THE EFFECTS OF AN ELECTRONIC MEDICAL RECORD ON PATIENT MANAGEMENT IN SELECTED HUMAN IMMUNODEFIENCY VIRUS CLINICS IN JOHANNESBURG

by

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DEDICATION

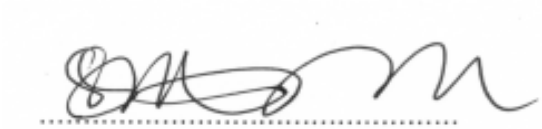
In memory of my late parents, ALICE MOSALIMOHOLO MASHAMAITE and JOHN KWENA MASHAMAITE, who taught me the value of a balanced existence. My value system owes its depth to their respect, humility, service to mankind and worship of the Lord.

DECLARATION

I declare that this research report on

THE EFFECTS OF AN ELECTRONIC MEDICAL RECORD ON PATIENT MANAGEMENT IN SELECTED HUMAN IMMUNODEFICIENCY VIRUS CLINICS IN JOHANNESBURG

is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.



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ABSTRACT

The purpose of the study was to describe the effects of an EMR on patient management in selected HIV clinics in Johannesburg.

A quantitative, descriptive, cross-sectional study was undertaken in four HIV clinics in Johannesburg. The subjects (N=44) were the healthcare workers selected by stratified random sampling. Consent was requested from each subject and from the clinics in Johannesburg. Data was collected using structured questionnaires.

Median age of subjects was 36, 82% were female. 86% had tertiary qualifications. 55% were clinicians. 52% had 2-3 years work experience. 80% had computer experience, 86% had over one year EMR experience. 90% used the EMR daily, 93% preferred EMR to paper. 93% had EMR training, 17% used EMR to capture clinical data. 87% perceived EMR to have more benefits; most felt doctor-patient relationship was not interfered with. 89% were satisfied with the EMR's overall performance. The effects of EMR benefit HIV patient management.

KEY CONCEPTS

Acquired immune deficiency virus; clinical decision support system; computer-based physician order entry; electronic medical record; human immunodeficiency virus; information and communication technology; patient management.

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LIST OF ABBREVIATIONS

AIDS: Acquired immune deficiency syndrome

ARV: Anti-retroviral

CBPRS: Computer-based patient record system

CDO: Care delivery organisation

CDSS: Computer-based decision support systems

CHRU: Clinical HIV Research Unit

CMV: Controlled medical vocabulary

CoJ: City of Johannesburg

CPOE: Computer-based physicians order entry

CPR: Computerized patient record

DICOM: Digital Imaging and Communications in Medicine

EHR: Electronic health record

EMR: Electronic medical record

EPR: Electronic patient record

HCT: HIV counselling and testing

HIV: Human immunodeficiency virus

HL7: Health Level Seven International

ICD10: International Classification of Diseases 10th revision

ICT: Information and communication technology

ISO: International Organization for Standardization

IT: Information technology

KZN: KwaZulu-Natal

M & E: Monitoring and evaluation

MAtCH: Maternal Adolescent and Child Health

MDG: Millennium Development Goal

NGO: Non-governmental organisation

NIH NCRR: National Institute of Health National Centre for Research Resources

PAAB: Patient Administration and Billing system

Pepfar: United States President's Emergency Plan for AIDS Relief

PHC: Primary health care

PHRU: Peri-Natal HIV Research Unit

PMTCT: Prevention of mother to child transmission

RHRU: Reproductive Health and HIV Research Unit

RTC: Right To Care (RTC)

TB: Tuberculosis

UNAIDS: Joint United Nations Programme on HIV/ AIDS

UNDP: United Nations Development Programme

Unisa: University of South Africa

USAID: United States Agency for International Development

WCR: Wits Clinical Research

WHC: The Wits Health Consortium

WHO: The World Health Organization

Wits: University of the Witwatersrand

WRHI: Wits Reproductive Health and HIV Institute

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CHAPTER ONE

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

The United Nations Millennium Development Goal 6 of 2001 aims to combat human immunodeficiency virus/acquired immune deficiency syndrome (HIV/ AIDS), malaria and other diseases (Chopra, Lawn, Sanders, Barron, Abdool Karim, Bradshaw, Jewkes, Flisher, Mayosi, Tollman, Churchyard & Coovadia 2009: 1024). According to the 2009 statistics from the World Health Organization, 33.3 million people were living with HIV worldwide (Joint United Nations Programme on HIV/AIDS 2010: 7). Of these 2.6 million were new infections in that year and 1.8 million died of HIV-related causes. Sixty-seven per cent of people living with HIV/ AIDS were living in Sub-Saharan Africa in 2008 and this region accounted for 72 per cent of AIDS deaths in that year (Joint United Nations Programme on HIV/ AIDS 2009: 21).

The South African National Strategic Plan on HIV/AIDS and sexually transmitted infections (STIs) 2007-2011 has one of the priority areas as monitoring, research and surveillance (South African National AIDS Council 2007: 10). One of the WHO's Three I's strategies, i.e. tuberculosis (TB) Intensive Case Finding (ICF); Isoniazid Preventive Therapy (IPT) to TB; and TB Infection Control (IC) for people living with HIV, is also developing monitoring and evaluation systems (WHO 2008: 1). Tierney, Beck, Gardner, Musick, Shields, Shiyonga and Spohr (2006: 253) also note that systems for providing, evaluating and improving HIV care are desperately needed in developing countries that bear the brunt of the HIV pandemic.

The Institute of Medicine has declared electronic medical records (EMRs) to be an essential technology for health care and a necessary tool for improving patient safety and the quality of care (Rotich, Hannan, Smith, Bii, Odero, Vu, Mamlin, Mamlin, Einterz & Tierney 2003: 295). However, comprehensive computer-based patient records that serve these functions are uncommonly used in developed countries, and are rare to non-existent in the developing world (Rotich et al 2003: 295).

The current study is undertaken to assess the effects of an electronic medical record (EMR) on patient care at selected HIV clinics. This chapter introduces the study to address the effects of medical record systems on management of HIV/AIDS in HIV clinics in Johannesburg. It discusses the research problem, its significance in the broader health context, the aims of the study, and its design and methodology.

1.2 THE RESEARCH PROBLEM

Burns and Grove (2005: 70) define a research problem as an area of concern where there is a gap in the knowledge base needed for nursing practice. This applies equally to other health areas.

Even though Garg, Adhikari, McDonald, Rosas-Arellano, Devereaux, Beyene, Sam and Haynes (2005: 1236) state that evaluations have shown that computer-based decision support systems (CDSSs) improve practice performance, there is no consensus on the effect of EMR in clinical practice (Delpierre, Cuzin, Fillaux, Alvarez, Massip & Lang 2004: 414). There is no all-inclusive information and communication technology (ICT)-based system in place for AIDS treatment in South Africa (Sørensen, Rivette & Fortuin 2008: 37). There are few evaluations of EMRs according to Lærum, Ellingsen and Faxvaag (2001: 1344). The current study adds to the knowledge base to try and fill this gap.

1.2.1 Source of, and background to, the problem

HIV and anti-retroviral (ARV) programmes have substantial data management needs. To address the problems highlighted above, electronic medical records (EMRs) are recommended because their most important capability is to retrieve critical information at the point of care.

The EMR in the clinics concerned is a proprietary system called TherapyEdge® which was implemented in the period 2007 to 2010. The information from the files was captured manually to the TherapyEdge® and from the date of implementation new information was captured directly onto the system. There were several modules in TherapyEdge® that were targeted at different staff members.

Receptionists captured demographic information, results and initiate the visit; nurses entered the patients' medical history, vital signs and order laboratory tests; doctors entered clinical findings on examination, diagnoses, investigation orders, management plan and medication orders and scheduled the patients' next appointment dates. However, the pharmacy module had not yet been developed on the evaluated TherapyEdge®.

There were 49 843 patient files on TherapyEdge® (Table 3.3) and both administrative and clinical healthcare workers used the system at the clinics. The growth rate of the patient base reflected the underlying epidemic in South Africa. Most of the patients were on anti-retroviral treatment (ARVs) and the minority were on the wellness programme, which catered for those who were not yet eligible for ARVs. The programmes catered for paediatric as well as adult patients, with most pregnant women in the latter group on the prevention of mother to child transmission (PMTCT) programme.

Some of the clinics offered circumcision as a preventative measure to curb HIV transmission. One of the clinics (Zuzimpilo) charged a fee for the service while the rest were free funded programmes run by government in collaboration with non-governmental organisations.

Patients were referred from local clinics, general practitioners, or were self-referred. The opinions of patients on the effects of the EMR system fell outside the scope of the current study.

The setting was the HIV clinics in the city of Johannesburg. The City of Johannesburg is one of eight metropolitan municipalities in South Africa (South Africa Online 2011). It is situated in the Gauteng Province, one of nine provinces in the country (Figure 1.1).

The Johannesburg City Metropolitan Municipality Department of Health runs 128 HIV counselling and testing (HCT) facilities: 96 local government, 30 provincial, and two facilities run by non-governmental organisations (NGOs). There are nine public hospitals in the City which also provide HCT services (City of Johannesburg Health Department 2011).

Source: City of Johannesburg

Figure 1.1 City of Johannesburg in Gauteng Province

The Wits Health Consortium (WHC) has several syndicates that run HIV clinics, some in support of government HCT facilities. Of all the HCT facilities, 14 have implemented an EMR. Four of these facilities were selected using simple random sampling and their EMR, TherapyEdge®, was evaluated in this study. One of the facilities selected, Zuzimpilo, runs on a subsidised model which is partly funded. The patients contribute a subsidised fee for the services.

The HCT facilities operate on an out-patient basis from 07h00 to 16h00 from Monday to Friday. One of the clinics (Zuzimpilo) also opens on Saturdays from 08h00 to 16h00 to accommodate working patients who cannot attend during the week.

The source of the problem for this study is a clinical situation found in practice. The area of concern which needs a solution, improvement or alteration is the lack of efficiency of the manual, paper-based systems. The effort to address the source of the problem in the current study has informed the formulation of the problem statement discussed in section 1.2.2 below. Stommel and Wills (2004: 26) contend that clinically oriented research often starts with problems encountered in clinical practice.

Little evidence has been documented on the use of information and communication technology (ICT) for mitigating HIV/AIDS in South Africa (Sørensen et al 2008: 37). EMR provides support for patient monitoring through summaries and alerts, programme monitoring through aggregate information and reporting, and for research activities.

Global experience in treating HIV in resource-poor areas, including information management, is limited (Fraser, Jazayeri, Nevil, Karacaoglu, Farmer, Lyon, Smith-Fawzi, Leandre, Choi & Mukherjee 2004: 1145). The current study is intended to supplement efforts made to address this shortcoming.

1.2.2 Statement of the research problem

A problem statement identifies the gap in the knowledge needed for practice (Burns & Grove 2005: 71).

Evaluation has been done on failed implementations and lessons learned (Littlejohns, Wyatt & Garvican 2003; Mbananga, Madale & Becker 2002) but few evaluations have been done on successful implementation in South Africa. Very few studies have dealt with the topic (design, implementation, acceptability and sustainability of the EHR) in the developing countries of sub-Saharan Africa (Kamadjeu, Tapang & Moluh 2005: 180). Furthermore, there have been few evaluations done on successful implementation in this setting.

The problem statement for this study is: What are the effects of an EMR on patient care in selected HIV clinics in Johannesburg? It is the researcher's opinion that the lack of adoption of EMR systems in South Africa stems from failed interventions which have not been properly evaluated.

1.3 AIM OF THE STUDY

The aim of the study contributes to existing body of knowledge and improving a particular area of life or practice (Unisa 2008b: 62).

The study will investigate attitudes of the health care workers to the effects of EMR on patient management in HIV clinics in an urban setting of Johannesburg and in a developing country (South Africa). These effects may differ to those that one finds in a developed country.

1.3.1. Research Purpose

The research purpose is a concise, clear statement of the specific goal or aim of the study that is generated from the research problem (Burns & Grove 2005: 71).
The purpose of the study was to explore and describe the effects (benefits and disadvantages) of an EMR on patient management in HIV clinics in Johannesburg. The findings will hopefully influence practice and policy development related to EMRs in this setting.

1.3.2 Research objectives

Based on the research purpose, the specific research objectives were developed to direct the study (Burns & Grove 2005: 80). The objectives of the study were:

- To describe demographics of the users of an EMR system in the identified clinics;
- To define the experience and training of the users of the EMR;
- To identify and describe the benefits and disadvantages of the EMR;
- To describe the positive and/or negative effects of EMR on patient management and the doctor-patient interaction in a clinical setting;
- To assess preferences of users for paper records or the EMR;
- To assess user satisfaction with different functions of the EMR.

These specific objectives explain how the research purpose would be achieved (Unisa 2008b: 63).

1.4 SIGNIFICANCE OF THE STUDY

The study contributes to existing knowledge and lack of evaluations of EMR in this setting. This is important for the successful implementation of further EMRs, and identification of weaknesses in the implemented EMRs as perceived by the users of the system.

Medical personnel and patients will benefit from the proper and successful implementation of EMRs. The findings will hopefully influence EMR practice and policies in South Africa.

One of the examples of innovation in health programming in South Africa is the development and introduction of electronic clinical information systems (Chopra et al 2009: 1023). The findings will add to the knowledge on acceptance and use of this relatively new technology in this setting. It is hoped that the findings of this study will assist in enhancing the current EMR systems, thereby motivating for the adoption of these systems to facilitate patient care. The weaknesses that are identified can be addressed to improve the implementation of EMRs.

The current research was essentially a descriptive study with limited overheads. Most of the costs were in printing questionnaires, training and remuneration of assistants and time to complete the questionnaires. Therefore, the current study was cost-effective to implement.

1.5 DEFINITIONS OF KEY CONCEPTS

The variables which need definition are ‘effects of EMR’ and patient management. The concepts of electronic medical record (EMR), Clinical decision support system (CDSS), and Computer-based physician order entry (CPOE) are also defined from the literature.

Effects of EMR

Effects are the clinical positive or negative impacts of the EMR in relation to the process of the patients’ disease management.

Patient management

Clinical procedures implemented to maintain or restore the health of a person who presents with a specific health problem.

The concepts of electronic medical/health/patient record (EMR/EHR/EPR), clinical decision support system (CDSS), computer-based physician order entry (CPOE), human immunodeficiency virus (HIV) and acquired immune deficiency syndrome (AIDS) are discussed in section 2.4.2.1.

1.6 FOUNDATIONS OF THE STUDY

The World Health Organization's Millennium Development Goal (MDG) 6 is to combat HIV, AIDS, malaria and other diseases, but Chopra et al (2009: 1024) report that there has been insufficient progress in the pursuit of this goal. Linked to this goal is Target 7 which is to have halved HIV/AIDS by 2015 and begin to reverse its spread. Therefore, monitoring of the country's progress towards reaching the MDGs has great significance for the health sector (Khumalo 2006: 67).

South Africa has the highest number of people infected with HIV of any country. More than half a million people were on antiretroviral treatment in South Africa in 2009, and the target, which was unprecedented worldwide, was 1.5 million by 2010 (Chopra et al 2009: 1026).

Chopra et al (2009: 1028) further state that several technological and organisational innovations that have been developed in South Africa and adopted in the public health sector have the potential to substantially increase access to treatment and services in the community and primary health care settings. One of the examples of innovations in health programming in South Africa is the development and introduction of electronic clinical information systems (Chopra et al 2009: 1028).

1.6.1 Meta-theoretical assumptions

The current study is a descriptive quantitative study whose foundations will therefore be based on a conceptual framework as below.

1.6.2 Theoretical framework

Concepts are abstract characteristics of subjects that are being studied (Polit, Beck & Hungler 2001 as cited in Brink 2006: 25). A framework helps the researcher to organise the study and provides a context in which the researcher examines a problem and gathers and analyses data (Brink 2006: 24). Specifically, the conceptual framework is a structure of concepts and/or theories which are pulled together as a map for the study

(to guide research) (Smith & Liehr 1999) and is developed through identifying and defining concepts and proposing relationships between these concepts (Brink 2006: 24).

The framework is further informed by the widely accepted criteria of the United Nations' Millennium Development Goals:

> In September 2000, building upon a decade of major United Nations conferences and summits, world leaders came together at United Nations Headquarters in New York to adopt the United Nations Millennium Declaration, committing their nations to a new global partnership to reduce extreme poverty and setting out a series of time-bound targets - with a deadline of 2015 - that have become known as the Millennium Development Goals (MDGs) (United Nations 2011b).

Goal 6 of the MDGs was to combat HIV/AIDS, malaria and other diseases. The target was to have halted the spread of the disease by 2015 and to begin to reverse the spread of HIV/AIDS (United Nations 2011a: 36).

An earlier target was to achieve, by 2010, universal access to treatment for HIV/AIDS for all those who needed it (United Nations 2011a: 41).

Chopra et al, (2009: 1028) listed one of the examples of innovations in health programming in South Africa, in relation to the MDGs, as the development and introduction of electronic clinical information systems. The current study uses MDG 6 as the framework and context on which the study problem is based and data is collected and analysed.

This study is based on the concepts of effects of an EMR on patient management in an urban HIV clinical setting.

The current study evaluates how clinicians perceive the clinical effects of the outpatient EMR on patient care while Lærum et al (2001: 1344) assessed frequency of use of EMR by doctors through a cross-sectional questionnaire survey and semi-structured interviews in more established and developed world settings. In the South African

setting EMR is a new technology whose impact among users and patients, especially in an HIV clinic context, has undergone only limited evaluation.

The concepts identified in this study are effects of the EMR and patient management as defined above. Questionnaires were used as instruments to measure these concepts which were assessed and discussed within the context of implementing an EMR in an HIV clinic. The establishment of relationships among the concepts was left to subsequent exploratory and explanatory studies.

1.7 RESEARCH DESIGN

A quantitative descriptive and contextual research design was used for this study. The dimensions of this study are quantitative, empirical and cross-sectional.

1.7.1 Descriptive design

The descriptive design serves to gain more information about characteristics within a particular field of study (Burns & Grove 2005: 232). This study describes a single broad variable which is the effects of EMR on patient management to obtain complete and accurate information about a phenomenon through description. It entails descriptive statistics to analyse the collected data and does not manipulate variables.

1.7.2 Contextual design

The context of the current study was clinics accredited for HIV services that are run by the Gauteng Department of Health and the health department of the City of Johannesburg metropolitan municipality. The clinics are run with support from non-governmental organisations (NGOs) such as Right To Care (RTC) and Peri-Natal HIV Research Unit (PHRU) of the Wits Health Consortium WHC). A sample of these clinics was selected for the purpose of implementing the current study as detailed in Chapter Three.

1.7.3 Quantitative design

The technique of data collection used was questionnaires administered to gather data in the specified population. The data collected was coded and reduced to numerical format in order to quantitatively analyse it. Quantitative methods used for analysis are discussed in detail in Chapter Four. The data on the selected variables was collected at a single point in time (Burns & Grove 2005: 236).

The research aim was to determine effects of an EMR on patient management. The chosen design assisted in attaining this research aim by assessing these effects through questionnaires and analysing them through descriptive statistics.

The research design is discussed in detail in Chapter Three.

1.8 RESEARCH METHODS

The study population was health care workers in selected HIV clinics in Johannesburg which had implemented the TherapyEdge® system. The final sample was selected from this population. The research methods are introduced here but are explained in more detail in Chapter Three of the current study.

1.8.1 Population and sample

Data sources were health care workers in HIV clinics in Johannesburg. These constituted all the elements that met certain criteria for inclusion in a given universe (Kerlinger & Lee 2000 as cited in Burns & Grove 2005: 40).

1.8.1.1 Population

The study population was healthcare workers in HIV out-patient settings in South Africa.

