# FRAMEWORK FOR THE IMPLEMENTATION OF ELECTRONIC MEDICAL RECORDS IN PUBLIC TEACHING AND REFERRAL HOSPITALS IN KENYA

**BY**

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# DECLARATION

**Declaration by Candidate**

This research is my own original work and has not been presented for any degree in any university. All sources consulted have been duly acknowledged.

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This research has been presented for examination with our approval as Moi University Supervisors.

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# DEDICATION

To my wife Alice and my children: Elphas, Willen, Jude, Mark and Larry, for their understanding and moral support during the preparation of this thesis, which denied them quality time; I am sincerely grateful to them.

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*Above all thanks are to Almighty God for making all things possible through His abounding grace.*

# ABSTRACT

The growing global trend towards Electronic Medical Records (EMRs) is driven by the acknowledgment that healthcare is information and knowledge-based service. Providing access to reliable information which can be accessed in a timely manner is the most effective strategy for improving and facilitating the quality of healthcare delivery process. In Kenya however, healthcare providers have had a slow transition to Electronic Medical Records. Subsequently this study was set out to examine the utilization of Electronic Medical Records in provision of health care services to the clients of Public Teaching and Referral Hospitals in Kenya with a view of developing an implementation framework. The objectives of the study were to: establish the type of medical records management systems existing in Public Teaching and Referral Hospitals in Kenya; examine the adequacy of the organization infrastructure in supporting the application of EMR in the provision of health care services; determine the extent to which electronic medical records are utilized in the provision of healthcare services to patients; examine the challenges encountered in the application of the EMR in the provision of health care services at these hospitals, and propose a framework of enhancing the use of EMR in public teaching and referral hospitals. The study was informed by Diffusion of Innovations theory and the Design and Implementation of Records Keeping Systems (DIRKS) Methodology. Case study research design in a qualitative approach was adopted. A sample of 90 respondents comprising 81 medical staff and 9 key informants was drawn from a target population of 463 Medical Records staff of Moi Teaching and Referral Hospital and Kenyatta National Hospital, Clinicians in charge and the two Chief Executive Officers (CEOs) as key informants using stratified and purposive sampling techniques. Semi-structured interview complemented by document review was used in data collection which was then analyzed using grounded theory. The findings established that a myriad of factors that influence the adoption EMR. These include parallel use of manual and electronic records, lack of Electronic Medical Records Implementation framework, inadequate opportunities for continuous training among the staff, lack of stakeholders involvement in establishing EMRs, inadequate ICT infrastructure such as computers, internet connectivity and bandwidth; insufficient Government funding; fragmented implementation policy framework and high installation, maintenance and operational costs. This study therefore concludes that the two hospitals' management needs to have adequate budget allocation for enhancing and sustenance of EMRs and to support human capacity building. The study recommends that a needs assessment be conducted in the two hospitals to enable the hospital management to put in place a robust ICT infrastructure to support provision of quality healthcare services. Subsequently, the study developed a framework for implementation of EMRs that would aid in circumventing the existing challenges to successful EMRs implementation.

**TABLE OF CONTENTS**

**LIST OF TABLES**

## LIST OF FIGURES

**LIST OF APPENDIX**

**APPENDIX A**

**APPENDIX B**

**APPENDIX C**

# LIST OF ABBREVIATIONS

**AMR**    Automated Medical Records

**CPR**    Computerized patient Record

**DIRKS** Design and Implementation of Records Keeping System

**DOI**   Diffusion of Information Theory

**EHR**   Electronic Health Records

**EMR Electronic** Medical Records

**EPR**    Electronic Patient Record

**GoK**   Government of Kenya

**HIS**    Hospital Information System

**HMIS** Hospital Management Information System

**ICT Information** and Communication Technology

**ISPs** Internet Service Providers

**IT Information** Technology

**KHPF** Kenya Health Policy Framework

**KNH** Kenyatta National Hospital

**MOH**   Ministry of Health

**MTRH**   Moi Teaching and Referral Hospital

**PEST**   Political Economical and Technological

**CHAPTER ONE**

**INTRODUCTION AND BACKGROUND TO THE STUDY**

**1.1 Introduction**

Health is one of the most vital sectors in any economy. A country that has deprived health systems and policies is expected to experience reduced economic growth as output of citizens might be greatly affected when they are not in good health. According to the World Health Organization (WHO), growing life expectancy at birth by 10% will add to the economic growth rate by 0.35% a year (World Health Organization, 2001). There are various setbacks of access to healthcare services by greater part of the people in developing countries; low quality of healthcare services due to shortage of highly qualified clinicians and other health personnel and soaring cost of healthcare services too expensive to majority of citizens are troubles that can be alleviated through embracing electronic Health in growing countries.

Maxwell et al (2012) argues out that the Electronic Health Record (EHR) is a key element of medical informatics that is more and more being utilized in developed countries to advance healthcare. So far, documentation of patient information in various hospitals in developing countries still remains on papers. Miller et al (2005) points out restrictions of these paper-based records as including poor handwriting, vagueness, deficient data, reduced accessibility and data disintegration. Laerum (2003) argues that recording of patient information on papers hamper the stability and value of care for patients. As Currie and Finnegan (2009) view, these are the problems that electronic Health through electronic medical records brings out to address. To be specific, Chaudry et al (2006) observes that electronic medical records applications can without delay, provide better

ordering for searching and retrieval, and allow sound checks for data worthiness, research, and above all decision support. Confines of paper-based records are influencing a shift across the world towards Electronic Medical Records (EMRs) and in general electronic health. Nevertheless, regardless of the well documented benefits of electronic Health, implementation particularly in developing nations remains an immense confront (Mugo & Nzuki , 2005).

Healthcare information is characterized by multiplicity of information that is disintegrated, scattered and highly context dependent. A strong strategy for capturing and sharing the information across departments is very important for the effective operation of healthcare facilities. Health institutions rely on information about the treatment of patients, patient's entity, services provided vs. outcome of care, as well as its concerted efforts to offer, organize and incorporate services. Similar to human beings, material and monetary resources, information is a resource that must be managed well in order to advance the health care and medical services' performance, control, organizational and maintenance process. The incorporation and adaption of information technology into clinical workflows is certainly a growing truth.

In attempts to lower the costs, improve the quality and expand the access to health services many governments of developing countries put much hope in electronic medical records (Nyella & Mndeme, 2010) and ICTbased Health Information Systems (HIS) (Mosse & Sahay, 2005). The migration to electronic medical records is necessitated by limitations in paper based records that include temporal, spatial, and monetary constraints associated with continued paper-based record accumulation and compression over time. Additionally, paper-based systems have limited functionality; many people cannot easily view the same record at the same time (Hwang *et al*., 2009). Having electronic medical

records can support medical professionals in their decision-making and also improve operating efficiency, thus improving medical care quality (Ayers *et al*., 2009).

