negative impact (Ludwick and Doucette 2009; Salazar *et al.* 2011; Schenarts and Schenarts 2012; Teufel Ii *et al.* 2012). However, studies on the perceptions of practitioners towards the impacts of EMRs use offer a mixed picture as there are variations in perceptions. This may be attributed to the difference in the systems and settings in which the research is conducted. Literature however does not show how perceived impacts affect the user's job satisfaction level as well as their intentions to continue using EMRs.

2.5.1 Perceived Impacts

Currently literature offers a mixed picture on the perceived impacts of EMRs on healthcare delivery and patient care. While literature exists that speaks to positive impacts of EMRs (Marshall and Chin 1998; Moody *et al.* 2004; de Veer and Francke 2010), literature also exists that presents a contrary picture (Ludwick and Doucette 2009).

Lenhart *et al.* (2000) found there to be varied perceptions of EMR systems between current users and non-users with non-users being more optimistic about the capabilities of EMR systems. This finding suggests that user experiences with EMR systems are not always satisfactory, leading to lower optimism. Therefore it is

important to explore the perceptions of users on the benefits and impacts of EMRs. Lenhart *et al.* (2000) identified five EMR perception areas, these include meeting all medical record requirements, providing documented improved patient care, providing a reliable database for research, aiding in the documentation of residency experience, and improving management of managed care.

Not all work has reached the same conclusion, for example Moody *et al.* (2004) researched the perceptions and attitudes of nurses towards EMR systems and found them to be generally optimistic. Nurses viewed EMRs as generally helping to improve the quality of documentation in healthcare though most did not perceive them to reduce their workload. Other studies have also reached similar conclusions, generally showing that healthcare workers found EMR systems to improve patient care (Marshall and Chin 1998; Adams *et al.* 2003;). However, de Veer and Francke (2010) found that while nurses may perceive patient care impacts they also expected EPRs to negatively affect their personal work circumstances.

Moody *et al.* (2004) presented a study that looked at the attitudes, perceptions and preferences of nurses towards Electronic Health Records (EHR). They found that nurses who were more experienced with computer usage had a more favourable attitude towards EHRs than those who did not. They also found that older nurses had a less favourable attitude towards the use of EHRs, thus linking attitudes to computer experience and age. With regards to perceptions, they found that majority of the nurses believed that EHRs had a positive impact on patient care, however they were not pleased that the EHR system did not allow them to capture records at the patients' bedside.

2.5.2 Actual Impacts

In terms of actual impacts, EMRs have been found to affect length of stay, infection rate and mortality rate thus evidencing improved patient care (Xue *et al.* 2012).

The use of EMR data has also been found to help identify patients with diabetes and asthma (Vollmer *et al.* 2004; Tu *et al.* 2011). This allows for the efficient monitoring of these patients.

In a study which conducted a comparison between documentation before and after the implementation of EMRs, it was found that EMRs aided physicians in paediatric

care by reminding them to address certain routine topics during a patient visit (Adams *et al.* 2003). This resulted in more complete documentation as well as improved patient care. However, in another study, it was found that even with the prompting functionality of EMRs, incomplete documentation was still common (Salazar *et al.* 2011).

EMRs have been shown to have positive financial implications by aiding with savings in drug expenditures, improved utilization of radiology tests, better capture of charges, and decreased billing errors (Wang *et al.* 2003). However, studies exist to suggest the contrary, where EMRs have had no positive impact on costs or results have been inconclusive (Chaudhry *et al.* 2006; Xue *et al.* 2012). Table 2-3 below, summarises the literature relating to the impacts of EMR systems.

Table 2-3: Summary of EMR Impacts Studies

Author(s)	Title	Methodology	Findings
Adams, Mann and Bauchner (2003)	Use of an Electronic Medical Record Improves the Quality of Urban Paediatric Primary Care	Pre-post intervention analysis	Though concerns over decreased eye to eye contact with patients and the increase in patient visit durations were raised, EMRs were found to improve patient care.
Chaudhry, Jerome, Shinyi, Maglione *et al.*(2006)	Systematic Review: Impact of Health Information Technology on Quality, Efficiency, and Costs of Medical Care	Systematic literature review	Health Information Technology (HIT) positively affected adherence to guideline-based care, surveillance and monitoring, and reduced medication errors.
de Veer and Francke (2010)	Attitudes of nursing staff towards electronic patient records: A questionnaire survey	Quantitative	While Nurses perceived Electronic Patient Records (EPR) to improve the quality and safety of care, they also expected them to negatively affect their work circumstances.
Garcia-Smith and Effken (2013)	Development and initial evaluation of the Clinical Information Systems Success Model (CISSM)	Quantitative	Clinical Information System (CIS) Use Dependency, Clinician Satisfaction, Social Influence and Facilitating Conditions are determinants of Net Benefit (Impact).
Ludwick and Doucette (2009)	Adopting electronic medical records in primary care: Lessons learned from health information systems implementation experience in seven countries	Systematic literature review	The implementation of EMRs did not affect the quality of care, patient safety or provider/patient relations.
Makoul, Curry and Tang (2001)	The use of electronic medical records communication patterns in outpatient encounters	Quantitative	EMR physicians focused more on information-intensive tasks and neglected patient-centred tasks.
Marshall and Chin (1998)	The Effects of an Electronic Medical Record on Patient Care: Clinician Attitudes in a Large HMO	Quantitative	Clinicians believed that EMRs improved the overall quality of care. EMRs were believed to positively impact patient-clinician interaction, patient care coordination, reduced medication errors, improved the timeliness of referrals, and acting on test results timeously.
Miller and Sim (2004)	Physicians' Use Of Electronic Medical	Qualitative	Healthcare quality improvements

	Records: Barriers And Solutions		were found to be dependent on physicians' use of EMRs and not paper-based medical records.
Moody, Slocumb, Berg and Jackson (2004)	Electronic Health Records Documentation in Nursing: Nurses' Perceptions, Attitudes, and Preferences	Quantitative and Qualitative	Nurses believed that EHRs improved the quality of documentation and that electronic charting improved safety and patient care.
Salazar, Best and Hiestand (2011)	Incomplete documentation of elements of Ottawa Ankle Rules despite an electronic medical record	Quantitative	EMRs do not help improve the completeness of documentation
Schenarts and Schenarts (2012)	Educational Impact of the Electronic Medical Record	Systematic literature review	EMRs have a negative impact on teacher learner interactions as well as clinical reasoning, while having an inconsistent effect on resident workflow. Impacts on patient safety, quality of care, and medical finances were mixed.
Teufel Ii, Kazley, Ebeling and Basco Jr (2012)	Hospital Electronic Medical Record Use and Cost of Inpatient Paediatric Care	Quantitative	EMRs were found to increase the cost of care.
Tu, Manuel, Lam, Kavanagh, Mitiku and Guo (2011)	Diabetics can be identified in an electronic medical record using laboratory tests and prescriptions	Quantitative Methods	Structured data within EMRs could be used to identify diabetic patients
Vishwanath, Singh and Winkelstein (2010)	The impact of electronic medical record systems on outpatient workflows: A longitudinal evaluation of its workflow effects	Concept mapping	Physicians were found to value the patients care coordination related impacts over the impacts patient safety, communication and confidentially.
Wang, Middleton, Prosser, Bardon *et al.* (2003)	A Cost-Benefit Analysis of Electronic Medical Records in Primary Care	Cost-benefit analysis	EMRs were found to have positive financial implications by aiding with savings in drug expenditures, improved utilization of radiology tests, better capture of charges, and decreased billing errors.
Xue, Liang, Wu, Gong *et al.* (2012)	Effects of electronic medical record in a Chinese hospital: A time series study	Time series study	EMRs were found to have a positive effect on length of stay, infection rate, and mortality rate while having no positive effect on patient costs.

2.6 Research Gap

The above studies offer a mixed picture of healthcare workers' perceptions of EMRs and their potential to improve healthcare. There are also variations in the usage patterns of EMRs amongst physicians which need to be better understood and explained. Finally there is no research on the relationship between the use of EMRs and job satisfaction or continuance intention. Further research is therefore needed to clarify the factors affecting the use of EMRs and thus the following research gap has been identified in this study.

Firstly, although the perceptions of healthcare workers towards EMR systems have been well documented in some contexts, namely the US, Europe and in contexts where users are highly computer literate (e.g. (Lenhart *et al.* 2000; Moody *et al.*

2004), the perceptions of healthcare workers in less developed countries where EMRs have yet to diffuse are largely unknown. Furthermore, the potential benefits of EMR have been articulated by many studies (e.g. Shortliffe 1999; Wang *et al.* 2003; Miller and Sim 2004; Fraser *et al.* 2005; Hillestad *et al.* 2005; Haux 2006) but there is not enough evidence to suggest that health workers experience those benefits in all contexts.

The factors affecting the EMRs use remain largely unknown. Research to date has not accounted for variations in the extent to which healthcare workers choose to infuse the technology into their clinical workflow.

Finally, with mixed findings regarding impacts on the individual user, there is a need for more research into the individual job satisfaction impacts resulting from the use of EMRs. The literature search returned no articles explaining this relationship.

With the intention of covering the above mentioned research gap, this study therefore intends to;

- examine healthcare workers' perceptions of the impacts of EMR use on public healthcare delivery in a developing economy context,
- examine and reveal the factors affecting healthcare workers' use of EMRs in a developing economy context,
- uncover perceptions of healthcare workers on how the use of EMRs affect their level of job satisfaction,
- examine the relationship between the perceived impacts of EMRs and users' intentions to continue using EMRs in light of these perceived impacts.

The next section of this chapter presents the theoretical underpinnings of the research model that will be developed to address these study objectives.

2.7 Theoretical Underpinnings of the Research Model

There is a wealth of literature on the factors that predict the usage behaviour of information technology (IT) and information systems (IS). Some of the more popular theories predicting usage behaviour include the Technology Acceptance Model (TAM) (Davis 1989), Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al.* 2003), the Information Systems Success Model (ISSM) (DeLone and McLean 2003) and the (Information Systems Continuance) ISC model

(Bhattacherjee 2001). This study draws on the above theories to conceptualise use and usage behaviour. Given the focus on perceived impact and usage behaviour, this study is underpinned by the works of DeLone and McLean (2003) and that of Bhattacherjee (2001). These are discussed next.

2.7.1 The Information Systems Continuance Model

The Information Systems Continuance model depicted below was developed by Anol Bhattacherjee and consists of the variables confirmation of expectation, perceived usefulness, satisfaction, and continuance intention. The ISC shows the perceptions, feelings and intentions of users *post* their initial acceptance of an information system. Bhattacherjee (2001) highlights the importance of continued use over adoption and initial acceptance. The paper notes that while initial acceptance of an information system is important, it is the continued use of the information system that will eventually determine its success.

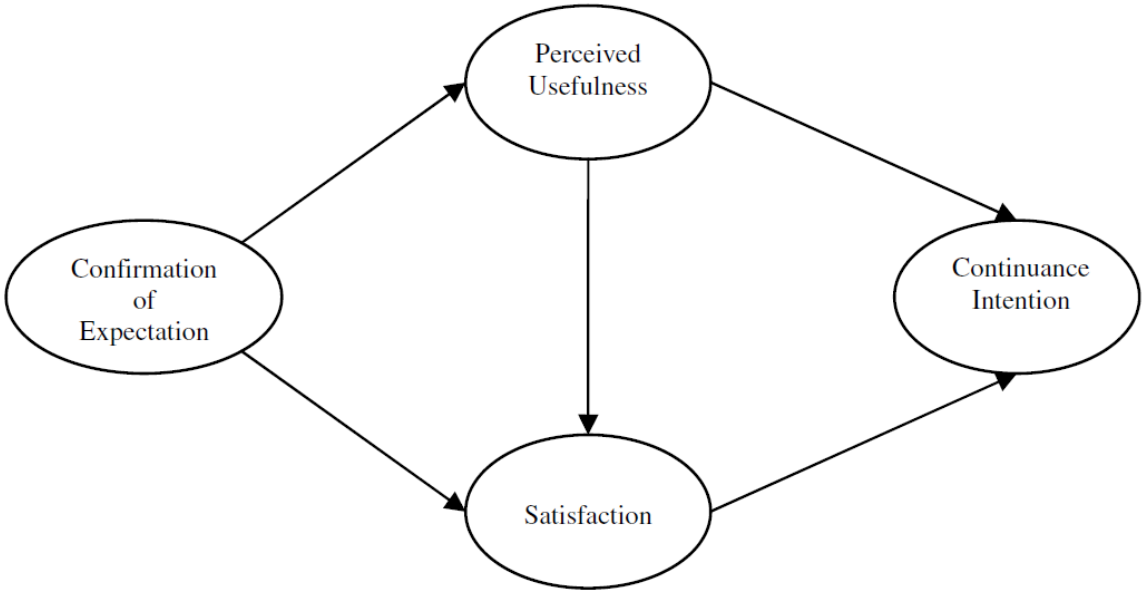


Figure 2-1: Information System Continuance Model (Source: Bhattacherjee, 2001)

Figure 1 above shows the relationships of the ISC as theorised and validated by Bhattacherjee (2001). As shown above, when a user's expectations are confirmed, this positively influences the extent to which they perceive the system as being useful (Bhattacherjee 2001) and also positively affects their satisfaction with the system(Mettler 2012). The extent to which a user perceives a system to be useful will also positively affect the user's satisfaction with that system along with their

intention to continue the use of that system. Finally, a user's level of satisfaction with an information system will positively influence that user's intention to continue using that system (Mettler 2012).

Bhattacherjee (2001) tested the above relationships and found them to hold. He found that satisfaction was primarily determined by the confirmation of expectations. He also found that satisfaction was the stronger determinant of continuance intention.

This study also draws on the DeLone and McLean Information Systems Success Model (ISSM), which is discussed next.

2.7.2 DeLone and McLean IS Success Model

The IS Success model by DeLone and McLean shown in Figure 2-2 is a combination of a process model as well as a causal variance model. The process is said to comprise of three components. Firstly an Information system is introduced into an environment. This information system is then used and experienced by the users of the system leading to the formulation of feelings of satisfaction or dissatisfaction with the information system. The use of the system will then impact the individual users which will in turn lead to an impact on the organisation (DeLone and McLean, 2010). A number of studies have been underpinned by this model in the Health Information Technology space (Morin, Tourigny, Pelletier, Robichaud *et al.* 2005; Su, Win and Fulcher 2006; Otieno, Toyama, Asonuma, Kanai-Pak *et al.* 2007; Otieno, Hinako, Motohiro, Daisuke *et al.* 2008; Bossen, Jensen and Udsen 2013; Garcia-Smith and Effken 2013) and much more in the general Information Systems space with the original paper being cited approximately 6334 times. Table 2-4 below summarises some of these studies in the EMR context.

Table 2-4: Studies Underpinned by the DeLone and McLean IS Success Model

Authors	Title	Methodology	Summary
Bossen, Jensen and Udsen (2013)	Evaluation of a comprehensive EHR based on the DeLone and McLean model for IS success: Approach, results, and success factors	Mixed methods case study	A descriptive study evaluating a comprehensive EHR system shortly after implementation.
Garcia-Smith and Effken (2013)	Development and initial evaluation of the Clinical Information Systems Success Model (CISSM)	Quantitative	Clinical Information System (CIS) Use Dependency, Clinician Satisfaction, Social Influence and Facilitating Conditions are determinates of Net Benefit (Impact).
Morin, Tourigny, Pelletier, Robichaud,	Seniors' views on the use of electronic health records	Mixed methods,	This study looks at the perceptions of frail seniors patients towards EHRs.

Mathieu, Vézina, Bonin and Buteau (2005)		quantitative and qualitative	Generally the perceptions of seniors were found to be favourable towards EHRs.
Otieno, Hinako, Motohiro, Daisuke and Keiko (2008)	Measuring effectiveness of electronic medical records systems: towards building a composite index for benchmarking hospitals	Quantitative	A conceptual framework in which a way to measure and compare the effectiveness of EMRs within different hospitals is proposed through the use of a composite index.
Otieno, Toyama, Asonuma, Kanai-Pak and Naitoh (2007)	Nurses' views on the use, quality and user satisfaction with electronic medical records: questionnaire development	Cross sectional survey. Quantitative	The development of an instrument to measure the effectiveness of EMRs from a nurse's point of view. The instrument, incorporating 34 items was found to be valid and therefore fit to be used to measure the effectiveness of EMRs.

The whole model itself is defined as the dependent variable "IS success", comprising of the success dimensions information quality, systems quality, systems use, user satisfaction, individual impact and organisational impact (DeLone and McLean 1992). In their ten year update on the original paper DeLone and McLean modified the model to include the dimension service quality. The use of the variable intention to use in place of system use where appropriate was suggested. Lastly, the success dimensions, i.e. individual impacts and organisational impacts, were combined to form the dimension "Net Benefits".

As a variance model, the relationships amongst the IS Success variables are described as follows. The system characteristics which include information quality, system quality and service quality, which will be measured separately, positively influence systems use and user satisfaction. User satisfaction is also influenced positively by a positive use experience. In turn, satisfaction with a system will result in the user of this system being more inclined to use this system (Iivari 2005). The positive use of the system and satisfaction with the system are positively related to the net benefits of the information system. This means that individuals who make use of the information system and are satisfied with it are more likely to realise the net benefits of the system. The realisation of these benefits by a user will then encourage them to continue using the system and will also inspire feelings of satisfaction with the system. This explains the positive relationship between the net benefits of the system and intention to use and user satisfaction. The relationships described above are depicted diagrammatically below.

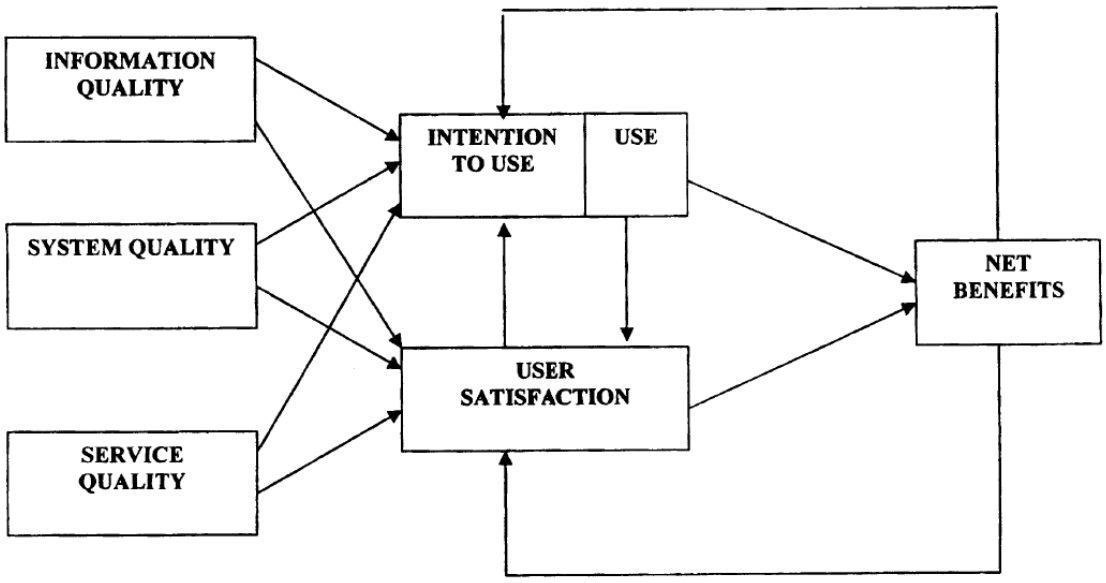


Figure 2-2: The Updated IS Success Model (source: DeLone and McLean, 2003)

Based on the above, this study's research model could then be derived.

2.8 Research Model and Hypotheses

This study focuses on the perception of healthcare practitioners of the impacts of EMRs rather than the actual impacts of EMRs on healthcare. Perceptions may not be regarded as an objective measure of outcomes (Schenarts and Schenarts 2012) nonetheless they do make an important contribution to literature (Boyer, Baumstarck-Barrau, Belzeaux, Azorin *et al.* 2011). Humans and their perceptions are a very important to the study of health informatics (Aarts and Peel 1999) or any information system for that matter as even the best systems may fail if the perceptions of users are not used to guide implementation (Aarts and Peel 1999). It is therefore meaningful to study the perception of healthcare practitioners towards the use and impacts of EMRs. However, this study does not attempt to infer actual impacts based on the perceptions of practitioners. Rather the aim is to understand how practitioners, the users of EMRs, view EMRs and how that affects their work process, productivity and ability to deliver healthcare. The study then attempts to uncover how these perceived impacts affect a practitioner's intention to continue using EMRs as well as their level of job satisfaction.

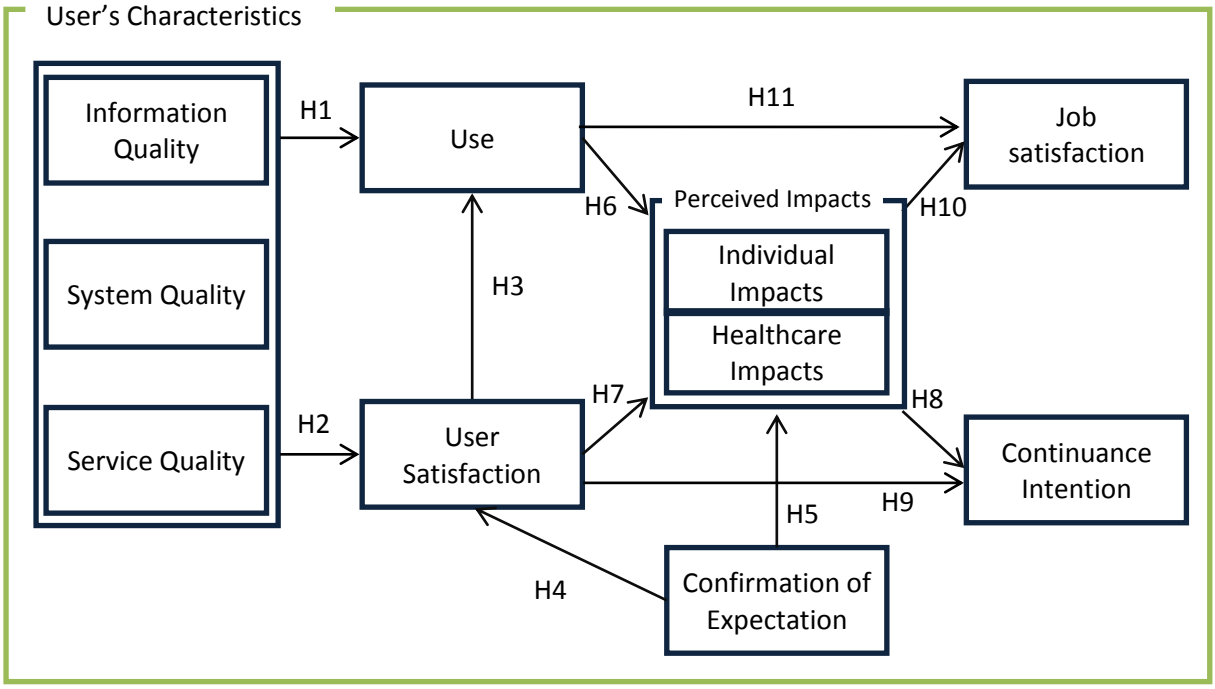


Figure 2-3: Proposed Synthesised Research

The above model is a synthesised model integrating the ISS model and the ISC model. The above model is a graphical representation of the hypotheses which are developed below.

2.8.1 System Quality

System quality refers to the extent to which the functionality of the system is able to meet the requirements of its user to enable them to carry out their work (Bossen *et al.* 2013). Aspects of the system which are addressed by the variable system quality include the extent to which it is easy to use, stable, the manner in which it integrates with other systems and performance-related issues (Bossen *et al.* 2013). While some studies have found a relationship between system quality and use, a study by Garcia-Smith and Effken (2013) was unable to support this hypothesis as no significant relationship was found between the two variables. This study therefore intends to test this relationship to uncover if the extent with which a system is viewed as easy to use, stable and well integrated, affects the extent to which it is used, and the extent to which its users are satisfied with it.

2.8.2 Information Quality

Information quality addresses the extent to which the information output produced by a system is both valuable and useful to its users (Otieno *et al.* 2008). Aspects of information quality include accuracy, timeliness, completeness, relevance, and consistency (DeLone and McLean 2003). Information quality has generally been found to be a predictor of usage behaviour and user satisfaction (Garcia-Smith and Effken 2013). This therefore implies that the more the information output that is produced by a system is accurate, timely, complete, relevant and consistent, the more likely it is to be used, and the more likely its users will be satisfied with it.

2.8.3 Service Quality

Service quality refers to the level of support and user training that comes with a system (Bossen *et al.* 2013). Facets of service quality include its tangibility, the extent to which it is reliable, the level of responsiveness of support staff, the assurance and therefore dependability of the support, and the empathy shown by support staff (DeLone and McLean 2003). DeLone and McLean (2003) highlight how service quality has been hypothesised and found to be a determinant of use as well as user satisfaction. Therefore the more a system is seen as having tangible, reliable, responsive, assured and empathetic support, the more likely it is to be used and the more likely its users will be satisfied with it.

2.8.4 Use

In this study use is defined in terms of extended use. Extended use is defined as the comprehensive use of an information system to support one's work process (Hsieh and Wang, 2006). It would be evidenced by the use of an increasing number of system features to support an increasing proportion of one's work tasks. According to DeLone and McLean (2010) the characteristics of a system are important to the usage process. For use to occur, a system must be easy to use and reliable, must provide valuable information, and must be supported in a manner that facilitates ongoing use. Based on the above, this study hypothesises the following:

> *Hypothesis 1a: A positive relationship exists between the "information quality" of EMRs and the "use" of EMRs.*

> *Hypothesis 1b: A positive relationship exists between the "system quality" of EMRs and the "use" of EMRs.*

Hypothesis 1c: A positive relationship exists between the "service quality" of EMRs and the "use" of EMRs.