Target population

The target population of the current study was health care workers involved in the management of HIV patients in out-patient clinics in Johannesburg.

Sampling

Multi-staged sampling was used in this study. Four of the HIV clinics out of a sample of 14 primary health care (PHC) facilities that have implemented an EMR in Johannesburg were randomly selected as the sample.

Stratified random sampling method was used to select health care workers from the available sampling frame at the respective clinics. There are several strata of health care workers in these clinics with different job descriptions:

- Administrative clerks
- Data capturers
- Nurses
- Doctors.

Sample frame

Brink (2006: 124) refers to sampling frame as a comprehensive list of the sampling elements in the target population. The sampling frame in the current study was the list of users of the EMR in the selected clinics.

Study population or accessible population

An accessible population is the portion of the target population to which the researcher has reasonable access (Burns & Grove 2005: 342). It may be defined in terms of their geographic location (Johannesburg) or institutional affiliation (the specific clinic) or personal characteristics (HIV health care workers) and observation period (August 2011) (Stommel & Wills 2004: 297). Stommel and Wills (2004: 298-300) further narrow down the samples to the following:

Approached sample

Members of the accessible population targeted for recruitment.

Obtained sample

Healthcare workers who provided active consent comprise the obtained sample.

1.8.1.2 Sampling method and technique

The sample in this descriptive and cross-sectional study was selected using random sampling. The healthcare workers were selected using stratified random sampling method to improve the likelihood of the sample to be representative. Consent was requested from the subjects who were selected before administering questionnaires. Sampling was done using sample frames of health care workers provided by the clinics concerned.

1.8.2 Data collection approach

Structured data collection using questionnaires was implemented. The instrument was derived from the tools previously used by researchers in the EMR field. The qualities of the instrument are further discussed in Chapter Three.

The questionnaire had codes to collect numerical data which was later analysed as explained in Chapter Four.

A pilot study was implemented before the actual study to test the instrument. A trained assistant applied the questionnaires to individual subjects and did the necessary follow-up when there were errors or missing information.

1.8.2.1 Instruments

In this study, data was collected using structured questionnaires. The questionnaire had a general section for all participants and different sections for the respective groups of participants:

General
This section captured profiles of respondents in terms of gender, age, role and duration in the clinic.

EMR experience
Health care workers gave their experience of the system regarding duration, frequency and type of use, preference between EMR and paper, and training on EMR.

Effects

This section details the perceived effects of EMR by the respective respondents, with each category responding to their specific performance areas.

A statistician was consulted to review the planned research methods and data analysis of this study. The instrument was also reviewed by the statistician before use to assess if it was an appropriate tool for the study as intended.

1.8.3 Data analysis

Data analysis entails categorising, ordering, manipulating and summarising the data, describing them in meaningful terms (Brink 2006: 170) and quantifying and statistically reducing raw data in order to make interpretations and conclusions (Unisa 2008a: 99). Methods of data analysis are explained in detail in Chapter Three.

1.9 DESIGN VALIDITY AND RELIABILITY

1.9.1 Validity

Stratified random sampling was used in the design and conduct phase so that the participants were representative of the target population of interest to minimise sampling bias. In an effort to limit information bias, a standardised questionnaire was used to measure variables in the same way for groups of participants. Confounding was not a major factor in this study due to its descriptive design in which associations between variables were not being examined.

Few studies have used questionnaires in this context; therefore the available questionnaires were adapted to suit this study design.

1.9.2 Reliability

Reliability is whether one would get the same result if the measurement was repeatedly done using the same tool. A reasonable sample size was used to improve reliability. The instrument used was derived from existing instruments and a pilot was undertaken before implementing the tool in the actual research.

1.10 ETHICAL CONSIDERATIONS

Approvals were sought before proceeding with the research study in an effort to have oversight and protect the participants. After the proposal had been approved, a clearance certificate was issued by the University of South Africa (Unisa) Health Studies Research Ethics Committee (HSREC) as confirmation that the study meets the criteria of the institution (Annexure A).

Some of the institutions fall under the University of the Witwatersrand Human Research Ethics Committee (Wits HREC), therefore clearance was sought and granted by this ethics committee as well (Annexure B).

Potential subjects were invited to participate in the study and were asked to give verbal consent before proceeding with administering the questionnaire. They were provided with information on the study from a document given to them by the assistant before consenting (Annexure E).

Confidentiality was maintained through use of anonymous identifiers and participants reserved the right not to participate or to withdraw at any time during their participation without being prejudiced.

These human rights require protection in research, as outlined by Burns and Grove (2005: 181):

- The right to self-determination;
- The right to privacy;
- The right to anonymity and confidentiality;
- The right to fair treatment; and

- The right to protection from discomfort and harm.

Efforts were made by the researcher to ensure protection of these rights.

1.11 PERMISSION TO CONDUCT THE STUDY

The University of South Africa Health Studies Research and Ethics Committee (Unisa HSREC) and the University of Witwatersrand Human Research Ethics Committee (Wits HREC) issued clearance certificates (Annexures A and B respectively) approving the study after the study proposal and instrument (Annexure D) were submitted for their consideration.

Permission to conduct the study in the selected clinics was requested from the respective authorities using the letter (Annexure C) to which the proposal and instrument were attached. The respective approvals granted are attached (Annexures F to J).

Prospective participants were given information (Annexure E) about the study prior to requesting their consent to participate in the study.

1.12 SCOPE AND LIMITATIONS OF THE STUDY

This study was conducted from the 19th to the 30th of August 2011 in four HIV clinics in Johannesburg, Gauteng Province. Limitations that were identified were:

- The study was done in HIV clinics situated in the City of Johannesburg only, which might limit the generalisation of results;
- The number of health care workers in each category was limited and therefore a more representative random sampling was not feasible;
- Establishing relationships and causation between variables was beyond the scope of this study;
- A single proprietary system (TherapyEdge®) was evaluated.

Limitations are discussed in more detail in section 5.4.

1.13 THE STRUCTURE OF THE DISSERTATION

Chapter One introduces the orientation to the study. An overview and introduction to the study is given.

Chapter Two discusses the literature review conducted on the research topic in terms of sources consulted on the topic and research methods used.

Chapter Three discusses the research design and method followed to conduct the study. The type of design, the population and sample, the sampling procedures, data collection and analysis and instrument used are discussed and justified.

Chapter Four presents the process followed in data analysis, the sample realisation, data management and analysis, presentation and description of the research results, and an overview of the research findings.

Chapter Five details the summary and interpretation of the research findings, makes conclusions, contributions and recommendations from the findings and discusses the limitations of the study.

1.14 CONCLUSION

This chapter outlines the project plan to explore and describe the effects of an electronic medical record on patient management in HIV clinics in Johannesburg. The problem is a clinical situation in which manual paper-based systems are found to be inefficient and ineffective. HIV or ARV programmes have substantial data management needs which require EMR.
At the settings in which the research was conducted such an EMR has been in operation for a considerable period. The purpose of this study is therefore to investigate the effects of the EMR on patient care in these clinics.

The chapter indicates what the investigator intended to study in the problem and objectives sections, why the investigator wanted to study this in the significance and philosophical foundations sections, and how the investigator undertook this study in the design and methods sections.

The chapter also indicates how design validity, and validity and reliability of the research instrument were assessed.

Since this study involves human subjects, protection of human rights is detailed in this chapter. The rights of the institution are also safeguarded and scientific integrity is maintained. The special and sensitive nature of HIV and AIDS ethical principles is emphasised.

Finally, the scope and limitations of the study are discussed.

The next chapter describes the literature that was reviewed, how the review was done, and the extent thereof. The type and scope of the literature is outlined before discussing the concepts and models relevant to the current study. The main concepts are then discussed in detail with reference to the relevant sources.

Subsequent chapters give details on the outline sketched in the current chapter. Methods, and the reasons for choosing such methods, are explained, how the study was conducted, and results and conclusions derived from the results are discussed. Finally, recommendations are made regarding further research emanating from the findings made in the current study.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The global impact of HIV/AIDS has been devastating. The WHO has confirmed this by noting that HIV has inflicted the “single greatest reversal in human development” in modern history (United Nations Development Programme, cited in Joint United Nations Programme on HIV/AIDS 2008: 13). With an estimated 5.6 million people living with HIV in 2009, according to the latest Joint United Nations Programme on HIV/AIDS (UNAIDS) Global Report on the HIV/AIDS epidemic, South Africa’s epidemic remains the largest in the world (UNAIDS 2010: 28).

The world has responded to this pandemic through various innovative interventions. One of these has been that since HIV was first recognised, approaches and methodologies to monitor the epidemic and the response have continuously improved (UNAIDS 2008: 20). It has been recognized that HIV/AIDS treatment and management strategies require ongoing monitoring and evaluation (M&E), and telemedicine and electronic health (e-health) systems have been recommended as a supporting tool (Sørenson, Rivette & Fortuin 2008: 37). Due to the magnitude of these responses, effective M&E systems are essential to track patient access to, and retention on, anti-retroviral therapy (Douglas, Gadabu, Joukes, Mumba, McKay, Ben-Smith, Jahn, Schouten, Lewis, van Oosterhout, Allain, Zachariah, Berger, Harries & Chimbwandira 2010: 1).

However, Sørenson et al (2008: 37) argue that locally there was no agency, private or public, which offered an overview of e-health and telemedicine projects and systems in South Africa.

This chapter presents a search and review of literature on Electronic Medical Records (EMR) which is a component of these systems, as it relates to the HIV/AIDS field both at theoretical and (primary and secondary) empirical levels.

2.2 THE PURPOSE OF THE LITERATURE REVIEW

Stommel and Wills (2004: 339) refer to literature search as the formal process of locating existing information about a topic with the goal of being able to summarise the state of knowledge. The subsequent literature review is a written summary and evaluation of the information gleaned from literature searches to provide a foundation on which to base new evidence.

In quantitative research, such as the current study, the review of literature is conducted to direct the development and implementation of a study (Burns & Grove 2005: 95). The purpose of literature review is to establish a context for the study and to convey to the reader what is currently known regarding the topic of interest (Burns & Grove 2005: 93).

Research aims and questions in the research study are based on gaps in knowledge that need to be filled (Stommel & Wills 2004: 340). The literature review, combined with the research problem, should lead to the formulation of empirical research questions (Randolph 2009: 8). The purpose of literature review, therefore, according to Brink (2006: 67), is to identify the research problem and refine research questions.

Brink (2006: 67) gives reasons for literature research as being:

- To conduct a critical analytical appraisal of the recent scholarly works on the topic;
- To identify the research problem and refine the research questions;
- To place the study in the context of the general body of knowledge;
- To obtain clues to the methodology and instruments;
- To refine the problem statement, hypothesis, conceptual framework, design and data analysis process;
- To compare the findings of existing studies with those of the study at hand.

The specific aims of the literature review are to acquire knowledge on the topic and to critique existing knowledge (Brink 2006: 68).

2.3 TYPES OF SOURCES

The key sources for a literature review include published literature, such as original articles, review articles, books, reports, websites, other media, personal communications, and other unpublished data.

Stommel and Wills (2004: 339) refer to three key dimensions of a literature review as what is known about the topic, what is not known about a topic (research gap), and what needs to be known about a topic.

Tools that were used for the literature research include reference lists suggested by the subject librarian, reference lists from journal articles, books and articles, reviews, and internet searches like Medline/ PubMed.

Polit, Beck and Hungler (2001, cited in Brink 2006: 68) give five types of information and sources:

- Facts, statistics and research findings;
- Theories and interpretations;
- Methods and procedures;
- Opinions, beliefs or points of view;
- Anecdotes, clinical impressions or narrations of incidents and situations.

There are two broad sources, primary and secondary, which were consulted, as explained below.

2.3.1 Primary sources

Most of the sources consulted comprised this category. These are those sources in which data are reported and written by the person or group that actually gathered the information, or conducted the investigation (Brink 2006: 69).

2.3.2 Secondary sources

Brink (2006: 70) refers to these sources as second-hand because they summarise or quote content from primary sources. Due to the subjective nature and the likelihood of introduction of bias in these sources, consultation of the secondary sources has been kept to a minimum in the current study.

2.4 SCOPE OF SOURCES

2.4.1 Depth and breadth of sources

Brink (2006: 70) refers to the depth of literature review as the number and quality of the sources that one examines. The breadth is determined by the number of different sources examined (Brink 2006: 70). Sources consulted for the current study were searched using the concepts identified in Section 2.4.2.1. The sources were varied in terms of whether they were primary or secondary, theoretical or empirical, design and methodologies, settings and findings.

2.4.2 Theoretical literature

Theoretical literature consists of concept analysis, models, theories, and conceptual frameworks that support a selected research problem and purpose (Burns & Grove 2005: 94).

2.4.2.1 Concept analysis

The study is based on various concepts in information systems and on the use thereof in the health care services.

Concepts refer to the common properties of phenomena, which together make up reality (Stommel & Wills 2004: 8), thus providing the phenomena with a separate identity or meaning (Burns & Grove 2005: 122).

Health Information Management Systems Society defines EHR (electronic health record) as a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting (National Institutes of Health National Center for Research Resources (NIH NCRR) 2006: 1). An EHR integrates data to serve different needs. The major value of the integrated clinical system is that they enable the capture of clinical data as a part of the overall workflow (NIH NCRR 2006: 3). The concept of EHR represents the integration of healthcare data from participating collection of systems for a single patient.

The concept of EMR has various other components which are defined below, namely, clinical decision support system (CDSS) and computerised provider order entry (CPOE).

2.4.2.2 Concepts and their definitions

Electronic Medical/Health/Patient Record (EMR/EHR/EPR)

EMR is a general term describing computer-based patient record systems. It is sometimes extended to include other functions such as order-entry for medications and tests, among others (Coiera 2003: 400).

According to Häyrinen, Saranto and Nykänen (2008: 293), the International Organization for Standardization (ISO) defines EHR as a repository of patient data in digital form, stored and exchanged securely, and accessible by multiple authorised users.

Garets and Davids (2005: 2) further differentiate EMR and EHR:

EMR

An application environment composed of the clinical data repository (CDR), clinical decision support system (CDSS), controlled medical vocabulary (CMV), computerised provider order entry (CPOE), pharmacy, and clinical documentation applications. The patient's electronic record is supported across in-patient and out-patient environments; is used by health care practitioners to document, monitor and manage care delivery within the care delivery organisation (CDO); and is owned by the CDO. The data in the

EMR is the legal record of what happened to the patient during encounters at the CDO (Garets & Davids 2005: 2).

EHR

A subset of each CDO's EMR, presently assumed to include summaries and possibly information from pharmacy benefit management firms, reference laboratories and other organisations about the health status of patients in the community. It contains patient input and access spanning episodes of care across multiple CDOs within a community, region, or state (or in some countries, the entire country). The patient controls access to this information (Garets & Davids 2005: 2).

Even though Garets and Davids (2005: 2) differentiate EMR and EHR as explained above, Häyrinen et al (2008: 292) argue that the meaning of EHR is unstable. Some of the sources in the current study use the concept EMR while other sources use EHR to refer to the same concept. The two concepts are, therefore, used interchangeably in the current study.

Clinical decision support system (CDSS)

CDSS is a computer-based system that assists physicians in making clinical decisions about patient care (Shortliffe & Cimino 2006: 923). CDSS can be in the form of reminders (to vaccinate a child), alerts (warning about drug-to-drug interaction, dosage errors or allergy to medication) and prompts (which give diagnosis and treatment options). The potential benefits of CDSS, according to Coiera (2003: 338), are improved patient safety, improved quality of care and improved efficiency in health care delivery.

Computer-based physician order entry (CPOE)

A clinical information system that allows physicians and other clinicians to record patient-specific orders for communication to other patient care team members and to other information systems such as test orders to laboratory systems or medication orders to pharmacy systems (Shortliffe & Cimino 2006: 927).

Human Immunodeficiency Virus (HIV)

The World Health Organization (2011b) defines the human immunodeficiency virus (HIV) as a retrovirus that infects cells of the immune system, destroying or impairing their function. As the infection progresses, the immune system becomes weaker, and

the person becomes more susceptible to infections. HIV is transmitted through unprotected sexual intercourse (anal or vaginal), transfusion of contaminated blood, sharing of contaminated needles, and from a mother to her infant during pregnancy, childbirth and/or breastfeeding.

Acquired Immune Deficiency Syndrome (AIDS)

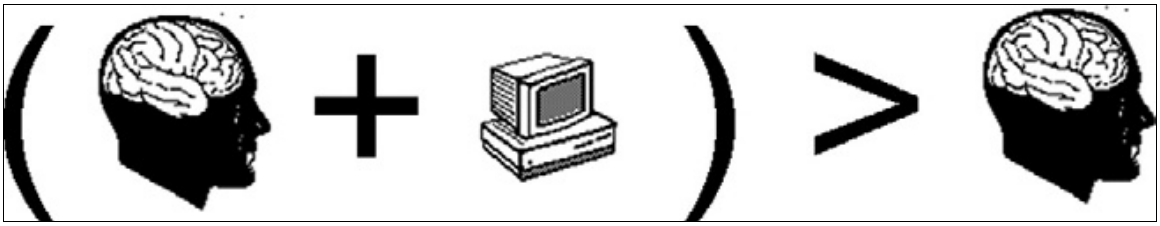
The most advanced stage of HIV infection is acquired immunodeficiency syndrome (AIDS). It can take 10-15 years for an HIV-infected person to develop AIDS, and antiretroviral drugs can slow down the process even further (World Health Organization 2011b).

2.4.2.3 Models

Models are abstractions of the real world (Coiera 2003: 4). They can be used as templates from which a new entity can be created (Coiera 2003: 7).

2.4.2.3.1 Friedman's "Fundamental Theorem" of biomedical informatics

According to the model proposed by Friedman (Figure 2.1), a person working in partnership with an information resource is 'better' than that same person unassisted (Friedman 2009: 169). The information resource complements the skills of the person in identifying solutions to certain problems. An EHR will never replace the health care worker, but it provides tools which assist the clinician in carrying out his duties.



Source: Friedman 2009: 170

Figure 2.1 A "Fundamental Theorem" of informatics model

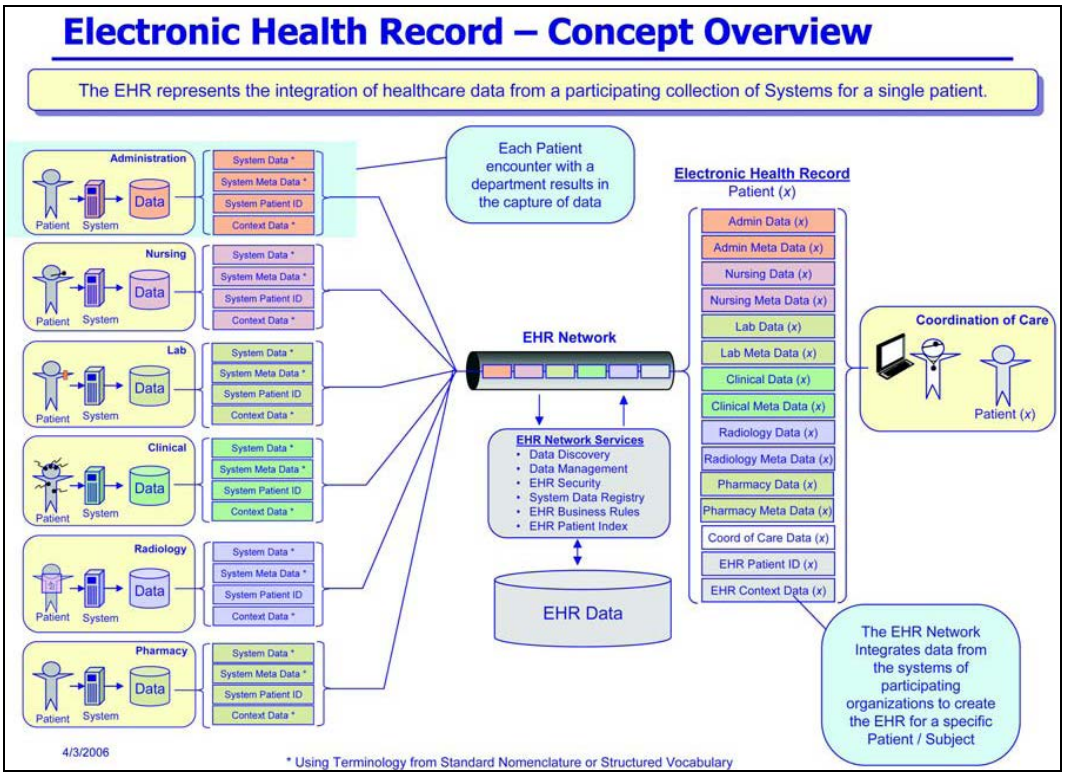
Friedman (2009: 170) provides corollaries to the theorem as follows:

- Informatics is more about people than technology. This means that information resources must ultimately be built for the benefit of people;

- The resource must offer something that the person does not already know. What the resource offers to the person must not only be correct but it must also be informative;
- Whether the theorem holds depends on an interaction between person and resource. What one knows about the person alone and what one knows about EHR cannot predict what will happen when EHR is deployed. It is therefore imperative to undertake assessments like the current study to determine the effect of implementation of the EHR.