Whetton (2005) observed that from the early 1960s computers were being used to process information in health organizations. From the 1970s to the mid-1990s, they were used internally to an enterprise level by organizations, initially within departments but increasingly across departments. Logical extensions from this inward approach and in response to an increasing emphasis on coordinated and integrated health care, organizations have turned towards exploring the potential of information sharing with each other. The Electronic Medical Record is therefore, where data is entered directly into the computer, and X-ray, pathology and pharmacy data can be integrated into the patient record. Although there may be some paper back-up, there is increased access within the facility and between facilities. More advanced records may incorporate functions such as clinical support, results reporting, and appointment scheduling. In our country, such systems have been established with a high quality case in point being the Mosoriot Medical Record System (MMRS) which is a computer-based patient record system within a crucial health centre in Eldoret, Kenya. The record system has a modular structure, programmed in Microsoft Access. The modules include Patient Registration, visits data, Medical reports and a core Records Vocabulary.

Today, most health care organizations and facilities, even quite small ones, have at least a basic level of computerized patient records. The focus of healthcare services is on increasing patient records into an electronic medical record and perhaps electronic patient records. Diverse versions of electronic records are currently being assimilated in health systems across the globe. Referral hospitals such as Kenyatta National Hospital and Moi Teaching and Referral Hospital utilize Electronic Medical Records, there are myriad of

challenges with implementation. Therefore, this study wanted to investigate the use of EMRs with view of developing an implementation framework.

Regardless of the challenges in setting up information systems in developing countries, a number of hospitals have effectively incorporated EMR systems into clinical workflows. whereas not any one system represent an absolute or perfect solution, their thriving use, with sharing patient records numbering in hundreds of thousands over the years, offer important insights into thriving deployments. One remarkable electronic medical records system is the Automated Medical Record System (AMRS) (Whetton, 2005)

### 1.2 Hospital Management Information System in Kenya

Health Management Information System is described as an efficient collection, collation, analysis, evaluation strategy, dissemination  and use of information about individual patients, population, resources used and health outcomes of intervention and the state and nature of systems through which the intervention are applied (Ministry of Health, 2014). Since 2003 various studies (Wamae, 2015) have been undertaken to assess *Kenya's* Health Information System (HIS). The findings of the assessments outline areas that require immediate attention to strengthen HIS in the country. One of the priority areas identified *is* the need to develop a comprehensive Strategic Plan for HIS to guide the implementation of its activities.

The successful implementation of this Strategic Plan is expected to provide a basis for quality information that can be used at all levels of the health system for planning, managing, monitoring and evaluation of desired outputs. This will assist to establish a functional, robust, effective and efficient health information system.

Health Information System, like any system, consists of parts which are interrelated, interdependent and work towards a common goal. The malfunctioning of any part affects other parts of the system. The functionality of an HIS may differ from organization to organization. In general the system is a combination of Health Information and Management Information. The system collects information on health (Morbidity and mortality statistics, Service statistics) and on management (human resources, financial, fixed assets and infrastructure, drugs and supplies logistics) and performs comparative analysis with population- based data from various surveys.

## 1.3    Primary Objectives of HIS

Amongst the broad objectives of HIS are to:

- Determine end-user information needs at the various levels of the health system;

- Facilitate data collection, analysis, information generation and storage;

- Facilitate information dissemination, feedback (horizontal and vertical and use of information for evidence based decision making; and

- Strengthening use and Application of Information and Communication Technology in data Management.

The HIS is expected to support informed strategic decision-making by providing quality data which help managers and health workers at all levels of the health system in planning and managing the health services; monitoring disease trends and control epidemics; and providing periodic evaluation towards agreed targets. In other words, HIS facilitate evidence-based decision making processes at all levels of the health pyramid (Level 1 to Level 6); that is from the level of individual patient care to the management of specific

health programmes through to the policy levels where strategic decisions are made. The current levels of care in the health sector are:

- Level 1 = Community

- Level 2 = Dispensary and Clinics

- Level 3 = Health Centre including maternity and nursing homes

- Level 4 = Sub-district and District Hospitals (Primary hospitals)

- Level 5 = Provincial and general hospitals (secondary hospitals)

- Level 6 = National referral hospitals (tertiary)

Kenyatta National Hospital and Moi Teaching and Referral Hospital are the two health facilities at Level 6 which are at National referral hospitals.

Odhiambo (2000) considers the primary goal of an HIS is to provide the right information to the right user at the right time. As such, properly organized HIS is a prerequisite for the effective and efficient management of health services. He concludes that no HIS can afford to discourage the successful use of its information resources by producing information products that are not aligned with the needs of the user in the forefront. Consequently, HIS should be developed with a careful assessment of the levels of the information generation, feedback mechanisms and use by all. Vincent (1993) point out that the benefits that accrue from such an HIS include:

- Helping decision makers to detect and control emerging and endemic health problems, monitor progress towards health goals, and promote equity;

- Empowering individuals and communities with timely and understandable health-related information, and drive improvements in quality of services;

- Strengthening the evidence-based decision for effective health policies, permitting evaluation of scale-up efforts, and enabling innovation through research.

- Improving governance, mobilizing new resources, and ensuring accountability in the way they are used.

Since a properly organized HIS is needed to produce information for taking action, the development of HIS strategic plan was envision to provide clear road map for the implementation of planned activities.

## 1.4 EMRs in Developing Countries

Developing countries are currently up doing well to the recognition that they have to embrace information and communication technologies to deal with the predicament of access, value and expenditure of healthcare. Ojo et al. (2007) is certain that adoption of ICT in health sector transversely in developing countries will speedup knowledge diffusion and boost access to health information.

Mugo et al (2014) confirms that there exists indication to demonstrate that electronic medical records are in advance in the health sector in developing countries. Case in point, the Open MRS developed by the Registered Institute and Partners in Health, endows with a user-friendly interface for electronically storing medical data and has been doing well in Kenya. The Mosoroit Medical Record System (MMRS), which was implemented at a most important rural health center in Kenya, provides patient registration and patient appointment records management with potential to hold information of over 60,000 patients (Sood et al., 2008). Additional electronic medical records that have accomplished in developing countries comprise the Lilongwe EMR

utilized for a variety of clinical crisis in a pediatric department of the Central Hospital in Malawi; Partners in Health (PIH)- EMR, Peru; HIV-EMR system, Haiti; Care ware, Uganda; PEPFAR project, Tanzania; National EMR, project Zambia (Sood *et al.*, 2008). Nevertheless, these electronic medical records need to tackle confidentiality, privacy and security matters for utmost suitability by clinicians. The clinicians have to also appreciate their profits and how they will force on daily and business processes in hospitals, patient documentation, schedules with General Practitioners, restore prescription drugs, monitor own drug conformity, review cold cases waiting lists for operations and excellence ratings of hospitals, register as organ donor, and get contact to local disease management systems in out-patient clinics (Mugo et al 2014).

### 1.4.1 EMR in Kenya

The Division of Health Information Systems (HIS) in the Ministry of Health acknowledges the need to develop the exploitation of ICT in health services. In the Strategic Objective five of the HIS Strategic Plan 2009-2014, the HIS aims to support the "use and relevance of information and communication technology, in data management". Jointly to this objective is the call for standardized and interoperable of ICT applications, together with EMRs. It is with this point in mind that the Ministries of Health, through the HIS, got on a process of standardization of EMRs in Kenya.