2.8.5 User Satisfaction

Satisfaction is an affective state or feeling that is inspired by a cognitive evaluation of one's expectation from an item or thing and the performance of that item (Bhattacherjee, 2001). DeLone and McLean's model suggests that satisfaction is determined by the three system characteristics system quality, information quality and service quality. The argument is that the relationship between satisfaction and the system characteristics exists because satisfaction is a feeling that is formed as a result of one's evaluation and perception of the attributes of an object (Iivari, 2005). Thus when a user evaluates an object and its attributes, in this case the system and its system quality, information quality and service quality, the perceptions formed as a result of this evaluation leads to satisfaction. Intuitively, a system that is lacking in necessary quality characteristics and which is poorly supported is unlikely to inspire feelings of satisfaction. If a system's performance exceeds one's expectations then feelings of satisfaction occur. If the system's performance fails to exceed the expectations then dissatisfaction occurs. Based on the above, this study hypothesises the following:

Hypothesis 2a: A positive relationship exists between the "information quality" of EMRs and "user satisfaction" with EMRs use.

Hypothesis 2b: A positive relationship exists between the "system quality" of EMRs and "user satisfaction" with EMRs use.

Hypothesis 2c: A positive relationship exists between the "service quality" of EMRs and "user satisfaction" with EMRs use.

DeLone and McLean (2003) suggest a reciprocal relationship between user satisfaction and use. This suggests that the more a user is satisfied with a system the more likely they are to use the system, and also that the more a user of a system uses that system the more likely they are to be satisfied with it. Most studies however consider only the first relationship (Wu and Wang 2006; Petter, DeLone and McLean 2008; Chen and Cheng 2009) i.e. that satisfaction leads to use. This is consistent with the attitude-behaviour theories of social psychology (Ajzen and Fishbein, 1980)

and other IS models such as TAM (Davis, 1989) which position affective states as preceding behaviours. This study will also consider only that relationship and thus hypothesises the following:

> *Hypothesis 3: A positive relationship exists between the "user satisfaction" and the "use" of EMRs.*

2.8.6 Confirmation of Expectation

Confirmation of expectation and satisfaction are concepts taken from the ISC which was introduced by Bhattacherjee (2001). Confirmation of expectation refers to the extent to which one sees their expectations as having been met during trial or use. According to Bhattacherjee, a user will form pre-usage expectations for a system's performance. Users of an EMR are thus more likely to be satisfied with a system if their expectations for what the system has to offer have been met by their usage experience. Confirmation of expectation is thus positively related to user satisfaction. This relationship exists because confirmation of expectation means a user would have attained the benefits that they expected to get as a result of system usage. Based on the above, this study hypothesises the following:

> *Hypothesis 4: A positive relationship exists between the "confirmation of expectations" of EMRs and "user satisfaction" with EMR use.*

2.8.7 Perceived Impact

Perceived usefulness was first defined by Davis (1989) in the IS context as the extent to which one believes that the use of a particular system would better the way in which they do their job. The more one believes a system to be useful to them the more likely they are to be satisfied with it and the more likely they are to continue using it extensively (Bhattacherjee 2001). Perceived usefulness in this study is reflected more broadly as perceived impacts. Ayatollahi, Bath and Goodacre (2010) looked at the perceived impacts of information systems at three levels, the individual impact, organisational impact and the impact on patient care. This study recognises two areas of perceived impact, individual impact and healthcare delivery impact as organisational level impacts such as cost savings may be difficult for individual users to evaluate. Thus, in this study, individual and healthcare impacts represent the net benefits or perceived usefulness of the system.

According to Bhattacherjee's ISC model when a user's expectations are confirmed, they are more likely to perceive the system as being useful (Bhattacherjee 2001) or as having positive impacts. Consequently, if an EMR user's expectations are confirmed, their perceptions of EMR impacts will be re-evaluated in a positive manner. The following is hypothesised with regards to the link between expectation confirmation and perceived impacts.

> *Hypothesis 5: A positive relationship exists between the "confirmation of expectations" of EMRs and the "perceived impacts" (individual impact and healthcare impact) of EMRs on healthcare delivery.*

Within the DeLone and McLean ISS model, net benefits (usefulness) are considered to be a function of both use and satisfaction. Without use, benefits cannot materialize. However, simply using an information system may not result in benefits, rather it is the nature, extent, quality and appropriateness of the use that is important. Consequently, this study focuses on the effects of extended use on the perceived impacts of the system. Satisfaction is also responsible for these impacts or net benefits since satisfaction will promote more extended use. The following is hypothesised with regards to the link between use, satisfaction and perceived impacts.

> *Hypothesis 6: A positive relationship exists between the "use" of EMRs and the "perceived impacts" (individual impact and healthcare impact).*

> *Hypothesis 7: A positive relationship exists between the "user satisfaction" and "perceived impacts" (individual impact and healthcare impact).*

2.8.8 Continuance Intention

Bhattacherjee (2001) states that the success and survival of a system is not based on its first time use but rather its continued use. Continuance intention refers to the extent to which a user of a system anticipates that they will continue using it on an on-going basis (Bhattacherjee 2001). Continuance intention is affected by the extent to which a user is satisfied with a system and the extent to which they perceive it to have positive impacts. Bhattacherjee (2001) suggests that this relationship exists because when users see a system as providing certain benefits, they then see that

system as a means to achieve those ends. This in turn will encourage continual usage behaviours. This study therefore hypothesises the following:

Hypothesis 8: A positive relationship exists between "perceived impacts" (individual impact and healthcare impact) and "continuance intention".

Hypothesis 9: A positive relationship exists between the "user satisfaction" and "continuance intention".

2.8.9 Job Satisfaction

Job satisfaction has been defined as an affective state which employees experience as a result of their interactions, characteristics, values and expectations in the environment and the organisation within which they work (Mueller and McCloskey 1990; Happell, Martin and Pinikahana 2003). Surprising there is very little literature on the effects of EMR use on job satisfaction. The use of EMRs is expected to have an influence on the job satisfaction levels of its users (Karsh, Beasley and Hagenauer 2004). It is also expected that the realisation of positive impacts will positively affect the level of job satisfaction. This study proposes that an individual experiencing positive impacts from the use of the EMR system will experience higher levels of job satisfaction, thus hypothesising the following:

Hypothesis 10: A positive relationship exists between "perceived impacts" (individual impact and healthcare impact) and "job satisfaction".

Hypothesis 11: A positive relationship exists between the use of EMRs and "job satisfaction".

2.8.10 User Characteristics

Ayatollahi, Bath and Goodacre (2010) in their qualitative study found that a user's characteristics such as age and computer literacy and experience with IT could affect a user's use of an information system. They found that older users and users with less experience with computers were more likely to not to use information systems for their jobs. In this study user's characteristics are taken as moderators of the relationships in the model. The demographics age and computer experience are said to affect the use of technology. Older individuals are said to be more resistant to

technology whilst younger ones are much readier and willing to use technology for a sea of tasks. The same goes for computer experience, individuals who know how to use a computer, and have experience using one, are more likely to accept using technology to complete their tasks than individuals who are computer illiterate (Lærum *et al.* 2001). The user's characteristics considered in this study are as follows, age, computer experience, gender, professional title/job level, level of education. These user characteristics will be used as control variables in this study.

2.9 Conclusion

This chapter discussed past literature related to the current study so as to give insight into the research field. The research gap was then revealed and a model, synthesised from the ISC model by Bhattacherjee, and the DeLone and McLean model, was proposed and illustrated and the hypotheses to be tested stated.

The following chapter will discuss the research methods used in this study. The data collection methods and the data analysis methods will be described and the credibility of the study will be analysed.

Chapter 3 Research Methods

3.1 Introduction

The previous chapter discussed past literature related to the current study so as to give insight into the research field. The research gap was then exposed and the proposed model and its underlying hypotheses were developed.

This chapter will discuss the research methods used to test the proposed research model. First, the research methodology is described and justified. The data collection methods including sampling, instrument development and ethical considerations are then discussed. This is followed by a discussion of reliability and validity. The data analysis techniques that have been used to test the hypotheses are then described. Finally, the limitations of the selected methods will be noted.

3.2 Research Problem

This study seeks to uncover the perceptions of health workers towards the system, information and service quality of EMR systems, their use and satisfaction with these systems, as well as their perceptions of the impacts of EMR use. The impacts of EMRs are separated into two dimensions being healthcare impact and individual impacts. Healthcare impacts in this study reflect how EMRs impact healthcare delivery as a whole, while individual impacts reflect how EMRs impact a healthcare worker's personal productivity. Furthermore it seeks to discover how these impacts affect healthcare works' job satisfaction as well as their intention to continue using EMRs. As shown in the previous chapter, there is insufficient literature on this particular topic and this study therefore intends to cover this gap.

3.3 Research Methodology

Generally, data collection methods in social research are either positivist or interpretive (Bhattacherjee 2012). This study follows the former.

With positivist methods, the research approach is deductive, whereby a theory is first conceptualised then tested using empirical data (Saunders, Saunders, Lewis and Thornhill 2011). Positivist research is mainly associated with a quantitative approach, where data is obtained from surveys or laboratory experiments (Bhattacherjee 2012). Variables are measured and quantified through numeric values which can be mathematically processed and analysed using quantitative techniques such as

correlation and regression analysis (Bailey 2008; Bhattacherjee 2012), and analysing the frequency of occurrence (Hussey & Hussey, 1997). Quantitative research is therefore used when seeking to numerically measure variables in order to test a theory, hypothesis or model (Saunders *et al.* 2011).

Interpretive methods on the other hand are inductive and theories are derived from the data (Bhattacherjee 2012). Interpretive research is mainly associated with qualitative research methods which seek to identify and explain the meaning of a phenomenon (Hussey & Hussey, 1997). Data is collected by means of interviews and observations and analysed using qualitative techniques such as coding (Bhattacherjee 2012). Qualitative research is therefore used when seeking to interpret the meaning of a variable in order to build theories (Saunders *et al.* 2011).

While positivist research is more aligned with quantitative research methods and interpretive research is aligned with qualitative methods, neither is limited to a specific method (Bhattacherjee 2012). Thus quantitative methods can be employed for interpretive research and qualitative for positivist research. A mixed method approach employing both quantitative and qualitative methods may also be used in order to gain a unique insight into a complex phenomenon (Saunders *et al.* 2011; Bhattacherjee 2012).

In essence, a positivist perspective is more useful when studying phenomena that can be quantified while an interpretive perspective is more appropriate when studying phenomena such as thought and emotions that cannot be directly measured (Bhattacherjee 2012). Given that the current study seeks to test set hypotheses and a research model, a positivist approach employing quantitative methods is therefore more applicable and suited to achieving the study's objectives. The study seeks to identify and measure, in numbers, the factors affecting the use of EMR systems as well as the extent to which the use of EMRs influences the perceptions of healthcare workers towards the impacts of EMRs. The variables are measured using a Likert scale on which responses are given a numeric value. The study also seeks to measure the variables by observing the number of respondents with a particular response to that variable. The study is not concerned with why the respondents respond in a particular way or the meaning of the response, but is only concerned the frequency of the response so as to test the hypotheses and proposed

model of the current study and furthermore, make generalisations and future predictions from the findings.

3.3.1 Research Design

This study employed a cross-sectional field survey methodology design. Field surveys involve the capturing of data from a sample of subjects in a field setting, mainly through the use of survey questionnaires (Bhattacherjee 2012). Field surveys are non-experimental and therefore the independent variables are neither controlled in a laboratory setting or manipulated but rather measured in order to then be tested (Bhattacherjee 2012). Field surveys strengths include high external validity, as the variables are measured in a field setting, the capability to measure a large number of variables and the ability to use multiple theories to study a phenomenon. However, field surveys have low internal validity and are prone to response bias (Bhattacherjee 2012). A cross-sectional survey is one where the sample group is surveyed at a single specific point in time, measuring the independent and dependant variables simultaneously, while on the other hand, a longitudinal field survey measures the dependent variable at a later point in time than the independent variable improving thereby internal validity (Saunders *et al.* 2011).

Internal validity refers to the extent to which a cause effect relationship between an independent variable and the dependent variable can be deduced from a study, while external validity refers to the extent to which the findings of a study can be generalised from the sample to a larger population (Bhattacherjee 2012). Thus, seeing as it is not the intention of this study to infer cause-effect relationships, but rather to observe associations amongst variables that are generalizable to a larger population, a cross-sectional field survey method is fitting for the current study.

3.4 Data Collection Strategy

3.4.1 The Research Site

This study was conducted at Tygerberg Hospital located in Parow, Cape Town, South Africa. Tygerberg Hospital is an academic hospital which was officially opened in 1976 and is affiliated with Stellenbosch University, University of the Western Cape and Cape Peninsula University of Technology. It is the largest hospital in the Western Cape and the second largest in South Africa. According to the Western

Cape government website [1], Tygerberg Hospital has an annual budget of approximately R 1,269 million and a capacity of 1899 beds though only 1310 are currently active. The hospital has approximately 4031 members of staff, 1265 of which are nurses. Annually, more than 90 747 patients are admitted and more than 500 000 outpatients are attended to. The hospital has eight nursing departments namely, Operating theatre, Intensive Care Unit (ICU) and High Care, Paediatrics, Emergency Services, Surgical, Medical, Outpatients and finally Obstetrics and Gynaecology.

In an attempt to advance healthcare in the Western Cape Province, the provincial government rolled out the Clinicom EMR system, designed to be a shared electronic patient record (EPR) system across the province, according to the Intersytems South Africa website[2]. According to this website, Clinicom was said to efficiently provide clinical data, improving the quality of data and the quality of workflow. Tygerberg Hospital is one of the hospitals that are currently using this system. The system was implemented in 2001 and replaced the legacy Cape Hospital System which was said to be non Y2K-compliant. The Clinicom Patient Information System is used by a number of hospitals in the in the Western Cape Province including the Groote Schuur Hospital where the world's first heart transplant took place, Tygerberg Hospital and the Red Cross War Memorial Children's Hospital. Permission to conduct the study by means of surveying healthcare workers was sought from the hospital research department. Permission was granted to survey only the nurses in the hospital (Ethics No. H120532 See Appendix C).

3.4.2 Sample

This study targeted nurses who are exposed to the use of the Clinicom Patient Information system. Nurses represent the largest user group of EMRs (Garcia-Smith and Effken 2013) and therefore are the primary stakeholders of EMRs (Hovenga *et al.* 2005). While the aim was to research healthcare practitioners as a whole, it is worthwhile to study the perceptions of nurses as they are an important, distinct stakeholder group of EMR users. Usage varied across the sampled nurses. The purpose of the study was to understand the causes of this variation in use and

[1] Information obtained from the following website: http://www.westerncape.gov.za/your_gov/153/
[2] Information obtained from the following website: http://www.intersystems.co.za/case-studies/local-case-studies/health-systems-technologies/

whether the hypothesized factors could predict usage behaviour. All respondents were however familiar with the Clinicom Patient Information System. Following the approval from the research department, 1120 questionnaires where provided to the nursing department of the hospital for distribution to potential respondents. The process for administration of the instrument is discussed further in section 3.6. Approximately 749 nurses collected questionnaires. While a target of 180 completed responses was sought, a response rate of 18.9% resulted in only 142 completed questionnaires being returned out of the 749 that had been collected. This response rate fall within the expected responses rate associated with survey research (Bhattacherjee 2012). A similar response rate to surveys of nurses was reported in a study by Otieno *et al.* (2007).

3.4.3 Instrument

To capture healthcare workers' use of EMRs, perceptions of the impacts of EMRs on healthcare, intention to continue using EMRs and finally levels of job satisfaction, a self-administered, structured questionnaire was used. Questionnaire items were derived from the literature as shown in the table below. The questionnaire consisted mainly of items measured on a 5-point Likert scale, ranging from 1 = "strongly disagree" to 5 = "strongly agree". It also captured demographics such as age, computer experience and the respondent's role. Table 3-1 below lists the constructs and measures used in this study and the literature from which these measures were derived.

Table 3-1: Construct Measures

Construct	Measure	Literature
System Quality	The Clinicom Patient Information System (PIS) is easy to use	Doll and Torkzadeh (1988)
	The Clinicom PIS is user friendly	
	The Clinicom PIS is difficult to access	Chen and Cheng (2009)
	The Clinicom PIS always does what it should	
	The Clinicom PIS is always up and running as necessary	
	The Clinicom PIS responds quickly enough	
Information Quality	The Clinicom PIS provides the precise information I need	Doll and Torkzadeh (1988)
	The information content provided in the Clinicom PIS meets my needs	
	The Clinicom PIS provides sufficient information about patients	
	The Clinicom PIS provides reliable information on patients	
	I am satisfied with the accuracy of the Clinicom PIS	
	The patient information from the Clinicom PIS is presented in a useful format	
	The patient information from the Clinicom PIS is clear to me	

	The Clinicom PIS provides up-to-date information on patients	
	The Clinicom PIS gives me the information I need in time	
Patient / Healthcare Impact	The use of the Clinicom PIS interferes with patient care	Moody, Slocumb, Berg and Jackson (2004)
	The use of the Clinicom PIS has helped to improve documentation of patient records	
	The use of the Clinicom PIS poses less of a threat to a patient's privacy than paper records	
	The use of Clinicom PIS has improved communication between healthcare workers in Tygerberg Hospital	
	The use of the Clinicom PIS has resulted in the improvement of healthcare delivery	
	The use of the Clinicom PIS has led to improved patient care	
	Using the Clinicom PIS improves my performance in providing patient care	Kositanurit, Ngwenyama, and Osei-Bryson (2006)
	Using the Clinicom PIS increases my productivity in providing patient care	
Individual impact	The use of the Clinicom PIS has reduced my workload	Moody, Slocumb, Berg and Jackson (2004)
	The Clinicom PIS saves me time	
	The Clinicom PIS makes my job easier	
	The quality of my interactions with other healthcare workers has been improved as a result of using the Clinicom PIS	
Service Quality	Support provided to users of the Clinicom PIS is sufficient	Kositanurit, Ngwenyama, and Osei-Bryson (2006)
	There is always support available if I need help with using the Clinicom PIS	
	Support for the Clinicom PIS is provided quickly enough	Chen and Cheng (2009)
Satisfaction	I am very satisfied with the Clinicom PIS	Bhattacherjee (2001)
	I am very pleased with the Clinicom PIS	
	I am very frustrated with the Clinicom PIS	
Use	Compared to when I first started, I am using many more of the Clinicom PIS's features	Schwarz (2003)
	Compared to when I first started, I am using the Clinicom PIS more often to support my work	
	Compared to when I first started, I now use Clinicom PIS for more of my work tasks	
Confirmation	My experience with using the Clinicom PIS is better than what I expected	Bhattacherjee (2001)
	The benefits of the Clinicom PIS are better than what I expected	
	Overall, most of my expectations from using the Clinicom PIS were confirmed	
Continuance Intention	I would be happy to continue using the Clinicom PIS rather than to stop/discontinue its use	Bhattacherjee (2001)
	I would prefer to continue using the Clinicom PIS than use any alternative means (e.g. paper based records)	
	If I could, I would like to discontinue my use of the Clinicom PIS	
Job Satisfaction	I am satisfied with my current situation at work	Happell, Martin and Pinikahana (2003)
	I am satisfied with the degree of support I receive in my job	
	I seldom think about finding another job within my profession	
	I seldom think about finding an occupation outside my current profession	

3.4.3.1 System Quality

The system quality variable was measured through the use of six (6) items taken from Doll and Torkzadeh (1988). The items asked the respondents if the Clinicom Patient Information System (PIS) is easy to use, user friendly, difficult to access, always does what it should, is always up and running as necessary and if it responds quickly enough.

3.4.3.2 Information Quality

The information quality variable was measured through the use of nine (9) items taken from Doll and Torkzadeh (1988). The items found out from the respondents if the Clinicom PIS provides, precise, sufficient, reliable, accurate, clear, timely, up-to-date information that meets their needs and is presented in a useful format.

3.4.3.3 Service Quality

The service quality variable was measured through the use of three (3) items taken from Kositanurit, Ngwenyama, and Osei-Bryson (2006). Items asked if support provided to users of the Clinicom PIS is sufficient, always available and if it is provided quickly enough.

3.4.3.4 Healthcare Impact

The healthcare impact variable was measured through the use of seven (7) items taken from Moody, Slocumb, Berg and Jackson (2004). The items asked if the use of the Clinicom PIS interferes with patient care, improves documentation, poses less of a threat to a patient's privacy than paper records, improves communication between healthcare workers, improves healthcare delivery and improves patient care.

3.4.3.5 Individual impact

The individual impact variable was measured through the use of five (5) items taken from Moody, Slocumb, Berg and Jackson (2004) and Kositanurit, Ngwenyama, and Osei-Bryson (2006). Respondents were asked if the use of the Clinicom PIS has reduced their workload, saves them time, makes their job easier.

3.4.3.6 Satisfaction

The satisfaction variable was measured through the use of three (3) items taken from Bhattacherjee (2001). Items asked respondents if they were satisfied, pleased or if they were frustrated with the Clinicom PIS.

3.4.3.7 Use

The use variable was measured through the use of three (3) items taken from Schwarz (2003). Items asked respondents if compared to when they first started using Clinicom, they were now using more of the Clinicom PIS's features, using it more often or if they now used it for more of their work tasks.

3.4.3.8 Confirmation

The confirmation variable was measured through the use of three (3) items taken from Bhattacherjee (2001). Items asked if experience and benefits of using the Clinicom PIS was better than what they expected and also if overall, their expectations from using the Clinicom PIS had been confirmed.

3.4.3.9 Continuance Intention

The continuance intention variable was measured through the use of three (3) items taken from Bhattacherjee (2001). Items asked if the respondent was happy to continue using the Clinicom PIS rather than to stop/discontinue its use, would prefer to continue using the Clinicom PIS than use any alternative means and if they would discontinue their use of the Clinicom PIS if they could.

3.4.3.10 Job Satisfaction

The job satisfaction variable was measured through the use of four (4) items taken from Happell, Martin and Pinikahana (2003). I am satisfied with my current situation at work, I am satisfied with the degree of support I receive in my job, I seldom think about finding another job within my profession, and I seldom think about finding an occupation outside my current profession

3.4.4 Pretest

In addition to drawing on the literature to establish the content validity of the measures, researchers who are familiar with the constructs in the proposed model were engaged with in a pre-test.

The pretest was conducted in order to identify and correct the flaws of the questionnaire and to improve the content validity of the instrument (Bailey 2008). Content validity refers to the extent to which an instrument actually measures what it is intended to measure (Bailey 2008; Bhattacherjee 2012). The draft questionnaire (see appendix D) was given to Information Systems researchers to review and give feedback for the pretest. The questionnaire was emailed out to the academic

researchers who responded promptly. The academic researchers were required to critically analyse the questionnaire and give feedback on it.

Permission was not obtained to include the "Job Satisfaction" items in the instrument for the pilot test and therefore these items were not included in this initial pre-test process.

Feedback from the pre-test with academics was obtained and the following amendments were made.

Firstly, the order of the items was changed so as to group together construct items in the following order, system quality, information quality, individual impact, service quality, satisfaction, use, confirmation of expectation, healthcare impact and finally continuance intention. This was done to reduce the cognitive load that a random ordering of questions would place on respondents.

It was further identified that the items "The information content meets my needs" and "The system provides sufficient information" should be rephrased to refer to the specific system in use. This was done in order to ensure that the respondents would understand that the question was referring to information generated by their EMR system. In the case of the pilot test, the items therefore referred to the information content in the Therapy Edge system whilst in the main study the items referred to the information content in the Clinicom patient information system.

Other changes included replacing references to "the output" with "patient information". This was done in order to avoid confusing the respondents as they may not have understood the word "output" as referring to patient information.

Other minor modifications were made to improve the grammar as well as the use of double-barrelled questions. For example, one item referred to "The quality and content of my interactions with other healthcare workers has been improved …" was rephrased to "The quality of my interactions with other healthcare workers has been improved …".

In an effort to get respondents to evaluate the extent to which their use of the system had increased, the items were rephrased as follows. The item "In a typical one-

month period, I often use most of the features of [the system][3] to support my work" was rephrased to "Compared to when I first started, I am using many more of [the system's] features". The item "In a typical one-month period, I often use more features than the average user of [the system] to support my work" was rephrased to "Compared to when I first started, I am using [the system] more often to support my work". The item "In a typical one-month period, I often use more obscure aspects of [the system] to support my work was rephrased to "Compared to when I first started, the time I spend using [the system] has increased"

The item "The use of [the system] has resulted in the improvement of healthcare delivery outcomes" was rephrased to "The use of [the system] has resulted in the improvement of healthcare delivery". This was done in order to simplify the item and ensure the process of delivering care was the focus of the respondents rather than a successful clinical outcome, which would be subject to many more factors.

In order to better capture some of the constructs in the instrument, it was recommended by pre-test participants that the following items be added "[The system] is difficult to access", "[The system] always does what it should", "[The system] is always up and running as necessary", "[The system] responds quickly enough", "[The system] provides reliable information on patients", "Support provided to users of [the system] is sufficient", "There is always support available if I need help with using [the system]", and "Support for [the system] is provided quickly enough" as measures of the DeLone and McLean IS factors of system quality, information quality and service quality.

In order to avoid making the instrument too long, the items "[The system] is accurate", "As a result of the extent to which I use [the system], my workload has reduced", "The system provides reports that seem to be just about exactly what I need", "My overall experience of [the system] use is absolutely delightful", "I use [the system] more frequently than my colleagues", "I am dependent on [the system]", "Using [the system] enhances my effectiveness in providing patient care", "Overall, [the system] is useful in improving patient care" were removed from the instrument.

[3] [the system] was replaced with Therapy Edge system in the context of the pilot test and Clinicom PIS in the context of the main study

The item "The use of [the system] helps improve the quality of data used for research purposes" was removed as it was discovered that most respondents would not be involved in any kind of research.

Following the pretest, the instrument was then sent for a pilot test.

3.4.5 Pilot test

The pilot test was conducted in order to ensure that respondents from the intended sampling frame would be capable of understanding the questions as intended. The pilot test was thus conducted to improve the face validity of the instrument. Face validity refers to the extent to which an instrument is accepted by its user as being relevant, understanding it as intended (Lynn 1986).