2.4.2.3.2 National Institutes of Health's National Centre for Research Resources (NIH NCRR) modular model

The Electronic Health Records Overview Report commissioned by National Institutes of Health's National Center for Research Resources (NIH NCRR) and implemented by MITRE's Center for Enterprise Modernisation (Figure 2.2) proposes the EHR concept based on its components (NIH NCRR 2006: 3). In this model EHR represents the integration of health care data from a participating collection of systems for a single patient.



Source: NIH NCRR 2006: 5

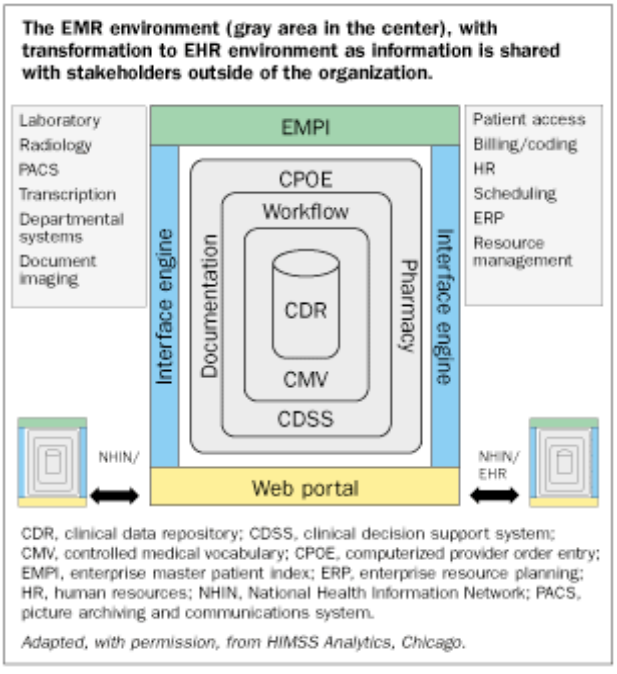
Figure 2.2 NIH NCRR modular model

The EHR is made out of various modules from within the health care environment: administration, nursing, pharmacy, clinical, radiology and laboratory. The patient data from these modules is integrated via a network and stored in a database which is accessed at each patient encounter. The patient details can be accessed by anyone who is authorised to view this data either entirely or only the modules the user is authorised to view.

2.4.2.3.3 The Electronic Patient Records model

Electronic Medical Records and Electronic Health Records

This concept by Garets and Davids expands on the NHI NCRR EMR concept as a way of differentiating between an EMR and an EHR. It also shows the components of an EMR being the clinical data repository (CDR) at the core, the controlled medical vocabulary (CMV) which is the dictionary, the computerized provider order entry (CPOE) and the clinical decision support system (CDSS) successively encompassing this core.



Source: Garets and Davids 2005: 4

Figure 2.3 The EPR model

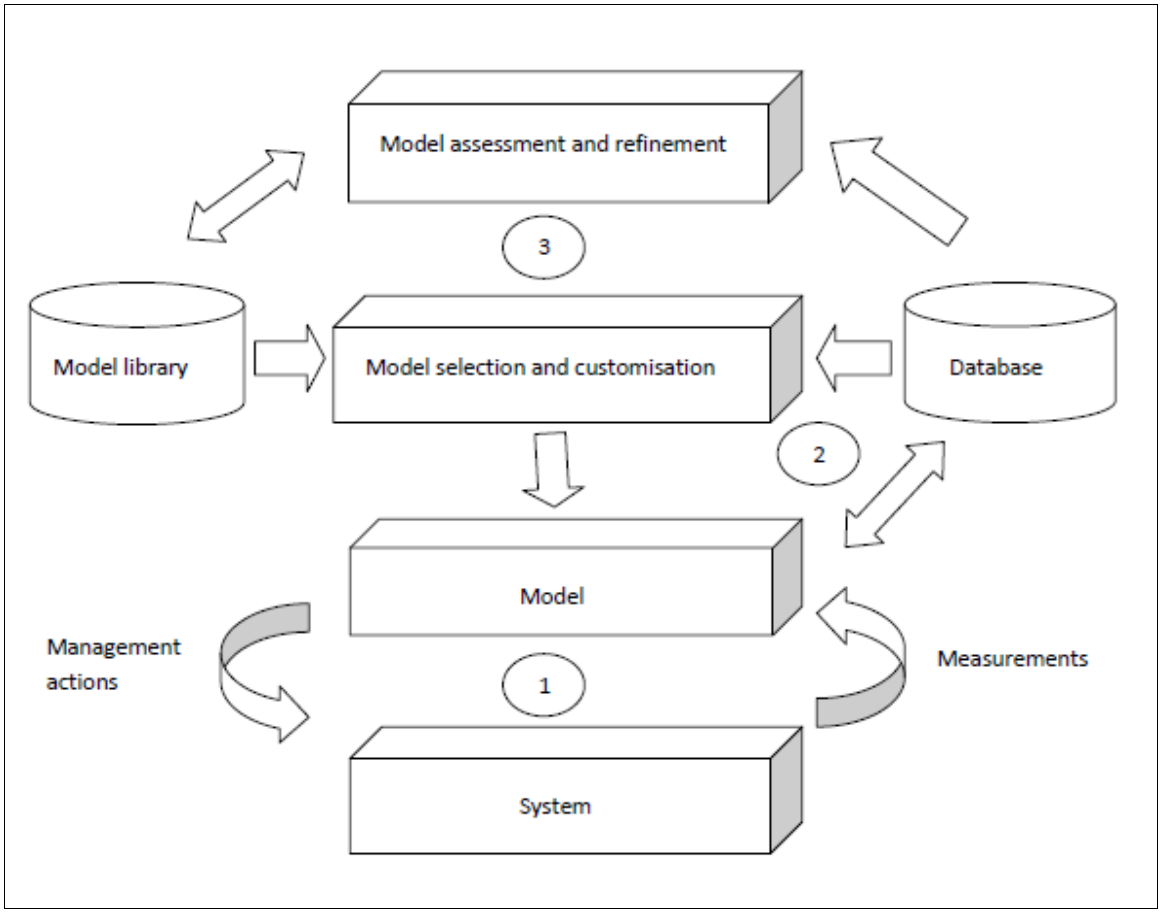
Garets and Davids (2005: 1) argue that EMR and EHR are completely different concepts. EMRs are computerized legal clinical records created in care delivery

organizations (CDOs), such as hospitals and physician offices. EHRs represent the ability to easily share medical information among stakeholders and to allow it to follow the patient through various modalities of care from different CDOs.

2.4.2.3.4 The three loop model

Coiera (2003: 103) describes EMR in terms of a three-loop model (Figure 2.4) in which:

Loop 1 defines the direct application of a model to a task. This entails application of knowledge to achieve a particular task. Using the knowledge in a model, and on the basis of measurements done, the patient's condition is managed (Coiera 2003: 104).



Source: Coiera 2003: 103

Figure 2.4 The three loop model

Loop 2 defines the way models are selected and customized. Loop 2 is an ongoing process of deciding which models and measurements are most appropriate for a specific task (Coiera 2003: 104).

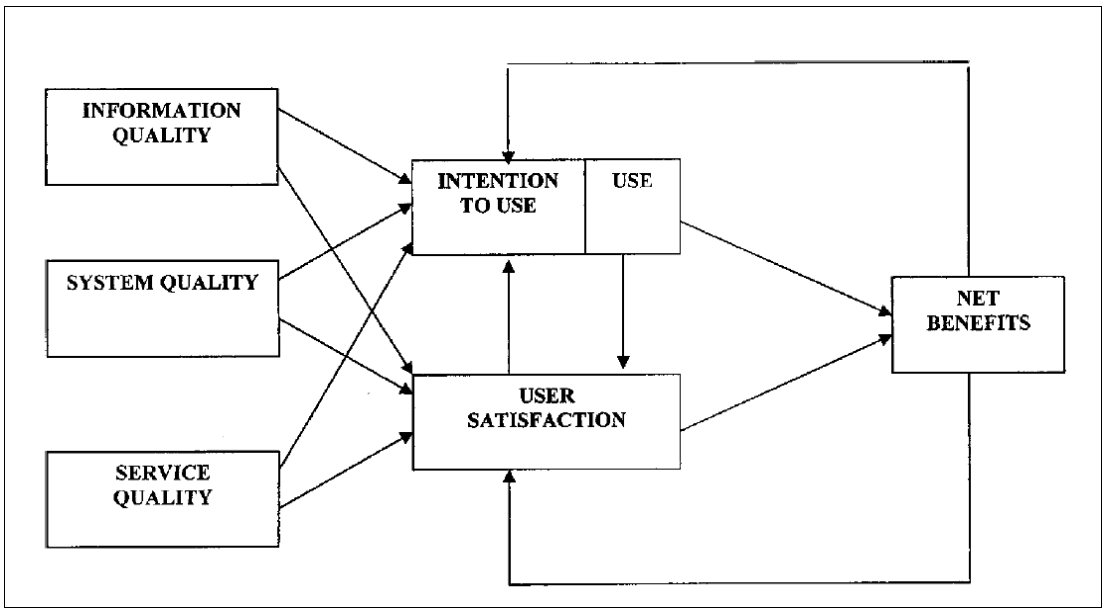
Loop 3 is responsible for model creation and refinement based upon the results of application over time. Knowledge that was used to complete a task is examined against the outcome of its application. This is the loop where scientific examination of existing theories leads to creation of new ones (Coiera 2003: 105).

2.4.2.3.5 DeLone and McLean Information System success model

DeLone and McLean (2003: 10) define information system success at three levels: the technical level of communication is the accuracy and efficiency of the communication system that produces the information; the semantic level is the success of the information in conveying the intended meaning; and the effectiveness level is the effect of the information on the receiver. The current study focuses on the effectiveness level with reference to the effect of EHRs on patient management. In the DeLone and McLean Information System success model, system quality measures technical success, information quality measures semantic success and use, user satisfaction and individual impacts measure effectiveness success (DeLone & McLean 2003: 10).

Information quality, system quality and service quality, each of which should be measured or controlled separately, singularly or jointly affect subsequent intention to use and user satisfaction (DeLone & McLean 2003: 23). As a result of use and user satisfaction certain net benefits will occur. For information systems to be continued, net benefits of the owner or sponsor of the system have to be positive, thus influencing and reinforcing subsequent use and user satisfaction (DeLone & McLean 2003: 23). System quality's attributes: usability, availability, reliability, adaptability and response time are examples of qualities that are valued by users (DeLone & McLean 2003: 24).

Information quality refers to completeness, ease of understanding, personalization, relevance and security of content (DeLone & McLean 2003: 25). The overall support is represented by service quality. Poor user support will translate into lost customers and lost sales. Service quality is determined by assurance, empathy and responsiveness (DeLone & McLean 2003: 25).



Source: DeLone & McLean 2003: 24

Figure 2.5 Updated DeLone and McLean Information System success model

Usage refers to nature of use, patterns thereof and frequency of use. User satisfaction is an important means of measuring the user experience cycle as indicated by repeat and frequent use. User surveys may be used to assess user satisfaction (DeLone & McLean 2003: 25).

Net benefits are the most important success measures as they capture the balance of negative and positive impacts of the service on customers, for example, saving time and money, or positive growth. They will include cost savings, expanded markets, time savings, reduced costs and additional sales (DeLone & McLean 2003: 25).

2.4.3 Empirical literature

Empirical literature comprises relevant studies in journals and books, as well as unpublished studies (Burns & Grove 2005: 94). The empirical literature is discussed under the respective concepts of this study.

2.4.3.1 Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome

The Millennium Development Goal 6 aims to combat human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), malaria and other diseases (Chopra et al 2009: 1024).

According to the World Health Organization (2011a), since the beginning of the epidemic, more than 60 million people have been infected with the HIV virus and nearly 30 million people have died of AIDS. In 2009, there were an estimated 33.3 million people living with HIV, 2.6 million new infections, and 1.8 million AIDS-related deaths (WHO 2011a). The World Health Organization African Region is the most affected, where 1.8 million people were infected with the virus in 2009. The estimated 1.3 million Africans who died of HIV-related illnesses in 2009 comprised 72 per cent of the global total of 1.8 million deaths attributable to the epidemic (WHO 2011a). Furthermore, 67 per cent of people living with HIV/AIDS were living in Sub-Saharan Africa in 2008 and this region accounted for 75 per cent of AIDS deaths in that year (UNAIDS 2009: 21).

The South African National Strategic Plan on HIV/AIDS and STIs 2007-2011 has one of the priority areas as monitoring, research and surveillance (South African National AIDS Council 2007: 10). Part of the WHO's three I's strategies (TB Intensive Case Finding (ICF), Isoniazid Preventive Therapy (IPT) to TB, and TB Infection Control (IC) for people living with HIV), is also developing monitoring and evaluation systems (WHO 2008: 1). Tierney et al (2006: 253) also note that systems for providing, evaluating and improving HIV care are desperately needed in developing countries that bear the greatest burden of the HIV pandemic.

The Institutes of Medicine of America has stated that electronic medical records (EMRs) are an essential technology for health care and a necessary tool for improving patient safety and the quality of care (Rotich et al 2003: 295). However, computer-based patient records that serve these functions are uncommonly used in developed countries and are rare to non-existent in the developing world (Rotich et al 2003: 295).

To hasten progress towards the 2015 deadline for the Millennium Development Goals, the global community had embraced the goal of moving towards universal access to HIV prevention, treatment, care and support by 2010. The challenge is to harness the

potential information and communication technology (ICT) to promote developmental goals, namely to combat HIV/AIDS (UNAIDS 2008: 23).

Sørenson et al (2008: 3) agree that HIV/AIDS treatment and management strategies require ongoing monitoring and evaluation.

2.4.3.2 Electronic Medical Records/ Electronic Health Records

2.4.3.2.1 Strengths and weaknesses

Strengths

Patient safety will be improved because computer-based physicians order entry (CPOE) can reduce the potential for error in increasingly complex computerized patient records (CPR) environments by ensuring that orders are more legible, complete and appropriate (Ball, Garets & Handler 2003: 506).

Overall, an EHR enables the administrator to obtain data for billing, the physician to see trends in the effectiveness of treatments, a nurse to report an adverse reaction, and a researcher to analyze the efficacy of medication in patients with co-morbidities (National Institutes of Health National Center for Research Resources 2006: 3).

There is an overwhelming consensus that EMR benefits everyone involved in health care. However, despite substantial evidence, only 15 per cent of American doctors (and even fewer South African doctors) use EMR (Gerntholtz, van Heerden & Vine 2007: 24).

According to Wulsin and Dougherty (2008: 7) one of the ways in which EMR improves the quality of care of patients is through helping physicians adhere to evidence-based guidelines and protocols, and thus through reduction of medical errors. In one literature review the majority of studies showed a reduction in medical errors which was quantified as high as 40-80 per cent (Clamp & Keen 2005: 33). The Audit Commission (2001: 10) agrees that computerized prescribing and health records have been shown to eliminate three-quarters of medical errors. This reduction in medical error rate, according to Clamp and Keen (2005: 33), improves efficiency of care.

Tang, Ash and Bates (2006: 124) found that EHR helps clinicians in making better decisions, thereby making health care safer for the patient and more satisfying for the clinician. Access to clinical information can be improved by well-organised, legible data in EMRs, but also with availability of information in several places simultaneously. Albers and Spil (2009: 3) see the focus of relevance of EHR as being on the availability of information at any time and any place. EMR occupy less storage space, and allow for simultaneous access to information and rapid searches (Coiera 2003: 113). In developing countries, Ndira, Rosenberger and Wetter (2008: 496) appreciate the potential of EHRs to improve on timeliness and availability of routine reports. These properties of EHR reduce redundancy and allow graphical display of results and formulary decision-making (Meinert 2005: 496). Patients can be followed through various modalities of care by the ability of EHR to allow easy sharing of medical information among stakeholders (Garets & Davis 2005: 1).

In broader health care programmes, health information systems can contribute to alleviating health service delivery problems and for monitoring health status of the population (Ndira et al 2008: 489).

Weaknesses

There have been well-publicised failures in implementation of health information systems. For example, Littlejohns, Wyatt and Garvican (2003: 863) report that the United Kingdom has had its fair share of failed health information systems and of wasted millions of pounds. Littlejohns et al (2003: 860) further found that about three-quarters of systems evaluated are considered to have failed.

Arnold, Wagner, Hyatt, and Klein (2007: 1) identify communication, standardization, funding, and inter-operability as common barriers to EHR implementation. The gap in communication that exists between and within countries is the greatest barrier to creating inter-operable standards in health care information and technology (Arnold et al 2007: 4).

Meinert (2005: 494) points out that physician resistance to EMRs has been attributed to a variety of factors including, but not limited to: 1) well-publicized EMR failures; 2) limited computer literacy on the part of physicians; 3) concerns over productivity (i.e.

fear that an EMR would slow physicians down); 4) patient satisfaction; and 5) unreliable technology.

User acceptance is critical in the successful implementation of EHRs because if users do not accept the system they are unlikely to use it. Physician acceptance of EMR applications has been slow mainly due to limited computer literacy, concerns over productivity and unreliable technology. Meinert (2005: 494) further emphasizes that if physician acceptance or “buy-in” is in fact a critical success factor in widespread adoption of EMRs, it is appropriate and necessary that the perceptions of physicians concerning such applications be examined. The current study contributes to fulfilling this need.

Another issue which affects user acceptance is lack of effective user-computer interfaces. The high cost of implementation and maintenance especially in the presence of little evidence that they improve the productivity of health professionals (Littlejohn et al 2003: 860) is a common barrier to EHR investment.

According to Sørenson et al (2008: 37) the barriers mentioned above contributed to the lack of all-inclusive information and communication technology-based systems for AIDS treatment in South Africa. Sørenson et al (2008: 37) further note that there is little evidence available on the use of information and communication technology for mitigating HIV/AIDS in South Africa.

2.4.3.2.2 Conflicting findings

In a study on EMR, Clamp and Keen (2005: 14) conclude that the overall results were mixed and that there is no agreed set of mechanisms whereby information technology services influence work practices in health or social care settings. To compound matters, Clamp and Keen (2005: 15) report reductions in time costs for some tasks with increases for others. Patient perceptions of EHR have resulted from both positive and negative experiences (Clamp & Keen 2005: 17).

Furthermore, EHR suppliers disagree about the exact rates of uptake, although it is accepted that they are slow (Cochrane & Ramokolo 2007).