Electronic Medical Records (EMRs) systems are more and more being adopted in Kenya to advance medical record management, health program management, and the quality of patient care. Moi University School of Medicine (Eldoret, Kenya) has worked in partnership with Indiana University School of medicine for over 17 years, whereby in 2001 the Mosoriot Medical Records System (MMRS) was established in primary care healthcare centre (Mugo et al 2014). However, the development and implementation of

these systems was not properly coordinated resulting in multiple EMR systems with varying objectives and functionality and without the ability to share patient information with other systems, programs and the Government (Sumbi, E.M. 2016).

. On the other hand, the buildup and execution of these systems has not been appropriately harmonized, ensuing in multiple EMR systems with divergent objectives and functionality, and without the capacity to distribute patient information with new systems, programs, and the Government. (Fraser *et al* 2005).

## 1.4.2 Strategies for the EMR Initiative in Kenya

The Division of Health Information System (HIS), Ministries of Health in Kenya, envisage a health information enterprise that include, as one of its parts, EMR systems that maintain the condition of holistic health care while progressing on health records management and causative to advance excellence of patient care.

Essential to this approach is the requirement to have systems that ought to: preserve the soundness, truthiness and secrecy of health information, making sure that there is safety through incorporated system audit trails that prevent right to use and abuse of data and authenticate the correctness of captured data (GoK, 2009).

One more significant characteristic of the EMR is the ease of information distribution among diverse customers. To draw attention to its importance, the Government of Kenya a number of years back indicated that inter-operability and data exchange is imperative for the achievement of the HIS enterprise planning. Relative to clinical systems, a patient management system is anticipated to allocate pertinent patient-level data with a pharmacy or laboratory information system and vice versa. Furthermore, patient management

information systems must afford a degree of decision support that would assist clinicians develop the value of patient care (GoK, 2009).

## 1.5 Kenya's Health Sector

Ten years back, Kenya's health position illustrate a descending drift in conditions of health indexes such as reduced access by the mass of the people, elevated charges of care that create it too expensive to majority of people, and surfacing and re-surfacing of diseases such as HIV/AIDS and tuberculosis (Ministry of Health, 2008). In spite of maintaining of a vibrant and ever- changing health sector as supposed by MoH, (2014), severe public health apprehension linger.

The overall policy guidance for the health sector in Kenya is the Government of Kenya Vision 2030 and the Kenya Health Policy Framework (KHPF, 1994-2010). The First Medium Term Plan of Vision 2030 acknowledged frail health information systems as a main test in the health sector. The exact part of limitations included lack of strategy and guiding principles, insufficient ability of HIS personnel, lack of incorporation, numerous similar data gathering systems, and weak organization, among others (Ministry of Health, 2014). It was generally agreed that the HIS offer incomplete information for checking health goals and allow a group of people and persons with appropriate and comprehensible information on health and health related involvement.

Attempt to undertake the challenges in the health sector are complex and diverse based on the horizontal and vertical character and range of institutions. At the nationwide, the Government of Kenya (GOK) through the ministry of Health (MOH) put up the National Health Sector Strategic plan (2005-2010), with a plan of a skillful and high value health care system that is available, fair and reasonably priced for all Kenyan family. With the

six objectives of the strategic plan of the health sector is to set up and uphold a well-organized, and tailored Hospital management information system (HMIS) that make it easy enhanced services delivery by the Hospital (MTRH Strategic plan 2005-2014). Along with the four serious features that motivate hospital's pursuit of the objectives of the strategic plan is on infrastructure wherever hospitals are projected to exploit information and communications technology (ICT) as a strategic resource to make it easy its transactions.

### 1.5.1    Status of Adoption and use of EMR in Healthcare Services in Kenya

Sumbi, E. M. (2016) confirms that Electronic Medical Record (EMRs) have expansively been established into medical practice and have been proved cost-effective in various clinical conditions in Kenya.

Although Kenya is far behind other countries (ECA, 2001), the utilization of ICT in provision of healthcare in Kenya has been established and management of many hospitals and healthcare service providers are currently computerized. Medical information systems, the Internet, telemedicine, personal digital assistant, electronic medical records and other functions are projected as unavoidably appropriate routine in health. The understanding of this has wide ranging over period of time.

Early 2000, it was established that the key players, medical professionals had not fully embraced the valuable resources of ICT (Gatero, 2006). Seventeen years later, Odekunle and Shankar (2017) indicated in their study that the staff at the private hospitals in Kenya had a higher knowledge on computer than those from the public hospitals. A large proportion of the respondents had access to and knew how to use the EMR applications at a moderate level. The study further revealed that unlike in the private hospitals, not all

the healthcare service delivery points in the public hospitals were linked to each other. Of the four individual characteristics studied, namely, sex, age, marital status and level of education, age was the only variable that significantly influenced adoption and utilization of EMR though the relationship was weak. The results further confirmed that the problems halting implementation of EMR in Kenya were: Insufficient internet connectivity, the elevated starting cost, fear of losing positions, privacy of the patients' records and the problem of implementing new way of life. Sumbi, (2016) advances that an Electronic Medical Record (EMR) system was progressively being implemented in Kenya to advance medical record management, health program management, and the worth of patient care.

On the contrary, despite the fact that Kenya has made tremendous steps in Information Communication Technology (ICT) as demonstrated by the growing number of telephone lines, Internet Service Providers (ISPs), the number of Internet users, broadcasting stations, mobile phones and the growing competition by mobile service providers, and development of National EMR standards, there has been no noticeable penetration of ICT in public hospitals (Thiong'o, 2017).

Otieno et al (2018) in their research results acknowledged a number of features that explain the low EMR diffusion in Kenya. These comprise: low contemplation of financial plan for EMR financial support and sustainability; little exploitation of accessible national EMR principles, a detach between tactical administrators and EMR consumers particularly in the area of consumer participation; little EMR contribution on healthcare services, and little dependability of EMR as prove, upholding of reliable records and requirements of other records management functions such as appraisal, disposal and permanent retention of records among others.  These findings suggests that there is need

for more sensitization on National EMR standards at both strategic and users level to ensure EMR quality, appropriate involvement of users and all stakeholders in all stages of implementation to enhance requirements analysis, ownership of system and utilization. Their study also recommends sensitization, before and after studies, in health facilities implementing EMRs in order to ensure early corrective measures and control of the implementation process.

### 1.5.1.1 Public Teaching and Referral Hospitals

Public Teaching and Referral hospitals are defined as major hospitals that usually have full complement of medical services such as surgery, pediatric, obstetric, general medicine and genealogy. Patients in Kenya are often referred from level 4 and 5 hospitals to referral hospitals when the health situation is more complex thus, requiring intensive solutions. According to Wamae (2015), Public Teaching and Referral hospitals in the country as per 2014 were Kenyatta National Hospital and Moi Teaching and Referral Hospital at Level 6 which are at National referral hospitals.