So as not to exhaust the pool of potential respondents at the main study site (Tygerberg Hospital), the pilot test was conducted at Harriet Shezi Children's Clinic. The Clinic uses the Therapy Edge EMR system. Prior to piloting the questionnaire at the site, permission had to be obtained from the clinic's ethics review board (refer to appendix B). The questionnaire (see appendix E) was then administered to 24 healthcare workers who are users of the Therapy Edge EMR system. These 24 individuals were asked to fill in the questionnaire and give feedback on it. Twelve (12) responses were received out of the 24.

Feedback was obtained and the following amendments were made.

The item "The use of [the system] is more of a help than a hindrance to patient care" was rephrased to "The use of [the system] interferes with patient care". This was done in order to simplify the item so as to make it more understandable to the respondent.

"Compared to when I first started, the time I spend using [the system] has increased" was rephrased to "Compared to when I first started, I now use [the system] for more of my work tasks". This was done in an attempt to get the respondent to focus on evaluating the use of the system with regards to their work tasks.

The item "The use of Clinicom PIS has improved communication between healthcare workers in Tygerberg Hospital" was introduced to the instrument so as to capture the communication aspect of the perceived impacts of EMRs on healthcare workers.

Permission was not obtained to include the "Job Satisfaction" items in the instrument for the pilot test and therefore these were re-added to the instrument for the main study. The items to measure the construct were "I am satisfied with my current situation at work", "I am satisfied with the degree of support I receive in my job", "I seldom think about finding another job within my profession", and "I seldom think about finding an occupation outside my current profession". These items were taken directly from Happell, Martin and Pinikahana (2003) and therefore content validity was of low concern.

The above changes are summarised in Table 3-2 below and the final questionnaire is presented in Appendix F.

Table 3-2: Changes to Questionnaire

Construct	Original Item	Pretest Revised Item	Pilot Test Revised Item
System Quality		3. Therapy Edge is difficult to access	
		4. Therapy Edge always does what it should	
		5. Therapy Edge is always up and running as necessary	
		6. Therapy Edge responds quickly enough	
	16. Therapy Edge is accurate		
Information Quality	13. The information content meets my needs	8. The information content provided in Therapy Edge meets my needs	
	15. The system provides sufficient information	9. Therapy Edge provides sufficient information about patients	
		10. Therapy Edge provides reliable information on patients	
	18. The output from Therapy Edge is presented in a useful format	12. The patient information from Therapy Edge is presented in a useful format	
	19. The information output from therapy Edge is clear to me	13. The patient information from Therapy Edge is clear to me	
Individual Impact		16. The use of Therapy Edge is more of a help than a hindrance to patient care	16. The use of the Clinicom PIS interferes with patient care
	3. The use of Therapy Edge poses less of a threat to a patient's privacy than paper records do	18. The use of Therapy Edge poses less of a threat to a patient's privacy than paper records	
	4. The quality and content of my interactions with other healthcare workers has been improved as a result of using Therapy Edge	19. The quality of my interactions with other healthcare workers has been improved as a result of using Therapy Edge	
			20. The use of Clinicom PIS has improved communication between healthcare workers in Tygerberg Hospital
	10. The Therapy Edge system saves me time	21. Therapy Edge saves me time	
	11. The Therapy Edge system makes my job easier	22. Therapy Edge makes my job easier	

	6. As a result of the extent to which I use Therapy Edge, my workload has reduced		
	7. The use of Therapy Edge helps improve the quality of data used for research purposes		
	14. The system provides reports that seem to be just about exactly what I need		
Service Quality		23. Support provided to users of Therapy Edge is sufficient	
		24. There is always support available if I need help with using Therapy Edge	
		25. Support for Therapy Edge is provided quickly enough	
Satisfaction	32. I am very satisfied with my Therapy Edge system usage	26. I am very satisfied with Therapy Edge	
	33. I am very pleased with my Therapy Edge system usage	27. I am very pleased with Therapy Edge	
	34. I am very content with my Therapy Edge system usage	28. I am very frustrated with Therapy Edge	
	39. My overall experience of Therapy Edge use is absolutely delightful		
Use	25. I use the Therapy Edge system more frequently than my colleagues		
	24. I am dependent on the Therapy Edge system		
	26. In a typical one-month period, I often use most of the features of Therapy Edge to support my work.	29. Compared to when I first started, I am using many more of Therapy Edge's features	
	27. In a typical one-month period, I often use more features than the average user of the Therapy Edge system to support my work.	30. Compared to when I first started, I am using Therapy Edge more often to support my work	
	28. In a typical one-month period, I often use more obscure aspects of the Therapy Edge system to support my work	31. Compared to when I first started, the time I spend using Therapy Edge has increased	32. Compared to when I first started, I now use Clinicom PIS for more of my work tasks
Healthcare Impact	8. The use of Therapy Edge has resulted in the improvement of healthcare delivery outcomes	35. The use of Therapy Edge has resulted in the improvement of healthcare delivery	
	37. Using Therapy Edge enhances my effectiveness in providing patient care		
	38. Overall, Therapy Edge is useful in improving patient care		
Job Satisfaction			43. I am satisfied with my current situation at work
			44. I am satisfied with the degree of support I receive in my job
			45. I seldom think about finding another job within my profession
			46. I seldom think about finding an occupation outside my current profession

Key

New item introduced to instrument
Item removed from instrument

3.5 Credibility of the Measures

To ensure the credibility of the constructs measured in this study, the scales used were tested for reliability and validity, which refer to the scales' level of consistency and accuracy respectively (Bryman 2012). Reliability does not guarantee validity and vice versa (Bhattacherjee 2012). Therefore, a scale can consistently measure a construct that it is not intended to measure or a scale can inconsistently measure the construct it is intended to measure. Thus, both the reliability and validity of the scales in this study are tested to ensure that items used are consistently measuring the underlying constructs that they are intended to measure.

3.5.1 Reliability

Reliability refers to the consistency with which a construct is measured (Bailey 2008; Bryman 2012). There are four main types of reliability, these are inter-rater reliability, test-retest reliability, split half reliability and internal consistency reliability (Bhattacherjee 2012). Inter-rater reliability refers to the consistency between different observers of a construct (Bhattacherjee 2012). Test-retest reliability refers to the consistency with which a single construct can be measured repeatedly at different points in time, obtaining the same result each time (Bailey, 1987). Split half reliability measures the consistency with which two halves of a construct measure that construct (Bhattacherjee 2012). Lastly, internal consistency reliability refers to the consistency with which the different items of a multiple-item construct measure the same construct (Bhattacherjee 2012).

This study uses multiple items to measure constructs, thus to ensure the internal consistency reliability of the scales used in this study, the Cronbach's Alpha reliability coefficient, which ranges between 0 and 1 was used. The Cronbach's Alpha measures the internal consistency of a scale (Gliem and Gliem 2003). The closer the coefficient is to 1, the more reliable the items in the scale. It was decided to use a cut-off point of 0.6 as a lower limit for acceptable reliability of the scale (Hair, Black, Babin and Anderson 2010).

3.5.2 Validity

Validity refers to the extent to which a scale measures the construct it is intended to measure and not something else (Gliem and Gliem 2003). Validity can be tested in terms of translational validity which refers to the extent to which the theoretical construct is represented by the operational measure, and criterion-related validity which refers to the extent to which the construct behaves in the manner it is expected to (Bryman 2012). Translational validity encompasses face validity and content validity while criterion-related validity encompasses convergent, discriminant, concurrent and predictive validity (Bhattacherjee 2012). This study considers and tests for convergent and discriminant validity as being the most important to establish (Bhattacherjee 2012).

While face validity and content validity have been said to be the same thing (Bailey 2008), some studies maintain that they are separate concepts and should be treated as such (Lynn 1986). Face validity is established when on a surface level, a measure or indicator has meaning from the perspective of intended respondents, while content validity is established when the measures of a construct are aligned with the theoretical content associated with that construct (Bhattacherjee 2012).

To ensure face and content validity, the constructs were taken from previous literature as discussed above. However, as the constructs were modified to suit the current study, to further ensure the face and content validity of the scales and constructs, a pretest and a pilot test were conducted. Results of this process were discussed above in sections 3.4.4 and 3.4.5 respectively.

Convergent validity is established when an indicator measures the construct it is intended to measure while discriminant validity is established when and indicator does not measure other constructs that it is not intended to measure (Bhattacherjee 2012).

Convergent and discriminant validity were confirmed by using the Principal Component Factor Analysis with a Varimax Rotation. A factor analysis measures the correlation between underlying dimensions and items of a scale. Items that correlate highly with the same dimension are grouped together to form a factor or component (Bailey, 1987). These items are therefore collectively taken as the measure of that dimension or construct. Convergent validity is implied when the items load together

and discriminant validity when they do not cross load with other factors (Bhattacherjee 2012). This study only considered items that had factor loadings that were above 0.6 in order to ensure convergent reliability and factors that did not load with factor above a score of 0.4 to ensure discriminant validity.

3.6 Data Collection Process

Given the likelihood that a number of users may not have had access to a computer or the internet outside of specific work tasks, a paper-based questionnaire was employed. To ensure that the anonymity and confidentiality of respondents was not compromised the questionnaire did not capture any personal details of the respondents.

The hospital research department had a standard process of conducting research in order to avoid interference with the clinical workflow and process. One thousand one hundred and twenty (1120) questionnaires were supplied to the administration of the hospital. Nurses at the hospital were informed about the study through the hospital administration. The questionnaires were then made available for collection in each department from the nursing managers to all the nurses who were willing to participate. Once completed, the questionnaires were collected in batches at specific times in order to avoid anonymity and confidentiality being compromised.

The data collection process took place over a 14 day period. In order not to systematically exclude any particular users, the questionnaires were made available for both day and night shift nurses. This procedure is consistent with the study of Clark and Trethewy (2005).

3.7 Data Analysis Strategy

First, descriptive statistics such as mean and percentages were used to summarise the perceptions of healthcare workers towards the documentation, workload, and patient care areas of impacts on healthcare delivery. Following tests of reliability and validity, composite scores were calculated for each of the model's variables.

Pearson's correlation was then used to test the correlations between the model's variables. This is used to test the strength of the relationship between two variables. This revealed to us if the hypothesised relationships existed between the various variables.

Multiple regression (MR), a multivariate analysis method, was then used to analyse the connection between multiple variables. In the process, the effect of each variable on the dependent variable was analysed. The first MR tested the effects of system quality, information quality, service quality and satisfaction on use. This relates to testing hypothesis 1 & 3. The second MR tested the effects of system quality, information quality and service quality on satisfaction. This relates to testing hypothesis 2. The third MR tested the effects of individual impact, healthcare impact and satisfaction on continuance intention. This relates to testing hypotheses 7, 8 and 9. The fourth MR tested the effects of use and satisfaction on individual impact. This relates to testing hypotheses 6 and 7. The fifth MR tested the effects of use and satisfaction on healthcare impact. This again relates to hypotheses 6 and 7. User characteristics were controlled for in all the above MRs. The sixth MR tested the effects of system quality, information quality, service quality and confirmation of expectation on satisfaction. This again relates to hypotheses 2 & 4. The seventh MR tested the effects of use and satisfaction and confirmation of expectation on healthcare impact. This again relates to hypotheses 5, 6 and 7. The eighth MR tested the effects of use and satisfaction and confirmation of expectation on individual impact. This again relates to hypotheses 5, 6 and 7.

3.8 Ethical Considerations

For ethical reasons, participation in the study was voluntary and refusal to participate did not bear any consequences, penalties or loss of benefits. The sample group was invited to participate and informed by means of a cover letter that participation was voluntary and involved no risks. It was indicated through the cover letter that the decision of the nurse to complete and to return the questionnaire would be taken as their informed consent to participate. Respondents were also informed that once they had started, completing the questionnaire was not compulsory and they could withdraw from the survey at any point in time. To ensure anonymity and confidentiality the instrument did not capture any personal details that could identify any of the respondents. In order to ensure that the administration of the instrument did not disrupt the workflow of the healthcare workers, the sample group was not approached during the course of their work, that is, they were not approached while attending to patients in wards or anywhere else where their work process could have been disturbed. The study was approved unconditionally by the Wits University

Human Research Ethics Committee (protocol number: H120532. see appendix A). Site permissions for both the pilot site (Appendix B) and the main study site (Appendix C) were also obtained.

3.9 Limitations

Due to the methods employed, this study was subject to some limitations. A cross-sectional survey approach was employed and quantitative techniques were used to collect and analyse the data. The limitations associated with the employed research methods, that this study is therefore subject to, are briefly discussed below.

As this is a cross-sectional study, it therefore lacks internal validity. As such, temporal precedence cannot be established and therefore causal inferences can only be made with reference to theory (Bhattacherjee 2012).

The study is also subject to common method bias, as all the variables are collected at the same time, from the same source, using the same instrument, which may result in false correlations being observed (Podsakoff, MacKenzie, Lee and Podsakoff 2003).

As self-administered questionnaires were used to collect data from the sample, this study is therefore susceptible to social desirability bias in which the questionnaire is likely to prompt respondents to give responses that are seen as favourable (Podsakoff and Organ 1986). The study is also prone to the consistency motif where respondent feel the need to maintain a consistent line when responding to questions (Podsakoff and Organ 1986).

Given that this study follows a survey approach, it is also subject to non-response bias. As participation is voluntary, it is possible that individuals that feel a certain way about the phenomenon being studied will be more likely to respond than others resulting in one sided or skewed results (Bhattacherjee 2012).

3.10 Conclusion

This chapter stated and discussed the research methodologies and research strategies of this study. The data collection methods and data analysis strategies were also revealed and explained.

This following chapter will analyse and report on the findings of the research. The chapter will cover the testing of the research hypotheses and will show which of them are supported and which are not supported by the research.

Chapter 4 Research Findings

4.1 Introduction

The previous chapter discussed the research methods and strategies that have been employed in this study. An account of where, how and from whom the data was collected and how it was to be analysed was described in detail.

This chapter will report on the findings obtained from the data analysis. The data screening process will be described, indicating how missing values were treated, and how tests for outliers carried out. Following this, the respondents' profile will be described, showing characteristics such as the gender, age, computer literacy and level of education. The validity and reliability of the variables will then be examined through the use of Principle Components Factor Analysis with a varimax rotation and the use of Cronbach's Alpha respectively. Finally, this chapter will employ correlation and regression analysis to test the hypothesized research model and will show which hypotheses are supported by the data.

4.2 Data Screening

A total of 142 questionnaires were received representing an 18.9% response rate. 23 questionnaires were then removed from the study for the following reasons:

1) Two responses were removed because large portions of the questionnaire were not completed and thus more than 10% of the data values for these respondents were missing.
2) 2 returned questionnaires were identified as duplicate submissions and were therefore discarded. The two responses clearly had an identical handwriting and had identical responses for majority of the questions.
3) 17 returned questionnaire had visible "straight-line" response patterns and were therefore removed from the study to avoid distorting the results. A straight-line response pattern occurs when a respondent gives the same response across every item in the questionnaire instrument, for example marking "strongly agree" for every single item (Herzog and Bachman 1981).
4) Service Quality 3, Impact 1, Satisfaction 3 and Continuance Intention 3 were reverse scored so as to maintain consistency with other scale items.

5) None of the remaining cases were missing responses on more than 5% of the items, and no items were missing data from more than 5% of the responses. Therefore no additional cases or items had to be excluded from the study as a result of missing data. The few missing responses (see appendix P) were thus replaced with the series mean.
6) Finally, a test for univariate outliers was carried out. This involved calculating the standardized scores for the scale items. Two responses with standardized scores greater than ±3 for a significant number of items were removed from the study.

This resulted in 119 responses for subsequent analysis. The profile of these 119 responses is presented next.

4.3 Respondent Profile

Given that the nursing profession is a female dominated profession (Moody *et al.* 2004), it is not surprising to observe that the 92.4% of the valid respondents were female. All age groups were well represented with the exception of those above 55 who only made up 5.9% of responses. The age group 35 – 44 had the largest number of respondents making up 31.9% of responses.

The respondents were fairly educated with most holding certificates or diplomas. Most respondents were registered nurses (44.5%). This group was significantly larger than other types of nurses who responded. 5 out of a possible 8 nursing managers participated in the study.

Respondents were asked to indicate the frequency with which they use the Clinicom PIS as well as the length of time since they first used the Clinicom PIS. This allowed respondents to be classified as users or non-users of the EMR system. Seventy nine (79) or 66.4% of the respondents were classified as users. Non-users were excluded from the sample group for the purposes of hypothesis testing as these tests were focused on perceptions of users. However, users and non-users were compared on responses to the job satisfaction questions, as well as perceptions of system impacts. .

The respondent profile is summarised in Table 4-1 below.

Table 4-1: Sample Profile (n=119)

	No. of Respondents	%
Gender		
Male	4	3.4
Female	110	92.4
Missing	5	4.2
Total	119	100.0
Education		
Certificate	24	20.2
Diploma	56	47.1
Bachelor's Degree	18	15.1
Masters	3	2.5
Other	7	5.9
Missing	11	9.2
Total	119	100.0
Use		
Non-Users	30	25.2
Users	89	74.8
Total	119	100.0
Nurse Type		
Nursing Manager	5	4.2
Registered Nurse	53	44.5
Staff Nurse	13	10.9
Nursing Assistant	24	20.2
Student Nurse	16	13.4
Other	5	4.2
Missing	3	2.5
Total	119	100.0
Age		
< 25	15	12.6
25 -34	29	24.4
35 -44	38	31.9
45 -54	27	22.7
55 >	7	5.9
Missing	3	2.5
Total	119	100.0

The descriptive statistics on the perceptions of healthcare workers along the EMR impacts (see Table 4-2) show that there is good variance with a number of respondents having positive perceptions whilst others having more neutral and negative responses.

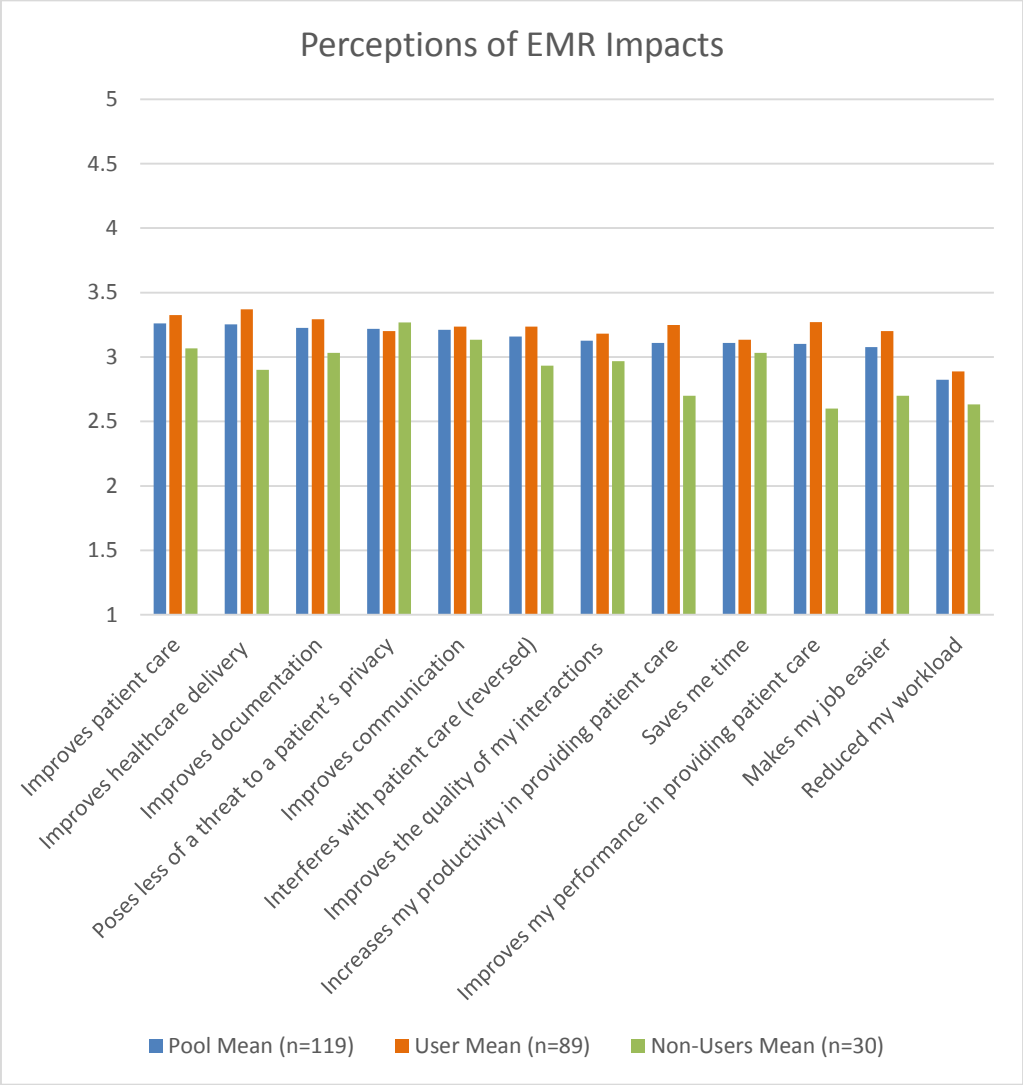
Understanding the causes and consequences of this variation in perceptions of EMR impacts is what this study has, in part, aimed to address. Subsequent sections will examine these through test of the study's hypotheses.

Table 4-2: Perceptions of EMR Impacts on Individuals and Healthcare Delivery (n = 119)

Perception	Mean	Agree	Neutral	Disagree	Std. Deviation
The use of the Clinicom PIS has led to improved patient care	3.261	38.7%	43.7%	17.6%	.9248
The use of the Clinicom PIS has resulted in the improvement of healthcare delivery	3.252	36.2%	48.7%	15.1%	.8256
The use of the Clinicom PIS has helped to improve documentation of patient records	3.227	41.2%	37%	21.8%	.9427
The use of the Clinicom PIS poses less of a threat to a patient's privacy than paper records	3.218	39.5%	37.8%	22.7%	1.0428
The use of Clinicom PIS has improved communication between healthcare workers in Tygerberg Hospital	3.210	39.5%	37.8%	22.7%	.9818
The use of the Clinicom PIS interferes with patient care **(reversed)**	3.160	39.5%	37.8%	22.7%	.9913
The quality of my interactions with other healthcare workers has been improved as a result of using the Clinicom PIS	3.126	29.4%	51.3%	19.3%	.8392
The Clinicom PIS saves me time	3.109	32%	44.5%	23.5%	.9369
Using the Clinicom PIS increases my productivity in providing patient care	3.109	33.7%	40.3%	26%	.9724
Using the Clinicom PIS improves my performance in providing patient care	3.101	32%	43.7%	24.3%	.9424
The Clinicom PIS makes my job easier	3.076	24.3%	53.8%	21.9%	.8453
The use of the Clinicom PIS has reduced my workload	2.824	20.2%	42.8%	37%	.8796

Based on the means of the impact items, this study found that respondents were most positive about EMR impacts on patient care, healthcare delivery and documentation and perceived EMR impact on workload to be the lowest area of impact. The results also showed that users of EMRs generally perceived the impacts of EMRs more positively than non-users, with the exception of impacts on patient privacy in which non-users were more positive than users. These results are shown in Table 4-3 and are depicted graphically in Figure 4-1.

Figure 4-1: Users vs. Non-Users



An independent sample t-test was then conducted to analyse the significance of these differences in the perceptions of users versus those of non-users. Five significant differences were found, where users had higher perceptions of

1. EMRs making the respondents job easier
2. EMRs improving healthcare delivery
3. Job satisfaction 1
4. Job satisfaction 2
5. Job satisfaction 3

Table 4-3: Means of Perceptions of Impacts (Users vs. Non Users)

Area of Impact	Pool Mean (n=119)	User Mean (n=89)	Non-Users Mean (n=30)	Std. Deviation
The use of the Clinicom PIS interferes with patient care **(reversed)**	3.160	3.236	2.933	.9913
The use of the Clinicom PIS has helped to improve documentation of patient records	3.227	3.292	3.033	.9427
The use of the Clinicom PIS poses less of a threat to a patient's privacy than paper records	3.218	3.202	3.267	1.0428
The quality of my interactions with other healthcare workers has been improved as a result of using the Clinicom PIS	3.126	3.180	2.967	.8392
The use of Clinicom PIS has improved communication between healthcare workers in Tygerberg Hospital	3.210	3.236	3.133	.9818
The use of the Clinicom PIS has reduced my workload	2.824	2.888	2.633	.8796
The Clinicom PIS saves me time	3.109	3.135	3.033	.9369
The Clinicom PIS makes my job easier	3.076	3.202	2.700	.8453
The use of the Clinicom PIS has resulted in the improvement of healthcare delivery	3.252	3.371	2.900	.8256
The use of the Clinicom PIS has led to improved patient care	3.261	3.326	3.067	.9248
Using the Clinicom PIS improves my performance in providing patient care	3.101	3.270	2.600	.9424
Using the Clinicom PIS increases my productivity in providing patient care	3.109	3.247	2.700	.9724

Detailed results are show in appendix O.

4.4 Validity and Reliability of Measures

4.4.1 Validity Testing

Principal components analysis (PCA) with varimax rotation was selected as the method for testing the convergent and discriminant validity of the variable measures. Because the number of responses was not sufficient for an analysis of all 46 likert scale items measuring all 10 variables together, two PCA analyses were conducted. The first PCA focused on the system quality, information quality, service quality, use and continuance intention variables which are the use related variables. The second

PCA focused on the satisfaction, confirmation of expectation, individual impact, healthcare impact and job satisfaction variables.

21 items either failed to meet the minimum criteria of having a primary factor loading of at least 0.6 or they cross loaded highly on more than one factor. These items were therefore excluded from the study. They are shown in Table 4-4 below that follows.