2.4.3.2.3 Areas of uncertainty

There have been several areas of uncertainty in the literature. Clamp and Keen (2005: 75) conclude that none of the published studies provided the consumers with adequate contextual information to properly evaluate the evidence presented. It was further observed that it is not possible to interpret most of the results with any confidence (Clamp & Keen 2005: 76).

Clamp and Keen (2005: 74) found limited evidence about the impact of EHR on patient experiences and outcomes. With regard to accuracy of data in EMRs, Ndira et al (2008: 496) argue that levels of accuracy are difficult to ascertain. One of the challenges Handler, Holtmeier, Metzger, Overhage, Taylor and Underwood (2001 cited in Meinert 2005: 494) found was that assessing physician perceptions concerning EMRs is complicated by the fact that there is no precise definition of such applications.

Furthermore, Garets and Davis (2005: 3) point out that for one thing, there is no agreed definition of the patient clinical summary that will comprise the EHR. To complicate matters further, the ways in which information systems, and particularly electronic network services, influence work patterns are not particularly well understood (Clamp & Keen 2005: 8).

The complicated relationship between the process of care and health outcomes might explain why improved outcomes are difficult to relate to the implementation of computer-based patient record system (CBPRS) (Clamp & Keen 2005: 12).

2.4.3.2.4 Gaps: areas needing more research

Although most industries have aggressively embraced the use of information technology (IT), Meinert (2005: 493) observes that health care is one noticeable exception. Even though physician acceptance is critical to widespread adoption of ambulatory EMRs, Meinert (2005:493) further notes that there is little independent research on physician perceptions.

In South Africa, as Sørenson et al (2008: 37) observe, there is no all-inclusive information and communication technology-based system in place for AIDS treatment

and little evidence has been documented on the use of information and communication technology (ICT) for mitigating HIV/AIDS. There is furthermore no baseline study on telemedicine, e-health or e-readiness for South Africa. Consequently, the WHO 'Global e-health observatory' has no information on South Africa.

Regarding research on EHR use in HIV/AIDS treatment, Sørenson et al (2008: 38) found no published scientific papers from South Africa nor were technical reports or relevant information readily available. Of the available systems, there were more ICT systems on information handling (hospital information system (HIS) and EHR) than on direct patient consultations (Sørenson, et al, 2008: 38).

The current study aims to bridge the gap by assessing an EHR system which has been deployed in the HIV clinical setting from the perspective of the users.

2.4.3.2.5 Cost factors

In a literature review, Clamp and Keen (2005: 76) could not identify any study that has attempted to capture all of the costs and benefits associated with EHR. This is in part because papers fail to consider all possible sources of costs (Clamp & Keen 2005: 76).

However, Wang, Middleton and Lisa (2003, cited in Albers & Spil 2009: 3) point out that benefits of an EHR reportedly have theoretical positive financial returns on investments due to savings caused by reductions in medical errors and inefficiency. Clamp and Keen (2005: 32) observe that CPOE is expensive and complex and requires large investment.

Implementation of an electronic medical record system in primary care can result in a positive financial return on investment to the health care organization. The EMR has the potential for annual savings for the overall health care system, by improving health care quality and efficiency (Hillestad, Bigelow, Bower, Girosi, Meili, Scoville & Taylor 2005: 1107-1114).

The majority of physicians currently believe that EMR benefits outweigh costs and most feel EMR systems should therefore be implemented (Meinert 2005: 502). There are

high start-up costs which include buying new computers and software and staff training (Cochrane & Ramokolo 2007).

Problems in funding of the EHR implementation are not confined to the developing countries only. Arnold et al (2007: 2) found that EHR funding in South Africa, Sweden, Germany, France and the Netherlands continues to be an international problem due to the significant cost of implementation.

However, increasing numbers of national health programmes and international funding agencies are willing to pay for electronic data collection, data management, and monitoring and evaluation (Braitstein, Einterz, Sidle, Kimaiyo, & Tierney 2009: 56). Nevertheless, Khotu and Cabuko (2006: 1) note that extensive provision of ICT is beyond the financial resources of the government alone. This presents an opportunity to establish public-private partnerships for the benefit of the community. Investments in EHR systems will also be recouped through benefits to programmes like HIV/AIDS (Braitstein et al 2009: 57).

2.4.3.2.6 Paper-based record

In most parts of the world paper-based records are still predominant despite the disadvantages associated with them. Poor availability, illegibility, poor organisation and incompleteness are some of the weaknesses found with paper-based records (Van der Meijden, Tange, Troost & Hasman 2001: 173).

However, the ease of data entry made paper-based reports often more extensive than necessary. Consequently, tracing relevant information often became difficult (Van der Meijden et al 2001: 182).

Meinert (2005: 493) observes that paper medical records or charts are by nature data-rich, but information-poor. A few studies found that, in general, the users were relatively satisfied with their paper clinical records and that users were more positive about the data entry aspects of both the paper medical and the paper nursing record than about the data retrieval aspects (Van der Meijden et al 2001: 178).

Coiera (2003: 115-116) states several disadvantages with the paper-based patient record: a paper record can only be used for one task at a time; it can be unavailable or lost; the time required for these notes to be requested and delivered can be unacceptably long; paper records consume space; large records can be difficult to search; and paper is fragile and susceptible to damage.

With regard to information entry, Coiera (2003: 113) notes that the information might be illegible and have unclear meaning. Errors are common, for example omission of relevant data. During information retrieval Coiera (2003: 113) further notes that clinical workers routinely fail to find pieces of information during consultation, e.g. laboratory results, procedures ordered, medications and history. This leads to duplication of tests and procedures. Tang and McDonald (2006: 448) found that inaccessibility is a common drawback of paper records.

In some settings both paper and electronic records are used, with paper acting as back-up in case the electronic record is not available due to power failures. However, Ndira et al (2008: 495) note that paper-based and electronic systems if used on a parallel basis could result in inconsistencies in the record systems.

Compared to paper, electronically compiled reports are generally easier to retrieve and analyze than paper-based reports (Ndira et al 2008: 490). In a study by Van der Meijden et al (2001: 182) the respondents indicated that an EPR should give them a greater overview than the paper records. However, the EMR has its own shortcomings in that the structured nature of electronic interactions takes longer than paper-based interactions.

2.4.3.2.7 South African context

The pace of adoption of EMR in the world has been slow and where implemented the progress varies among the different countries. For example, Sweden, France and South Africa have already moved towards a government-funded national system, while Germany and the Netherlands have not yet formally committed to this model (Arnold et al 2007: 2).

In their research Cochrane and Ramokolo (2007) found that EHR technology is rapidly being adopted by doctors in the United States, but whether this will happen in a low to middle income country such as South Africa remains uncertain. It is undisputed that EHR could revolutionise the way doctors provide services in South Africa (Cochrane & Ramokolo, 2007). However, this technology has, for various reasons, not been as widely implemented as anticipated.

In attempting to find resolutions to problems encountered in the implementation of EHR, many companies agree that South Africa needs to learn from the mistakes made in other countries (Cochrane & Ramokolo, 2007). Because EHR requires connectivity to function optimally, Cochrane and Ramokolo (2007) observe that connectivity is another challenge that South Africa will face with regard to EHR.

Cochrane and Ramokolo (2007) further believe that the success of the EHR system in South Africa will be dependent on the input of all providers and end-users. The South African National Department of Health has issued a tender for the procurement of an Electronic Health Record (eHr.ZA) system (Cochrane & Ramokolo, 2007). To this end, Arnold et al (2007: 3) highlight that South Africa is in the process of selecting an EHR vendor utilising a request-for-information process. Arnold et al (2007: 3) further express the hope that with the selection of a mainstream vendor there would be considerable inter-operability and utilisation of industry standards such as HL7 (Health Level Seven International - the global authority on standards for inter-operability of health information technology) and DICOM (Digital Imaging and Communications in Medicine - the industry standard for transferral of radiologic images and other medical information between computers).

South Africa has embarked on a process of developing a national EHR for all patients in public hospitals (Mahlong 2009). In KwaZulu-Natal (KZN) the successful installation of an EHR system at the Inkosi Albert Luthuli Hospital is an indication of their feasibility in hospitals (Cochrane & Ramokolo 2007).

Currently in South Africa each province has implemented different EMRs, some with several vendors within the same province. This is because implementation and support of health systems is managed at provincial level. However, each province has a dominant EHR (Sørenson et al 2008: 39). In Gauteng alone a number of different

systems are currently being operated in various institutions, for example, some institutions run the Patient Administration And Billing system (PAAB) and some use the Medicom hospital information system (Gauteng Department of Health 2009: 93). Recently, in the Gauteng province a joint venture contract by the Baoki Consortium to implement the Hospital Information and Gauteng Electronic Health Record systems for the Gauteng Department of Health, was cancelled by Baoki Consortium due to non-payment by the Department of Health in Gauteng, according to Mawson (2009).

In assessing the implementation and use of EMR for HIV management Sørenson et al (2008: 3) found that there is no all-inclusive ICT-based system for AIDS treatment in South Africa. They also found little information on the use of ICT for mitigating HIV/AIDS in South Africa (Sørenson et al 2008: 3).

2.5 SUMMARY OF FINDINGS

South Africa has the largest population of people living with HIV globally. The ARV programme in the country is consequently the largest response to the epidemic in the world. With a response programme of this magnitude there have been challenges in co-ordinating and monitoring the ARV roll-out throughput in the country. There is unfortunately no overview of electronic Health (eHealth) projects and systems in South Africa to address these challenges.

There are clinical settings in which EMRs have been deployed as a tool to manage HIV patients and monitor and evaluate these programmes. Adoption of these systems has been slow, especially in the public health sector, where most patients access their treatment. Some NGOs, for example, Right To Care, have partnered with the national Department of Health to implement these systems.

However, there have thus far been few studies which evaluated the effectiveness of these systems in the management of HIV patients. The current research study is an attempt to fill this gap. In pursuit of this aim a literature search was conducted to determine existing information on EMR inasmuch as it relates to HIV, and the sources found were summarized and evaluated. This process is aimed at acquiring knowledge on the use of EMRs in HIV treatment and to critique this knowledge.

Most of the sources consulted were of a primary nature. A diverse number of sources from a global to a local perspective were consulted. Several concepts were analysed to represent the different perspectives on EMR. The models on each concept from the theoretical literature were discussed. Empirical literature was discussed under the respective concepts of HIV and EMR.

The severity of HIV is highlighted by the World Health Organization (WHO) through its inclusion in the Millennium Development Goals. Southern Africa carries a disproportionate burden of this epidemic in both morbidity and mortality. The strengths and weaknesses of EMRs have been extensively investigated in empirical literature sources. Even though EMR has been shown to improve the quality of care there have been failures in the implementation of these systems worldwide. These failures have been due to several barriers such as lack of communication systems, standardization, funding and inter-operability among them.

It has furthermore been noted that user acceptance is critical for successful implementation of these systems. In the current study, users' views were assessed to determine the effectiveness of these systems.

Findings in literature have at times conflicted with certain studies reporting mixed results. Consensus has not been established in terms of influence of EMRs on work practices in health. This might partly explain the slow adoption of these systems in the health sector.

There are also areas of uncertainty as regards adequate evidence, accuracy and lack of definitions. It is thus difficult to relate improved outcomes to EMR implementation. Implementation of EMR has been proven to have high cost implications, and it is therefore important to motivate the cost-benefit balance before implementation is approved. However, the cost of implementation is mitigated by the savings in improving quality and efficiency of care. Due to the prohibitive cost implications, the public sector needs to partner with the private sector, in this study, Right To Care, to finance these implementations.

The disadvantages of paper records have been well documented. Even though it might be easy to enter data on paper, data retrieval has been notoriously inefficient, hence the view that paper records are data-rich but information-poor.

Implementation of EMR in South Africa has been at best erratic. There is no co-ordination between provinces, with each province adopting its own system and vendor for its implementation. The massive rollout of ARV programmes in the country has been undermined by these disparate systems, which has contributed to a lack of co-ordination. However, the country is in the process of setting up a national EHR system which will hopefully help improve inter-operability and standardization.

2.6 CONCLUSION

This literature search has revealed the existing knowledge base on HIV and EMR. The sources were reviewed to determine the strength of evidence and knowledge gaps that exist in this field.

The current study aims to address one of the identified gaps. The users of the EMR system evaluate the effectiveness of an EMR system in the management of patients in selected HIV clinics in Johannesburg.

The next chapter discusses the research design and methods used in the current study.

CHAPTER THREE

RESEARCH DESIGN AND METHOD

3.1 INTRODUCTION

This chapter discusses the study's research design and methodology. The chapter further outlines population and sampling methods that were used; the data collection and analysis methods implemented; ethical considerations, validity and reliability; and formulation and standardisation of instrument(s) for the study. The purpose was to explore and describe the effects of an electronic medical record (EMR) on patient management in human immunodeficiency virus (HIV) clinics. The variables were measured using a questionnaire applied to users of the system. The research aim was to determine the effects of an EMR on patient management.

3.2 RESEARCH DESIGN AND METHODOLOGY

The design and methodology chosen was guided by the purpose of the study and was targeted at meeting the objectives of the study. The study design aims to be suited to the problem and purpose of the study, and the methods are designed to align with the study design (Unisa 2010: 96).

3.2.1 Research design

Joubert and Ehrlich (2007: 77) refer to a study design as the structured approach followed by researchers in order to answer a particular question. The choice of study design determines how the researcher samples the population, collects measurements and analyses the data. A quantitative, descriptive and contextual research design was chosen for this study and this influenced the subsequent methodology selected. The dimensions of this study are quantitative, descriptive, empirical and cross-sectional.

3.2.1.1 Quantitative design

Burns and Grove (2005: 23) refer to quantitative design as a formal, objective, systematic process in which numerical data are used to obtain information about the world. The current study collected data through a questionnaire and converted this to numerical data in order to analyse it. The data was classified as nominal, ordinal, interval or ratio data to determine which statistical data analysis methods to use. Data analysis is discussed in detail in Chapter Four.

3.2.1.2 Descriptive design

Descriptive designs do not manipulate variables, do not attempt to establish causality, and are designed to gain more information about characteristics within a particular field of study while they identify problems with current practice (Burns & Grove 2005: 232).

A descriptive design was used to describe and investigate the variables. Morroni and Myer (2007: 77-78) note that a descriptive study is limited to the description of the occurrence of disease (or phenomenon) in a population. This study attempted to achieve this goal by describing a single broad variable – the effects of electronic medical record (EMR) on patient management, obtaining complete and accurate information about a phenomenon through description and using descriptive statistics to analyse the collected data.

3.2.1.3 Contextual design

A contextual design is described as clearly defined structures within which the study is implemented (Burns & Grove 2005: 211). The context of the current study is the clinics which are accredited to manage HIV patients and provide ARVs in the City of Johannesburg (COJ) Metropolitan Municipality area. According to the City of Johannesburg Health Department (2011), there are 128 primary health care (PHC) facilities offering HIV counselling and testing (HCT) services in the 7 regions of the city (Table 3.1).

Of these, 96 are local government PHC facilities, 30 are provincial and two are run by non-government organisations (NGOs). Of the 30 hospitals in the city, all the nine public

hospitals have HCT facilities on their premises. The 21 private hospitals provide these services through individual practitioners to private clients in addition to their services.

TABLE 3.1: COJ PHC HEALTH FACILITY LIST OFFERING HCT SERVICES

REGION	CLINICS	HOSPITALS
A	11	0
B	11	2
C	12	0
D	38	2
E	11	3
F	17	2
G	28	0
TOTAL	**128**	**9**

(City of Johannesburg Health Department 2011)

The Wits Health Consortium (WHC), a division of the University of the Witwatersrand, has several syndicates that conduct research in the public health facilities and assist these facilities by providing financial, human and infrastructural resources. WHC's syndicates are the Peri-Natal Health Research Unit (PHRU); Wits Reproductive Health and HIV Institute (WRHI), previously known as Reproductive Health and HIV Research Unit (RHRU); Clinical HIV Research Unit (CHRU); Maternal Adolescent and Child Health (MAtCH); and Wits Clinical Research (WCR). Of these, PHRU and WRHI are involved in the HCT programmes of the City of Johannesburg Health Department. PHRU also runs a subsidised HCT facility, Zuzimpilo, in the Johannesburg city centre.

Another NGO, Right To Care (RTC), has partnered with the City's Health Department to support the HCT programme in other facilities of the City.
The NGOs are funded by the United States President's Emergency Plan for AIDS Relief (Pepfar) which is administered by the United States Agency for International Development (USAID).

The EMR assessed in the current study has been implemented in the City's health facilities by the respective partner NGOs. The technique of data collection used was questionnaires administered to gather data in the specified population. The data on the selected variables was collected over several days.

The chosen design assisted in attaining the objective by assessing the effects of EMR on patient management through questionnaires and analysing them through descriptive statistics.

3.2.2 Research method

Burns and Grove (2005: 211) define research methodology as the entire strategy for the study, from identification of the problem to final plans for data collection. The research method explains how the population was identified and the sample selected, how data was collected, and the methods used for data analysis.

3.2.2.1 Population and sample

The methodology identifies the study population, describes the sampling strategy in detail and states the intended sample size (Joubert & Ehrlich 2007: 49). The method of data collection (measurement) and measuring instruments is described and an indication of validity and reliability are identified (Joubert & Ehrlich 2007: 49).

3.2.2.1.1 Population

A population is the universe of all of the units or elements to which we want to generalize (Stommel & Wills 2004: 297). The study population in the current study was health care workers in HIV out-patient clinics in South Africa.

The target population is the entire set of individuals or elements who meet the sampling criteria (Burns & Grove 2005: 342). In this study the target population refers to all health care workers involved in the management of HIV patients in out-patient clinics in Johannesburg.

A descriptive cross-sectional study was undertaken in HIV clinics in Johannesburg. The subjects were the health care workers in the HIV clinics. A questionnaire was designed by adapting tested formats which have been utilised in other settings.

3.2.2.1.2 Sampling

Sampling involves selecting a group of people, events, behaviours, or other elements with which to conduct a study (Burns & Grove 2005: 341). Data sources were health care workers in HIV clinics in Johannesburg. These constitute all the elements that meet certain criteria for inclusion in a given universe (Kaplan 1964; Kerlinger & Lee 2000, as cited in Burns & Grove 2005: 40).

Joubert and Ehrlich (2007: 95) describe a sample frame as a list or some representation (for example, a map) of the study population, either of individuals or of groups of individuals, depending on the specific type of sampling used. Of the 128 HCT facilities referred to in Table 3.1, 14 have implemented the EMR system. Four HCT facilities were randomly sampled using the simple random sampling method from these 14 facilities. A sample frame was compiled on the users of the EMR in the selected four facilities (Table 3.2).

TABLE 3.2: USERS OF EMR IN THE SELECTED HCT FACILITIES

HCT FACILITY	DOCTORS	NURSES	ADMINISTRATIVE CLERKS	DATA CAPTURERS	TOTAL
TSAKANI	4	3	6	1	**14**
ZUZIMPILO	3	3	4	1	**11**
THEMBA LETHU	6	10	12	11	**39**
THUTHUKANI	3	4	3	3	**13**
TOTAL	**16**	**20**	**25**	**16**	**77**

Selection of subjects was done by stratified random sampling, which, according to Burns and Grove (2005: 348), is used in situations in which the researcher knows some of the variables in the population that are critical to achieving representativeness. This sampling method was used because the EHR, according to the National Institutes of Health's National Center for Research Resources (NIH NCRR) modular model, consists of various modules from within the health care environment: administration, nursing, pharmacy, clinical, radiology and laboratory (NIH NCRR 2006: 3). There are mutually exclusive and collectively exhaustive strata of respondents (Joubert & Ehrlich 2007: 98), namely, administrative clerks, data capturers, nurses and doctors, in this study. Joubert and Ehrlich (2007: 97) recommend that if the researcher has some knowledge that certain relevant strata (sub-groups) of the population differ with regard to the

measurements being made, the researcher would want these strata to be represented adequately in the sample. Therefore, each sub-group or stratum was sampled separately to achieve this representation, using stratified random sampling. Questionnaires were administered to the 44 subjects who consented to participate in the study (Figure 3.3).