**Kenyatta National Hospital (KNH)**

Kenyatta National Hospital is recognized under the state Corporations Act as per Legal Notice No. 109 of 6th April 1987. The Hospital was put up to perform the function of a National Referral and Teaching Hospital, as well as to offer medical research milieu. Began in 1901 with a bed facility of 40, KNH was upgraded to a state corporation in 1987 with a board of management and is at the peak of the referral system in the Health sector in Kenya. The main functions of the Hospital are to offer expertise eminent healthcare and support medical training and research. Within the KNH complex are college of Health Sciences (University of Nairobi); the Medical Training College, Kenya Medical Research Institute and National Laboratory Services (Ministry of Health).

Kenyatta National Hospital has 50 wards, 22 outpatient clinics, 24 theatres (16 specialized) and Accident and Emergency Department. Out of the total bed capacity of 1800, 209 beds are for the private wing (KNH Annual Report and Financial Statements, 2012/2013)

**Moi Teaching and Referral Hospital (MTRH)**

Moi Teaching and Referral Hospital is the next national referral hospital in Kenya following Kenyatta National Hospital (KNH). The Hospital plays a key position in the health delivery and it also proffer teaching facilities to the school of medicine, Public Health of Moi University and other tertiary institutions amongst others.

The Hospital is situated along side Nandi Road in Eldoret town, Uasin Gishu County, in Rift Valley Province of Kenya. The hospital began in 1917 as a cottage hospital with bed facility of 60 to provide for the health requirements of Africans. The hospital has progressively been established to a national referral hospital with bed capacity of over 800. The catchment area for MTRH are Nyanza province with a population of 4.5 million, North Rift with population of 4 million, Western Province with 3.7 million people bringing a total of 15.24 million of the total Kenyan population of approximately 40 million.

The core functions and services of MTRH are directly consequent from the mandate provided out in the Legal Notice that recognized the hospital as a teaching and referral institution.

**1.6     Statement of the Problem**

Health records and information services departments of Public Teaching and Referral hospitals in Kenya such as Kenyatta National Hospital (KNH) and Moi Teaching and Referral Hospital (MTRH) are striving to put in place sound medical records systems that represent data that accurately capture the state of the patient at all times and allows for entire patient history to be viewed to ensure the effective management of their patient.. The two health institutions have put in place an Electronic Medical Records System called Fun Soft. Example MTRH first started with the hospital management information system (HMIS) in 2006 and later automated medical records system (AMRS) in 2010 and changeover to Fun Soft in 2013.  However, their efforts have been hampered by a myriad of factors. There are claims that most of the existing medical records systems do not allow easy accessibility to patient information by medical workers (Akanbi, 2014). Additionally, there are assertions that computerized records slow down, create and raise more work for Clinicians (Akanbi, 2014). This is further exacerbated by the existence of different medical records systems in the hospital where some patient records are in paper format (i.e. manual system) while other patient services are in automated/electronic format (Thiong'o, 2017; Hasanain, 2015). In addition, inadequate ICT skills by some staff have resulted into inefficient application of the medical records system (Mwangi, 2005).

The inefficiency of the current health information provision and access system represents a significant service delivery challenge to the hospitals. Given the increased expenditure on health care, individually, institutionally and nationally, minimizing these obstacles is critical for the overall improvement of delivery of healthcare services.

It has been extensively recognized that background issues play a significant function in controlling the capability of an organization to realize and effectively apply technological

innovations (Barret, 1999, Allen, 2000; Avgrou, 2000; Greenhalgh, Glenn, Bate, Macfarlane, & Kyriakidou, 2005). Even if a number of researches have scrutinized the applications of Information Communication and technology in the health organizations (Fleuren, Wiefferink, & Paulussen, 2004), practice with generating EMR systems for the developing countries is limited. In the Kenyan situation, research that have looked at health associated information systems (Gatero, 2011; Munge, 2005 Maiga, Makori, & Miph, 2013; Thiong'o, 2017) have not sufficiently tackled the purpose of EMR in healthcare service prerequisite.

The application of Electronic Medical Records is an intricate and resource demanding task. McLane (2005) affirms that still in well off countries, the progress of EMR systems is still an indecisive and demanding assignment. This calls for a responsive marching of local requirements to accessible expertise and resources. Based on the premise that the referral hospitals are receptive to EMR but its optimal assimilation is constrained by a myriad of factors, this study is conceived to: firstly extend empirical-based understanding of the status and the difficulties in the utilization of electronic medical records in terms of healthcare services in referral hospitals in Kenya; and secondly, propose a framework of EMR that would serve as blue-print for the successful implementation and application in enhancing the performances, governance, management and support of healthcare services in Kenyan public teaching and referral hospitals. No studies were located that have developed an EMR implementation Framework to comprehensively guide those seeking to implement EMR systems in Kenya (Sumbi, E.M. 2016). Such a framework would ensure a consistent approach to adopting a new system including interpretation.

**1.7     Aim of the Study**

The aim of this research was to examine the utilization of Electronic Medical Records in provision of health care services to the clients of Public Teaching and Referral Hospitals in Kenya with a view of developing an implementation framework.

**1.8     Objectives of the Study**

The study was guided by the following objectives to:

1) Establish the type of medical records systems in Public Teaching and Referral Hospitals in Kenya;

2) Determine the extent to which electronic medical records are utilized in the provision of healthcare services to patients at Public Teaching and Referral Hospitals in Kenya;

3) Establish the skills in terms of  understanding and ability amongst medical staff in using of Electronic Medical Records;

4) Examine the adequacy of the organization infrastructure in supporting the application of EMR in provision of health care services;

5) Examine the difficulties they come across in the application of the EMR in the provision of health care services and establish how these challenges can be addressed.

6) Propose a framework for implementation of EMR in public teaching and referral hospitals in Kenya.

**1.9      Research Questions**

The study addressed the following research questions:

1) What kind of medical records systems exist in Public Teaching and Referral Hospitals in Kenya?

2) To what extent do the existing administrative, social-economic, regulatory and technological infrastructure support the application of EMR in public teaching and referral hospitals?

3) What competencies do public teaching and referral  hospital staff possess in utilization of EMRs

4)  How are EMRs utilized in providing healthcare services in referral hospitals?

5) What difficulties are met in the utilization of the EMR in Public Teaching and Referral Hospitals?

6) How can the difficulties they come across in the application and use of the electronic medical records be overcome?

7) What Framework can improve implementation of EMR in Public Teaching and Referral Hospitals in Kenya?

**1.10 Assumptions of the Study**

This study effort was based on the following assumptions:

1) That although electronic medical records have great potential in facilitating access to quality healthcare services they are not put to optimum use by health workers.

2) That if factors that contribute to inadequate use of electronic medical records were objectively identified, realistic alternatives and possible solutions could be recommended.

3) That there is potential role of electronic medical records in improving healthcare services in the teaching and referral hospitals in Kenya.

4) That the use of ICTs by health workers has been hampered by inadequate infrastructure and lack of prerequisite skills.

5) That the institutional ICT policies are not implemented to improve use of EMRs to access and use patient information for service delivery.