Table 4-4: Dropped Items

Item	Measure	Reason for elimination
System Quality 1	The Clinicom Patient Information System (PIS) is easy to use	Cross loaded with information quality items
System Quality 2	The Clinicom PIS is user friendly	Cross loaded with information quality items
System Quality 3	The Clinicom PIS is difficult to access	Loading on unlikely factor
Information Quality 1	The Clinicom PIS provides the precise information I need	Highly correlated with system quality items
Information Quality 2	The information content provided in the Clinicom PIS meets my needs	Highly correlated with system quality items
Information Quality 3	The Clinicom PIS provides sufficient information about patients	Highly correlated with system quality items
Information Quality 4	The Clinicom PIS provides reliable information on patients	Highly correlated with system quality items
Information Quality 5	I am satisfied with the accuracy of the Clinicom PIS	Highly correlated with system quality items
Information Quality 9	The Clinicom PIS gives me the information I need in time	Cross loaded with systems quality factor
Impact 1	The use of the Clinicom PIS interferes with patient care	Loaded separately from other impact items
Impact 2	The use of the Clinicom PIS has helped to improve documentation of patient records	Loaded separately from other impact items
Impact 3	The use of the Clinicom PIS poses less of a threat to a patient's privacy than paper records	Loaded separately from other impact items
Impact 4	The quality of my interactions with other healthcare workers has been improved as a result of using the Clinicom PIS	Cross loaded with job satisfaction items
Impact 5	The use of Clinicom PIS has improved communication between healthcare workers in Tygerberg Hospital	Cross loaded with job satisfaction items
Impact 8	The Clinicom PIS makes my job easier	Cross loaded with multiple factors
Impact 9	The use of the Clinicom PIS has resulted in the improvement of healthcare delivery	Cross loaded with an unlikely factor
Satisfaction 3	I am very frustrated with the Clinicom PIS	Loaded separately
Confirmation 2	The benefits of the Clinicom PIS are better than what I expected	Cross loaded with healthcare impact items
Confirmation 3	Overall, most of my expectations from using the Clinicom PIS were confirmed	Cross loaded with satisfaction items

Continuance Intention 2	I would prefer to continue using the Clinicom PIS than use any alternative means (e.g. paper based records)	Cross loaded with an unlikely factor
Continuance Intention 3	If I could, I would like to discontinue my use of the Clinicom PIS	Loaded separately
Job Satisfaction 1	I am satisfied with my current situation at work	Cross loaded with an unlikely factor
Job Satisfaction 2	I am satisfied with the degree of support I receive in my job	Cross loaded with an unlikely factor

A stable 13-item solution was achieved in the first PCA and a stable 10 item solution for the second. The continuance intention and confirmation of expectation constructs could only be measured with one item. Results related to these constructs should therefore be interpreted with caution. The results of the PCA are presented in the Table 4-5 and Table 4-6 below with item loadings on respective constructs in bold.

Table 4-5: Factor Analysis - Use Items

	Factor				
	ServQ	Use	SQ	IQ	CI
SQ4	.087	.158	**.838**	.200	-.104
SQ5	.188	-.030	**.892**	.062	.031
SQ6	.203	-.008	**.765**	.306	.095
IQ6	.134	.201	.270	**.731**	-.043
IQ7	.010	.028	.037	**.915**	-.012
IQ8	.199	.126	.311	**.706**	.154
ServQ1	**.743**	.332	.201	.274	-.039
ServQ2	**.881**	.190	.129	.105	.177
ServQ3	**.908**	.078	.191	.018	.093
Use1	.162	**.884**	.051	.193	-.076
Use2	.114	**.888**	-.044	.031	.248
Use3	.274	**.732**	.149	.117	.321
CI1	.161	.273	-.010	.036	**.909**

Table 4-6: Factor Analysis - Impact Items

	Factor				
	HC Imp	Satisf	Indiv Imp	JS	CoE
Impact6	.241	.244	**.848**	-.084	-.042
Impact7	.228	.181	**.830**	.184	.189
Satisf1	.274	**.885**	.199	-.014	.149
Satisf2	.330	**.806**	.282	.115	.158
Impact10	**.810**	.290	.128	.162	.124
Impact11	**.878**	.233	.255	.125	.110
Impact12	**.873**	.189	.241	.134	.139
JS3	.247	-.025	.148	**.800**	.180
JS4	.056	.089	-.050	**.911**	.000
CoE1	.209	.219	.091	.138	**.929**

4.4.2 Reliability testing

Reliability testing showed acceptable levels of internal consistency for all scales, with the lowest Cronbach's alpha score being .705 (see Table 4.6). Following the reliability and validity testing, composite scores were then created for each of the eight remaining variables. The composite scores are used in the hypothesis testing that is to follow.

Table 4-7: Descriptive Statistics

Variable	No of items	Mean	Std Dev	Cronbach's alpha	Skewness	Kurtosis
SQ	3	3.2959	.79366	.835	-.127	-.480
IQ	3	3.6067	.65049	.770	-.023	-.630
ServQ	3	3.1157	.84997	.879	-.256	-.356
Use	3	3.2921	.74843	.861	-.680	1.159
Satisf	2	3.2921	.80414	.886	-.063	.107
CoE	1	3.4944	.64179		-.638	-.220
Indiv Imp	2	3.0112	.87574	.776	.225	-.132
HC Imp	3	3.2809	.89315	.922	-.049	-.308
JS	2	3.2022	1.08376	.705	-.093	-.435
CI	1	3.2472	1.15090		-.502	-.443

4.5 Hypothesis Testing

4.5.1 Pearson's Correlation

A Pearson's correlation test was conducted to test the bivariate correlations between the variables. As shown in Table 4-8, statistically significant correlations were found between the following variables:

- Information quality and use ($r = 0.311$, $p<0.01$)
- Service quality and use ($r = 0.438$, $p<0.001$)
- System quality and user satisfaction ($r = 0.501$, $p<0.001$)
- Information quality and user satisfaction ($r = 0.410$, $p<0.001$)
- Service quality and user satisfaction ($r = 0.734$, $p<0.001$)
- User satisfaction and use ($r = 0.533$, $p<0.001$)
- Confirmation of expectation and user satisfaction ($r = 0.433$, $p<0.001$)
- Confirmation of expectation and individual impact ($r = 0.283$, $p<0.01$)
- Confirmation of expectation and healthcare impact ($r = 0.416$, $p<0.001$)

- Use and continuance intention (r = 0. 443, p<0.001)
- Use and individual impact (r = 0. 449, p<0.001)
- Use and healthcare impact (r = 0. 471, p<0.001)
- User satisfaction and individual impact (r = 0. 536, p<0.001)
- User satisfaction and healthcare impact (r = 0. 602, p<0.001)
- Individual impact and continuance intention (r = 0.459, p<0.001)
- Healthcare impact and continuance intention (r = 0.226, p<0.05)
- Healthcare impact and job satisfaction (r = 0.336, p<0.001)

These findings provide support for hypothesis 1a and 1c and hypotheses 2 to 9. No significant correlation was found between system quality and use resulting in hypothesis 1b not being supported. Hypothesis 10 could only be partially supported as no significant relationship was found between individual impact and job satisfaction.

While no significant correlation was found between use and job satisfaction, the independent-samples t-test showed that users had higher means on all the job satisfaction items than non-users and these differences were significant for three of the four job satisfaction items. Hypothesis 11 was therefore partially supported.

The results of the Pearson's correlation are presented in the table below.

Table 4-8: Correlation Matrix

	SQ	IQ	ServQ	Use	Satisf	CoE	Indiv Imp	HC Imp	JS	CI
SQ	1									
IQ	.468**	1								
ServQ	.396**	.346**	1							
Use	.159	.311**	.438**	1						
Satisf	.501**	.410**	.734**	.533**	1					
CoE	.394**	.235*	.317**	.587**	.433**	1				
Indiv Imp	.330**	.347**	.550**	.449**	.536**	.283**	1			
HC Imp	.535**	.438**	.500**	.471**	.602**	.416**	.529**	1		
JS	.447**	.192	.071	.188	.169	.279**	.168	.336**	1	
CI	.052	.126	.307**	.443**	.455**	.048	.459**	.226*	.028	1

4.5.2 Multiple Regression

Hierarchical regressions were conducted to further understand the inter-relationships amongst the variables and the relative effects of certain factors on dependent variables identified in the model. Each hierarchical regression was conducted using two steps. The first step involved regressing the dependent variable on the control variables age, nurse type, education and computer experience. Given that the male population was not sufficiently represented in the sample, the gender control was dropped from the study. The second step involved regressing the dependent variable on the control variables and the independent variables. Those variables shown above not to be significantly correlated with a respective dependent variable were not included in the regression equations. The results are discussed next.

A multiple regression (MR) analysis was conducted to test the effects of information quality and service quality and user satisfaction on use with age, nurse type, education and computer experience as control variables. The results showed that the effect of the control variables was not significant. The model accounted for 41.3% of the variance in use of EMRs ($R^2 = 0.413$, $p<0.001$). It was found that use is most influenced by user satisfaction ($\beta = 0.444$, $p<0.01$). In the presence of user satisfaction, information quality and service quality had a non-significant effect on EMR use. (Refer to appendix G)

A second MR was conducted to test the effects of information quality, system quality, and service quality on user satisfaction with age, nurse type, education and computer experience as control variables. The results showed that the effect of the control variables was significant ($R^2 = 0.150$, $p<0.05$) with nurse type and education having the most significant impact ($P<.1$). The model accounted for 67.2% of the variance in user satisfaction with EMRs ($R^2 = 0.672$, $p<0.001$). It was found that satisfaction is most influenced by service quality ($\beta = 0.544$, $p<0.001$) followed by system quality ($\beta = 0.247$, $p<0.01$) and finally information quality ($\beta = 0.145$, $p<0.1$). (Refer to appendix H)

A third MR was conducted to test the effects of satisfaction, individual impact and healthcare impact on continuance intention with age, nurse type, education and computer experience as control variables. The results showed that the effect of the control variables was significant ($R^2 = 0.185$, $p<0.01$) with nurse type and computer

experience having the most significant impact ($p<0.05$) followed by education ($p<0.1$). The model accounted for 35.3% of the variance in continuance intention ($R^2 = 0.353$, $p<0.001$). It was found that continuance intention is most influenced by satisfaction ($\beta = 0.342$, $p<0.05$) followed by individual impact ($\beta = 0.269$, $p<0.05$). In the presence of satisfaction and individual impact, healthcare impact had a non-significant effect on continuance intention. (Refer to appendix I)

A fourth MR was conducted to test the effects of use and satisfaction on individual impacts with age, nurse type, education and computer experience as control variables. The results showed that the effect of the control variables was significant ($R^2 = 0.125$, $p<0.05$) with age and education having the most significant impact ($p<0.05$). The model accounted for 38.5% of the variance in individual impact ($R^2 = 0.385$, $p<0.001$). It was found that individual impacts is most influenced by satisfaction ($\beta = .419$, $p<.001$). In the presence of satisfaction, use had a non-significant effect on individual impacts. (Refer to appendix J)

A fifth MR was conducted to test the effects of use and satisfaction on perceived healthcare impacts with age, nurse type, education and computer experience as control variables. The results showed that the effect of the control variables was insignificant. The model accounted for 43.6% of the variance in healthcare impact ($R^2 = 0.436$, $p<0.001$). It was found that perceived healthcare impact is most influenced by satisfaction ($\beta = 0.552$, $p<0.001$) followed by use ($\beta = 0.198$, $p<0.1$). (Refer to appendix K)

A sixth MR was conducted to test the effects of information quality, system quality, service quality and confirmation of expectation on user satisfaction with age, nurse type, education and computer experience as control variables. The results showed that the effect of the control variables was significant ($R^2 = 0.150$, $p<0.05$) with nurse type and education having the most significant impact ($p<0.1$). The model accounted for 69.1% of the variance in user satisfaction with EMRs ($R^2 = 0.691$, $p<0.001$). It was found that satisfaction is most influenced by service quality ($\beta = 0.526$, $p<0.001$) followed by system quality ($\beta = 0.187$, $p<0.05$) and finally confirmation of expectation ($\beta = 0.164$, $p<0.05$). Information quality had a non-significant effect on satisfaction in the presence of system quality, service quality and confirmation of expectation. (Refer to appendix L)

A seventh MR was conducted to test the effects of use, satisfaction and confirmation of expectation on healthcare impacts with age, nurse type, education and computer experience as control variables. The results showed that the effect of the control variables was insignificant. The model accounted for 40.2% of the variance in healthcare impacts (R^2 = 0.402, $p<0.001$). It was found that perceptions of healthcare impacts are most influenced by user satisfaction (β = 0.523, $p<0.001$). In the presence of satisfaction, use and confirmation of expectation had a non-significant relationship with perceptions of healthcare impacts. (Refer to appendix M)

An eighth MR was conducted to test the effects of use, satisfaction and confirmation of expectation on individual impacts with age, nurse type, education and computer experience as control variables. The results showed that the effect of the control variables was significant (R^2 = 0.125, $p<0.05$) with age and education having the most significant impact ($p<0.05$). The model accounted for 38.8% of the variance in individual impact (R^2 = 0.388, $p<0.001$). It was found that individual impact is most influenced by satisfaction (β = 0.409, $p<0.01$). In the presence of satisfaction, use and confirmation of expectation had a non-significant relationship with individual impacts. (Refer to appendix N)

Table 4-9: Summary of findings

	Hypothesis	**Result**
H1a	A positive relationship exists between the "information quality" of EMRs and the "use" of EMRs.	Supported
H1b	A positive relationship exists between the "system quality" of EMRs and the "use" of EMRs.	Not Supported
H1c	A positive relationship exists between the "service quality" of EMRs and the "use" of EMRs.	Supported
H2a	A positive relationship exists between the "information quality" of EMRs and "user satisfaction" with EMRs use.	Supported
H2b	A positive relationship exists between the "system quality" of EMRs and "user satisfaction" with EMRs use.	Supported
H2c	A positive relationship exists between the "service quality" of EMRs and "user satisfaction" with EMRs use.	Supported
H3	A positive relationship exists between the "user satisfaction" and the "use" of EMRs.	Supported
H4	A positive relationship exists between the "confirmation of expectations" of	Supported

	EMRs and "user satisfaction" with EMR use.	
H5	A positive relationship exists between the "confirmation of expectations" of EMRs and the "perceived impacts" (individual impact and healthcare impact) of EMRs on healthcare delivery.	Supported
H6	A positive relationship exists between the "use" of EMRs and the "perceived impacts" (individual impact and healthcare impact).	Supported
H7	A positive relationship exists between the "user satisfaction" and "perceived impacts" (individual impact and healthcare impact).	Supported
H8	A positive relationship exists between "perceived impacts" (individual impact and healthcare impact) and "continuance intention".	Supported
H9	A positive relationship exists between the "user satisfaction" and "continuance intention".	Supported
H10	A positive relationship exists between "perceived impacts" (individual impact and healthcare impact) and "job satisfaction".	Partially Supported
H11	A positive relationship exists between the use of EMRs and "job satisfaction".	Partially Supported

Appendix Q includes tests of assumptions for each of the eight multiple regressions. There does not appear to be any major violations of assumptions, collinearity statistics are acceptable, and residuals appear to vary randomly around zero.

4.6 Conclusion

This chapter analysed the research findings of the current study. The validity and reliability of the data was shown and the results of the hypothesis testing through Pearson's correlation and multiple regression were presented.

The following chapter will discuss the results of the research and the hypotheses in detail, explaining the possible meaning of the findings and each of the research hypotheses.

Chapter 5 Discussion of Findings

5.1 Introduction

The previous chapter presented the findings of this research. This chapter will discuss these findings and show how they relate to the literature from which the hypotheses of this study were derived.

The primary aims and objectives of this study are to

1) test the potential effects of system quality, information quality, service quality and user satisfaction on the use of EMRs through the use of the Pearson's correlation test and multiple regression analysis
2) review and examine the perceptions of healthcare workers regarding the impacts of EMR use on healthcare delivery and other workplace outcomes such as documentation, workload, communication and patient care through the use of descriptive statistics
3) examine healthcare workers' intention to continue using EMRs as well as job satisfaction as a result of EMRs use through the Pearson's correlation test and multiple regression analysis.

To effectively study the relationships consequent from the above mentioned aims and objectives this study conceptualised and tested a proposed research model. The proposed model was an integration of the DeLone and McLean (2003) Information Systems Success model (D&M IS Success Model) and Bhattacherjee's (2001) Information Systems Continuance (ISC) model. The integrated model incorporated the different concepts essential to achieving this study's aims and objectives mentioned above in one model. The results are discussed below.

5.2 Hypothesis Discussions

The proposed model drew on the D&M IS Success Model to conceptualise the factors that affect healthcare workers' use and satisfaction with EMRs. These two intermediary outcomes were hypothesised to be positively influenced by system quality, information quality and service quality and also hypothesised to positively

influence each other. These hypotheses which are discussed next enabled this study to answer research question 1 below:

What are the relative effects of the factors "System Quality", "Information Quality" and "Service Quality" as well as the "Confirmation of Expectation" and "Satisfaction", on healthcare workers' use of EMRs?

5.2.1 Use

The use variable was measured by asking respondents if compared to when they first started using the EMR system, they were now using more of its features, using it more often or if they now used it for more of their work tasks. This helped us understand if users had increased their usage of the EMR system. As per the D&M IS Success Model, it was hypothesised that use was influenced by the factors, information quality, system quality and service quality as well as user satisfaction.

Hypothesis 1a: A positive relationship exists between the "information quality" of EMRs and the "use" of EMRs.

The findings of this study support this hypothesis. A positive relationship was found between information quality and use of the EMR system by nurses. This suggests that the better the quality of information produced by an EMR system, the more likely it is to be used. Information is very important to the decisions taken in the provision of healthcare. Quality information allows healthcare workers to make better decisions. According to the D&M IS Success Model, the more a user associates quality information with a system, the more they are likely to refer to that system in order to obtain the quality information they need so to assist them in performing their duties. Information quality was measured in terms of its precision, sufficiency, reliability, accuracy, clearness, timeliness and relevancy (Petter *et al.* 2008). This finding is consistent with the findings of Garcia-Smith *et al.* (2013) who found the same relationship to exist between information quality and use in their study on Clinical Information Systems (CIS) success.

Hypothesis 1b: A positive relationship exists between the "system quality" of EMRs and the "use" of EMRs.

According to the D&M IS Success Model, the extent to which an individual finds a system to be of a high quality standard will determine the extent of their use of the system. System quality was measured in terms of ease of use, accessibility, reliability and performance (Iivari 2005; Petter *et al.* 2008). It was expected that the more users perceive the quality of a system to be high the more likely it is that users will increase their use (DeLone and McLean 1992). However no relationship was found between system quality and use. This hypothesis was therefore rejected by this study. This finding suggests that the quality of a system has no effect on whether users will use it more. The finding is consistent with the findings of Garcia-Smith *et al.* (2013) in their study of CISs and Wang and Liao (2008) in their study of eGovernment systems. These studies similarly found that system quality did not significantly influence use. A possible reason for this is that in this day in age most individuals are computer literate and are therefore confident in their ability to use a computer and therefore system quality does not deter them from using the system (Wang and Liao 2008).

Hypothesis 1c: A positive relationship exists between the "service quality" of EMRs and the "use" of EMRs.

The D&M IS Success Model proposes that an individual's perception of the service provided for a system will determine their use of the system. In the context where research is targeted at employees within an organisation, service quality is generally conceptualised as the level of support available for the system in question (Xu, Benbasat and Cenfetelli 2013). Service quality was measured in terms the sufficiency, availability and promptness of the support services that are provided for the EMR system (Kositanurit, Ngwenyama and Osei-Bryson 2006; Petter *et al.* 2008; Chen and Cheng 2009). Service quality was found to have a significant positive relationship with the use of EMRs. This finding is consistent with the findings of Chen and Cheng (2009) who found the same relationship to exist between service quality and the intention to use online websites. This suggests that users value the quality of the support that comes with a system and it is a predictor of the extent to which they will use the system. Sufficient and prompt support should therefore be available to users to assist them when they encounter difficulties with the system.

5.2.2 Satisfaction

The next intermediary outcome that this study aimed to examine was user satisfaction. This is defined as a feeling that is inspired by a cognitive evaluation of one's expectation from an item or thing and the performance of that item (Bhattacherjee, 2001). The D&M IS Success model proposes that user satisfaction is predicted by the system quality, information quality, service quality as well as the use of a system.

Hypothesis 2a: A positive relationship exists between the "information quality" of EMRs and the "user satisfaction" with EMR use.

This hypothesis is supported by this study as a positive relationship was found between information quality and satisfaction. This suggests an important association between information quality and satisfaction (DeLone and McLean 1992) in the EMR context. According to Bhattacherjee (2001), satisfaction is experienced when a user's expectation is met or exceeded. When a user of an EMR queries information from the system, expectations with regards to the quality of the information that will be produced by the system are created. The higher the quality of this information the more likely it is to meet or exceed the user's expectations, leading to satisfaction. This finding suggests that when a user of an EMR system is able to obtain precise, sufficient, reliable, accurate, clear, timely, relevant information from the system (Doll and Torkzadeh 1988), the level of the user's satisfaction with that system is enhanced. Information quality was however the least significant predictor of satisfaction. This suggests that information quality may only marginally influence satisfaction when system quality and service quality are lower than expected.

Hypothesis 2b: A positive relationship exists between the "system quality" of EMRs and the "user satisfaction" with EMRs use.

A positive relationship was found between system quality and satisfaction. Therefore the extent to which the quality of an EMR system meets or exceeds a user's expectations for quality the higher will be their satisfaction (DeLone and McLean 1992). Moreover, system quality retained its significance in the presence of information quality and service quality, thus suggesting its importance as a system characteristic.

Hypothesis 2c: A positive relationship exists between the "service quality" of EMRs and the "user satisfaction" with EMRs use.

A strong positive relationship was found between service quality and satisfaction. This finding suggests that the quality of service and support that comes with an EMR greatly influences the extent to which its users form a positive satisfaction response.

The above three hypotheses are consistent with the findings of Garcia-Smith *et al.* (2013), Chen and Cheng (2009) and Wang and Liao (2008) who found the same relationships to exist between the above mentioned variables. However, Wang and Liao (2008) found information quality to have stronger effect on satisfaction while this study found its effect to be less significant in the presence of system quality and service quality. Service quality was found to have the most significant impact on user satisfaction. This finding suggests that a user's satisfaction response is more reliant on attributes of system quality and service quality and without these a user is less likely to form a positive satisfaction response. Information quality alone is thus not sufficient by itself to create satisfaction if these other attributes are absent. Having information quality at the expense of system or service quality will not result in a satisfaction outcome. This finding is not consistent with other studies that have analysed the relationships between satisfaction and systems quality, information quality and service quality (Halawi, McCarthy and Aronson 2007; Wang and Liao 2008; Chen and Cheng 2009). Thus the relative importance of system versus information quality in explanations of EMR use and satisfaction deserves continued exploration in future studies.

Hypothesis 3: A positive relationship exists between the "user satisfaction" and the "use" of EMRs.

A positive relationship was found between user satisfaction and use. This finding suggests that the more a user is satisfied with a system the more likely they are to use it. This finding is consistent with the findings of Iivari (2005), Wu and Wang 2006) and Chen and Cheng (2009). Satisfaction was found to be the most significant determinant of use. Taken together with the above discussion related to hypothesis 1a – 1c, and the regression results reported previously, it appears that satisfaction can also be understood to fully mediate the relationships between the system characteristics (system quality, information quality, service quality) and use. This is

because satisfaction influences use, system characteristics influence satisfaction, but do not have a significant influence on use in the presence on satisfaction.

Hypothesis 4: A positive relationship exists between the "confirmation of expectations" of EMRs and "user satisfaction" with EMR use.

A positive relationship was found between confirmation of expectations and satisfaction thereby supporting the above hypothesis. This finding suggests that the more an EMR system meets the expectations of a user the more the user forms a positive satisfaction response to the system (Bhattacherjee 2001). This finding supports that of Mettler (2012) who finds the same relationship to exist between confirmation of expectation and satisfaction.

5.2.3 EMR outcomes

EMR outcomes, which were conceptualised according to the D&M IS Success model and the ISC model to be perceived individual impacts, perceived healthcare impacts and continuance intention. Furthermore, this study conceptualised job satisfaction to be an EMR outcome. These outcomes are inter-related in the following manner. Perceived individual impacts and perceived healthcare impacts together form the perceived impacts of the EMR system which are conceptualised to influence continuance intention and job satisfaction.

5.2.3.1 Perceived Impacts

This study recognised two areas of perceived impacts, being individual impacts and healthcare impacts. Individual impacts were measured in terms of the effects of EMRs on workload, saving time, job ease and interactions with other healthcare workers (Moody *et al.* 2004). Healthcare impacts were measured in terms of the effects of EMRs on documentation, patient's privacy, communication, healthcare delivery and patient care. The hypotheses which are discussed next enabled this study to answer research question 2 below:

What are the perceptions of healthcare workers regarding the impacts of EMR use on healthcare delivery and other workplace outcomes (i.e. individual work performance and job satisfaction)?

The findings show that users of EMRs were more positive about the healthcare impacts of EMRs than they are of the individual impacts. This suggests that while healthcare workers perceive EMRs as having a positive impact on the patient care, documentation, communication, patient's privacy and healthcare delivery, they however are not as positive about their ability to reduce their workload, save them time and make their job easier. This confirms earlier findings that healthcare workers often have concerns about the impacts of EMRs on their workloads and its ability to improve their personal productivity (de Veer and Francke, 2010).

Hypothesis 5: A positive relationship exists between the "confirmation of expectations" of EMRs and the "perceived impacts" (individual impact and healthcare impact) of EMRs on healthcare delivery.

The findings show that a positive relationship exists between confirmation of expectations and the perceived impacts (conceptualised in this study to be the same as perceived usefulness) of EMRs on healthcare delivery. This finding implies that the more an EMR system meets the expectations of a user the more they perceive it as having an impact on healthcare delivery (Bhattacherjee 2001).

Hypothesis 6: A positive relationship exists between the "use" of EMRs and the "perceived impacts" (individual impact and healthcare impact).

Positive relationships where found between use and individual impacts as well as between use and healthcare impacts. This hypothesis is therefore supported by this study. The increased use of a system is likely to result in the user forming a positive perception of the impacts of EMRs on their individual capacity as well as on overall healthcare (DeLone and McLean 2003). This finding is consistent with that of Wang and Liao (2008) who found the same relationship to exist between use and net benefits (impacts).