TABLE 3.3: USERS OF EMR WHO PARTICIPATED IN THE STUDY

HCT FACILITY	DOCTORS	NURSES	ADMINISTRATIVE CLERKS	DATA CAPTURERS	TOTAL
TSAKANI	1	3	1	3	**8**
ZUZIMPILO	2	3	1	1	**7**
THEMBA LETHU	5	5	3	5	**18**
THUTHUKANI	1	4	3	3	**11**
TOTAL	**9**	**15**	**8**	**12**	**44**

The number of patient files on the EMR system in the four clinics was 49 843 at the time of data collection (Table 3.4). However, no patient files were accessed during the study because patients were not part of the sample.

TABLE 3.4: PATIENT FILES ON EMR

CLINIC	FILES	%
ZUZIMPILO	5348	11
THUTHUKANI	7998	16
TSAKANI	7244	15
THEMBA LETHU	29253	59
TOTAL	**49843**	**100**

The sample in descriptive and cross-sectional studies should be representative of the study population since the aim is to describe some characteristic(s) of a population (Joubert & Ehrlich 2007: 94). Random sampling, a stratified method of which was used in the current study, is a specific selection technique which can ensure that the sample is representative of the population (Joubert & Ehrlich 2007: 95). Therefore, the subjects were selected using the stratified random sampling method to improve the likelihood of the sample to be representative. Only the subjects who were legally eligible to consent were included.

3.2.2.1.3 Ethical issues related to sampling

The researcher strived to make the selection of the population to study and the specific subjects to study fair, and, therefore, the risks and benefits to be fairly distributed (Burns & Grove 2005: 189).

Subjects were selected for reasons directly related to the problem being studied. Since subjects were selected using stratified random sampling methods, there was little chance that the researcher would select subjects because he liked them or wanted them to receive specific benefits of the study. This method eliminates some of the researcher's biases that might influence subject selection (Burns & Grove 2005: 190).

Only subjects employed in the selected clinics were enrolled and no referrals were considered. No compensation was given, hence accusations of favouritism were not expected.

3.2.2.1.4 Sample

The accessible population is the portion of the target population to which the researcher has reasonable access (Burns & Grove 2005: 342). This population may be defined in terms of their geographic location, institutional affiliation, personal characteristics, and observation period (Stommel & Wills 2004: 297); these were City of Johannesburg, the specific HCT facility, HCT facility workers and August 2011, respectively. Samples were narrowed down to members of the accessible population targeted for recruitment (approached sample) and to those who provide active consent (obtained sample) (Stommel & Wills 2004: 298-300).

Burns and Grove (2005: 356) point out that descriptive studies tend to use very small samples because comparisons between groups are not being performed, and problems related to sampling error and generalisation have little relevance. Unisa (2010: 91) recommends that the very smallest number of subjects acceptable in terms of quantitative research would be 32 usable completed questionnaires; this was the minimum sample size of subjects in the current study.

3.2.2.2 Data collection

Data collection refers to the gathering of all information that is relevant to the research questions or hypotheses (Stommel & Wills 2004: 363). The researcher discusses the data collection approach and method to be used, development and testing of the instrument, the data collection process and the ethical issues that are anticipated during this process.

3.2.2.2.1 Data collection approach and method

Structured data collection which entails a fixed set of questioning to be answered in a specified sequence and with designated response options (Polit & Beck 2004: 318) was used. This approach included strategies that provide increasing degrees of control by the researcher over the content of the interview (Burns & Grove 2005: 396). The questions asked by the interviewer were pertaining to items in the questionnaire as described below, and the order of the questions was specified (Burns & Grove 2005: 396). The questions were close-ended and had options selected by the researcher (Burns & Grove 2005: 399).

Structured approaches facilitate the coding and analysis of data. Respondents are able to complete more close-ended items in a given amount of time, and they are frequently more willing to complete close-ended items than they are to compose lengthy responses to open-ended questions (Brink 2006: 149), therefore ensuring a satisfactory response rate.

One disadvantage of closed-ended questions is that they are more difficult to construct than open-ended items; the items may also be superficial and limit the answers to the options provided by the researcher (Brink 2006: 149). This restricts further explanation of reasons for giving a particular answer to a specific question.

3.2.2.2.2 Development and testing of the data collection instrument

In this study data was collected using structured questionnaires. The questionnaire has the same demographics section for all participants and different sections for the respective groups of participants (Annexure D).

The questionnaire is based on DeLone and McLean's (2003: 10) taxonomy of information systems success which identifies factors that contribute to information systems success. DeLone and McLean (2003: 25) refer to these categories as follows:

- System quality refers to the characteristics of the information system itself which produces the information;
- Information quality is the information product's desired characteristics such as accuracy, meaningfulness, and timeliness;
- The overall support is represented by service quality which is determined by assurance, empathy and responsiveness;
- Usage refers to nature of use, patterns thereof and frequency of use;
- User satisfaction is an important means of measuring user experience cycle as indicated by repeat and frequent use. User surveys may be used to assess user satisfaction;
- Net benefits are the most important success measures as they capture the net impacts of the service on customers. These will include cost savings, expanded markets, time savings, reduced costs, and additional sales.

However, DeLone and McLean (2003: 12) note that researchers have used many different measures of this success, focusing only on certain categories. Some of these measures have merely been identified but not empirically used (DeLone & McLean 2003: 12). Since there is no single instrument which includes all these categories, several instruments, including those used by Carlsen and Aakvik (2006) and Lærum et al (2001), have been adapted in this study to cover most aspects of DeLone and McLean's categories.

To this end the questionnaire includes the following sections:

Section A: Demographics

This section captures demographic profiles of respondents. There are five items in this section: age, gender, educational level, role and experience of the health care worker at the clinic. This section is based on the questionnaire used by Carlsen and Aakvik (2006: 7) and that used in a study by Lærum et al (2001: 1344), both of which were implemented in Norway.

Section B: Computer and EMR experience

Health care workers gave their experience in seven categories: computer experience, EMR experience, frequency of EMR use, what EMR is used for, whether EMR is used more than paper or not, preference between EMR and paper, and the level of training on EMR.

This section profiles the characteristics of the health care workers who use EMR in these clinics for purposes of comparing and standardising the samples in similar studies and generalising the findings to similar populations.

The computer literacy item was adapted from Lærum et al (2001: 1346).

Section C: Effects

The section details the perceived effects of EMR by the respective cluster of respondents, with each category corresponding to their specific performance areas.

There are three items in this section:

i. General: general assessment of benefits and disadvantages, and frequency of certain events. The general item pertained to all subjects.
ii. Administration: assessed administrative functions of the EMR and was targeted at administrative clerks and data capturers.
iii. Clinical: assessed the clinical functions of the EMR and was completed by nurses and doctors. The user satisfaction checklist was adapted from Saba and McCormick (2001: 225).

A statistician was consulted to review the planned research methods and data analysis of this study. The instrument was also reviewed by the statistician to assess if it was an appropriate tool for the intended study.

A research assistant administered the questionnaire and assisted the respondents to explain questions and fill in the questionnaire appropriately. Attempts were made to complete the questionnaires on the same day for all subjects at a particular clinic. However, due to work and time demands, one facility, Themba Lethu clinic, was assessed on two separate days. The questionnaires were administered in the period 19th to 30th August 2011 on different days for the respective clinics.

A limited sample of the potential respondents from one of the settings, who were not part of the study sample, was selected as a pilot to pre-test the questionnaire. Through pre-testing the researcher was able to assess the time taken to administer the questionnaire, the level of understanding and the error rate in answering the questions. Issues raised from this exercise were used to modify and improve the questionnaire and refine training for the research assistant.

Brink (2006: 147) regards questionnaires as a quick way of obtaining data from a large group of people and that they are one of the easiest research instruments to test for reliability and validity.

Advantages of self-administered questionnaires include absence of interviewer variation, anonymous participation, and generally being less costly and time-consuming (Joubert & Ehrlich 2007: 108).

Disadvantages of questionnaires, according to Joubert and Ehrlich (2007: 108), are that respondents must be literate, that there is little control over data quality and form completion, and that the questionnaire must be very clear and well-laid out. Furthermore, the response rate may be low, respondents may provide socially acceptable answers and may fail to answer some of the questions, and subjects who respond may not be representative of the population (Brink 2006: 147). The questions also tend to have less depth (Burns & Grove 2005: 398).

3.2.2.2.3 Data collection process

The researcher trained a research assistant to implement the sampling procedures as discussed above.

The research assistant was selected based on experience working in the research field. The assistant was trained in administering the specific questionnaire and on the importance of confidentiality, anonymity and privacy. The assistant was not requested to provide counselling or compensation by the subjects who were briefed about the study, using the participant annexure sheet (Annexure E) prior to consenting to participate in the study. The assistant was trained to understand the dynamics of working with health professionals and within the health care environment.

Training was provided on the questionnaire and the methodology of the study over a period of a week. The researcher recruited an assistant who was available to administer the questionnaires at the four clinics.

The research assistant first discussed the study with the prospective respondent and if the respondent agreed to proceed, the respondent gave a verbal consent. The researcher avoided written consent in order to maintain confidentiality, anonymity and assure the privacy of the respondent.

Respondents were selected according to the sampling method discussed above. The research assistant helped in administering and collecting the completed questionnaires.

3.2.2.2.4 Ethical considerations related to data collection

Approvals were sought from relevant authorities before proceeding with the research study in an effort to have oversight and protect the participants.

After the study's proposal had been approved a clearance certificate was issued by UNISA HSREC as confirmation that the study meets the criteria of the institution.

The clinics targeted as settings for this study are run by the Gauteng Department of Health, local government and/or non-governmental organisations (NGOs). Therefore, these authorities were approached for permission to conduct the study on their premises. Health care workers who were interested in participating in the study were asked to give verbal consent before proceeding with completing the questionnaire.

Data collection started from the 19th to the 30th of August 2011, once the approvals and consents had been given. Copies of each document are attached to the study report as Annexures A, B, F, G, H, I and J.

Confidentiality was maintained through use of anonymous identifiers and participants reserved the right not to participate or to withdraw at any time during their participation without being prejudiced.

According to Burns and Grove (2005: 181) the following human rights require protection in research:

The right to self-determination (Respect, Autonomy)

The respondents have the right to full disclosure about the study and will be allowed to choose to participate and/or later withdraw (Burns & Grove 2005: 181). Informed consent which includes risks and benefits of the study was sought before enrolling the participants. No persons with diminished autonomy, for example, minors, were included in the study.

The right to privacy

The right an individual has to determine the time, extent and general circumstances under which information will be shared with or withheld from others (Burns & Grove 2005: 186). There was no individually identifiable information collected during this study and the results will only be shared with the authorities who run the clinics in which the study is conducted. This was explained to the potential respondents before asking for consent.

The right to anonymity and confidentiality

Anonymity implies that the subject's identity cannot be linked with her/his responses (Burns & Grove 2005: 188). This was maintained by giving each respondent a code number for his/her questionnaire. The master list was also kept separate from the data collected and the informed consent was only verbal.

Confidentiality relates to the researcher's management of private information shared by the subject that must not be shared with others without authorisation of the subject (Burns & Grove 2005: 188). The information collected will not be identifiable and will

therefore not be traceable to the informant, in order to avoid compromising his/her anonymity and confidentiality.

The right to fair treatment (Justice)

Each person should be treated fairly and should receive what he or she is due or owed (Burns & Grove 2005: 189). Fair selection of respondents was ensured through the random sampling methods referred to above.

The right to protection from discomfort and harm (Beneficence)

One should do good and, above all, do no harm. Discomfort and harm can be psychological, emotional, social and/or economic in nature (Burns & Grove 2005: 190). According to Reynolds' categories on levels of discomfort and harm (cited in Burns & Grove 2005: 190) this study had temporary discomfort (minimal risk). This might have involved physical risk namely, headache, fatigue or muscle tension. The questionnaires took a reasonable time to complete to avoid causing such physical risk and the research assistant facilitated the process to minimise the time taken for this process. Further risk may be emotional and social, e.g. anxiety. The research assistant was trained to look out for signs of emotional or social agitation and attend to this appropriately.

Due to the fact that the respondents in this study work with HIV-positive patients, some psychological discomfort was anticipated. The discomfort might involve the respondents' concern about anonymity and the confidentiality of patients' records, breach of which might result in stigmatisation. However, the respondents were reassured that no patient records would be accessed by the assistant during the course of the study.

Economic risk was minimised in that the time to complete the questionnaire was short and did not encroach unduly on the respondent's commitments.

3.2.2.3 Data analysis

Data analysis entails categorising, ordering, manipulating and summarising the data, describing them in meaningful terms (Brink 2006: 170), and quantifying and statistically reducing raw data in order to draw interpretations and conclusions (Unisa 2008a: 99).

This study is mainly quantitative in nature and therefore mostly used statistical strategies. Statistical methods enable the researcher to reduce, summarise, organise, manipulate, evaluate, interpret and communicate quantitative data (Brink 2006: 171). The basic summary is the first step of statistical analysis (Joubert & Ehrlich 2007: 135).

Since the purpose of analysis was description of variables, descriptive statistics dominated the data analysis. Descriptive statistics are used to describe and summarise data (Brink 2006: 171). A descriptive approach which employs measures such as frequency distributions, measures of central tendency and dispersion or variability, and measures of relationships (Brink 2006: 171) was utilised.

Frequency distributions were assessed using ratios, proportions, percentages and rates. The mode, the median and the mean were calculated to determine measures of central tendency. Measures of dispersion or variability were determined using standard deviation and inter-quartile range.
Graphic representation of data was used to visually represent the data. Numerical data was presented as histograms, while categorical data was presented as bar graphs or pie charts.

3.3 VALIDITY AND RELIABILITY OF THE STUDY

According to Joubert and Ehrlich (2007: 156) there are two general classes of error that affect studies. There is error that occurs at random, which introduces imprecision into study results, and there is error that occurs systematically, that leads to bias (Joubert & Ehrlich 2007: 156).

3.3.1 Validity

Validity refers to how close a measurement or study finding comes to the truth (Joubert & Ehrlich 2007: 156). Common sources of invalidity, according to Joubert and Ehrlich (2007: 157), are selection bias, information bias and confounding bias.

Selection bias was minimised by including both private (NGO) clinics and public clinics

in the study. The sample therefore includes health care workers in private and public clinics. Health care workers in the different clinics were all offered to participate in order to improve inclusivity of the sample.

In an effort to limit information bias a standardised questionnaire was used to measure variables in the same way for groups of participants. Confounding was not a major factor in this study due to its descriptive design in which associations between variables are not being examined.

3.3.2 Reliability

Joubert and Ehrlich (2007: 155) define reliability as whether the same result would be found if the measures were taken over and over again. A relatively large sample size was used to improve reliability.

The instrument to be used was derived from used, tested and standardised instruments to minimise random measurement error. This tool was pre-tested to improve its reliability.

3.4 CONCLUSION

This chapter outlined and provided details on the study design and methodology. The researcher discussed sampling approaches and methods and their ethical implications, and how the population will be represented by the sample. The data collection approach and methods and their ethical considerations were described. The researcher further elaborated on the development and testing of the collection instrument and discussed how the data was analysed. Lastly, measures of ensuring the validity and reliability were explained.

The next chapter discusses the analysis, presentation and discussion of the research findings.

CHAPTER FOUR

ANALYSIS, PRESENTATION AND DESCRIPTION OF THE RESEARCH FINDINGS

4.1 INTRODUCTION

The preceding chapter discussed the research design and the methodology used in the current study. This chapter discusses how the collected data was prepared for analysis, description of the data, and its presentation.

The purpose of the study was to explore and describe the effects of an electronic medical record (EMR) on patient management in selected HIV clinics in Johannesburg. The variables were measured using a questionnaire applied to users of the system. The objectives of the study as discussed in Chapter One were:

- To describe the demographics of the users of the EMR system;
- To define the experience and training of the users of EMR;
- To identify and describe the benefits and disadvantages of EMR;
- To describe the effects of EMR on patient management and the doctor-patient interaction in a clinical setting;
- To assess preferences of users for paper records or the EMR;
- To assess user satisfaction with different functions of the EMR.

4.2 THE PROCESS OF DATA ANALYSIS

Data analysis was done by categorising, ordering, manipulating and summarising the data and describing them in meaningful terms (Brink 2006: 170). The raw data was quantified and statistically reduced in order to draw interpretations and conclusions (Unisa 2008a: 99).

The process of data analysis followed was as described by Burns and Grove (2005: 452), namely, preparing data for analysis, describing the sample, testing reliability of

measurement, exploratory analysis of data, confirmatory analysis guided by questions and objectives, and interpreting results of statistical procedures.

The problem statement this study was designed to address was: “What are the effects of an EMR on patient management in selected human immunodeficiency virus (HIV) clinics in Johannesburg?”

4.3 SAMPLE REALISATION

There were 77 users of the EMR system on the sample frame in the four sampled clinics (Table 3.2). Stratified random sampling was used to select 45 EMR users to be included in the study. After the study procedures were explained using the participant information sheet (Annexure E), one person declined to consent for reasons that were not disclosed. Therefore, 44 subjects participated in the study.

Data was collected from selected subjects in the four identified HIV counselling and testing (HCT) and anti-retroviral (ARV) sites by an assistant using the questionnaire attached as Annexure D. Each clinic was accessed on a different day from the 19th to the 30th August 2011. At one of the clinics, not all subjects could be accessed in one day because of lack of time, and another appointment was made to access the rest of the subjects.

Questionnaires were completed from the 44 subjects who comprised the obtained sample (Figure 3.3). The completed questionnaires were collected and checked for missing values and errors. Questionnaires were completed in a single session except for one where the questionnaire could not be completed in full at the initial session due to the users’ work pressure. A follow-up appointment was made to complete the questionnaire.

During the pilot one subject did not complete one of the questions and this was completed on follow-up. One questionnaire during the actual research had a missing value because the subject declined to disclose her age. The coded data was entered into a computer programme and checked for completeness.

4.4 DATA MANAGEMENT AND ANALYSIS

A statistician was consulted during the design phase of the questionnaire. After data was collected the statistician was consulted again to advice on data management and analysis, and his input has proved invaluable in planning and performing data analysis as presented in this chapter.

Raw data in the questionnaires was initially assessed and entered into the spreadsheet programme. Data was then checked for missing values and errors and thereafter verified against the source. The different answers to the respective sections were separated for individual analysis. The data was ordered in tables, then frequencies, and percentages were calculated. Data was then explored with the use of graphical displays, a process known as exploratory data analysis. Formal statistical methods were then applied using confirmatory data analysis. Analysis of the data was guided by the study question and objectives.

4.4.1 Data analysis

Exploratory data analysis was undertaken using tables and graphs. The data in the tables was manipulated to obtain frequencies and percentages. Appropriate graphs were chosen to display the data for visual interpretation. Confirmatory data analysis was done using measures of central tendency and measures of dispersion for further interpretation.

4.5 RESEARCH RESULTS

In the following sections the researcher discusses data analysis in the context of the study's research objectives and in an effort to answer the question posed by the study. The tool used consisted of the following sections:

4.5.1 The demography of the users

The sample size (N) was 44.

4.5.1.1 Age

The median age of the subjects was 36 years [interquartile range (IQR) 30-45] with a range of 25 to 71 years. The mean age was 38.4 years (SD 10.6) and the mode was 29 years. 16 of the subjects (37 per cent) were aged 30 to 39 years (median 35; IQR 34-36), with 63 per cent below the age of 40 years (median 32; IQR 29-35). One subject did not want to disclose her age, therefore the sample size for age was N=43 (Figure 4.1).