## 1.11.   Significance of the Study

This research provides empirical evidence of utilization of electronic medical records in the provision of health services at Public Teaching and Referral hospitals in Kenya drawing inferences from the experience of the two case studies Moi Teaching and Referral Hospital and Kenyatta National Hospital. On the basis of this study, it is hoped that:

The study will help in understanding the theoretical framework on the adoption of EMR systems in public teaching and referrals hospitals in Kenya.

In practice the findings will assist the management in understanding  the key challenges to adopting EMR systems and approving as a standard to help in making informed decisions. The recommended interventions can also be considered.

The finding of research will also of great assistance to the Ministry of Health and other stakeholders to target policies and measures in sustenance of EMRs.

Further, this study will be of benefit to future scholars and researchers as it will form a basis for future research and provide literature for reference.

The results of this research would offer quality information towards the utilization at all levels of the health system for planning, managing, monitoring and evaluation of the desired output such as:

- Detecting and controlling emerging and endemic health problems, monitor progress towards health goals, and promote equity.

- Empowering individuals and communities with timely and understandable health related information and drive improvement in quality of services.

- Strengthening the evidence based for effective health policies; permit evaluation of scale-up efforts; and enable innovation through research.

- Improving governance; mobilize new resources and ensure accountability in health institutions;

- Monitoring short term programme output and support performance based resources allocations regularly.

- Enhancing reporting of health outcomes to monitor MDGs and

- Strengthening national, provincial and county health information systems will also require collaborative efforts.

- Choosing appropriate system architecture and design of the EMR system and technology.

## 1.12 Scope and Limitations of the Study

The study focused on the framework for the implementation of Electronic Medical Records in Public Teaching and Referral Hospitals in Kenya.

### 1.12.1 Scope

This study adopted a multiple case study design in which two Public Teaching and Referral Hospitals in Kenya: Moi Teaching and Referral Hospital and Kenyatta National Hospital where the respondents targeted for this study were confined to the Medical Records Department as core, Clinical and Nursing divisions also involved. These are main divisions and department handling medical records on daily basis.

### 1.12.2  Limitations of the study

This study had three limitations that need to be acknowledged.

First the results of the research were found on participants self-reporting and could be open to some answers which are biased.

Secondly, the study used the interpretive research model / paradigm which presume that the world is basically what people distinguish it to be. This interpretative lens is found on the assumption that truth is collectively build through words, perception and common connotations (Myers, 1997). The interest of study was in the respondents' interpretation of electronic medical records through their own experiences and involvement. This means that information from some respondent can be construed as personal based on their own experience and limited to what they were able to recollect. To minimize on potential subjectivity, multiple respondents was used to increase internal validity of the findings.

Third limitation is related to the generalization of results. According to Silverman (2011) arithmetical generality to a people is not easy due to small figure of cases usually integrated in a case study research and the distinctive lack of a random selection of samples. As such, given that the current study was conducted at only two public teaching and referral hospitals, the findings may not sufficiently reflect EMR utilization trends in other hospitals in the country since the level of technology, use of ICTs are significantly different. While this limits the statistical generalization of the study, its theoretical generalization remains viable. A good example being execution and utilization of EMR systems is low in developing nations, such as Kenya. A number of EMR implementation frameworks in the literature have been created exclusively for developed and/or developing nations and still for specific health facilities. Nevertheless, no general EMR implementation framework exists that can be utilized in each country, hospital, or health setting. Moreover, and of particular significance to this study, no EMR implementation frameworks have been set up particularly for Kenyan public hospitals.

## 1.13    Chapter Summary

This chapter provided conceptual and contextual setting by highlighting various health information subsystems and their functionalities including the Public Teaching and Referral hospitals. The chapter provided a description of EMR and a synopsis of its growing presence in the provision of healthcare services, and formulated a problem statement, research objectives, research questions, significance, and scope, limitations of the study and definitions of key terms used.

## 1.14    Definitions of Operational Terms

The following terms have been defined:

**Diffusion** is considered as a process by which knowledge is spread. It refers to communication processes by which ideas, practices or products are spread through certain channels overtime among members of a community.

**E-government** defined as: electronic government (egovn), digital Government, online government or transformational government referred to as the use of information and communication technology to make available and advance government services, business and communications with general public, and other arms of government.

**Electronic Medical Record** has been variedly defined in the literature (Conrick, 2006; ISO, 2003; McLean, 2006; Miller, 1993; Mon, 2004). For the purpose of this study, the term EMR includes the following elements:

**Electronic record of patients' health information,** wherever information is stored up on a healthcare organization's computer system and every patient's personal and clinical information including a patient' personal data, laboratory test results, treatment, allergy reaction details, vaccinations history.

**E-readiness**: means the ability to utilize Information communication Technologies (ICT) to build up one's economy and to promote one's wellbeing. According to the IBM Institute for Business Value, the six pillars of e-readiness are as follows: connectivity and technology infrastructure, business atmosphere, societal and educational environment, lawful environment, government procedures, visualization and end user and business acceptance.

**Implementation:** Could be defined as those processes needed for designing and organizing the process of change to be effective.

**Framework:** Has been described as a management tool that demonstrates the steps and phases of starting a new project.

**Health Information System (HIS):** According to this research (HIS) is a computerized or paper based system that consist people, machines, and processes for gathering, storing, and processing health data, and exchange health information to clients at the precise time and in the correct place.

**National EHR Framework:** laid down rules that seek to incorporate health record systems in the nation by defining general enterprise architecture, with other frequent attributes such as Accessibility, Data protocol, Safety and privacy issues, Legislation, moral Considerations, Staff Development, Implementation organization and stages of Implementation.

**Organizational infrastructure** is the appropriate and casual channels of information communication technology

**Scalability:** The procedure of building the EMR accessibility in many facilities, by developing and positioning the necessary infrastructure, the human resources, and the Software solution to computerize the manual processes.

**CHAPTER TWO**

**THEORETICAL FRAMEWORK**

**2.1     Introduction**

Theories and models are informative to most researchers. A theoretical framework is the "conceptual underpinning of a research study which could be based on theory or on a specific conceptual model" (Pickard, 2007: 298).

Multiple purposes of theoretical framework in scientific research have been cited. For instance, Silverman (2011), notes that theories make a study scientifically meaningful, and informs the organization of study. In support, Odini (2008) for example, points out that good social researches are framed by conceptual and theoretical consideration and goes further to show how such frameworks enrich and enhance the research. The explicit use of concepts and theories is therefore part of good research practice in that the researcher is more in control of the direction, meaning and implications of the research work.

Silverman (2011) further explains that theoretical frameworks allow for generalization of results to settings beyond those of the study. At the same time, theoretical and conceptual framework can instigate new conducts of looking at the social world and propose fresh point of view of approach or position of inquiry, Bulmer (2001) and Guba 1992). Their input provides emphasize to the declaration that theoretical framework offer a significant observation of some characteristics of people and present prospects to re-conceptualize the societal world and in so doing inspire decisive inquiries regarding the experience. It also subscribes to the need to seek theoretical framework that can provide explanation of data and observation. In support to this latter school of thought, Hasalambos (2000) explains that a theory highlights and explains something that one would otherwise not see

or would find puzzling. Because, a theory provides a researcher with a definite viewpoint which goes a long way towards enquiring the relationships between certain variables selected from among and almost infinite array of variables.