Hypothesis 7: A positive relationship exists between the "user satisfaction" and "perceived impacts" (individual impact and healthcare impact).

Strong significant relationships were found between satisfaction and the two areas of perceived impacts recognised by this study. The above hypothesis is therefore supported by this study. The more a user is satisfied with their use encounter with an EMR system, the more they perceive EMRs to positively impact healthcare delivery

(DeLone and McLean 2003). However, when continuance intention was regressed on satisfaction, individual impacts and healthcare impacts, the effects of healthcare impacts were insignificant. Thus the hypothesis that perceptions of healthcare impacts are important to continuance intentions is a less preferred explanation for usage behaviours. It cannot be ruled out that perceptions of impacts exert influences on satisfaction (as per the Bhattacherjee ISC model). In other words, when users perceive the impacts of EMRs, they form a satisfaction response. Wu and Wang (2006) for example hypothesised and found that net benefits influence satisfaction. This alternative set of relationships should be considered in future work.

5.2.3.2 Job Satisfaction

Job satisfaction refers to an affective state which employees experience as a result of their interactions, characteristics, values and expectations in the environment and the organisation within which they work (Mueller and McCloskey 1990; Happell, Martin and Pinikahana 2003). Job satisfaction was hypothesised in this study to be affected by perceived impacts and use.

Hypothesis 10: A positive relationship exists between "perceived impacts" (individual impact and healthcare impact) and "job satisfaction".

A positive relationship was found between perceived healthcare impact and job satisfaction. However, no significant correlation was found between individual impacts and job satisfaction thus leading to hypothesis 10 only being partially supported by this study. This finding is partially consistent with the findings of Karsh et al. (2004) who found no relationship to exist between EMR usage and the working conditions and quality of work life, which included similar concepts to job satisfaction.

Hypothesis 11: A positive relationship exists between the use of EMRs and "job satisfaction".

While no significant relationship was found between use (measured as increasing levels of use) and job satisfaction, t-test results show that users of EMRs are more satisfied with their jobs than non-users. These findings suggest that an increase in the use of EMRs does not lead to more job satisfaction but rather it was usage at any level that impacts job satisfaction positively. Therefore use and not the increasing levels of use is important to job satisfaction, thus partially confirming hypothesis 11 above.

5.2.3.3 Continuance Intention

Continuance intention was defined as the extent to which a user of a system anticipates that they will continue using it on an on-going basis (Bhattacherjee 2001). This study conceptualised continuance intention as being determined by user satisfaction, individual impacts and healthcare impacts. The hypotheses which are discussed next enabled this study to answer research question 3 below.

To what extent do the healthcare delivery impacts of an EMR affect the extent to which users of the system intend to continue using it?

Hypothesis 8: A positive relationship exists between "perceived impacts" (individual impact and healthcare impact) and "continuance intention".

Positive relationships were found between the two areas of impacts recognised by this study and continuance intention. This result suggest that the extent to which users of an EMR perceive it as having an individual level impact and an impact on healthcare delivery has an impact on their intention to use it again in the future. This finding is consistent with the findings of Bhattacherjee (2001) who found that perceived usefulness had an impact on continuance intention.

Hypothesis 9: A positive relationship exists between the "user satisfaction" and "continuance intention".

A positive relationship was found between user satisfaction and continuance intention. This finding suggests that the more a user is satisfied with their use encounter with an EMR system the more likely they are to use it again in the future. This finding supports that of Mettler (2012) who finds the same relationship between satisfaction and continuance intention.

5.3 Conclusion

This study proposed the integration of the D&M IS Success model with the ISC model. This was successfully achieved. The results show that the two models represent complementary theories and together provide us with a better explanation for the factors surrounding the use of EMRs as well as the outcomes of EMRs. Eight out of the eleven hypotheses were supported and two were partially supported. Only one hypothesis could not be supported.

This chapter discussed the findings of this study in relation to each hypothesis and research question. The findings were also compared to prior literature.

The following chapter summarises this study and discusses its limitations while suggesting areas of future research.

Chapter 6 Conclusion

6.1 Introduction

This chapter summarises and concludes this study. The limitations of the study will be stated and discussed. Possible areas for future research will then be suggested. This chapter also presents guidelines for healthcare institution managers, in relation to EMR use and impacts, before finally concluding this dissertation by highlighting the contributions this study has made to academia and practice.

6.2 Summary of Study

This study sought out to research the perceptions of healthcare workers towards the impacts of EMR systems. An integrated model of the D&M IS Success model and the ISC model was proposed and tested. In order to test the model, a survey was conducted at Tygerberg Hospital in Cape Town, South Africa. 142 responses were obtained from the nurses at the hospital and analysed using the IBM SPSS statistics program. After splitting respondents into users and non-users, results showed the following. System characteristics, namely, system quality, information quality and service quality were found to be significant predictors of user satisfaction which in turn was found to be a significant predictor of EMR use. Satisfaction was found to potentially lead to continuance intention. Any level of EMR use was found to have a have a relationship with job satisfaction. Healthcare impact also relates to job satisfaction. Both individual impacts and healthcare impacts were found important to continuance intention. The implications of these findings are discussed next.

6.3 Implications for Theory and Research

This study makes a contribution to theory by firstly showing empirical evidence for existing theories and support for existing literature. Some findings that differ from existing literature were also exposed and are worth noting. System quality was not found to have a direct impact on use. This is contrary to the propositions of the D&M IS Success model. Further research is needed to better understand why system quality does not influence use in certain contexts.

This study tested and further confirmed the validity of the D&M IS Success model as well as the ISC model. Furthermore, this study has extended theory by successfully

integrated two popular models in the field of information systems. The D&M IS Success model and the ISC model were found to be compatible and the resulting integrated model helped to better explain the outcomes of EMRs, which this study conceptualised to be perceived impacts, continuance intention and job satisfaction. More specifically, the confirmation of expectation variable and continuance intention variables from the ISC model were added to the DeLone and McLean model. Satisfaction is common to both models, whilst net benefits is a broader conceptualization of perceived usefulness than exists within the ISC model. These net benefits from the DeLone and McLean model were hypothesized to influence continuance intentions and it was shown that satisfaction and individual impacts were important to continuance intention. Moreover, the IS characteristics of service quality and system quality were shown to be important to satisfaction together with expectation confirmation from the ISC model.

This study has also contributed to the EMR context by determining the factors which influence the use of EMRs as well as determining the outcomes of EMR use.

The effects of EMR use and job satisfaction were tested in this study. The findings showed that the usage of EMRs at any level was related to job satisfaction. As no prior literature was found to examine this relationship, this finding therefore constitutes a new contribution to the research field.

6.4 Implications for Healthcare Practice

The main result of improving healthcare delivery is that patients receive a better quality of service from healthcare institutions. Through researching the perceived impacts of EMR use on healthcare delivery and the various factors surrounding the use of EMRs, this study contributes to knowledge that may assist in the decision making processes ultimately leading to improved healthcare delivery and therefore a better quality of service for patients.

This study reveals a model that identifies the factors that potentially lead to job satisfaction. This is beneficial to healthcare workers as well as managers wishing to improve the moral and motivation of healthcare workers. As job satisfaction is potentially influenced by use at any level, it is imperative that managers consider ensuring that all healthcare workers are given the option and are encouraged to

make use of EMRs to carry out their tasks. This may be beneficial to the nurses as EMR use may result in an increase in their levels of job satisfaction.

Improved healthcare delivery is a desirable goal for most governments which are pursuing the improvement of the quality of life of their people. This study could assist these governments as well as healthcare institutions in making decisions that may help improve the usage behaviour associated with EMRs.

The findings of this study suggest that decision makers, policy makers and EMR vendors should pay attention to the service quality and the system quality of EMRs and ensure that it is to a satisfactory level as these are potential determinants of user satisfaction. More specifically, focus should be placed on ensuring that the EMR system is always up and running as necessary, that it responds quickly in the high pressured environment of healthcare delivery, and that it is trusted to perform as expected when processing user inputs. Moreover, service quality should focus on providing sufficient support to users, that it is readily available, and provided quickly enough so as to ensure little disruption to clinical operations.

6.5 Limitations of Study

The following are limitations of this study that should be taken into consideration.

The data in this study was collected from one institution. The results of this study might therefore not apply to institutions where different contextual factors exist. Future research could survey multiple sites in different contexts to as to further test the proposed model.

The response rate was lower than expected and yielded a smaller sample size than that which had been hoped for. Thus the PCA had to be conducted in two stages. While the sample size was large enough to allow for the model to be tested, it makes this study susceptible to a non-response bias, thus limiting the external validity of this study. The results of this study might therefore not be generalizable to nurses who declined to take part in the study. To test such a large model a larger sample size would have been ideal.

The variables continuance intention and confirmation of expectation were both measured using one item scales. Results involving these two variables should

therefore be interpreted with caution. Future research therefore needs to consider how to refine the measures of these variables so they can be more successfully integrated into an extended D&M IS Success model.

This is a cross-sectional survey in which a self-administered questionnaire was used to collect data, and is thus subject to consistency motif, social desirability bias, common method bias and low levels of internal validity. Thus any causal inferences are made only with respect to theory.

6.6 Recommendations for Future Research

The limitations of this study create an opportunity for future research. As shown previously, future researchers should consider testing this study's model in multiple contexts in order to reveal if contextual differences have an effect on the results of the model. Conducting a longitudinal study may also reduce some of the limitations this study is subject to and also improve its internal validity. This may also further confirm the finding that usage leads to job satisfaction. Better measures of continuance intention and confirmation of expectation are also needed in order to better integrate the ISC into the D&M IS Success model.

Research is needed to assess the perceptions of patients who are currently not users of EMRs but are largely affected by them. Qualitative research could be used to find out what aspects of EMRs make patients comfortable and which ones do not.

Another area of research that remains unexplored is the readiness of patients to have access to EMR records in a developing context. Future research could find out the extent to which patients are ready to have access to their own medical records and the factors which would affect their intentions to use such a technology should it be available. The Technology Readiness Index could be used as a theoretical underpinning such a study (Parasuraman 2000).

Lastly, given that the few institutions that have EMRs implemented use them alongside paper-based medical records, research is needed to understand why institutions find it difficult to go paperless. The research question "What are the organisational factors that inhibit healthcare institutions from achieving paperless EMR environments?" needs to be answered.

6.7 Conclusion

Literature showed variations in usage patterns and perceptions of the impacts of EMR systems on healthcare delivery. Furthermore, little was known about how EMR outcomes such as perceived impacts, continuance intention and job satisfaction interacted with each other.

This study conceptualised a model to explain what the predictors of EMR use were showing that service quality is the most important predictor of user satisfaction which in turn significantly impacts use and continuance intentions. The model also helped us understand EMR outcomes, showing that job satisfaction is higher amongst EMR users.

As a result of this study, health care organisations will be better positioned to understand the perceptions of health workers regarding EMR systems and how those come to influence their usage behaviours.

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Appendices

Appendix A – Ethics Clearance

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON MEDICAL)
H120532 Katsande

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER H120532**
PROJECT TITLE	Electronic Medical Records: An Empirical Study of South African Health Workers' Attitudes, Extended Use and Perceptions of Impacts
INVESTIGATOR(S)	Mr T Katsande
SCHOOL/DEPARTMENT	Information Systems
DATE CONSIDERED	18 May 2012
DECISION OF THE COMMITTEE	Approved Unconditionally
EXPIRY DATE	31 May 2014
DATE 21 May 2012	**CHAIRPERSON** (Professor R Thornton)

cc: J Cohen

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

Signature **Date** 23 / 05 / 2012

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix B – Harriet Shezi Children's Clinic Site Permission

WITS REPRODUCTIVE HEALTH & HIV INSTITUTE
+27 11 358 5300
www.wrhi.ac.za

Mr. Tinashe Katsande
Mcom Student
Faculty of Commerce, Law and Management
University of Witwatersrand

Dear Mr. Katsande

RE: Request to do a survey of Therapy Edge users at Harriet Shezi Children Clinic for the purposes of completing a Master's Degree dissertation.

In response to the above mentioned request, I am glad to inform you that the Research Leadership Group (RLG) at WRHI has granted your request with the following conditions:

- Good clinic practice and all ethical considerations are observed throughout the duration of your work at the clinic.
- The write up should acknowledge WRHI, HSCC and their staff.
- If the dissertation is published, WRHI/HSCC should be allowed to see the publication prior to doing so.
- Results/findings should be shared with WRHI/HSCC so that we can learn and improve our work.

Warm regards

Dr Daniel Nhemachena
Clinic Manager: Harriet Shezi Children's Clinic
Chris Hani Baragwaneth Academic Hospital
Soweto

Acknowledgement of conditions:

Mr Tinashe Katsande

POSTAL ADDRESS
P.O Box 18512 | Hillbrow 2038
Johannesburg, South Africa

PHYSICAL ADDRESS
University of the Witwatersrand | Hillbrow Health Precinct | Hugh Solomon Building
Corner Esselen Street and Klein Street, Hillbrow 2001

Appendix C – Tygerberg Hospital Site Permission

Western Cape Government
Health

Tygerberg Hospital and
Mitchells Plain & Tygerberg Oral Health Centres
REFERENCE: Researches
ENQUIRIES: Dr M A Mukosi
TELEPHONE: 021 938-5966

ETHICS NO: H120532

Electronic Medical Records: An Empirical Study of South African Health Workers' Attitudes, Extended Use and Perceptions of Impacts.

Dear Mr T Katsande

PERMISSION TO CONDUCT YOUR RESEARCH AT TYGERBERG HOSPITAL

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

Please Note: Nursing questionnaires to be distributed through Nursing Department, Tygerberg Hospital, A-Ground with Ms G Davel at telephone number (021) 938-4675.

DR M MUKOSI
MANAGER: MEDICAL SERVICES
Date: 25/04/2013

AdministrationBuilding, Francie van Zijl Avenue, Parow, 7500
tel: +27 21 938-5966 fax: +27 21938-6698

Private Bag X3, Tygerberg, 7505
www.capegateway.go.v.za

Appendix D – Original Questionnaire

Date: April 2012

Dear Clinician

My name is Tinashe Katsande and I am a student at Wits University, studying towards a MCom in Information Systems. I am conducting research on the perceptions and attitudes of healthcare practitioners using an Electronic Medical Records system. As a user of Therapy Edge, you are invited to participate in the study by completing the attached questionnaire.

Your honest response is appreciated and there are no right or wrong answers. This survey is anonymous. You are not asked to provide any identifying details anywhere on the questionnaire. Your participation is completely voluntary and involves no risk, penalty, or loss of benefits whether or not you participate. You may withdraw from the survey at any stage.

The first part of the survey comprises 42 statements. Please indicate the extent to which you agree or disagree with each statement, by ticking in the appropriate box.

The second part of the survey captures some demographic data. Please answer appropriately.

Should you wish to participate, the entire survey should take about 10 minutes to complete. You may return your completed questionnaire into the sealed collection box.

Thank you for your participation. Should you have any questions, or should you wish to obtain a copy of the results of the survey, please retain this cover letter and contact me on: 0768016045 or at: katsandet@gmail.com

Kind regards

Tinashe Katsande

Division of Information Systems
School of Economic & Business Sciences
University of the Witwatersrand

The Impacts of EMR Use on Health Worker Process and Health Care Delivery Outcomes Questionnaire

Please complete the questionnaire by marking with an (x), your level of agreement with the following statements.

Please select <u>one</u> response.	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
E.g. The sun will rise tomorrow					X
1. The use of Therapy Edge is more of a help than a hindrance to patient care					
2. The use of Therapy Edge has helped to improve documentation of patient records					
3. The use of Therapy Edge poses less of a threat to a patient's privacy than paper records do					
4. The quality and content of my interactions with other healthcare workers has been improved as a result of using Therapy Edge					
5. The use of Therapy Edge has reduced my workload					
6. As a result of the extent to which I use Therapy Edge, my workload has reduced					
7. The use of Therapy Edge helps improve the quality of data used for research purposes					
8. The use of Therapy Edge has resulted in the improvement of healthcare delivery outcomes					
9. The use of Therapy Edge has led to improved patient care					
10. The Therapy Edge system saves me time					
11. The Therapy Edge system makes my job easier					
12. Therapy Edge provides the precise information I need					
13. The information content meets my needs					
14. The system provides reports that seem to be just about exactly what I need					
15. The system provides sufficient information					
16. Therapy Edge is accurate					
17. I am satisfied with the accuracy of Therapy Edge					
18. The output from Therapy Edge is presented in a useful format					
19. The information output from therapy Edge is clear to me					
20. Therapy Edge is user friendly					
21. Therapy Edge is easy to use					
22. Therapy Edge gives me the information I need in time					
23. Therapy Edge provides up-to-date information on patients					
24. I am dependent on the Therapy Edge system					
25. I use the Therapy Edge system more frequently than my colleagues					
26. In a typical one-month period, I often use most of the features of Therapy Edge to support my work.					
27. In a typical one-month period, I often use more features than the average user of the Therapy Edge system to support my work.					
28. In a typical one-month period, I often use more obscure aspects of the Therapy Edge system to support my work					
29. I would be happy to continue using Therapy Edge rather than to stop/discontinue its use					
30. I would prefer to continue using Therapy Edge than use any alternative means (e.g. Paper based records)					
31. If I could, I would like to discontinue my use of Therapy Edge					
32. I am very satisfied with my Therapy Edge system usage					
33. I am very pleased with my Therapy Edge system usage					
34. I am very content with my Therapy Edge system usage					

35. Using Therapy Edge improves my performance in providing patient care					
36. Using Therapy Edge increases my productivity in providing patient care					
37. Using Therapy Edge enhances my effectiveness in providing patient care					
38. Overall, Therapy Edge is useful in improving patient care					
39. My overall experience of Therapy Edge use is absolutely delightful					
40. My experience with using Therapy Edge is better than what I expected					
41. The benefits of Therapy Edge are better than what I expected					
42. Overall, most of my expectations from using Therapy Edge were confirmed					

Instructions: Please **circle** the correct answer where applicable.

1. Age: _____
2. Gender (*Circle one*): Male / Female
3. Professional Title: _____
4. Your site/hospital: _____
5. Does your site/hospital use paper-based records in addition to Therapy Edge? Yes / No
6. For which patient population does your institution primarily use Therapy Edge? Adult Care / Paediatrics
7. Length of time since you first started using Therapy Edge: _____
8. Time with current Department: _____
9. Are you a hands on user of Therapy Edge? Yes / No
10. Do you own a PC at home? Yes / No

Appendix E – Pretest Revised Questionnaire

Date: April 2012

Dear Healthcare Practitioner

My name is Tinashe Katsande and I am a student at the University of the Witwatersrand. I am studying towards a Master of Commerce Degree in Information Systems, for which I am conducting research on the experiences and attitudes of healthcare practitioners using Therapy Edge. As a user of Therapy Edge, you are invited to participate in the study by completing the attached questionnaire.

Your honest response is appreciated and there are no right or wrong answers. This survey is anonymous. You are not asked to provide any identifying details anywhere on the questionnaire. Your participation is completely voluntary and involves no risk, penalty, or loss of benefits whether or not you participate. You may withdraw from the survey at any stage.

The first part of the survey comprises 42 statements. Please indicate the extent of your agreement with each statement, by making a cross in the appropriate box.

The second part of the survey captures some demographic data. Please respond as appropriate.

The entire survey should take about 10 minutes to complete. You may return your completed questionnaire into the sealed collection box.

Thank you for considering your participation. Should you have any questions, or should you wish to obtain a copy of the results of the survey, please retain this cover letter and contact me on: 0768016045 or at: tinashe.katsande@students.wits.ac.za

Kind regards

Tinashe Katsande

Division of Information Systems
School of Economic & Business Sciences
University of the Witwatersrand

Therapy Edge User Questionnaire

Please indicate by marking with an (x) in the applicable box, your level of agreement with each of the following statements.

Please select one response.	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
E.g. The sun will rise tomorrow					X
1. Therapy Edge is easy to use					
2. Therapy Edge is user friendly					
3. Therapy Edge is difficult to access					
4. Therapy Edge always does what it should					
5. Therapy Edge is always up and running as necessary					
6. Therapy Edge responds quickly enough					
7. Therapy Edge provides the precise information I need					
8. The information content provided in Therapy Edge meets my needs					
9. Therapy Edge provides reports that seem to be just about exactly what I need					
10. Therapy Edge provides sufficient information about patients					
11. Therapy Edge provides reliable information outputs					
12. I am satisfied with the accuracy of Therapy Edge					
13. The output from Therapy Edge is presented in a useful format					
14. The information output from Therapy Edge is clear to me					
15. Therapy Edge provides up-to-date information on patients					
16. Therapy Edge gives me the information I need in time					
17. The use of Therapy Edge is more of a help than a hindrance to patient care					
18. The use of Therapy Edge has helped to improve documentation of patient records					
19. The use of Therapy Edge poses less of a threat to a patient's privacy than paper records					
20. The quality of my interactions with other healthcare workers has been improved as a result of using Therapy Edge					
21. The use of Therapy Edge has reduced my workload					
22. Therapy Edge saves me time					
23. Therapy Edge makes my job easier					
24. I am very satisfied with Therapy Edge					
25. I am very pleased with Therapy Edge					
26. I am very frustrated with Therapy Edge					
27. My overall experience of Therapy Edge is absolutely delightful					
28. I am dependent on Therapy Edge					
29. I use Therapy Edge more frequently than my colleagues					
30. In a typical one-month period, I often use most of the features of Therapy Edge to support my work.					
31. In a typical one-month period, I often use more features than the average user of Therapy Edge to support my work.					
32. In a typical one-month period, I often use more obscure aspects of Therapy Edge to support my work					
33. My experience with using Therapy Edge is better than what I expected					
34. The benefits of Therapy Edge are better than what I expected					
35. Overall, most of my expectations from using Therapy Edge were confirmed					
36. I would be happy to continue using Therapy Edge rather than to stop/discontinue its use					
37. I would prefer to continue using Therapy Edge than use any alternative means (e.g. paper based records)					

Thank you for your responses

38. If I could, I would like to discontinue my use of Therapy Edge					
39. The use of Therapy Edge helps improve the quality of data used for research purposes					
40. The use of Therapy Edge has resulted in the improvement of healthcare delivery					
41. The use of Therapy Edge has led to improved patient care					
42. Using Therapy Edge improves my performance in providing patient care					
43. Using Therapy Edge increases my productivity in providing patient care					

Instructions: Please fill in, make a cross or **circle** where applicable.

1. Gender (*Circle one*): Male / Female
2. Professional Title: _____
3. Does your site/hospital use paper-based records in addition to Therapy Edge? Yes / No
4. For which patient population does your institution primarily use Therapy Edge? Adult Care / Paediatrics
5. Are you a hands on user of Therapy Edge? Yes / No

6. Please select your age group

below 25 ☐ | 25 - 34 ☐ | 35 - 44 ☐ | 45 - 54 ☐ | 55 - 64 ☐ | 65 - 74 ☐ | Above 75 ☐

7. How many years have you been with the current department?

Less than 1 ☐ | 1 - 2 ☐ | 3 - 4 ☐ | 5 - 6 ☐ | 6 - 7 ☐ | More Than 7 ☐

8. At which site are you primarily based?

Hillbrow Community Health Centre ☐ | Thembalethu Clinic ☐ | Harriet Shezi Children's Clinic ☐ | South Rand Hospital ☐

9. How many months has it been since you first used Therapy Edge?

Less than 6 ☐ | 6 - 12 ☐ | 12 - 18 ☐ | 18 – 2 years ☐ | More Than 2 years ☐

10. How many years experience do you have with using a computer?

Less than 2 ☐ | 2 - 5 ☐ | 5 - 10 ☐ | More Than 10 ☐

Thank you for your responses

Appendix F – Final Questionnaire

June 2013

Dear Healthcare Practitioner

My name is Tinashe Katsande and I am a student at the University of the Witwatersrand, Johannesburg. I am studying towards a Master of Commerce Degree in Information Systems, for which I am conducting research on the experiences and attitudes of healthcare practitioners using the Clinicom Patient Information System (PIS). As a user of the PIS, you are invited to participate in the study by completing the attached questionnaire.

Your honest response is appreciated and there are no right or wrong answers. This survey is anonymous. You are not asked to provide any identifying details anywhere on the questionnaire. Your participation is completely voluntary and involves no risk, penalty, or loss of benefits whether or not you participate. You may withdraw from the survey at any stage.

The first part of the survey comprises 46 statements. Please indicate the extent of your agreement with each statement, by making a cross in the appropriate box.

The second part of the survey captures some demographic data. Please respond as appropriate.

The entire survey should take about 10 minutes to complete. You may return your completed questionnaire into the sealed collection box provided.

Thank you for considering your participation. Should you have any questions, or should you wish to obtain a copy of the results of the survey, please retain this cover letter and contact me on: 0768016045 or at: tinashe.katsande@students.wits.ac.za

Kind regards

Tinashe Katsande

Division of Information Systems
School of Economic & Business Sciences
University of the Witwatersrand

Clinicom Patient Information Service (PIS) User Questionnaire

The questions in this questionnaire refer to the Clinicom Patient Information System used at Tygerberg Hospital and in other hospitals in the Western Cape Province. Please indicate by marking with an (x) in the applicable box, your level of agreement with each of the following statements.