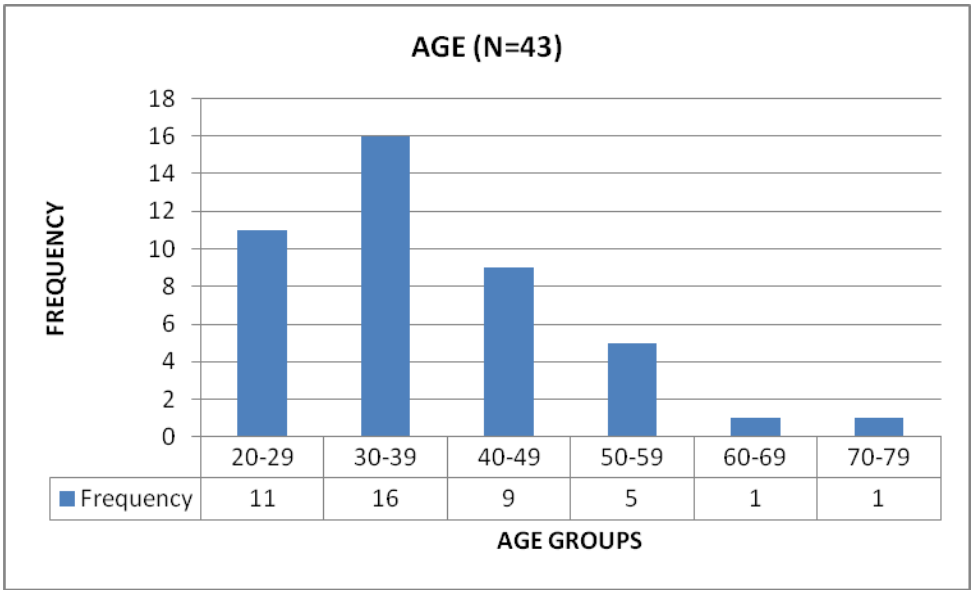


Figure 4.1 Age of EMR users

4.5.1.2 Gender

36 of the subjects (82 per cent) were female (Table 4.1).

TABLE 4.1: GENDER OF EMR USERS

	No.	%
FEMALE	36	82
MALE	8	18
TOTAL	**44**	**100**

4.5.1.3 Education level

38 of the subjects (86 per cent) had tertiary education and the remainder had secondary level education.

4.5.1.4 Job categories

Nurses (34 per cent) comprised most of the subjects, followed by the data capturers (27 per cent), doctors (21 per cent) and administration clerks (18 per cent) (Figure 4.2).

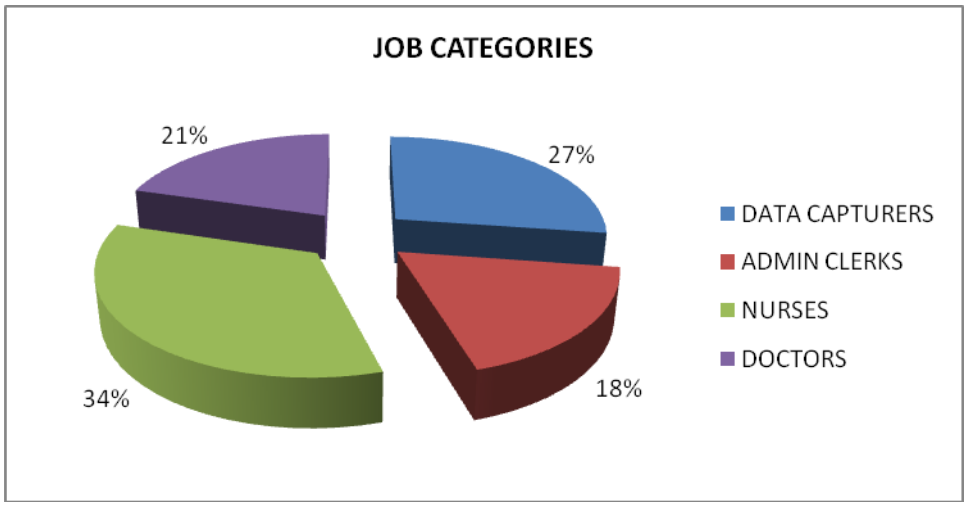


Figure 4.2 Job categories of EMR users

4.5.1.5 Work experience in HIV clinics

Of the respondents, 23 (52 per cent) had been working at their respective clinics for two to three years (Figure 4.3). Six (14 per cent) had been working for less than a year, eight (18 per cent) for four to five years and seven (16 per cent) for six to seven years. In total the subjects had a mean of 3.25 years (SD 1.63) work experience at the particular clinic.

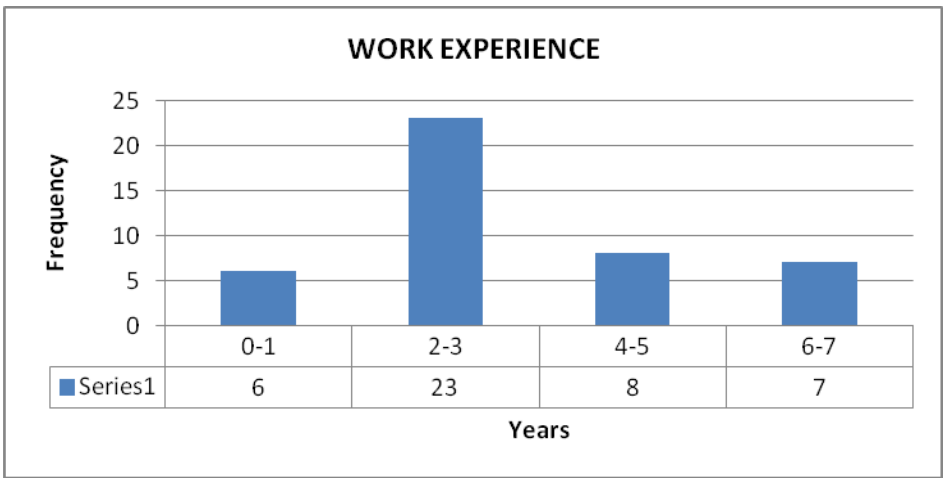


Figure 4.3 Work experience of EMR users

4.5.2 Computer and EMR experience

4.5.2.1 Computer experience

All the subjects had some computer experience, with 20 per cent gaining the experience through the EMR and 80 per cent with prior computer experience.

4.5.2.2 EMR experience

28 subjects (64 per cent) had been using the EMR for 25 to 30 months (Figure 4.4). Three (7 per cent) had less than 6 months experience with the EMR, another three (7 per cent) had seven to 12 months experience. Four (9 per cent) had used the EMR for 13 to 18 months, while six (14 per cent) had 19 to 24 months EMR experience.

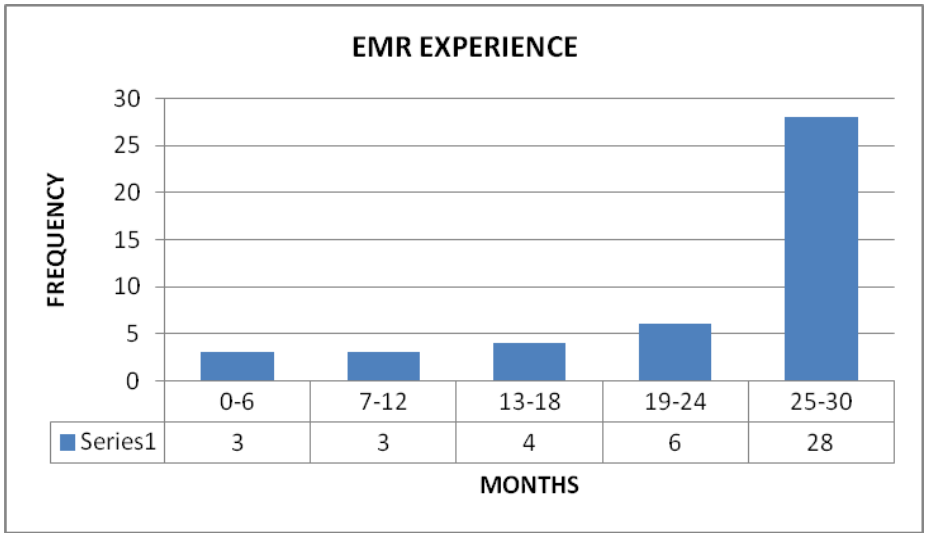


Figure 4.4 Extent of EMR experience of users

4.5.2.3 Frequency of EMR use

All except one of the subjects used the EMR daily. The subject claimed that he used the EMR weekly.

4.5.2.4 EMR functions used

Each subject used more than one of the EMR's functions. Capturing clinical data was the function used by most (17 per cent) of the subjects (Figure 4.5). The next common functions used were searching for files, checking results and decision support (each used by 14 per cent of the subjects).

Booking patients function was used by 23 (11 per cent) of the subjects, capturing demographic data by 20 (10 per cent) of subjects, order entry and pharmacy by 19 (9 per cent) of subjects each and capturing counselling data by four (2 per cent) of subjects.

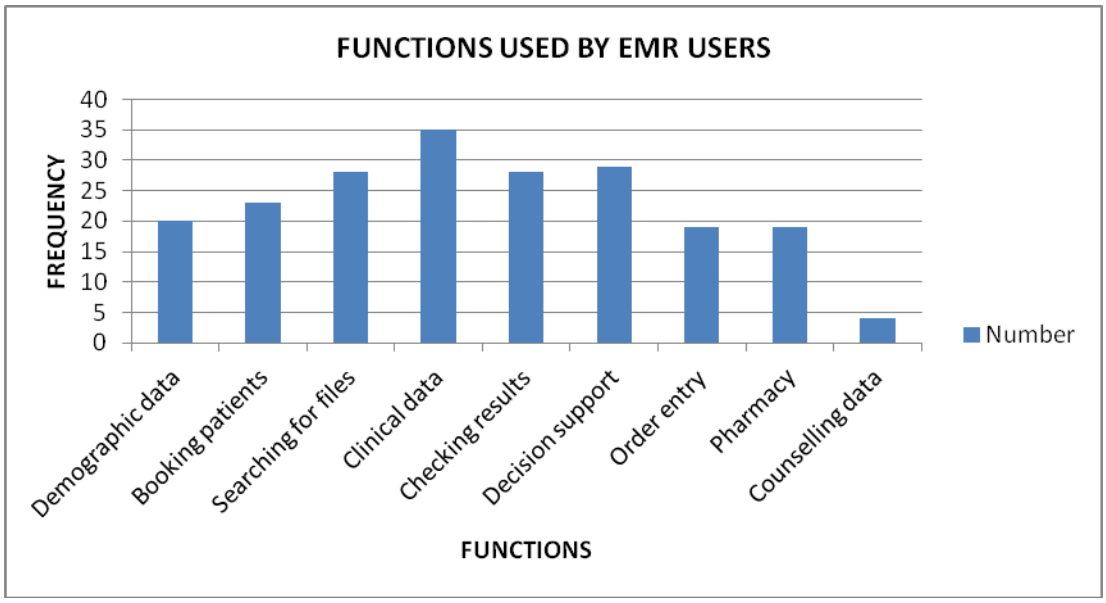


Figure 4.5 Functions used by EMR users

4.5.2.5 EMR use compared to paper

All the subjects used EMR more than paper. Files were still being utilised as back-up, for instances where the computers were off-line and when there were power outages.

Some modules such as pharmacy had not been implemented in the EMR but paper was still used for these functions.

4.5.2.6 Preferences

Forty-one of the subjects (93 per cent) preferred using EMR more than paper. One subject did not have any preference.

4.5.2.7 Training

Fifty-nine per cent of subjects received basic training on the EMR (Figure 4.6). Advanced and intermediate training was attended by 25 per cent and 9 per cent of the subjects, respectively. Significantly, 7 per cent of the subjects claimed not to have received any training at all on the EMR.

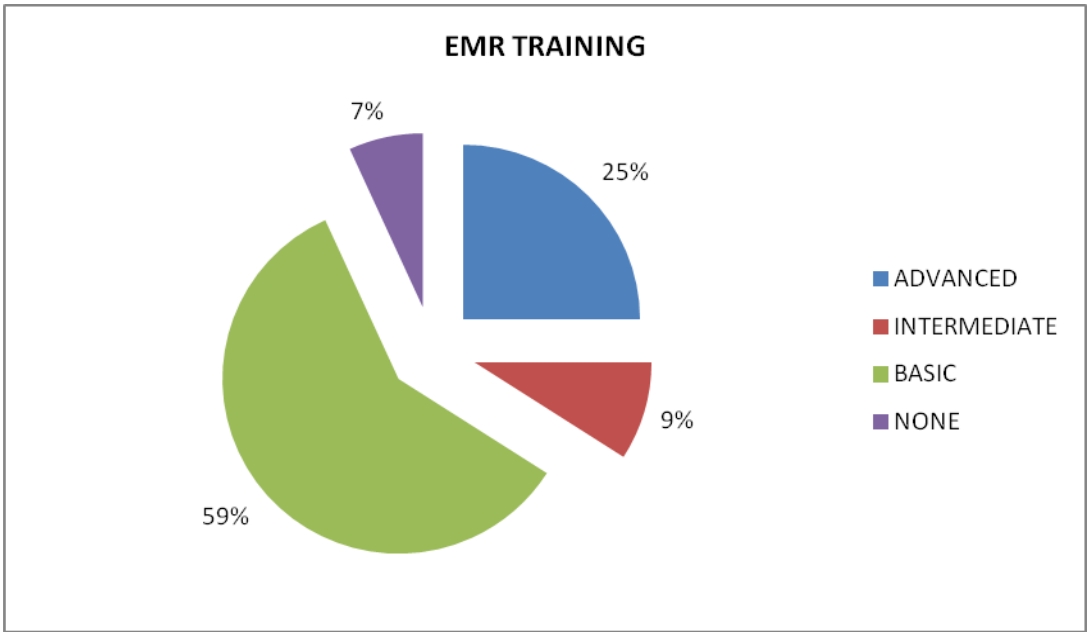


Figure 4.6 EMR Training

4.5.3 Benefits and disadvantages

All subjects agreed or strongly agreed that the EMR makes notes legible, that it makes data accessible, that it facilitated sharing of data between health care workers and that regular back-up made data safe. Most of the subjects agreed that the EMR:

- Reduces waiting time;
- Improves workflow;
- Is easy to use;
- Reduces error rates;
- Improves the quality of data;
- Has improved quality of patients' care;
- Helps maintain patient confidentiality;
- Data is secure;
- Improves co-ordination of patient care;
- Has huge storage capacity;
- Graphs help monitor trends;
- Technical support is readily available;
- Can validate data; and
- Is available to be used.

More subjects disagreed than those who agreed that patient data could be accessed simultaneously at different sites.

Almost the same number of subjects disagreed as those who agreed that the EMR was compatible with other programmes. This feature of EMR is referred to as interoperability which Shortliffe and Cimino (2006: 952) define as the ability for systems to exchange data and operate in a coordinated, seamless manner.

Fifty-nine per cent agreed and 23 per cent disagreed that the EMR was updated regularly.

4.5.4 Frequency of events

With regard to availability of the system,

- 30 (60 per cent) subjects felt that the system is seldom not available, and 7 (16 per cent) that this never occurred, whereas six (14 per cent) felt that this often took place.

- 43 (98 per cent) of the subjects always used the programme while one (2 per cent) often used it.
- 21 (48 per cent) of the subjects never received refresher training, 17 (39 per cent) seldom did and five (11 per cent) often did. One (2 per cent) was unsure whether this did happen.
- 19 (43 per cent) of the subjects felt the system never had downtime or crashes, 21 (48 per cent) felt it seldom did, three (7 per cent) that it often did, and one (2 per cent) that it always did.
- 36 (82 per cent) of the subjects indicated that one never missed a patient's file on EMR, while seven (16 per cent) felt that this seldom happened.
- 31 (70 per cent) said the network was seldom unavailable, 11 (25 per cent) that it was never unavailable and two (5 per cent) that it was often unavailable.
- According to 32 (73 per cent) of the subjects, it never occurred that one could not find what one was looking for on the system and 12 (27 per cent) felt this seldom happened.

4.5.5 Administrative functions

Only the administrative clerks and data capturers had to respond to this section. Therefore, the sample size was N=20.

Most of the administrative staff either agreed or strongly agreed that the scheduling module improved patient booking, that it facilitated patient registration, that searching for files was easy and quick, that capturing data was simple, that records were complete, that data was accurate and that it saved filing space. Ten per cent disagreed that records were complete and 10 per cent disagreed that data was accurate. Those who disagreed that EMR saved filing space made up 15 per cent of the sample.

4.5.6 Clinical functions

The clinical section was completed by the nurses and doctors who comprised a sample size of N=24.

More subjects agreed or strongly agreed than those who disagreed that with the EMR:

- Previous patient history is easily accessed;
- Results are received and accessed in time;
- There is less duplication of tests;
- There is easy capturing of vital signs;
- It prompts history items;
- Consultation is shorter, i.e. it saves time;
- Its reminders and alerts are useful tools;
- There are fewer prescription and clinical errors. According to the Audit Commission (2001: 10), computerized prescribing and health records have been shown to eliminate three-quarters of medical errors. This reduction in medical error rate improves efficiency of care (Clamp & Keen 2005: 33);
- Trends can be assessed;
- There is a quicker search for items;
- Referrals are easy to do;
- There is access to history, vitals, findings, scripts and investigations;
- It is easy to assign diagnosis and ICD10;
- Ordering of tests is simple;
- Management planning is easier;
- It improves clinical decision-making;
- Information is up-to-date;
- It helps one to adhere to clinical guidelines.

Conversely, more subjects disagreed than those who agreed that EMR interfered with the doctor-patient relationship.

4.5.7 User satisfaction

In terms of user satisfaction, several attributes of the EMR system were assessed based on Saba and McCormick's tool (2001: 225). DeLone and McLean (2003: 25) consider user satisfaction as an important means of measuring the user experience cycle as indicated by repeat and frequent use. Thirty-five subjects (80 per cent) were satisfied with the accuracy of the EMR. However, four (9 per cent) were equivocal about this attribute.

Twenty-eight subjects (64 per cent) felt satisfied about the timeliness of the EMR, while eight (18 per cent) were equivocal about this. Thirty-eight (86 per cent) of the subjects were either satisfied or very satisfied about the system's reliability, whereas five (11 per cent) were non-committal.

All subjects were satisfied with the training provided on EMR's routine tasks, with 11 subjects (25 per cent) very satisfied. This is a contradictory finding since 7 per cent of the subjects claimed that they had not received any training on EMR (Figure 4.6). Thirty-nine of the subjects (89 per cent) were satisfied with the training on the full system potential of the EMR, while 15 (34 per cent) of the subjects were equivocal because they did not receive any manuals on the EMR (Figure 4.7). Of those who received manuals, eight (18 per cent) were not satisfied with them.