Drawing from these definitions and purpose statements of theories, it can reasonably be concluded that no experiential enquiry can continue exclusive of creating assumptions regarding the kind of justification and understanding required. These suppositions, as Odini (2008) observed, should not be and rarely are, made clear, except are embedded in pre-suppositions relating to the topic, character and entity of that investigation. Consequently, for a study to be scientifically meaningful, variables in a theory should be integrated into the research.

Effective access and use of EMRs is dependent on its successful implementation. Consequently, to provide a theoretical framework for the access and use of EMR in referral hospitals, the study identified determinants of innovation and adoption and how this informs the adoption, and assimilation of EMRs in teaching and referral hospitals. In addition the study considered a frame of reference that can be used to guide the implementation of EMRs. The following sections examine conceptual and theoretical constructs that could be used to understand the implementation of EMR and subsequently their access and use.

Theories are applied variably depending on the research approach (Creswell, 2008); in qualitative research, theories could serve three functions. (1) They may serve as a lens for the inquiry providing an overall orienting lens for the study of questions. (2) They could be used as an expansive elucidation for behavior and attitudes, using themes drawn from the literature. (3) They may be inductively being built from the data to broad themes to a generalized model or theory. In the context of this study, the theoretical framework is significant to the extent to which it informs the study. This is with the consideration that

there is at all times a preliminary catalogue of related theories among which the researchers are apprehensive with and without which it is not easy to identify what questions to ask or to make out. The following section examines the theoretical constructs underpinning the study.

## 2.2    Theories Related to EMR Adoption

Several notable theories and models have been used to explain electronic medical records uptake and diffusion. Notably amongst them comprise Roger's diffusion of innovations model of 1995, Task-technology fit (TTF) theory (Goodhue & Thompson, 1995), people-process-technology model as presented by (Curtis, Hefley, & Miller 1995), Collins' risk mitigation model (Collins, 1998), the socio-technical model (Berge, 2001),Technology Acceptance Model cited by (Fishbein, 1967; Fishbein & Ajzen 1975),Theory of Reasoned Action presented by (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980); Unified Theory of Acceptance and Use of Technology (UTAUT) (Vernkatesh et al, 2003) Theory of Planned Behaviour (TPB) (Ajzen, 1985). Collectively, these works have generated various adoption metrics that can be utilized to estimate the probability of acceptance and successful implementation of ICT, IS and electronic medical records use at health institutions.

As an applied discipline, electronic medical records is focused on solving the practical problems in the health care environment, drawing on the theories of other disciplines, rather than developing its own. The theoretical framework guiding this study is therefore based on NSW government, (2003), DIRKS Methodology and Manual, (2006) and Roger's (1995) theory of diffusion of innovations.

## 2.2.1 Design and Implementation of Records Keeping Systems (DIRKS) Methodology

State of New South Wales government (2003) confirms that DIRKS Methodology and Manual is neither step structured process for designing and implementing recordkeeping systems with sufficient utility that are explicit towards and that convene specific organizational requirements. It provides for an intensive analysis of all facets of an organization – its structure, environment, stakeholders, processes and outputs with the ultimate objective of producing record keeping tools. In this study, it is used to determine a hospital recordkeeping system that meets both the needs of the staff and the hospital clients of public teaching and referral hospitals in Kenya.

At the heart of the manual is a best practice methodology for the design and implementation of recordkeeping systems. The information provided in the table below is about the purpose of this manual.

**Table 2.1 Purposes of DIRKS' Methodology**

| Develop better recordkeeping | Build skills and knowledge |
|---|---|
| guarantee the creation and capture of records<br><br>Organizing essential records appropriately<br><br>Organizing records access and safety<br><br>Improving business processes and systems<br><br>Building up new systems with sufficient recordkeeping functionality<br><br>Make easy procurement and application of off-the-shelf records management software<br><br>guarantee records remain core functions | DIRKS Provides opportunity for end users operating throughout to achieve an appreciation of:<br><br>Institutional functions, both in terms of its needs and how it is carried out,<br><br>wide end users discussions,<br><br>Real practice of transformation, records management requirements and how these should be applied in the most excellent way to meet up institutional requirements. |
| **Building up recordkeeping tools** | **Achieve broad support and direction** |
| Generating and applying a keyword thesaurus<br><br>Generating and applying a retention and disposal authority<br><br>Identifying and implementing recordkeeping metadata | DIRKS can be utilized to maintain a variety of additional transaction result in ones institution<br><br>Within its application, DIRKS can be utilized to maintain both wide and littlel plans |

**Source: NSW Government**

**2.2.2.1 Relevance of DIRKS Methodology to the study**

*Step A-Preliminary investigation.* This identifies and documents organization's limitations, tasks, management practice, directive and shared culture. It involves undertaking political, economic, social, regulatory and technological (PEST) analyses through interviews and documentary analysis of annual reports, organizational charts extra. This kind of analysis can be used to build a business case for this investigation.

Preliminary investigation provides an understanding of the contextual factors that may influence the records management practices at the hospital and therefore provide for a sound basis for defining the scope for the EMRs.

*Step B* is the study *of organizational activities* as well as the recognition of major tasks and procedures. Its objective is to develop a hierarchical organizations business process model of its functions, activities and transactions. This ensures that the proposed resolutions are customized to the precise requirements of the business.

The study of organizational activities would offer an appreciation of the connection between the hospitals major functions and the records that are as a result and proof of its actions.

*Step C* is the recognition *of evidential requirements and record-keeping necessities* obtained from an analysis of the business needs, legal and regulatory and community obligation. These requirements specify why it is necessary to create, capture, secure, provide access to and dispose records. It also identifies the management framework the organization requires if it has to achieve and accountably manage its business information. A chief output of this step is a record retention schedule applied that specifies the disposition rules to files and documents.

Categorizing the public teaching and referral hospitals' recordkeeping obligations which entail appreciating of necessities to create and maintain the medical records as proof of actions as well as appreciating level of disclosure to data associated to risks. Given the sensitivity of records generated in the healthcare business process (including patients' records) issues related to evidence of the electronic records had to be considered and addressed.

*Step D*. A*ssessment of the organization's existing systems* measures the extent to which existing recordkeeping and other information systems provide evidence of business activities, or have the required functionality.

The output of this was useful in identifying gaps and strengths in the current recordkeeping system, duplication of information, potential areas of records related business and accountability risks and areas that may require to be replaced.

*Step E-identification of strategies for record keeping*. The objective of Step **E** is towards setting up a good number of suitable policies, application, principles, instruments and additional measures that a business ought to implement to tackle limitations recognized in Step **D** and consequently to confirm that they meet recordkeeping conditions acknowledged in Step **C**.

In developing an EMR framework for the creation, capture, maintenance, use and preservation of records in the referral hospitals, it is supposed to address directly to the referral hospitals' prevailing business activities, corporate culture, socio-political constraints, and supporting technological infrastructure.