Please select <u>one</u> response.	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
E.g. The sun will rise tomorrow					X
1. The Clinicom Patient Information System (PIS) is easy to use					
2. The Clinicom PIS is user friendly					
3. The Clinicom PIS is difficult to access					
4. The Clinicom PIS always does what it should					
5. The Clinicom PIS is always up and running as necessary					
6. The Clinicom PIS responds quickly enough					
7. The Clinicom PIS provides the precise information I need					
8. The information content provided in the Clinicom PIS meets my needs					
9. The Clinicom PIS provides sufficient information about patients					
10. The Clinicom PIS provides reliable information on patients					
11. I am satisfied with the accuracy of the Clinicom PIS					
12. The patient information from the Clinicom PIS is presented in a useful format					
13. The patient information from the Clinicom PIS is clear to me					
14. The Clinicom PIS provides up-to-date information on patients					
15. The Clinicom PIS gives me the information I need in time					
16. The use of the Clinicom PIS interferes with patient care					
17. The use of the Clinicom PIS has helped to improve documentation of patient records					
18. The use of the Clinicom PIS poses less of a threat to a patient's privacy than paper records					
19. The quality of my interactions with other healthcare workers has been improved as a result of using the Clinicom PIS					
20. The use of Clinicom PIS has improved communication between healthcare workers in Tygerberg Hospital					
21. The use of the Clinicom PIS has reduced my workload					
22. The Clinicom PIS saves me time					
23. The Clinicom PIS makes my job easier					
24. Support provided to users of the Clinicom PIS is sufficient					
25. There is always support available if I need help with using the Clinicom PIS					
26. Support for the Clinicom PIS is provided quickly enough					
27. I am very satisfied with the Clinicom PIS					
28. I am very pleased with the Clinicom PIS					
29. I am very frustrated with the Clinicom PIS					
30. Compared to when I first started, I am using many more of the Clinicom PIS's features					
31. Compared to when I first started, I am using the Clinicom PIS more often to support my work					
32. Compared to when I first started, I now use Clinicom PIS for more of my work tasks					
33. My experience with using the Clinicom PIS is better than what I expected					

34.	The benefits of the Clinicom PIS are better than what I expected					
35.	Overall, most of my expectations from using the Clinicom PIS were confirmed					
36.	The use of the Clinicom PIS has resulted in the improvement of healthcare delivery					
37.	The use of the Clinicom PIS has led to improved patient care					
38.	Using the Clinicom PIS improves my performance in providing patient care					
39.	Using the Clinicom PIS increases my productivity in providing patient care					
40.	I would be happy to continue using the Clinicom PIS rather than to stop/discontinue its use					
41.	I would prefer to continue using the Clinicom PIS than use any alternative means (e.g. paper based records)					
42.	If I could, I would like to discontinue my use of the Clinicom PIS					
43.	I am satisfied with my current situation at work					
44.	I am satisfied with the degree of support I receive in my job					
45.	I seldom think about finding another job within my profession					
46.	I seldom think about finding an occupation outside my current profession					

Instructions: Please fill in, make a cross or **circle** where applicable.

1. Gender (*Circle one*): Male | Female
2. Type of Nurse:
   Nursing Manager | Registered Nurse | Staff Nurse | Nursing Assistant | Other: _____
3. Is your use of the Clinicom Patient Information System voluntary?: Yes | No
4. Which unit do you currently work in? CCU | Theatre | Trauma/Casualty| Outpatient | Other**:** _____
5. Does your unit/department/hospital use paper-based records in addition to the Clinicom PIS? Yes | No
6. On average how often do you use the Clinicom PIS? Less than once a week | About once each week |
   Several times each week | About once a day | Several times each day
7. On an average day of use how much time would you spend using the Clinicom PIS? Less than ½ an hour|
   ½ - 1 hour | 1 – 2 hours | 2 – 3 hours | More than 3 hours
8. Education Level: Certificate | Diploma | Bachelor's Degree | Masters | Other: _____
9. Total years of service as a healthcare worker: _____
10. Total number of years at Tygerberg Hospital: _____
11. How many years have you been with the current department at Tygerberg Hospital? _____
12. How long in years has it been since you first used the Clinicom PIS? _____
13. How many years of experience do you have with using a computer? _____

14. Please select your age group

Below 25 ☐	25 - 34 ☐	35 - 44 ☐	45 - 54 ☐	55 - 64 ☐	Above 65 ☐

Appendix G – First Multiple Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.298[a]	.089	.040	.72989	.089	1.808	4	74	.136
2	.643[b]	.413	.355	.59823	.324	13.052	3	71	.000

a. Predictors: (Constant), Age, Education, CompExp, Profession

b. Predictors: (Constant), Age, Education, CompExp, Profession, Information Quality, Service Quality, Satisfaction

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.852	4	.963	1.808	.136[b]
	Residual	39.423	74	.533		
	Total	43.274	78			
2	Regression	17.865	7	2.552	7.131	.000[c]
	Residual	25.409	71	.358		
	Total	43.274	78			

a. Dependent Variable: Use

b. Predictors: (Constant), Age, Education, CompExp, Profession

c. Predictors: (Constant), Age, Education, CompExp, Profession, Information Quality, Service Quality, Satisfaction

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.082	.501		6.146	.000		
	Profession	.044	.072	.080	.606	.546	.700	1.430
	Education	-.143	.096	-.171	-1.482	.143	.927	1.078
	CompExp	.017	.014	.149	1.218	.227	.827	1.209
	Age	.079	.095	.120	.831	.409	.591	1.691
2	(Constant)	.672	.664		1.012	.315		
	Profession	-.008	.063	-.015	-.125	.901	.612	1.633
	Education	-.025	.082	-.030	-.303	.763	.860	1.163
	CompExp	.010	.012	.086	.843	.402	.800	1.251
	Age	.159	.081	.242	1.951	.055	.537	1.863
	Information Quality	.148	.121	.132	1.225	.225	.716	1.396
	Service Quality	.111	.122	.127	.906	.368	.423	2.362
	Satisfaction	.393	.133	.444	2.960	.004	.368	2.721

a. Dependent Variable: Use

Appendix H – Second Multiple Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df 1	df 2	Sig. F Change
1	.387[a]	.150	.104	.79730	.150	3.264	4	74	.016
2	.820[b]	.672	.640	.50568	.522	37.654	3	71	.000

a. Predictors: (Constant), Age, Education, CompExp, Profession

b. Predictors: (Constant), Age, Education, CompExp, Profession, System Quality, Information Quality, Service Quality

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.301	4	2.075	3.264	.016[b]
	Residual	47.041	74	.636		
	Total	55.342	78			
2	Regression	37.186	7	5.312	20.775	.000[c]
	Residual	18.156	71	.256		
	Total	55.342	78			

a. Dependent Variable: Satisfaction

b. Predictors: (Constant), Age, Education, CompExp, Profession

c. Predictors: (Constant), Age, Education, CompExp, Profession, System Quality, Information Quality, Service Quality

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.358	.548		6.130	.000		
	Profession	.147	.079	.239	1.865	.066	.700	1.430
	Education	-.204	.105	-.216	-1.939	.056	.927	1.078
	CompExp	.018	.015	.137	1.162	.249	.827	1.209
	Age	-.088	.103	-.119	-.852	.397	.591	1.691
2	(Constant)	-.362	.562		-.645	.521		
	Profession	.116	.052	.189	2.246	.028	.656	1.525
	Education	-.068	.071	-.072	-.962	.339	.824	1.214
	CompExp	.021	.010	.163	2.142	.036	.799	1.251
	Age	.040	.069	.054	.583	.562	.539	1.854
	System Quality	.254	.087	.247	2.922	.005	.644	1.552
	Information Quality	.185	.103	.145	1.795	.077	.705	1.418
	Service Quality	.538	.082	.544	6.592	.000	.679	1.472

a. Dependent Variable: Satisfaction

Appendix I – Third Multiple Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.430[a]	.185	.141	1.0930	.185	4.192	4	74	.004
2	.594[b]	.353	.289	.9940	.168	6.155	3	71	.001

a. Predictors: (Constant), Age, Education, CompExp, Profession

b. Predictors: (Constant), Age, Education, CompExp, Profession, Healthcare Impact, Individual Impact, Satisfaction

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	20.031	4	5.008	4.192	.004[b]
	Residual	88.399	74	1.195		
	Total	108.430	78			
2	Regression	38.276	7	5.468	5.534	.000[c]
	Residual	70.155	71	.988		
	Total	108.430	78			

a. Dependent Variable: Continuance Intention

b. Predictors: (Constant), Age, Education, CompExp, Profession

c. Predictors: (Constant), Age, Education, CompExp, Profession, Healthcare Impact, Individual Impact, Satisfaction

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.104	.751		4.134	.000		
	Profession	.228	.108	.265	2.114	.038	.700	1.430
	Education	-.243	.144	-.184	-1.689	.095	.927	1.078
	CompExp	.042	.021	.234	2.029	.046	.827	1.209
	Age	-.154	.142	-.148	-1.083	.282	.591	1.691
2	(Constant)	.840	.914		.919	.361		
	Profession	.153	.102	.178	1.502	.137	.649	1.541
	Education	-.073	.137	-.056	-.534	.595	.844	1.185
	CompExp	.029	.019	.158	1.478	.144	.800	1.249
	Age	-.054	.133	-.052	-.403	.688	.554	1.804
	Satisfaction	.479	.195	.342	2.455	.017	.470	2.130
	Individual Impact	.367	.170	.269	2.156	.034	.584	1.711
	Healthcare Impact	-.207	.170	-.158	-1.213	.229	.540	1.851

a. Dependent Variable: Continuance Intention

Appendix J – Fourth Multiple Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.354[a]	.125	.078	.83134	.125	2.643	4	74	.040
2	.621[b]	.385	.334	.70637	.260	15.249	2	72	.000

a. Predictors: (Constant), Age, Education, CompExp, Profession

b. Predictors: (Constant), Age, Education, CompExp, Profession, Use, Satisfaction

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.307	4	1.827	2.643	.040[b]
	Residual	51.143	74	.691		
	Total	58.449	78			
2	Regression	22.524	6	3.754	7.524	.000[c]
	Residual	35.925	72	.499		
	Total	58.449	78			

a. Dependent Variable: Individual Impact

b. Predictors: (Constant), Age, Education, CompExp, Profession

c. Predictors: (Constant), Age, Education, CompExp, Profession, Use, Satisfaction

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.908	.571		6.842	.000		
	Profession	.017	.082	.027	.204	.839	.700	1.430
	Education	-.226	.110	-.233	-2.062	.043	.927	1.078
	CompExp	.015	.016	.116	.973	.334	.827	1.209
	Age	-.236	.108	-.309	-2.186	.032	.591	1.691
2	(Constant)	1.794	.622		2.882	.005		
	Profession	-.056	.071	-.089	-.782	.437	.665	1.503
	Education	-.107	.096	-.111	-1.123	.265	.880	1.136
	CompExp	.004	.014	.031	.304	.762	.808	1.238
	Age	-.215	.094	-.282	-2.293	.025	.566	1.767
	Use	.217	.138	.186	1.572	.120	.607	1.648
	Satisfaction	.431	.126	.419	3.413	.001	.566	1.766

a. Dependent Variable: Individual Impact

Appendix K – Fifth Multiple Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.176[a]	.031	-.022	.90849	.031	.589	4	74	.671
2	.660[b]	.436	.389	.70249	.405	25.881	2	72	.000

a. Predictors: (Constant), Age, Education, CompExp, Profession

b. Predictors: (Constant), Age, Education, CompExp, Profession, Use, Satisfaction

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.945	4	.486	.589	.671[b]
	Residual	61.076	74	.825		
	Total	63.021	78			
2	Regression	27.489	6	4.582	9.284	.000[c]
	Residual	35.532	72	.493		
	Total	63.021	78			

a. Dependent Variable: Healthcare Impact

b. Predictors: (Constant), Age, Education, CompExp, Profession

c. Predictors: (Constant), Age, Education, CompExp, Profession, Use, Satisfaction

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.757	.624		6.020	.000		
	Profession	.006	.090	.010	.071	.943	.700	1.430
	Education	-.051	.120	-.050	-.424	.673	.927	1.078
	CompExp	.002	.017	.011	.090	.929	.827	1.209
	Age	-.139	.118	-.176	-1.181	.242	.591	1.691
2	(Constant)	1.045	.619		1.688	.096		
	Profession	-.090	.071	-.138	-1.272	.208	.665	1.503
	Education	.103	.095	.102	1.086	.281	.880	1.136
	CompExp	-.013	.014	-.094	-.951	.345	.808	1.238
	Age	-.106	.093	-.134	-1.138	.259	.566	1.767
	Use	.239	.137	.198	1.741	.086	.607	1.648
	Satisfaction	.589	.125	.552	4.692	.000	.566	1.766

a. Dependent Variable: Healthcare Impact

Appendix L – Sixth Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.387[a]	.150	.104	.79730	.150	3.264	4	74	.016
2	.832[b]	.691	.656	.49394	.541	30.703	4	70	.000

a. Predictors: (Constant), Age, Education, CompExp, Profession

b. Predictors: (Constant), Age, Education, CompExp, Profession, Confirmation of Expectation, Information Quality, Service Quality, System Quality

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.301	4	2.075	3.264	.016[b]
	Residual	47.041	74	.636		
	Total	55.342	78			
2	Regression	38.264	8	4.783	19.605	.000[c]
	Residual	17.078	70	.244		
	Total	55.342	78			

a. Dependent Variable: Satisfaction

b. Predictors: (Constant), Age, Education, CompExp, Profession

c. Predictors: (Constant), Age, Education, CompExp, Profession, Confirmation of Expectation, Information Quality, Service Quality, System Quality

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	3.358	.548		6.130	.000		
	Profession	.147	.079	.239	1.865	.066	.700	1.430
	Education	-.204	.105	-.216	-1.939	.056	.927	1.078
	CompExp	.018	.015	.137	1.162	.249	.827	1.209
	Age	-.088	.103	-.119	-.852	.397	.591	1.691
2	(Constant)	-.558	.556		-1.002	.320		
	Profession	.094	.051	.154	1.838	.070	.630	1.587
	Education	-.072	.069	-.076	-1.040	.302	.823	1.215
	CompExp	.021	.010	.163	2.202	.031	.799	1.251
	Age	-.007	.071	-.010	-.105	.917	.484	2.064
	System Quality	.192	.090	.187	2.138	.036	.575	1.738
	Information Quality	.164	.101	.129	1.620	.110	.698	1.432
	Service Quality	.520	.080	.526	6.491	.000	.672	1.488
	Confirmation of Expectation	.210	.100	.164	2.102	.039	.728	1.374

a. Dependent Variable: Satisfaction

Appendix M – Seventh Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.176[a]	.031	-.022	.90849	.031	.589	4	74	.671
2	.675[b]	.455	.402	.69534	.424	18.440	3	71	.000

a. Predictors: (Constant), Age, Education, CompExp, Profession

b. Predictors: (Constant), Age, Education, CompExp, Profession, Confirmation of Expectation, Satisfaction, Use

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.945	4	.486	.589	.671[b]
	Residual	61.076	74	.825		
	Total	63.021	78			
2	Regression	28.693	7	4.099	8.478	.000[c]
	Residual	34.328	71	.483		
	Total	63.021	78			

a. Dependent Variable: Healthcare Impact

b. Predictors: (Constant), Age, Education, CompExp, Profession

c. Predictors: (Constant), Age, Education, CompExp, Profession, Confirmation of Expectation, Satisfaction, Use

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.757	.624		6.020	.000		
	Profession	.006	.090	.010	.071	.943	.700	1.430
	Education	-.051	.120	-.050	-.424	.673	.927	1.078
	CompExp	.002	.017	.011	.090	.929	.827	1.209
	Age	-.139	.118	-.176	-1.181	.242	.591	1.691
2	(Constant)	.836	.627		1.334	.187		
	Profession	-.109	.071	-.166	-1.524	.132	.648	1.544
	Education	.077	.096	.077	.809	.421	.854	1.171
	CompExp	-.009	.014	-.063	-.635	.527	.777	1.287
	Age	-.141	.095	-.178	-1.485	.142	.535	1.869
	Use	.113	.157	.094	.719	.474	.452	2.214
	Satisfaction	.559	.126	.523	4.444	.000	.553	1.808
	Confirmation of Expectation	.255	.161	.186	1.578	.119	.551	1.816

a. Dependent Variable: Healthcare Impact

Appendix N – Eighth Multiple Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.354[a]	.125	.078	.83134	.125	2.643	4	74	.040
2	.623[b]	.388	.327	.70997	.263	10.154	3	71	.000

a. Predictors: (Constant), Age, Education, CompExp, Profession

b. Predictors: (Constant), Age, Education, CompExp, Profession, Confirmation of Expectation, Satisfaction, Use

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.307	4	1.827	2.643	.040[b]
	Residual	51.143	74	.691		
	Total	58.449	78			
2	Regression	22.662	7	3.237	6.423	.000[c]
	Residual	35.788	71	.504		
	Total	58.449	78			

a. Dependent Variable: Individual Impact

b. Predictors: (Constant), Age, Education, CompExp, Profession

c. Predictors: (Constant), Age, Education, CompExp, Profession, Confirmation of Expectation, Satisfaction, Use

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.908	.571		6.842	.000		
	Profession	.017	.082	.027	.204	.839	.700	1.430
	Education	-.226	.110	-.233	-2.062	.043	.927	1.078
	CompExp	.015	.016	.116	.973	.334	.827	1.209
	Age	-.236	.108	-.309	-2.186	.032	.591	1.691
2	(Constant)	1.723	.640		2.692	.009		
	Profession	-.062	.073	-.098	-.853	.397	.648	1.544
	Education	-.116	.098	-.120	-1.190	.238	.854	1.171
	CompExp	.006	.014	.042	.399	.691	.777	1.287
	Age	-.227	.097	-.297	-2.340	.022	.535	1.869
	Use	.174	.161	.150	1.085	.282	.452	2.214
	Satisfaction	.420	.128	.409	3.276	.002	.553	1.808
	Confirmation of Expectation	.086	.165	.065	.523	.603	.551	1.816

a. Dependent Variable: Individual Impact

Appendix O – T-Test Users vs. Non-Users

Group Statistics

	User	N	Mean	Std. Deviation	Std. Error Mean
SMEAN(Impact1)	1	89	3.236	1.0447	.1107
	0	30	2.933	.7849	.1433
SMEAN(Impact2)	1	89	3.292	1.0136	.1074
	0	30	3.033	.6687	.1221
SMEAN(Impact3)	1	89	3.202	1.1400	.1208
	0	30	3.267	.6915	.1262
SMEAN(Impact4)	1	89	3.180	.8734	.0926
	0	30	2.967	.7184	.1312
SMEAN(Impact5)	1	89	3.236	1.0768	.1141
	0	30	3.133	.6288	.1148
SMEAN(Impact6)	1	89	2.888	.9224	.0978
	0	30	2.633	.7184	.1312
SMEAN(Impact7)	1	89	3.135	1.0134	.1074
	0	30	3.033	.6687	.1221
SMEAN(Impact8)	1	89	3.202	.8814	.0934
	0	30	2.700	.5960	.1088
SMEAN(Impact9)	1	89	3.371	.8579	.0909
	0	30	2.900	.6074	.1109
SMEAN(Impact10)	1	89	3.326	.9744	.1033
	0	30	3.067	.7397	.1350
SMEAN(Impact11)	1	89	3.270	.9386	.0995
	0	30	2.600	.7701	.1406
SMEAN(Impact12)	1	89	3.247	.9686	.1027
	0	30	2.700	.8769	.1601
SMEAN(JS1)	1	89	3.596	.9620	.1020
	0	30	2.733	1.1121	.2030
SMEAN(JS2)	1	89	3.494	.9668	.1025
	0	30	2.667	1.0613	.1938
SMEAN(JS3)	1	89	3.281	1.2153	.1288
	0	30	2.800	.9613	.1755
SMEAN(JS4)	1	89	3.124	1.2506	.1326
	0	30	2.800	.9248	.1688

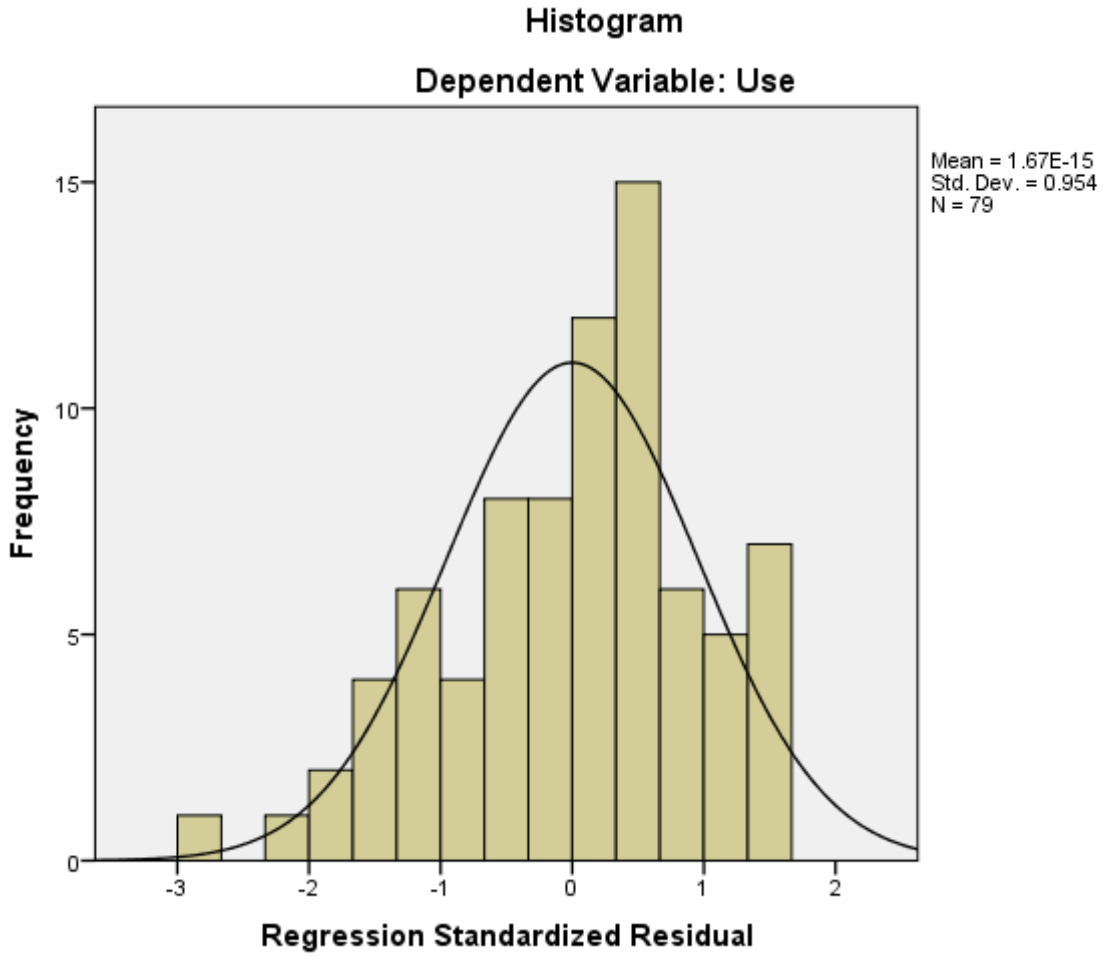
	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SMEAN(Impact1)	8.212	.005	1.453	117	.149	.3026	.2083	-.1099	.7152
			1.671	66.196	.099	.3026	.1811	-.0589	.6642
SMEAN(Impact2)	12.415	.001	1.304	117	.195	.2588	.1984	-.1342	.6518
			1.591	76.243	.116	.2588	.1626	-.0651	.5827
SMEAN(Impact3)	6.823	.010	-.291	117	.771	-.0644	.2210	-.5021	.3733
			-.369	83.405	.713	-.0644	.1748	-.4120	.2831
SMEAN(Impact4)	3.398	.068	1.205	117	.231	.2131	.1768	-.1371	.5633
			1.327	60.171	.189	.2131	.1605	-.1080	.5342
SMEAN(Impact5)	13.647	.000	.494	117	.623	.1026	.2079	-.3092	.5144
			.634	86.741	.528	.1026	.1619	-.2192	.4244
SMEAN(Impact6)	.667	.416	1.375	117	.172	.2543	.1850	-.1121	.6207
			1.554	63.705	.125	.2543	.1636	-.0725	.5812
SMEAN(Impact7)	6.742	.011	.512	117	.610	.1015	.1984	-.2915	.4945
			.624	76.233	.534	.1015	.1626	-.2224	.4254
SMEAN(Impact8)	3.309	.071	2.901	117	.004	.5022	.1731	.1594	.8451
			3.502	74.227	.001	.5022	.1434	.2165	.7880
SMEAN(Impact9)	8.595	.004	2.777	117	.006	.4708	.1695	.1350	.8066
			3.283	70.590	.002	.4708	.1434	.1848	.7568
SMEAN(Impact10)	6.191	.014	1.332	117	.186	.2592	.1946	-.1262	.6446
			1.524	65.467	.132	.2592	.1700	-.0803	.5987
SMEAN(Impact11)	1.513	.221	3.525	117	.001	.6697	.1900	.2935	1.0459
			3.888	60.327	.000	.6697	.1722	.3252	1.0142
SMEAN(Impact12)	1.504	.223	2.738	117	.007	.5472	.1999	.1514	.9430
			2.877	54.709	.006	.5472	.1902	.1660	.9284
SMEAN(JS1)	.605	.438	4.079	117	.000	.8622	.2114	.4435	1.2808
			3.795	44.540	.000	.8622	.2272	.4044	1.3199
SMEAN(JS2)	.066	.798	3.956	117	.000	.8277	.2092	.4134	1.2421
			3.776	46.297	.000	.8277	.2192	.3866	1.2689
SMEAN(JS3)	5.746	.018	1.968	117	.051	.4809	.2444	-.0031	.9649
			2.209	62.670	.031	.4809	.2177	.0458	.9160
SMEAN(JS4)	5.463	.021	1.301	117	.196	.3236	.2488	-.1691	.8162
			1.507	67.345	.136	.3236	.2147	-.1048	.7520