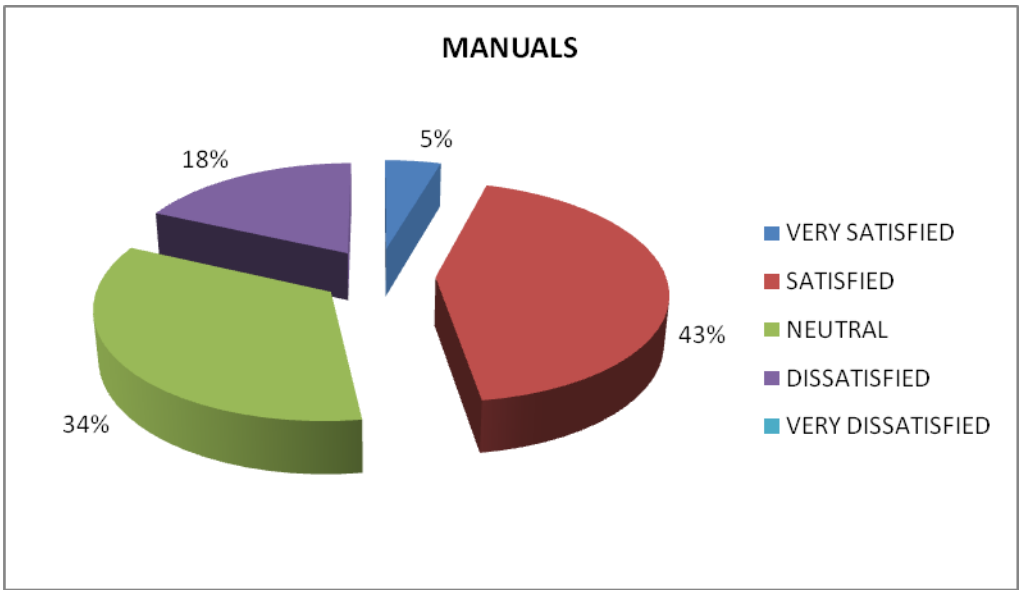


Figure 4.7 EMR manuals

All subjects were satisfied with the ease of use of data entry of the EMR, with 15 (34 per cent) of these very satisfied.

One subject could not comment on the ease of use of information retrieval of the system. However, an overwhelming 43 (98 per cent) were satisfied about this attribute.

All subjects felt satisfied about the legibility of the EMR, with 16 (36 per cent) of these very satisfied. One subject was dissatisfied about the completeness of data entry of the system, five (11 per cent) were not sure and 38 (87 per cent) showed satisfaction with

this. Thirty-one (70 per cent) of the subjects were satisfied with the completeness of information retrieval and 21 per cent were very satisfied with this attribute. One subject (2 per cent) was dissatisfied with this, while three (7 per cent) were equivocal.

One respondent (2 per cent) expressed dissatisfaction about the flexibility of data entry, while two (5 per cent) were not sure. The rest (41 subjects, 94 per cent) were either satisfied or very satisfied. Forty-two of the subjects (96 per cent) were either satisfied or very satisfied with the flexibility of information retrieval of the system. However, one (2 per cent) was dissatisfied while another one (2 per cent) was non-committal.

The system's conciseness of data entry satisfied 42 (96 per cent) of the subjects. One (2 per cent) would not commit and another one (2 per cent) expressed dissatisfaction on this. All subjects were satisfied or very satisfied with the conciseness of information retrieval of the EMR.

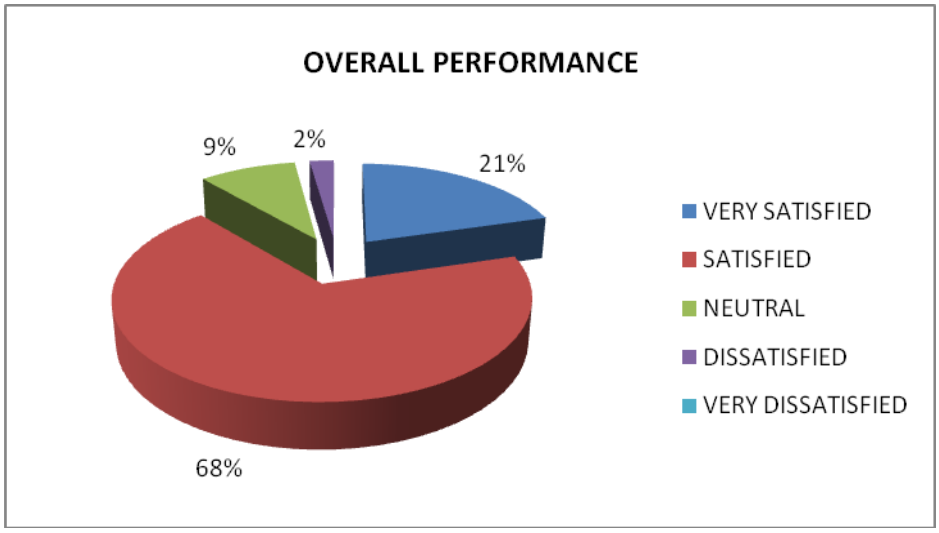


Figure 4.8 Satisfaction with overall EMR performance

Net benefits, which are measured in the current study as the overall satisfaction, are, according to DeLone and McLean (2003: 25), the most important success measures as they capture the balance of negative and positive impacts of the service on customers. Thirty-nine subjects (89 per cent) were either satisfied or very satisfied with the overall performance of the system (Figure 4.8). Only one (2 per cent) was dissatisfied about this attribute while another four (9 per cent) were undecided.

4.6 DISCUSSION OF RESEARCH FINDINGS

The subjects in the study were mostly female, and most were below 40 years of age. However, in a survey of physicians by DesRoches, Campbell, Rao, Donelan, Ferris, Jha, Kaushal, Levy, Rosenbaum, Shields and Blumenthal (2008: 53) in the United States, 72% were male. Marshall et al (1998: 3), also in the United States, had a sample with the mean age of 46 and 62% were male. Lærum et al (2001: 1346), in a study in Norway, had sample of doctors which was 71% male and 63% of which was over 50 years of age. However, the third world setting and the profiles of the subjects in the current study were different to those of these studies.
The majority of the subjects had tertiary education. With this age profile and education level, the researcher expected the level of computer literacy to be high, which the findings confirmed.

More than half of the subjects were health care professionals, with nurses comprising 34 per cent and doctors 21 per cent of the sample. According to the World Health Organization (2011: 122), South Africa's health workforce has more nurses (40.8 per 10 000) than doctors (7.7 per 10 000), in keeping with the study's findings.

Most of the subjects had more than two years of working in the respective clinics and more than a year of using the EMR system.

Eighty per cent of the subjects had prior computer experience before encountering the EMR system. This is encouraging since Meinert (2005: 494) observes that physician resistance to EMRs has been attributed to a variety of factors including limited computer literacy on the part of physicians. Prior computer experience, according to Whittaker, Aufdenkamp and Tinley (2009: 296), was a factor in acceptance of EHR. The same study recommends that nurses with limited computer experience may require basic computer literacy classes prior to EHR training.

Almost all of the subjects used the EMR system on a daily basis. Therefore, they were relatively familiar with the EMR system and the workflow of the particular clinic. When the impact of an EMR system is investigated, Lærum et al (2001: 1347) suggest, its actual use should be considered rather than its claimed functionality. Mbananga et al

(2002: 67) further note that frequency of use of a system can affect attitudes towards it. The function that was used the most was capturing of clinical data. This kind of data is the most important in managing the patient's condition on a chronic, ongoing basis. It is also time-sensitive in most cases because the health care worker has a window of opportunity during the current encounter with the patient to act on the clinical data available. EMR was used by more subjects and was more preferred by them than paper-based notes.

It is concerning that 7 per cent of the subjects claimed that they had not received any training on the EMR system. These subjects are likely to be those who benefitted less and experienced more disadvantages with the system. They are more likely to find it time-consuming to capture data, have more errors in their data, and have negative perceptions of the attributes of the system than those who received training. However, there was a contradiction in that all subjects, including this 7 per cent who claimed they were not trained, were satisfied with the training provided on EMR's routine tasks.

Whittaker et al (2009: 296) identified education of nursing staff as a critical component of successful EMR implementation. At one of the clinics there was a dedicated training programme in place especially for new recruits. It was also noted that most subjects indicated that refresher training seldom or never happened once the initial training was done.

Although the majority of the subjects perceived the system to have more benefits than disadvantages, a significant proportion felt that there was no simultaneous access to data from different sites either within or outside their clinic. This is in contrast to Albers and Spil's (2009: 3) contention that the relevance of EHR is strongly based on the availability of information at any time and any place. The subjects were also equivocal about the system's interoperability capabilities. Arnold et al (2007: 1) identify interoperability as one of the common barriers to EHR implementation. Almost a quarter of the subjects felt that the system was not regularly updated.

Most of the administrative staff, who dealt mainly with data on the system, approved of most the system's attributes. The clinical staff mostly felt the features of the system benefitted the clinical process of patient management. Significantly, they indicated that the system does not interfere with the doctor-patient relationship.

It was noted that more than a third of the subjects did not receive any EMR manuals after training. This is concerning because manuals serve as references when a subject encounters difficulties on the system and when they need to refresh their memory about something they have been trained on but have forgotten or are uncertain about.

Most subjects were satisfied with the EMR's attributes based on Saba and McCormick's (2001: 225) assessment tool. The majority were satisfied with the overall performance of the system.

4.7 CONCLUSION

In this chapter the preparation, management and analysis of data was presented. The researcher discussed how the data was prepared, described the sample's main characteristics, explained how the instrument's reliability was tested, explored the data through tables and graphs, confirmed the data guided by the objectives and questions of the study, and interpreted the study findings.

The next chapter deals with conclusions based on the current study. It highlights limitations identified and makes recommendations on future studies to explore the topic further.

The importance of the current study is placed in the context of the science of medicine and application to clinical practice.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

The previous chapter discussed analysis, presentation and description of the data collected in the current study.

The current chapter discusses conclusions made from the study findings, highlights the limitations of the study and makes recommendations based on the problems identified.

According to the Millennium Development Goals (MDG) Report of 2011, Sub-Saharan Africa remains the most heavily affected region in terms of the human immunodeficiency virus (HIV), accounting for 69 per cent of new HIV infections, 68 per cent of all people living with HIV and 72 per cent of AIDS deaths (WHO 2011: 37). MDG 6 aims to combat HIV/AIDS, malaria and other diseases. Its target is to have halted and begun to reverse the spread of HIV/AIDS by 2015 (WHO 2011: 36).

Tierney et al (2006: 253) have recommended that systems for providing, evaluating and improving HIV care are desperately needed in developing countries that bear the brunt of the HIV pandemic. To this end, the Institute of Medicine has declared electronic medical records (EMRs) to be an essential technology for health care and a necessary tool for improving patient safety and the quality of care (Rotich et al 2003: 295). DesRoches et al (2008: 51) agree that health information technology, such as sophisticated electronic health records, has the potential to improve health care.

However, Sørensen et al (2008: 37) observe that there is no all-inclusive information and communication technology (ICT)-based system in place for AIDS treatment in South Africa. This might be because there is no consensus on the effect of EMR in clinical practice (Delpierre et al 2004: 414) partly because there are few evaluations of EMRs, according to Lærum et al (2001: 1344). Even in developed countries such as the United States of America, adoption of EMR systems has been slow, with estimations of 9 to 29 per cent (DesRoches et al 2008: 51).

The current research study, therefore, aims to evaluate the effects on patient management of EMR systems implemented in selected HIV clinics in Johannesburg. The findings and recommendations discussed in this chapter aim to influence practice and policy which might lead to more widespread adoption and implementation of these systems.

The purpose of the study was to investigate, describe and explore the effects (benefits and disadvantages) of an EMR system on patient management in selected HIV clinics in Johannesburg. The current study addresses this purpose by meeting the study objectives, which were describing demographics of the users of an EMR system in the identified clinics; defining the experience and training of the users of the EMR; identifying and describing the benefits and disadvantages of the EMR; describing the positive and/or negative effects of EMR on patient management and the doctor-patient interaction in a clinical setting; assessing preferences of users for paper records or the EMR; and assessing user satisfaction with different functions of the EMR.

A quantitative, descriptive and contextual research design was used for the current study.

Data was collected from health care workers and administrative staff in four HIV clinics in Johannesburg from 19th to the 30th August 2011, using a questionnaire.

Descriptive data analysis was done on the data, initially using exploratory methods and subsequently confirmatory data analysis. The study findings were discussed in the preceding chapter.

5.2 SUMMARY AND INTERPRETATION OF THE RESEARCH FINDINGS

5.2.1 Demography of the sample

The sample consisted mainly of females and the age distribution was mostly below 40 years of age. Because the setting was an HIV clinic, most of the subjects were clinical staff, that is, nurses and doctors. However, it must be noted that other members of the

team, for instance, social workers, counsellors, dieticians and pharmacists were not included because they did not use the EMR at the time. Most subjects had been working in the clinics for more than two years and had been using the EMR for more than a year.

Lærum et al (2001: 1346) found that there was no significant difference between different EMR systems in terms of respondents' age, gender or work experience, nor any correlation between these terms and total computer use or user satisfaction. However, it must be noted that correlations and establishing associations were beyond the scope of the current study.

5.2.2 Computer and EMR experience

Most of the subjects had at least a year of prior computer experience before encountering the assessed EMR system at the clinics. Whittaker et al (2009: 296) in their study note that prior computer experience was a factor in acceptance of EHR by users. Inexperienced computer users, according to a study by Van der Meijden et al (2001: 177), had a less positive attitude towards an EPR. These inexperienced respondents thought that an EPR would cost them more time to enter data into and to retrieve data from and that it would take a long time to learn to work with an EPR (Van der Meijden et al 2001: 178).

Factors that have been assessed in the current study such as years of professional experience, the profession of respondents, and self-reported previous computer experience, are considered to be predominant factors in accepting or rejecting information systems (Van der Meijden et al 2001: 182). Almost all of the subjects use EMR in their daily duties, so they were quite familiar with the functions and attributes of the EMR assessed in this study. The EMR was used mainly for capturing clinical data which comprised the bulk of the health care workers' responsibility.

5.2.3 Training

Even though most users were trained in the use of the EMR system, it is concerning that 7 per cent reported having not received any training. However, this is contradicted by the fact that all the users reported being satisfied with the training. Whittaker et al

(2009: 296) emphasise that the critical component of successful EHR implementation involves the education of nursing staff and recommend that nurses with little computer experience may require basic computer literacy classes prior to EHR training. The training of staff, according to Forster, Bailey, Brinkhof, Graber, Boulle, Spohr, Balestre, May, Keiser, Jahn and Egger (2008: 943), has also been found to be strongly associated with more complete data.

Van der Meijden et al (2001: 182) recommend that, especially for inexperienced potential users, EPR should be simple and easy to use.

5.2.4 Benefits and disadvantages of EMR

Most of the subjects confirmed that the attributes of the EMR were beneficial to their work. However, most did not think that the patients' data can be accessed simultaneously at different sites through the EMR. There was also no consensus on whether the system was compatible with other computer programmes, that is, inter-operability of the system.

Almost a quarter of the subjects felt the system was not updated regularly. There was a lack of refresher training on the EMR. The system was often available, seldom had downtime or crashes, seldom experienced missing files or an inability to locate data, and the network was often available.

5.2.5 Administrative functions

Most of the administrative clerks, who capture patients' details, and data capturers, who capture clinical data, felt the administrative functions of the EMR were adequate. These included the scheduling module for patient bookings, patient registration, searching for files, capturing data, and accuracy and completeness of the data.

5.2.6 Clinical functions

The clinical functions of the EMR improved patient management according to the clinical staff. They also felt that the system did not interfere with the doctor-patient

relationship.

5.2.7 User satisfaction

Most subjects were satisfied with the overall performance of the system. DeLone and McLean (2003: 25) refer to the overall performance as the net benefits and consider them the most important success measures of the system. However, Carlsen and Aakvik (2006: 13) argue that overall satisfaction has a tendency to be rated higher than satisfaction as regards specific aspects. Whittaker et al (2009: 293) see user acceptance as a critical factor in the successful implementation of an EHR. In a study by DesRoches et al (2008: 57), the majority of respondents reported overall satisfaction with their electronic records system. Ndira et al (2008: 496), in a study in a developing country, found that user acceptance of electronic systems is no longer a strong barrier to the successful implementation of such systems.

There was also satisfaction regarding ease, completeness, flexibility and conciseness of data entry and information retrieval and legibility of data. These findings were in keeping with Ndira et al (2008: 494), who further found that EHRs have the potential to improve on timeliness and availability of routine health reports in developing countries.

5.3 CONCLUSIONS

The conclusions are discussed in respect of the study question, objectives and the problem statement.

The problem statement and the study question for this study as stated in Chapter One were: “What are the effects of an EMR on patient care in selected HIV clinics in Johannesburg?” The purpose of the study, therefore, was to investigate, describe and explore the effects of an EMR on patient care in HIV clinics in Johannesburg. This purpose was achieved through meeting the study objectives.

Most respondents were nurses and doctors. The majority had tertiary qualifications. Computer and EMR experience was substantial in the sample. Most of the respondents used the EMR daily. The function that was used the most was capturing clinical data. EMR was preferred over paper-based records and used by most subjects. Most of them

had some training on the EMR. The majority of the respondents perceived the EMR to have more benefits than disadvantages. Administrative staff approved of most of the EMR's attributes. Clinical staff felt the features of the EMR benefitted the clinical management of the patients. Most clinicians were satisfied with the overall performance of the system with regard to patient management. According to most health care workers, the doctor-patient interaction was not interfered with by the introduction of the system.

5.4 LIMITATIONS

The study design was mainly descriptive and contextual. Burns and Grove (2005: 232) point out that, descriptive designs like the current study, do not manipulate variables, do not attempt to establish causality and are designed to gain more information about characteristics within a particular field of study while they identify problems with current practice. The findings in the current contextual study thus have limited generalisability.

Laerum et al (2001: 1347) are of the opinion that self-reporting, as in the current study, carries a risk of misinterpretation and bias.
A close ended questionnaire was used whose items, Brink (2006: 149) argues, may be superficial and limit the answers to the options provided by the researcher. The questionnaire used was adapted from used, tested and standardised instruments and a pilot study was conducted before the actual research study to reduce the chance of random measurement error (Joubert & Ehrlich 2007: 159).

To minimise selection bias the sample was randomly selected from a target population (Joubert & Ehrlich 2007: 161). Information bias was reduced by implementing the questionnaire the same way on all subjects.

Joubert and Ehrlich (2007: 165) argue that confounding is not of concern in purely descriptive studies, like the current study, that do not examine the association between variables.

5.5 RECOMMENDATIONS

To improve generalisability a bigger study sample is needed, which should be randomly selected from a national study population. A design in which variables can be manipulated, relationships established, and causality investigated will improve generalisability. To improve richness and depth of the data a qualitative study using open-ended questionnaires or interviews is recommended.

More rigorous, multi-disciplinary and independent evaluations, such as, for example, randomised controlled trials, will be more appropriate to establish the impact of the EMR on patient management and patient outcomes and on health care worker performance.

Future research should also assess the patients' views on the impact of the EMR on their care in the clinics involved. Garg et al (2005: 1236) recommend that further research is needed to elucidate the effects of such systems on patient health.

The study findings and conclusions found that, according to the EMR users, the EMR benefits the process of patient management. These findings will be communicated to the Department of Health at the local level where the clinics are situated. The aim is to influence the Department's policies and practices in relation to implementation of EMR systems. The programme might be expanded to the Gauteng Province and ultimately nationally.

Due to the slow implementation of EMR systems, the researcher concurs with DesRoches et al (2008: 59), who propose using incentives for the adoption of health information technology (HIT) by physicians as a means of promoting greater use. For example, the American Recovery and Reinvestment Act of 2009, commonly known as the "Stimulus Package", is a financial incentive for physicians who demonstrate "meaningful use of EMR". The objectives of this programme are to lower health care costs, to reduce medical errors, to improve point care, to improve access to data, such as health care IT, to utilise opportunities that may arise to improve business intelligence programmes in health care, and to improve quality (MedIntechno 2011).

The system that has been assessed in this study was implemented as a complete off-the-shelf product. However, it has been suggested by Van der Meijden et al (2001: 181)

that the participation of health care workers in the development and implementation process of a system is said to be crucial for its success. Potential users should therefore be involved in the development phase of software design to improve their acceptance of an EMR system.