*Step F-design of a record-keeping system*. This step involves converting the strategies and tactics selected in Step E into a blueprint for a records management system that

satisfies the recordkeeping requirements expressed in Step C recordkeeping insufficiency or missing elements recognized through Step D.

In developing the proposed EMR framework, an iterative approach addressing the unmet or poorly satisfied records management requirements established was used in suggesting solutions considered more practical and effective.

*Step G-Implementation of a record-keeping system*. At this point the plan that established the procedures, public and technology fundamentals created in Step **F** became a reality. Staff preparation and change management are crucial elements.

This is useful in determining a suitable mix of strategies for implementation and application in provision of healthcare services in the proposed framework for EMR.

*Step H -review and monitoring*. This is the final stage in a DIRKS project and/or the first stage of a new one. The objective is to make sure new record-keeping systems continue to work properly and to meet the requirement of the organization.

Suggestions regarding EMR post-implementation review considerations and approach were integrated in the proposed EMR framework.

The scope of the study was limited to only development of an EMR framework. Overall however, DIRKS methodology was considered pertinent in this study in identifying fundamental factors for consideration in analyzing the referral hospital recordkeeping system and in determining requirements for designing of the EMR implementation and assimilation framework for the provision of healthcare services. In addition, DIRKS methodology offered an efficient, accountable, and flexible approach when developing the proposed EMR framework. This is because DIRKS allows the use of as much or as little of the methodology as fitting to an organization needs; it does not have to be

employed in a linear method despite the fact that the strides are sequentially numbered. Moreover, it offers a sound reference for best practice for EMR implementation and assimilation considering that it is grounded on a sound structure and has been widely applied.  Hasanain and Cooper, (2014) in his Study on *EMR Implementation Framework in Hospitals in Saudi Arabia* reaffirmed that research worldwide have acknowledged both obstacles to and catalyst for employing EMRs in healthcare institutions. Nevertheless, owing to the divergence in society, organizational make up, accessibility to resources, and a number of additional characteristics in healthcare institutions, it is recognized that application of frameworks will probably have to differ from individual background to another. Furthermore, the previous studies indicate that application of EMRs in public hospitals is more problematic and complicated than in private hospitals.

Notwithstanding the highlighted strength of DIRKS methodology, several criticisms have been levied on this approach. Notably amongst them is that DIRKs Framework fails to account for information system process design ramification and disregards the users-driven forces that dictate technology adoption (Olok et al., 2015). This model's approach has also been criticized for its top-down tendency considered by some clients as authoritarian and inflexible. This may be unavoidable given that risk management is the dominant driver for change. In this study, DIRKS methodology was considered not specific in terms of implementation of ICT in an organization particularly health institutions. The DIRKS methodology is exploited for the planning or revamping of systems that generate, gather and preserve records in a specified organization excluding being unsuccessful to tackle the exact problem with the intention of recounting to ICT diffusion. In support of this reason, the research considered in addition ICT diffusion model.

## 2.2.3  ICT Diffusion Models

A systematic review of empirical research studies on determinants of diffusion, dissemination, and implementation of innovations shows that diffusion of innovation theory, which emerged over several decades, has been used extensively to describe adoption and assimilation of health information technology (Greenhalgh, Glenn, Bate, Macfarlane, & Kyriakidou, 2005).

The terms adoption, diffusion, implementation and assimilation have sometimes been used interchangeably in the literature in spite of the fact that they are different. Diffusion is defined as a process by which an innovation is communicated through certain channels over time among members of social systems. The main theory applied in appreciating the diffusion of innovation is Diffusion of Innovations Theory (DOI). The theory examines a diversity of factors that influence the uptake and assimilation of an innovation; these include attributes of the innovation, the implementation process, adopter characteristics, interactions between the implementers, and organizational factors. Table 2.2 provides a succinct summary of these attributes, their characteristics as well as their perceived influence on innovation implementation.

Table 2.2 Succinct summary of these attributes, their characteristics as well as their perceived influence on innovation implementation.

| ATTRIBUTE | POTENTIAL INFLUENCE | DESCRIPTION |
|---|---|---|
| Relative advantage | ++ | Degree to which the innovation is perceived as being better than the previous state |
| Compatibility | + | Degree to which the innovation fits with users' values, needs, and past experiences |
| Complexity | - | Degree to which the innovation fits with users' values, needs, and past experiences |
| Observability | 0 | Ability of others to see the results of the innovation |
| Reinvention | + | Extent to which the innovation can be modified to fit the organization and local context as it is implemented |
| Organizational size | 0 | Number of staff and size of budget in the organization |
| Organizational slack | + | Presence of resources beyond those required for the management of daily tasks |
| Presence of champion | ++ | Opinion leader actively engaged in supporting implementation efforts |
| Supportive leadership | + | Organizational leader positively inclined toward the innovation |

**Source: Greiver, Barnsley, Glazier, Moineddin, & Harvey (2011).**

The impact of these dispersal elements have been shown to vary depending on the diffusion stage (Greiver, Barnsley, Glazier, Moineddin, & Harvey (2011); Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, (2004); Fleuren, Wiefferink, Paulussen (2004). Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou (2004) conceptual model(Figure 2.2) considers the determinants of diffusion, dissemination, and implementation of innovations in health service delivery and organizations drawn from a systematic review of empirical research studies. This model illustrates that an organization may be agreeable to an innovation but may not readily or willingly assimilates a particular innovation. However, considering that the conceptualization and operationalization of these attributes vary from study to study as well as the contextual environments and innovations under study, the posited impact may not be conclusive. Most importantly, the conceptual model underscore the need to examine diffusion holistically, both from the perspective of assimilation and re-utilization and individual and organizational determinants. Other studies (Barret, 1999; Allen, 2000; Avgro, 2000) reaffirm the same.

Thus in spite of their extensive review, Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou (2004) acknowledge the impact of contextual differences and suggest that their model, as presented in Figure 2.2, only highlights the diverse problems in diffusion of innovation. Its objective is only to raise awareness of areas to consider rather than provide definitive answers, they add.

**Figure 2.1: Conceptual Model for Considering the Determinants of Diffusion, Dissemination, and Implementation of Innovations in Health Service Delivery and Organization.**

SYSTEM ANTECEDENTS FOR INNOVATION

THE INNOVATION
Relative advantage
Compatibility
Low complexity
Trialability
Observability
Potential for reinvention
Fuzzy boundaries
Risk
Task issues
Nature of knowledge
 required (tacit/explicit)
Technical support

Structure
Size/maturity
Formalization
Differentiation
Decentralization
Slack resources

Absorptive capacity for new knowledge
Preexisting knowledge/skills base
Ability to find, interpret, recodify,
 and integrate new knowledge
Enablement of knowledge sharing
 via internal and external networks

Receptive context for change
Leadership and vision
Good managerial relations
Risk-taking climate
Clear goals and priorities
High-quality data capture

SYSTEM READINESS
FOR INNOVATION
Tension for change
Innovation-system fit
Power balances
 (supporters v. opponents)
Assessment of implications
Dedicated time/resources
Monitoring and feedback

COMMUNICATION
AND INFLUENCE
DIFFUSION
(informal, unplanned)