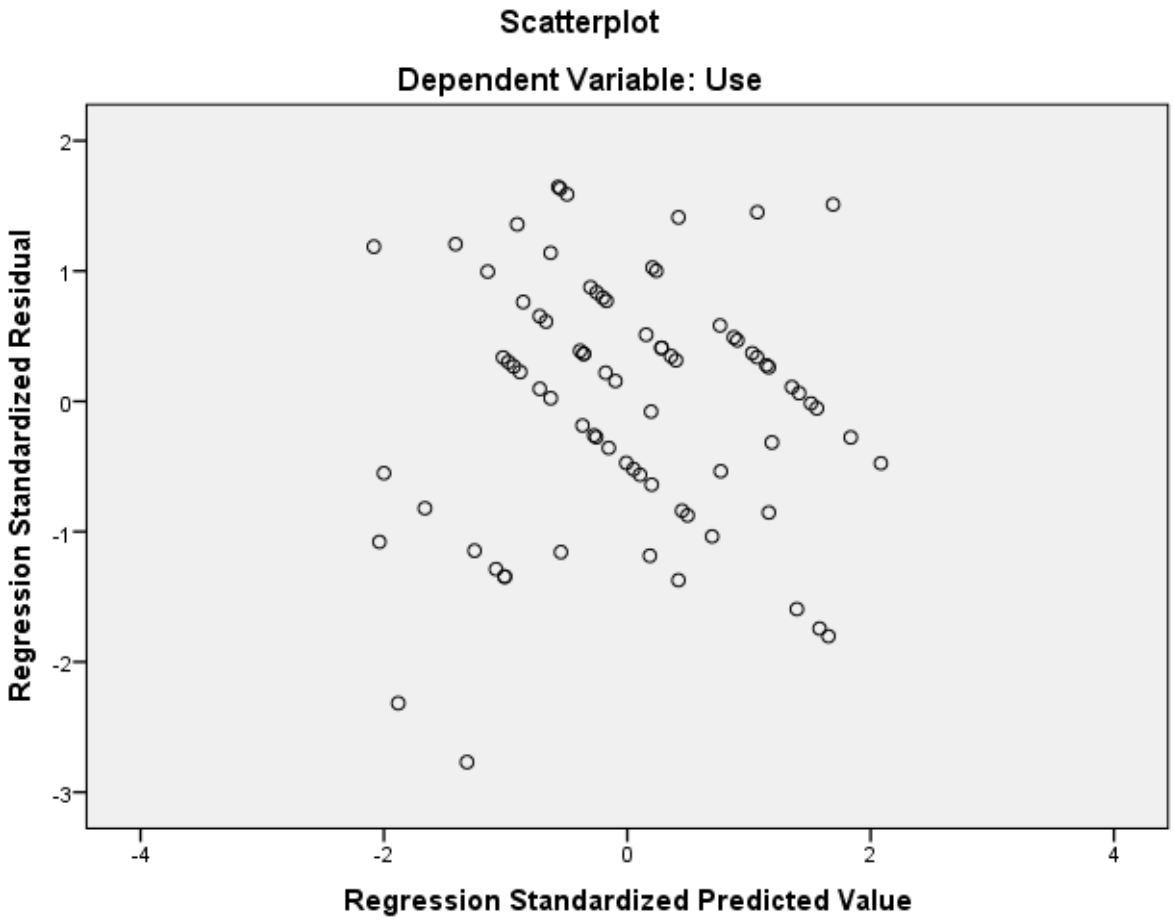
Appendix P – Missing Values

Item	Count
SQ1	2
SQ2	4
SQ3	2
SQ4	5
SQ5	3
SQ6	3
IQ1	5
IQ2	1
IQ3	3
IQ4	3
IQ5	3
IQ6	2
IQ7	5
IQ8	1
IQ9	2
Impact1	2
Impact2	3
Impact3	2
Impact4	1
Impact5	0
Impact6	3
Impact7	2
Impact8	4
ServQ1	5
ServQ2	1
ServQ3	2
Satisf1	2
Satisf2	1
Satisf3	2
Use1	2
Use2	2
Use3	0
CoE1	4
CoE2	1
CoE3	3
Impact9	3
Impact10	1
Impact11	2
Impact12	2
CI1	1
CI2	4
CI3	2
JS1	2
JS2	2
JS3	4
JS4	3

Appendix Q – Tests of Assumptions

First Regression

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Dependent Variable: Use
Regression Standardized Residual
Regression Standardized Predicted Value
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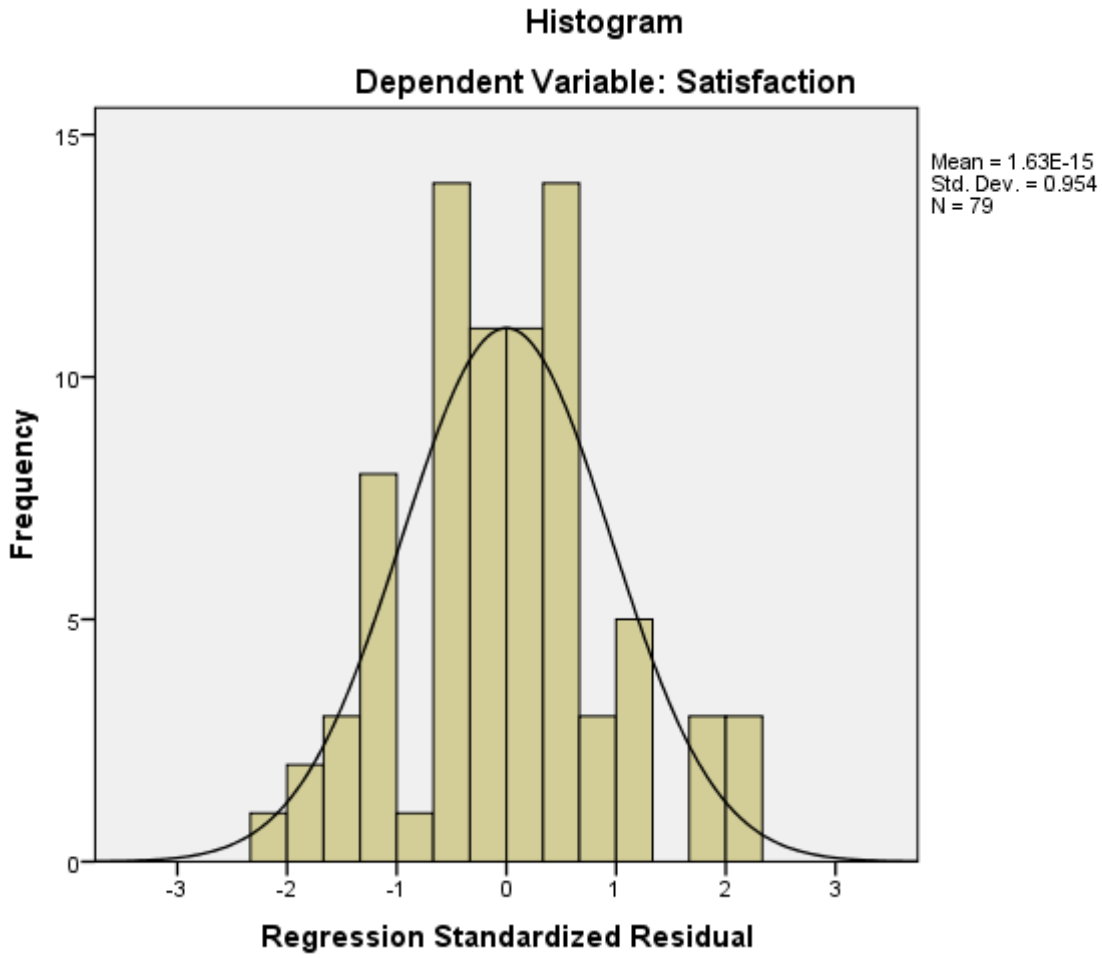
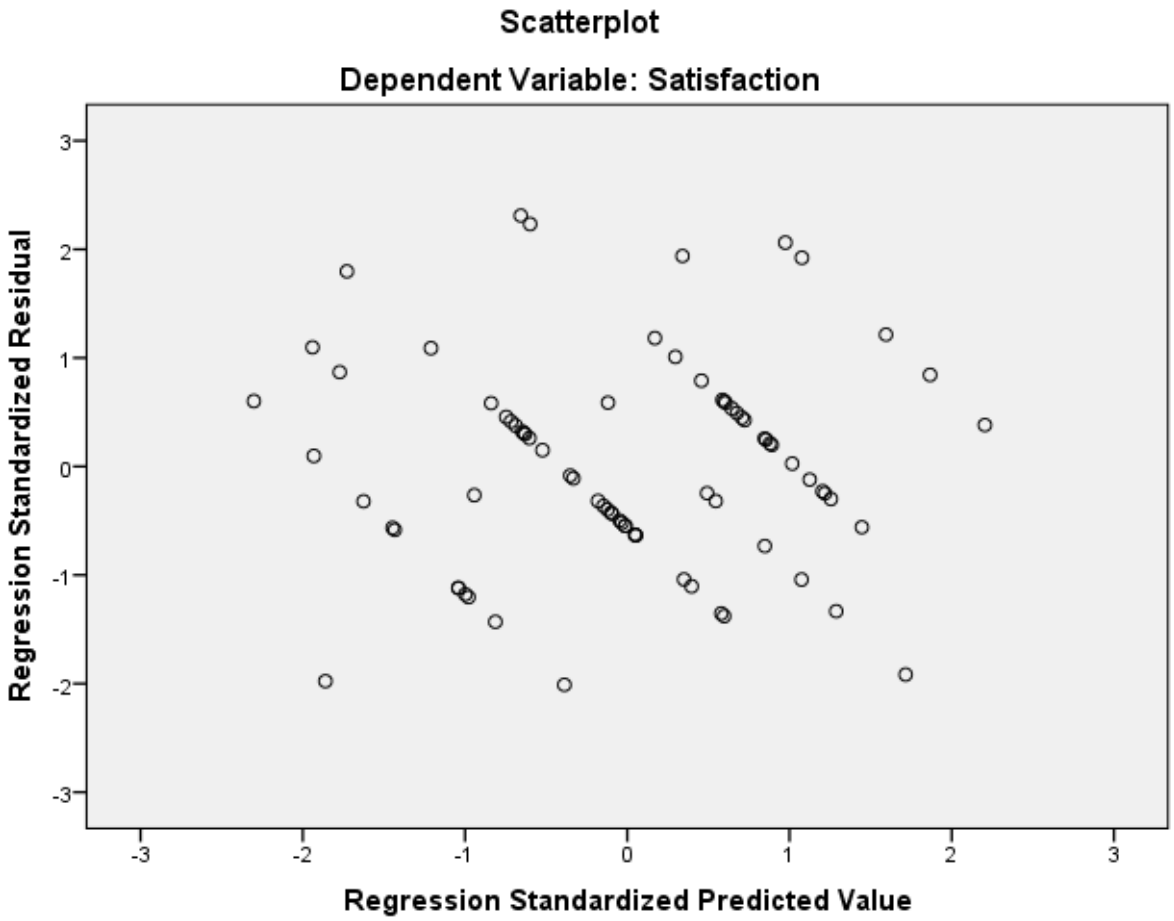
-1
-2
-3
-4
-2
0
2
4

Second Regression




Scatterplot
Dependent Variable: Satisfaction
Regression Standardized Residual
Regression Standardized Predicted Value
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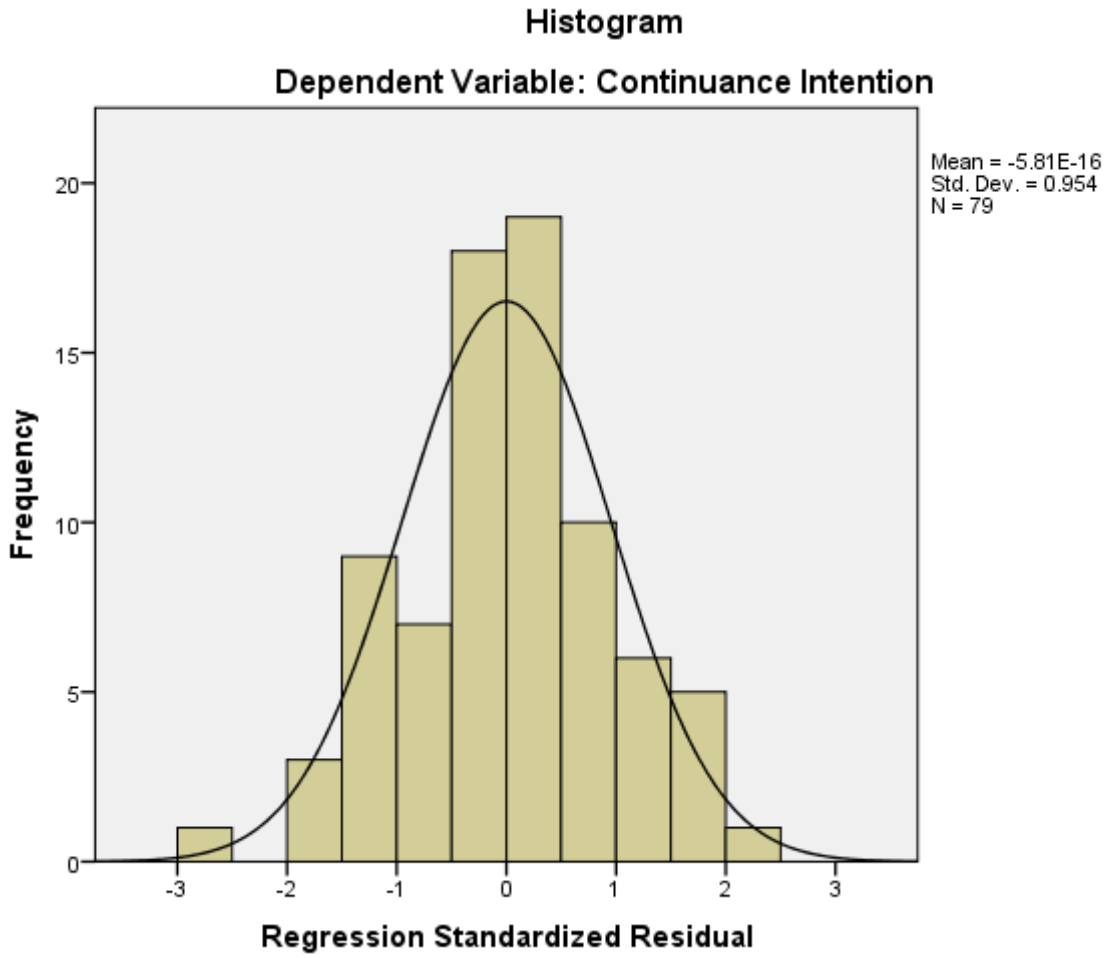
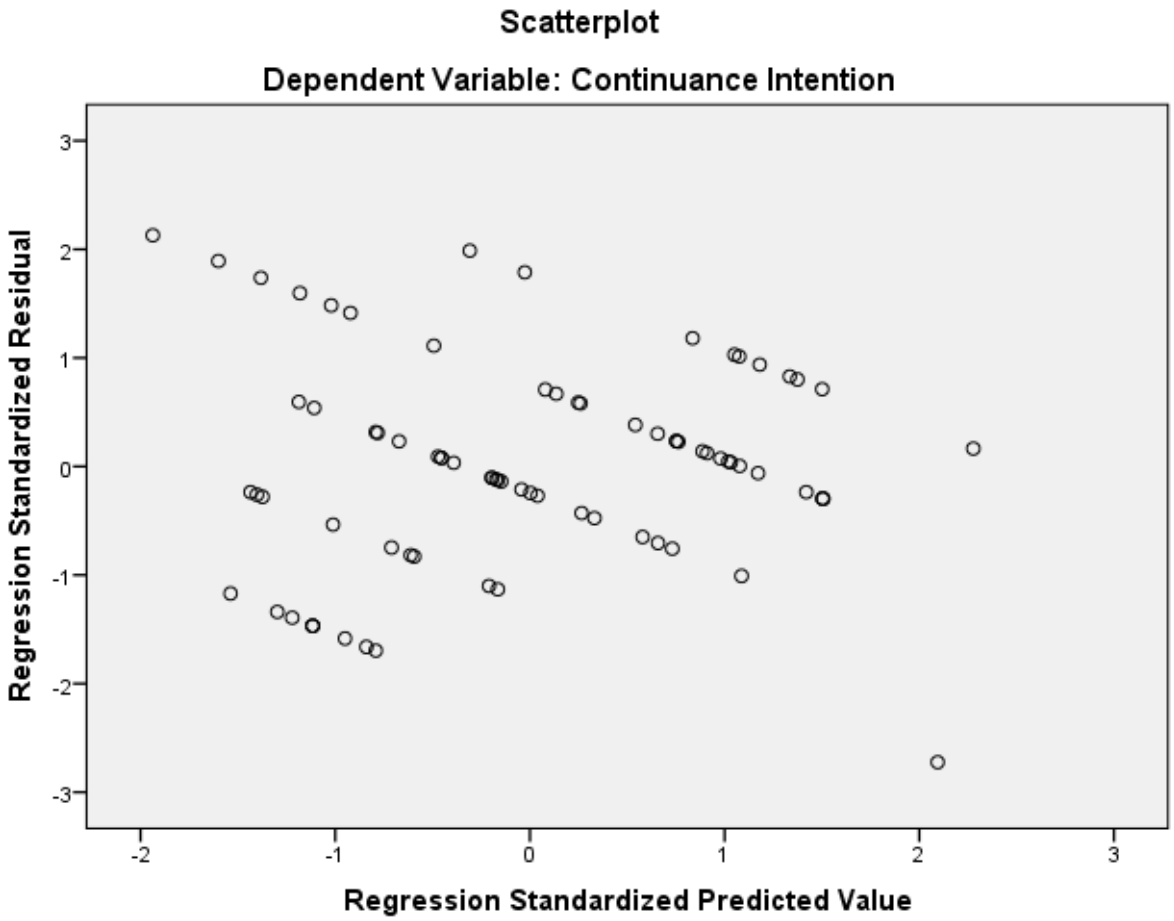
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2
3

Third Regression




Scatterplot
Dependent Variable: Continuance Intention
Regression Standardized Residual
Regression Standardized Predicted Value
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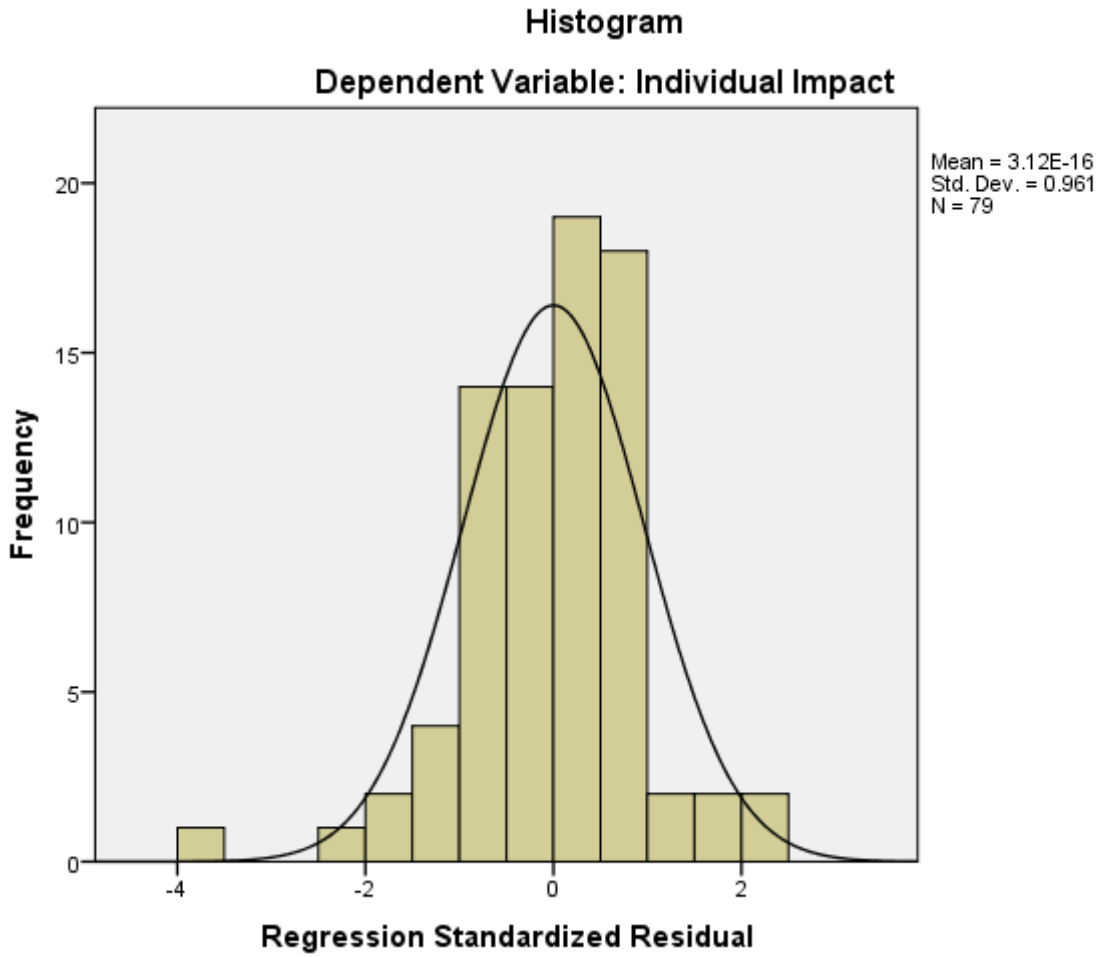
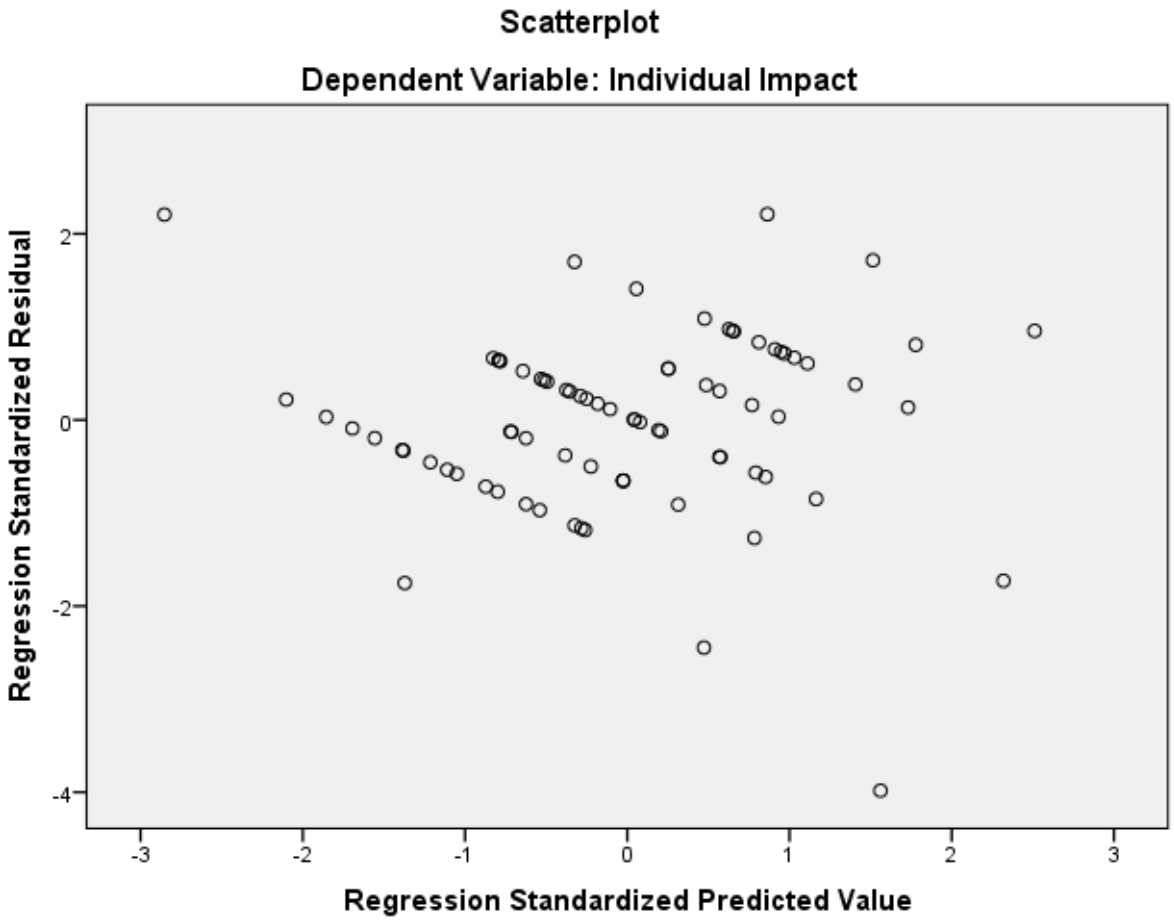
2
1
0
-1
-2
-3
-2
-1
0
1
2
3