Users who are satisfied with a system and who see the benefits thereof can act as change agents for new users in the same setting or in environments where the system is being introduced. Van der Meijden et al (2001: 183) believe these change agents can promote innovations and can influence the opinion of others about a certain innovation, an EMR in the case of the current study. Delpierre et al (2004: 1235) agree that the importance of local champions to facilitate implementation cannot be underestimated.

5.6 CONTRIBUTIONS OF THE STUDY

The study will add to the evaluations of EMR systems in developing countries where these have been lacking. The findings will strengthen the policies and practices of EMR in the Department of Health, leading to a more informed approach in adopting and implementing the systems.

It cannot be overemphasised enough that training of users and refresher training is critical for the users to actively use the EMR for the benefit of patient care as evidenced by the findings of this study.

The more frequently the EMR is used, the more acquainted the users will be with the different functions of the system. In this study it was found that the most central function of the system, namely, capturing clinical data was used the most. This augurs well for the proper clinical management of the patient. This data can further benefit the patient by being used in research to improve clinical care and minimise errors. Users can also contribute to improving later versions of the EMR with suggestions of areas which need to be added or altered to streamline the user experience and improve the system performance.

The study has highlighted several weaknesses in the implementation of the EMR programme assessed in this study. Seven percent of the subjects claimed that they had not been trained on the EMR system. Half of the subjects felt that the EMR was not

compatible with other programmes. Almost a quarter of the subjects argued that the system was not updated regularly; 34 per cent did not receive any manuals on the system; and 18 per cent of those who did, were not satisfied with them. Interoperability of the EMR with other programmes that users utilise in facilitating their duties needs to be addressed. Since this is a proprietary system, licence agreements need to be signed among the various programme developers to achieve seamless interoperability. These shortcomings need to be addressed in future implementations of EMRs to improve acceptability and adoption of these by potential users.

5.7 CONCLUDING REMARKS

The study shows that most of the subjects were satisfied with the EMR and confirmed that it is beneficial to the clinical management of the patients.

The problem statement and purpose of the study have been addressed by describing the effects of EMR on patient management in selected HIV clinics in Johannesburg. This has been achieved by describing the characteristics of the sample, assessing the computer experience and training of the subjects, identifying and describing the benefits and disadvantages of the EMR, describing benefits of the EMR on patient management and the influence on patient-doctor relationship, assessing preferences of the subjects about EMR and paper-based systems, and finally determining user satisfaction on various EMR functions.

The study was conducted in the context of MDG 6 which aims to combat HIV/AIDS, malaria and other diseases. The specific target in relation to HIV/AIDS is to have halted and begun to reverse by 2015 the spread of HIV/AIDS. The benefits of the EMR as identified and confirmed in this study will hopefully lead to more rigorous and more extensive studies identifying causal and correlational relationships of variables. Ultimately the findings aim to influence policy and practice of the Department of Health and lead to wider adoption and implementation of EMR systems. The current implementation has proved invaluable in enhancing patient management, facilitating report generation, providing patient and programme statistics, and enabling research studies.

“Information technology tools can provide the health care sector with unprecedented productivity and quality of care if there is a strategic vision and adequate research to ensure success” (Ball et al 2003: 505).

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ANNEXURE A: CLEARANCE CERTIFICATE FROM UNISA HSREC

UNISA university of south africa

UNIVERSITY OF SOUTH AFRICA
Health Studies Research & Ethics Committee
(HSREC)
Faculty of Human Sciences
CLEARANCE CERTIFICATE

Date of meeting: 9 November 2010 Project No: 3738-090-7

Project Title: The effects of an electronic medical record on patient management in an human immunodeficiency virus (HIV) clinic in Johannesburg

Researcher: Sello Sophonia Mashamaite

Supervisor/Promoter: Dr BL Dolamo

Joint Supervisor/Joint Promoter: N/A

Department: Health Studies

Degree: Masters in Public Health

DECISION OF COMMITTEE

Approved [√] **Conditionally Approved** [ ]

Prof TR Mavundla
RESEARCH COORDINATOR

Prof MC Bezuidenhout
ACADEMIC CHAIRPERSON: DEPARTMENT OF HEALTH STUDIES

PLEASE QUOTE THE PROJECT NUMBER IN ALL ENQUIRES

ANNEXURE B: CLEARANCE CERTIFICATE FROM WITS HREC

M110302

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dr Sello Sophonia Mashamaite

CLEARANCE CERTIFICATE	**M110302**
PROJECT	The Effects of An Electronic Medical Record on Patient Management in Selected Human Immunodeficiency Virus Clinics in Johannesburg
INVESTIGATORS	Dr Sello Sophonia Mashamaite.
DEPARTMENT	UNISA
DATE CONSIDERED	25/03/2011
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 25/03/2011 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor :

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 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 a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

ANNEXURE C: REQUEST FOR PERMISSION TO CONDUCT THE STUDY

Marleen Naidoo

Regulatory Manager

CHRU

Department of Medicine

Helen Joseph Hospital

19 January 2011

Dear Sir/ Madam

REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY

I would like to request permission to conduct a study in your institution as per the attached summary.

I am currently completing my dissertation for an MPH degree at UNISA. My research will entail administering a questionnaire to the administrative and clinical staff that have experience in using the electronic medical record (EMR) for at least 6 months and are willing to give consent for this. It is estimated that this process, with the help of research assistants which I will provide, should take no more than 30 minutes of the staff member's time.

I have attached the research study summary and a clearance certificate from the Health Studies Research and Ethics committee of UNISA.

The logistics of the study's implementation will be outlined as soon as permission is granted and effort will be taken to minimize disruption to the operational workflow in the clinic. If required, the findings of the study will be shared with your institution thereby giving crucial feedback on the users' view regarding the effects of the EMR on patient management.

I look forward to your favourable response to this humble request.

Yours Faithfully

Dr. S. S. Mashamaite

MPH Student

ANNEXURE D: QUESTIONNAIRE

THE EFFECTS OF ELECTRONIC MEDICAL RECORD ON PATIENT MANAGEMENT IN SELECTED HUMAN IMMUNODEFICIENCY VIRUS CLINICS IN JOHANNESBURG

Answering this questionnaire should take approximately 20 minutes of your time. Please answer all questions to the best of your ability. Answer by putting a cross (X) in the appropriate box. Choose only 1 answer per question, unless if requested otherwise.

Fill in the following sections:
All respondents: A, B, C1, D.
Administrative staff: C2
Clinical staff (Doctors and nurses): C3

SECTION A: DEMOGRAPHICS

1. Indicate your gender:

1	Male	
2	Female	

2. How old are you (years)?

..... years

3. What is your level of education?

1	None	
2	Primary	
3	Secondary	
4	Tertiary	

4. What is your role in the clinic?

1	Data capturer	
2	Admin clerk	
3	Counsellor	
4	Nurse	
5	Pharmacist	
6	Doctor	
7	Other	

5. How long have you worked at this clinic (years)?

1	0-1	
2	2-3	
3	3-4	
4	5-6	
5	6-7	

SECTION B: COMPUTER AND ELECTRONIC MEDICAL RECORD (EMR) EXPERIENCE

1. What is your computer experience?

1	I have used a computer before	
2	I only use the computer for this program	
3	I have no computer experience	

2. How long have you used this EMR (months)?

1	0-6	
2	7-12	
3	13-18	
4	19-24	
5	25-30	

3. How frequently do use the EMR?

Daily 1	**Weekly 2**	**Monthly 3**	**Rarely 4**

4. What do you use EMR for?

1	Capturing demographic data	
2	Booking patients	
3	Searching for files	
4	Capturing and assessing clinical data	
5	Checking results	
6	Decision support: alerts, warnings, reminders, prompts	
7	Order entry: investigations	
8	Pharmacy: prescribing, dispensing	
9	Counselling data	

5. Do you use EMR more than paper record?

1	Yes	
2	No	

6. What do you prefer?

1	Paper record (patient file)	
2	EMR	

7. What training did you receive on EMR?

Advanced 1	**Intermediate 2**	**Basic 3**	**None 4**

SECTION C: EFFECTS OF EMR ON PATIENT MANAGEMENT

1. GENERAL

1.1. BENEFITS AND DISADVANTAGES

	Indicate whether you agree with the following benefits or disadvantages of EMR:	**Strongly agree 1**	**Agree . 2**	**Disagree . 3**	**Strongly disagree 4**
1	Reduces waiting time				
2	Improves workflow				
3	Makes notes legible				
4	Is easy to use				
5	Reduces error rates				
6	Improves the quality of data				
7	Makes data accessible				
8	Has improved quality of patients' care				
9	Helps maintain patient confidentiality				
10	Data is secure				
11	Improves coordination of patient care				
12	Patient's data can be accessed simultaneously at different sites				
13	Has huge storage capacity				
14	Graphs on EMR help monitor trends				
15	Facilitates sharing of data between health care workers				
16	Back up makes data safe				
17	Is compatible with other programs				
18	Technical support is readily available				
19	Is updated regularly				
20	Can validate data				
21	Is available				

1.2. FREQUENCY

	How often does the following occur:	**Always 1**	**Often 2**	**Seldom 3**	**Never 4**
1	System not available				
2	Use of the program				
3	Refresher training				
4	System downtime/ crashing				
5	Missing file				
6	Network unavailable				
7	Cannot find what I am looking for				

2. ADMINISTRATION (To be filled by administrative staff)

	Indicate whether you agree with the following statements:	Strongly agree 1	Agree . 2	Disagree . 3	Strongly disagree 4
1	The scheduling module improves patient booking				
2	Facilitates patient registration				
3	Searching for files is easy and quick				
4	Capturing data is simple				
5	Records are complete				
6	Data is accurate				
7	Saves filing space				

3. CLINICAL (To be filled by the Nurse or Doctor)

	Indicate whether you agree with the following clinical benefits or disadvantages of EMR:	Strongly agree 1	Agree . 2	Disagree . 3	Strongly disagree 4
1	Previous patient history easily accessed				
2	Results are received and accessed in time				
3	Less duplication of tests				
4	Easy capturing of vital signs				
5	Prompts history items				
6	Shorter consultation/ saves time				
7	Reminders and alerts are useful tools				
8	Less prescription and clinical errors				
9	Trends can be assessed				
10	Quicker search for items				
11	Interferes with doctor patient relationship				
12	Referrals are easy to do				
13	Access to history, vitals, findings, scripts and investigations				
14	Easy to assign diagnosis and ICD10				
15	Ordering of tests simple				
16	Management plan easier				
17	Improves clinical decision making				
18	Information up to date				
19	Adhere to clinical guidelines				

SECTION D: USER SATISFACTION CHECKLIST (Adapted from Saba & McCormick 2001: 225):

	Perfomance area Indicate your satisfaction	**Very satisfied 1**	**Satisfied 2**	**Neutral 3**	**Dissatisfied 4**	**Very Dissatisfied 5**
1	Accuracy					
2	Timeliness					
3	Reliability					
4	Training	*Training regarding the following:*				
4.1	*Routine task*					
4.2	*Full system potential*					
5	Manuals					
6	Ease of use	*Ease of use in terms of:*				
6.1	*Data entry*					
6.2	*Information retrieval*					
7	Legibility					
8	Completeness	*Completeness of data in terms of:*				
8.1	*Data entry*					
8.2	*Information retrieval*					
9	Flexibility	*Flexibility of data in terms of:*				
9.1	*Data entry*					
9.2	*Information retrieval*					
10	Conciseness	*Conciseness of data in terms of:*				
10.1	*Data entry*					
10.2	*Information retrieval*					
11	Overall performance					

Thank you for your participation.

ANNEXURE E: PARTICIPANT INFORMATION SHEET

INFORMATION DOCUMENT

Study title: The effects of an electronic medical record on patient management in selected human immunodeficiency virus (HIV) clinics in Johannesburg.

Greeting:

Introduction:
I, Sello Mashamaite, an MPH student at Unisa (Student number 37380907), am doing research on how the electronic medical record system (EMR) affects patient management in HIV clinics in Johannesburg. Research is just the process to learn the answer to a question. In this study we want to learn what your opinion is on the effects of the EMR system that you use on patient management in your clinic.

Invitation to participate:
We are asking / inviting you to take part in a research study.

What is involved in the study:
Once you have read this information document and agree to take part in the study, you might be randomly selected to take part in the study. You will be requested to fill in a questionnaire by answering specific questions in the questionnaire with the help of an assistant. The study participants are health care workers in HIV clinics in Johannesburg South Africa. Completion of the questionnaire will be in the comfort of your work environment and at a time convenient to you. Questions will be asked on your experience in using the EMR and the questionnaire will take 20-30 minutes to be completed. No blood samples will be taken.

Risks:
There is no risk in taking part in the study. We only need your views on specific questions in the questionnaire.

Benefits:
The results of the study will be used to improve patient management through enhancing the features of the EMR being used in the clinic.

Alternative procedures:
No alternative procedures are necessary to the study.

You, the participant, will be given pertinent information on the study while involved in the project and after the results are available.

Participation is voluntary, and refusal to participate will involve no penalty or loss of benefits to which you, the participant, is otherwise entitled and you may discontinue participation at any time without penalty loss of benefits to which you are otherwise entitled.

Reimbursements:
No expenses are necessary for you to take part in the study. No reimbursement will be made to participants.

Confidentiality:
Efforts will be made to keep personal information confidential. Absolute confidentiality cannot be guaranteed. Personal information may be disclosed if required by law.
Organizations that may inspect and/or copy your research records for quality assurance and data analysis include groups such as the Research Ethics Committee and the Medicines Control Council (where appropriate).
The results will be shared with the institutions where the study is conducted and will not identify individual participants in the study.

Contact details of researcher/s:
For further information / reporting of study related adverse events please contact the investigator Sello Mashamaite on 0729055983, my supervisor Dr BL Dolamo on +251 11 435-0080 or Professor Sarie Human on (012) 429-6290.

Contact details of Wits Human Research Ethics Council administrator and chair:
For reporting of complaints / problems please contact Anisa Keshav, Wits Research Office, 10th Floor Senate House, East Campus at (011) 717-1265 or Prof Cleaton Jones at (011) 717-2301.

ANNEXURE F: APPROVAL FROM HELEN JOSEPH HOSPITAL

Gauteng Department of Health

Helen Joseph Hospital

PERMISSION FOR RESEARCH

DATE: 08 August 2011

NAME OF RESEARCH WORKER: Dr Sello S Mashamaite

CONTACT DETAILS OF RESEARCHER (INCLUDE ALTERNATE RESEARHER):
Zuzimpilo Clinic, Tel: (011) 336 2861 / 072 905 5983

TITLE OF RESEARCH PROJECT The Effects Of An Electronic Medical Record On Patient Management In An Human Immunodeficiency Virus (HIV) Clinic In Johannesburg

OBJECTIVES OF STUDY (Briefly or include a protocol):
The objectives of the study are:

- To describe demographics of the users of an EMR system in the identified clinics;
- To define the experience and training of the users of the EMR;
- To identify and describe the benefits and disadvantages of the EMR;
- To describe the positive and/ or negative effects of EMR on patient management and the doctor-patient interaction in a clinical setting;
- Finally to assess preferences of users for paper records or the EMR.

METHODOLOGY (Briefly or include a protocol):
A descriptive cross-sectional study will be undertaken in HIV clinics in Johannesburg. The subjects will be the health care workers in this clinic. A questionnaire will be designed by adapting tested formats which have been utilised in other settings.

CONFIDENTIALITY OF PATIENTS MAINTAINED: Yes

COSTS TO THE HOSPITAL: NIL

APPROVAL OF HEAD OF DEPARTMENT:

APPROVAL OF CRHS OF WITS UNIVERSITY: Yes

SUPERINTENDENT PERMISSION:

Signature: [signature] Date: 8/8/2011

Subject to any restrictions: ANY FINANCIAL IMPACT ON THE RUNNING OF THE HOSPITAL

ANNEXURE G: APPROVAL FROM CITY OF JOHANNESBURG

Joburg

a world class African city

ENQUIRIES: C Fraser
Tel: +27(0) 11 407 7437
Tel: +27(0) 11 407 6840

4th Floor B Block
Metropolitan Centre
158 Loveday Street
Braamfontein

PO Box 31244
Braamfontein
SouthAfrica
2017

Tel +27(0) 11 407 7543
Fax +27(0) 11 339 2868

20 February 2011

Dear Dr Mashamaite

APPROVAL TO CONDUCT RESEARCH WITHIN HEALTH IN THE CITY OF JOHANNESBURG

Permission has been granted to you to conduct research in the Health Department within the City of Johannesburg.

Topic: The Effects of an Electronic Medical Record (EMR) on Patient Management in an HIV Clinic in Johannesburg

Please contact the following person(s) before you commence with your project and to gain access to the clinics:

Region A	Contact Person(s)	Contact No.	Cell phone
Regional Health Manager	Mr Harry Pieters	011 237 8010	082 467 9284
Research Representative	Ms Mariaan Jensen	011 237 8073	082 467 9614

Should you have any queries please do not hesitate to contact our department.

We look forward to your Final Research Report.

Thank you

22/2/11

DR. R. BISMILLA
Executive Director
City of Johannesburg
Health Department

ANNEXURE H: APPROVAL FROM RIGHT TO CARE

Right to care

TREATING AIDS SERIOUSLY

3 March 2011

TO WHOM IT MAY CONCERN

This serves to confirm that Dr Sello Mashamaite has permission to conduct a research project at Themba Lethu, Thuthukani and Edenvale clinics. No access to patient information is required participants in the research will be health care workers.

Thank you for your co-operation.

Yours sincerely,

PROF. IAN SANNE
(MBBCH, FCP (SA), FRCP, DTM&H)
Mobile: +27 (0)82 457 5223

ANNEXURE I: APPROVAL FROM ZUZIMPILO CLINIC

Drs Neil Martinson and Partners

Zuzimpilo clinic

Practice Number: 014 000 0306738

2nd Floor Anstey's Building
59 Joubert Street
Cnr Jeppe & Joubert Streets
Johannesburg; 2000
Tel: 011 336 2861
Fax: 011 336 2862

Company Registration No. 97/15443/07

www.zuzimpilo.co.za

24 February 2011

Dear Dr Mashamaite

Re: Request for permission to conduct research study at ZuziMpilo Clinic

Your request dated 17 January 2011, for permission to perform research study at ZuziMpilo Clinic was received; together with the ethics approval letter for the study. I would like to inform you; on behalf of the ZuziMpilo management that your request has been granted.

ZuziMpilo Clinic uses Therapy Edge Patient Management Program for all clinical records. Therefore you can send trained assistants to the clinic to conduct questionnaires with the Health Care workers that use the Therapy Edge Patient Management Program. The staff members will be informed about your study.

We look forward to the results of your study, and to know what positive and negative effects Electronic Medical Records has on patient care. ZuziMpilo Clinic management would also like to take this opportunity to wish you well in your studies.

Yours Sincerely

Dr Limakatso Lebina
Project Director
ZuziMpilo Clinic

ANNEXURE J: APPROVAL FROM EDENVALE HOSPITAL

health and social development
Department: Health and Social Development
GAUTENG PROVINCE

EDENVALE GENERALHOSPITAL

Department of Health
Lefapha la Maphelo
Departement van Gesondheid
Umnyango wezeMphilo

☎: (011) 321 6001
Fax: (011) 443 6162

11th July 2011

TO WHOM IT MAY CONCERN

RE: DR. SELLO MASHAMAITE

This serves to confirm that Dr. Sello Mashamaite has permission to conduct a research project at Tsakani Clinic. No access to patient information is required, participantes in the research will be health care workers.

Thank you for your cooperation.

With thanks,

DR. D.R. MALULEKE
CLINICAL MANAGER

DR. D.R. MALULEKE
MBCHB (NATAL) MP 0498100
PR 5601290
CLINICAL MANAGER