Fourth Regression




Scatterplot
Dependent Variable: Individual Impact
Regression Standardized Residual
Regression Standardized Predicted Value
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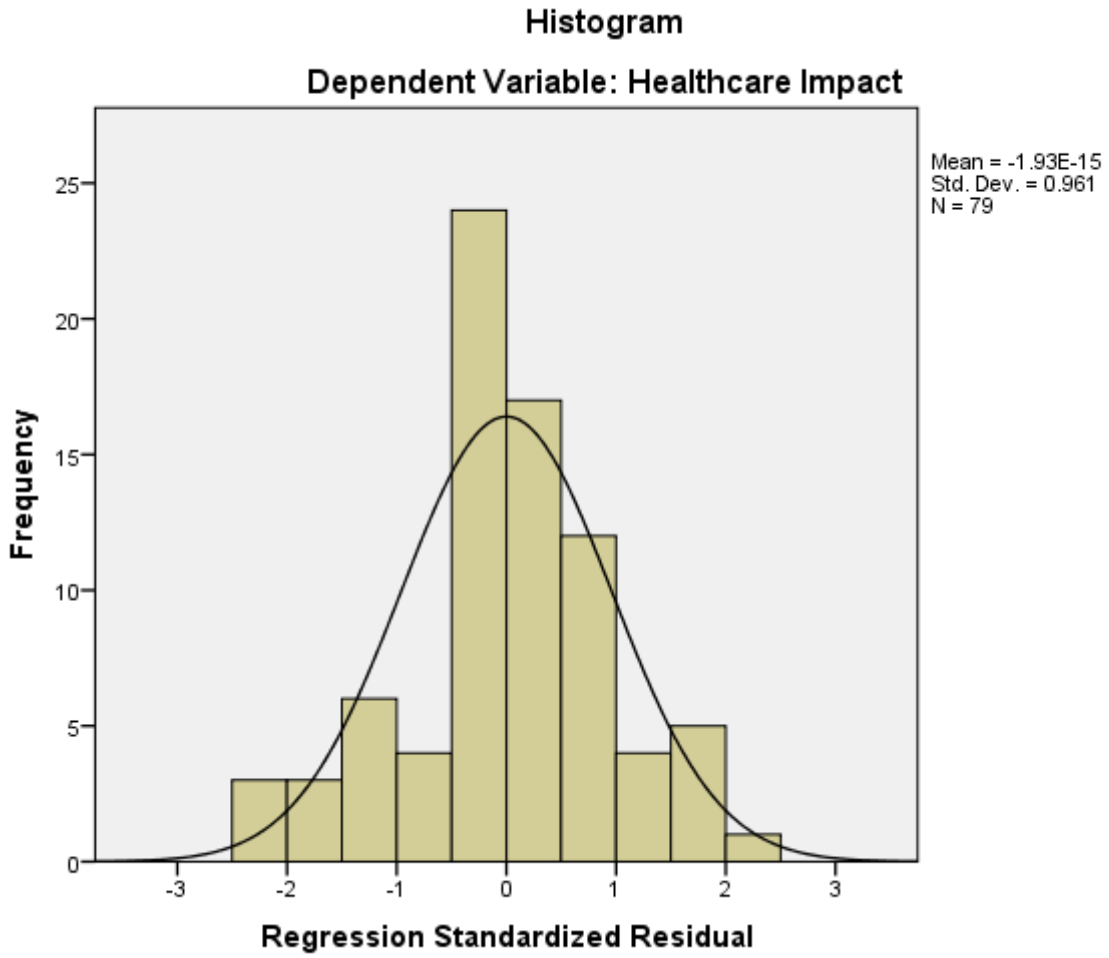
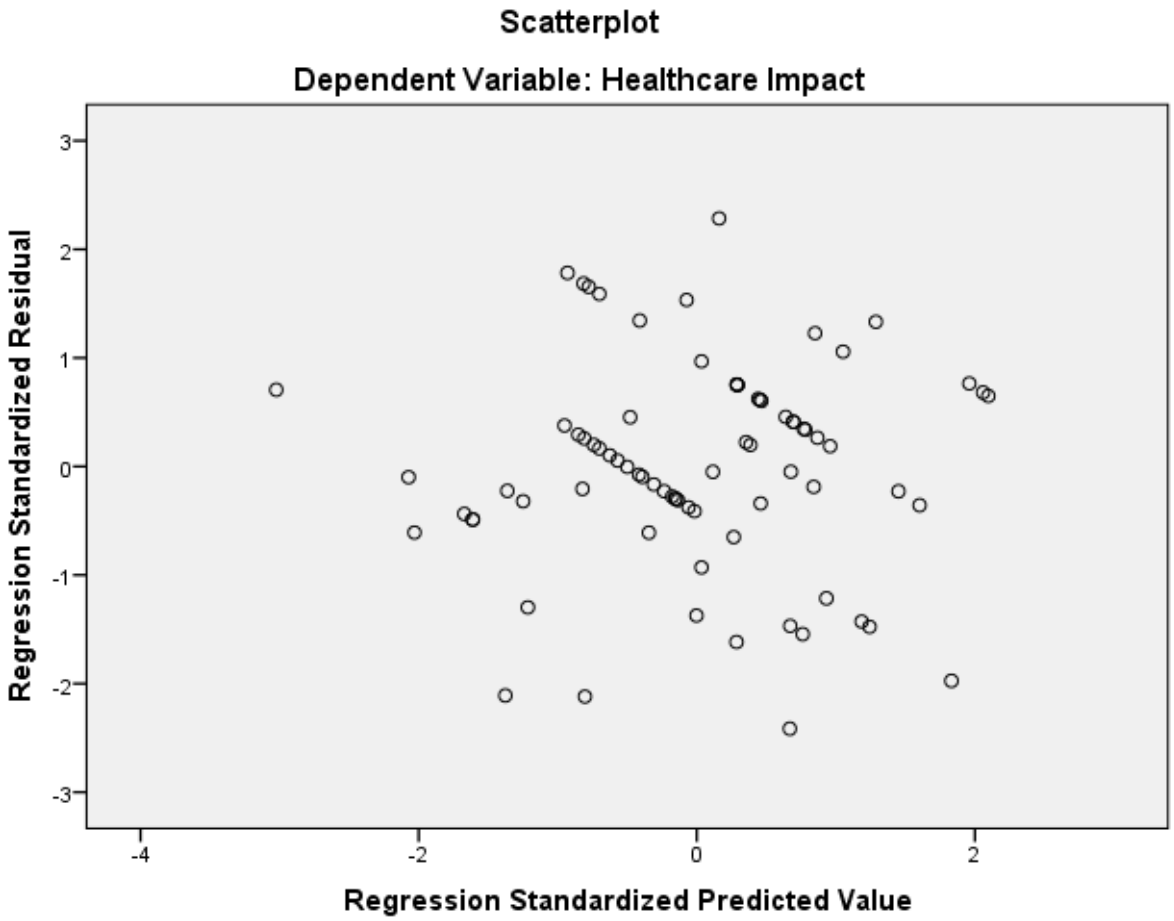
-2
-4
-3
-2
-1
0
1
2
3

Fifth Regression




Scatterplot
Dependent Variable: Healthcare Impact
Regression Standardized Residual
Regression Standardized Predicted Value
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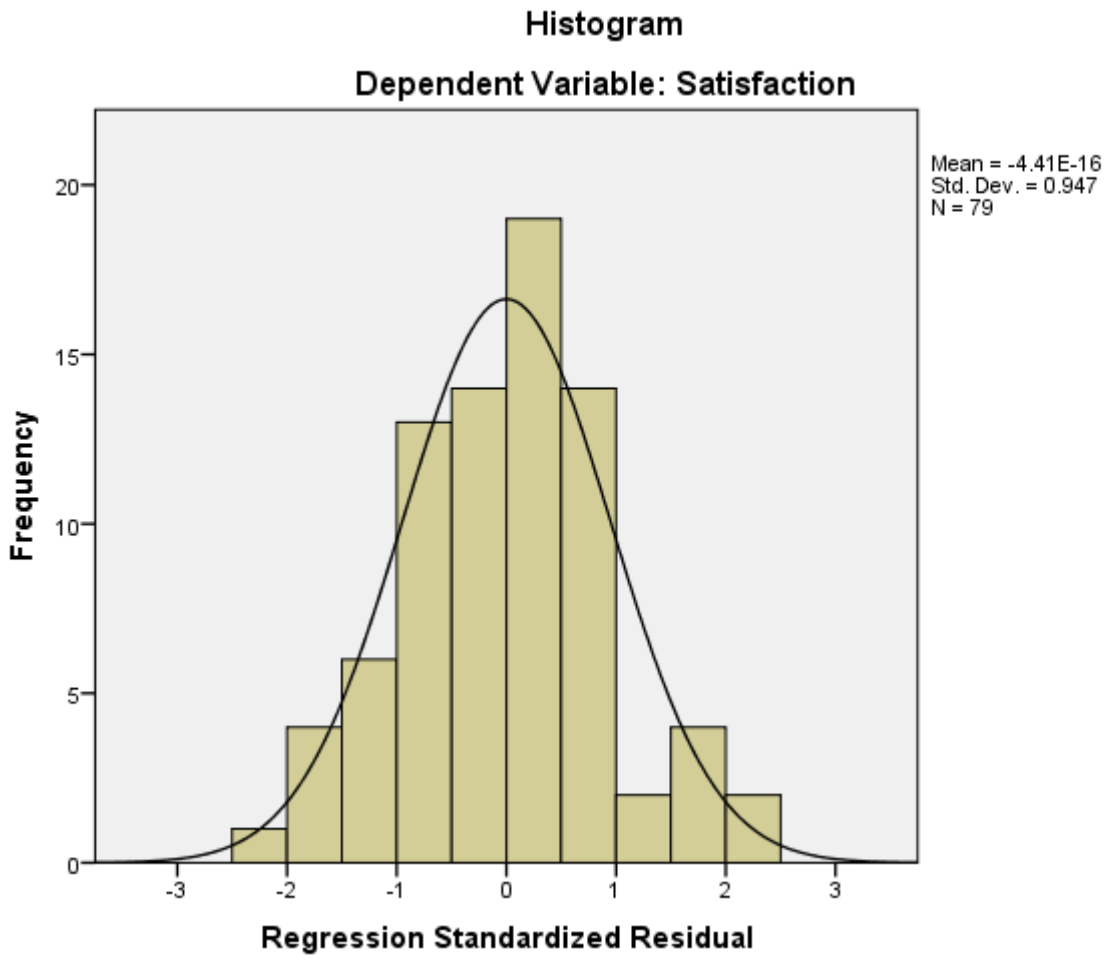
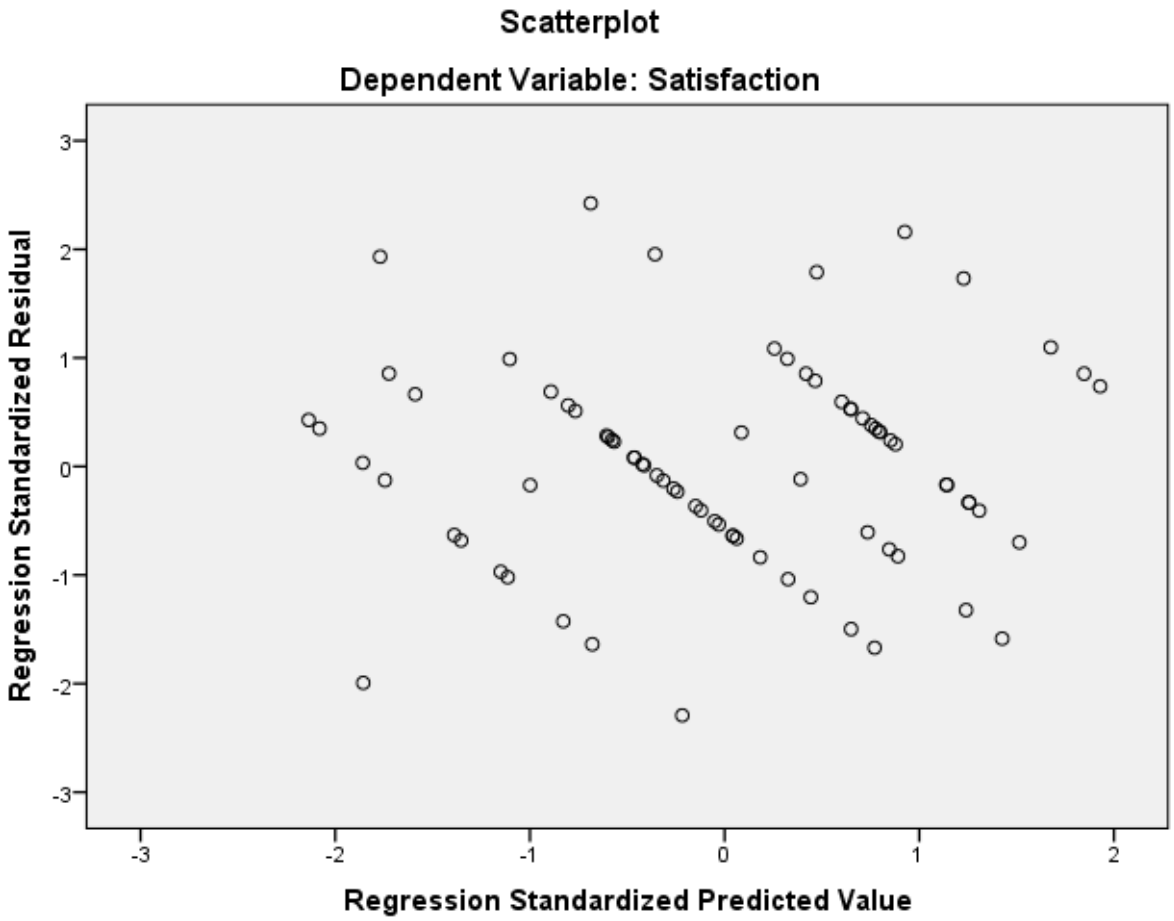
0
-1
-2
-3
-4
-2
0
2

Sixth Regression




Scatterplot
Dependent Variable: Satisfaction
Regression Standardized Residual
Regression Standardized Predicted Value
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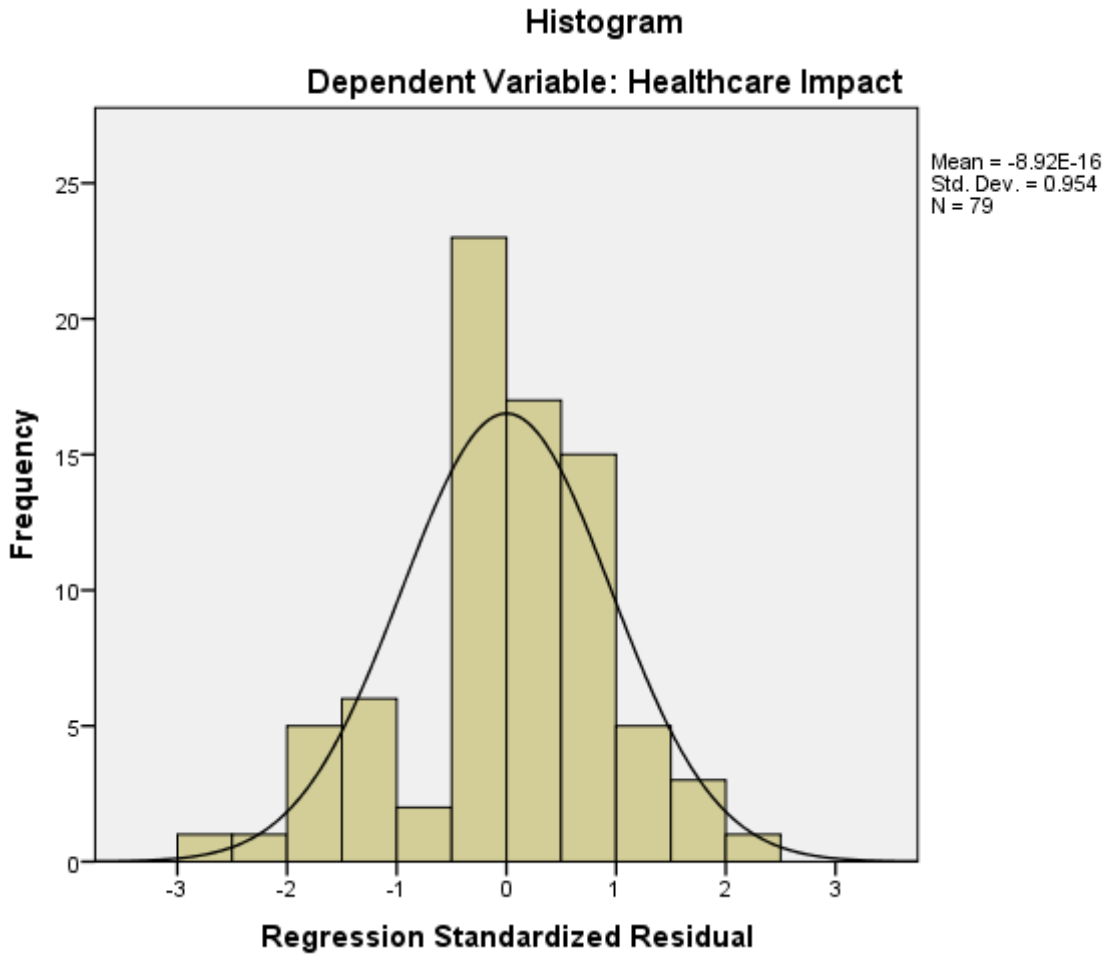
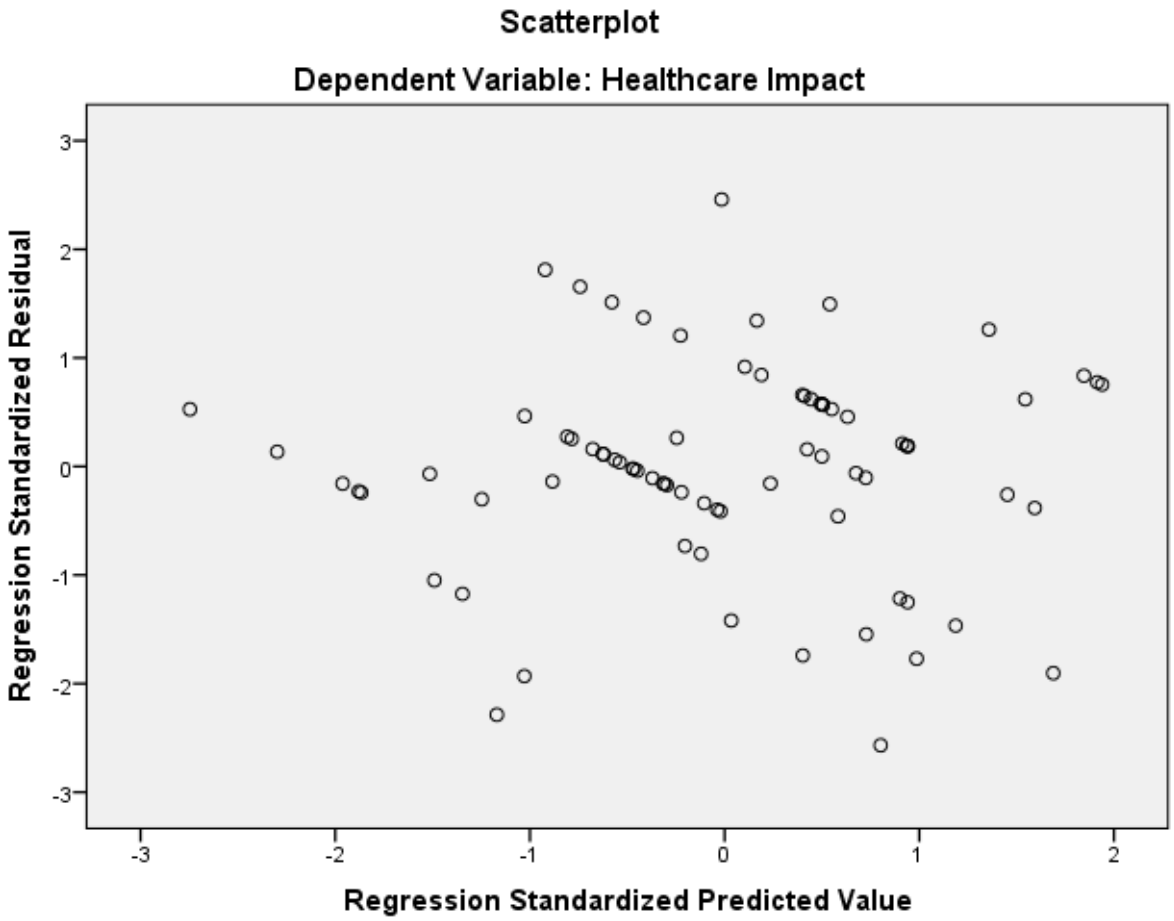
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2

Seventh Regression




Scatterplot
Dependent Variable: Healthcare Impact
Regression Standardized Residual
Regression Standardized Predicted Value
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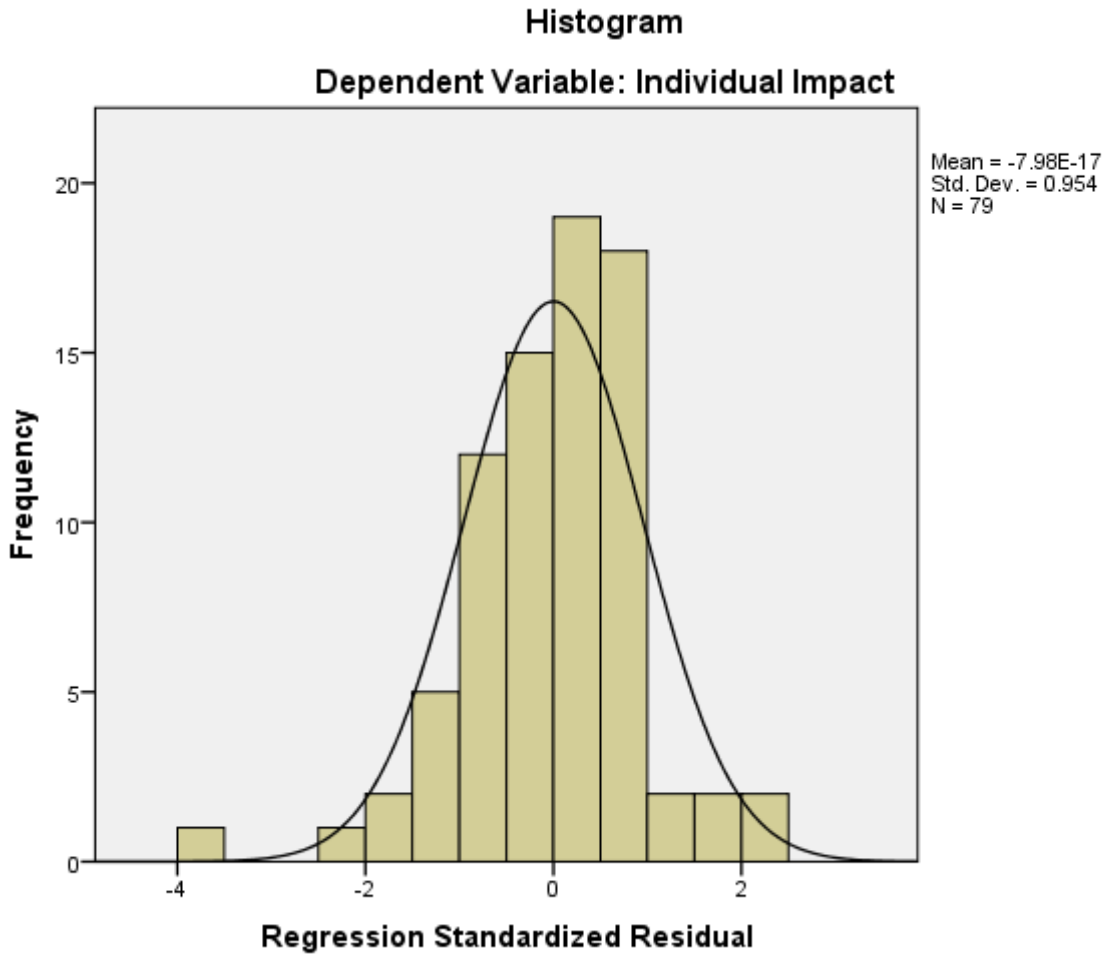
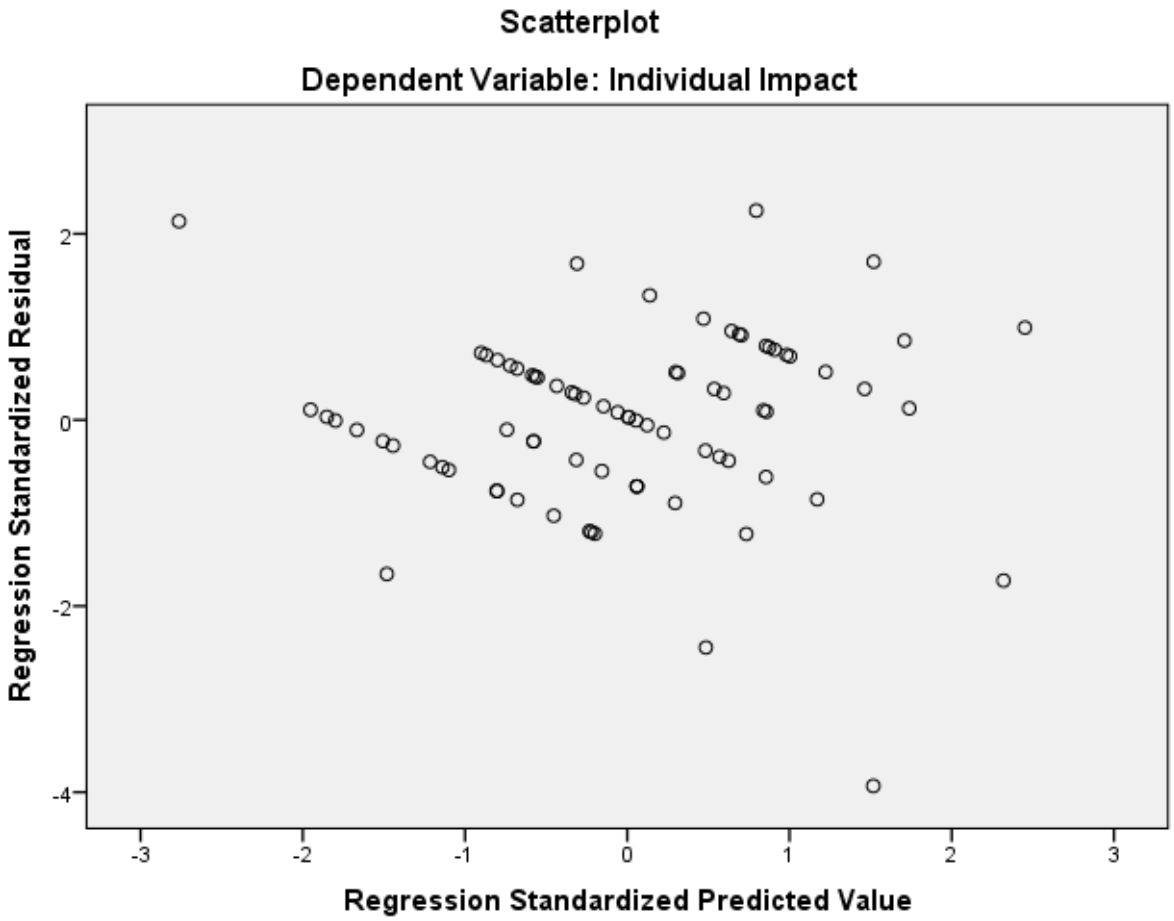
2
1
0
-1
-2
-3
-3
-2
-1
0
1
2

Eighth Regression




Scatterplot
Dependent Variable: Individual Impact
Regression Standardized Residual
Regression Standardized Predicted Value
2
0
-2
-4
-3
-2
-1
0
1
2
3