Social networks
Homophily
Peer opinion
Marketing
Expert opinion
Champions
Boundary spanners
Change agents

DISSEMINATION
(formal, planned)

Resource system

Knowledge purveyors

The innovation

Diffusion

Dissemination

Change agency

LINKAGE

LINKAGE

User system

System antecedents

System readiness

Adoption/assimilation

Implementation

Consequences

Outer context

ADOPTER
Needs
Motivation
Values and goals
Skills
Learning style
Social networks

ASSIMILATION
Complex, nonlinear
 process
"Soft periphery" elements

IMPLEMENTATION
PROCESS
Decision making devolved
 to frontline teams
Hands-on approach by
 leaders and managers
Human resource issues,
 especially training
Dedicated resources
Internal communication
External collaboration
Reinvention/development
Feedback on progress

OUTER CONTEXT
Sociopolitical climate
Incentives and mandates
Interorganizational
 norm-setting and
 networks
Environmental stability

LINKAGE
Design stage
 Shared meanings and mission
 Effective knowledge transfer
 User involvement in specification
 Capture of user-led innovation

Implementation stage
 Communication and information
 User orientation
 Product augmentation, e.g. technical help
 Project management support

**Source: Greenhalgh, Robert, Macfarlane, Bate, and Kyriakidou (2004:595**

In yet another study on determinants of innovation within health care organizations, Fleuren, Wiefferink, and Paulussen (2004) propose a framework representing the main stages in innovation processes and related categories of determinants. Their framework shows that determinants of diffusion vary from one stage to another of the innovation process (dissemination, adoption, implementation, and continuation). They categorize these determinants into five broad groups: (i) the socio-political context, such as the legal framework and patient characteristics; (ii) organizational characteristics, such as

decision-making process in the organization; (iii) Individual adopters' characteristics such as knowledge, skills, and perceived support from colleagues; and (iv) characteristics of the innovation, such as complexity, relative advantage (pp. 108). Figure 2.2 is a presentation of their conceptualized theoretical framework.

**Figure 2.2 Framework representing the innovation process and related categories of determinants**
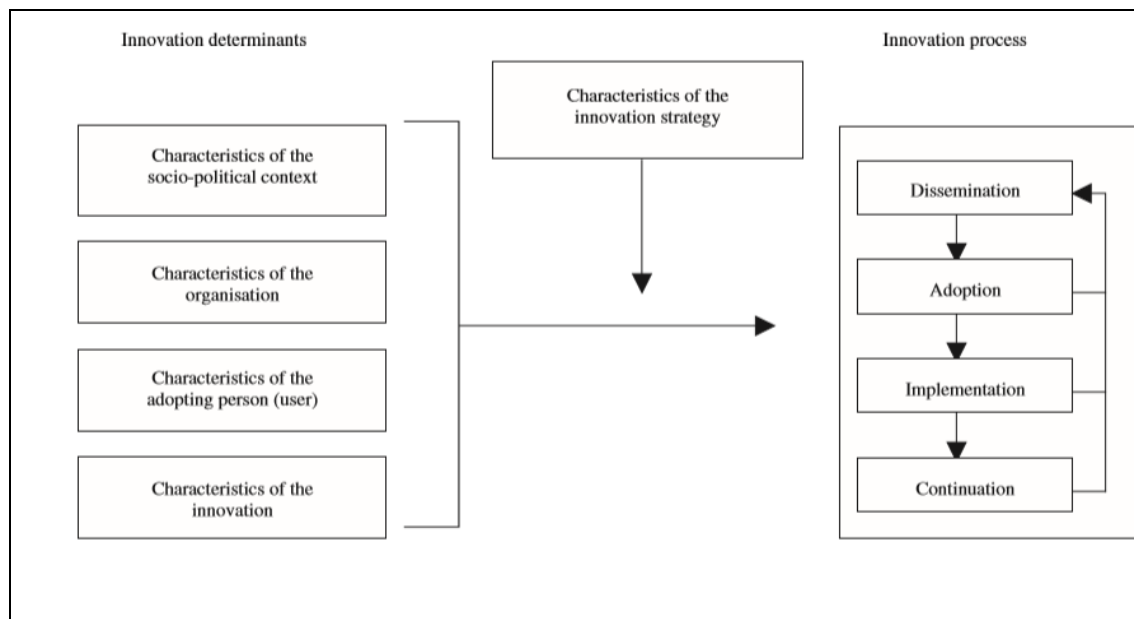


**Source: Fleuren, Wiefferink, and Paulussen (2004:108)**

From Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou (2004) and Fleuren, Wiefferink, and Paulussen (2004) works, it is reasonable to argue that a framework for EMR in the provision of healthcare services should consider both facilitating and impeding factors to its entire diffusion. That is, from the initial stage when an uptake decision is made (adopt), to the point where it is integrated into the business activities (implementation) up to the point where the business activities have been restructured to conform to the innovation (actualization/assimilation). In this study therefore the term 'implementation' has been used to represent all the stages (adoption, implementation and assimilation) The two health institutions decided to use EMRs into their business

activities and therefore most services are utilizing it to enhance their services to their clients.

There are two different meanings of the term innovations found in the literature. The first one refers to something totally new in society, 'an invention'. The second meaning of innovation refers to something within a particular setting, but not new per se (Wamae,2012). Previous studies indicate that EMR has already partially been implemented in health organizations in Kenya. This study therefore was concerned primarily with the second kind of innovation. Similarly, there are three diffusion phases and associated modes of technological usage (Hasanain & Cooper, 2014)

- **Substitution**- involves simple replacement of existing technology with IT. The usual expectation is that new technology performing the old function will improve productivity, though this is not always the case.
- **Enhancement**- This involves redesigning an existing process to make the best use of the new technology, improve product quality and provide additional and related services.
- **Transformation**- involves taking a systems perspective on the role of the process within the organization as a whole. As a result, the process may be merged with another, eliminated or expanded.

### 2.2.4 Limitations of Diffusion Modeling

In-spite of the wide application and acceptance of DOI's capacity to explain the acceptance and use of innovation, this theoretical approach is not without shortcomings.

To begin with, the long established innovation diffusion theory focal point is on the implementation of ICT innovation by self-regulating users, who come to a decision

whether to take up or decline it. The condition is diverse in health care services in which the health institutions adopt ICT innovation and subsequently influence and make possible its utilization to probable consumers. In this case, a client reaction to diffusion of innovation is dependent on hospitals' judgment (Boore, 2012).

As pointed out by Minishi and Kiplang'at (2005) the theory do not satisfactorily offer a foundation for neither predicting outcomes nor providing leadership for speeding up ICT implementation pace. They pointed out that very little study has been carried out on features and procedures that manipulate the use following the implementation verdict have been through.

In addition, as earlier observed, the determinants of diffusion vary from stage to stage of the diffusion process. Unfortunately, Roger's DOI does not seem to adequately address these differences. Neither does the theory take cognizance of the contextual influence on the diffusion process. As several works show, contextual determinants have been used in giving details why ICTs set up fail, predominantly following the preliminary procurement as presented by (Minish & Kiplang'at, 2005, and Peansupap & walker 2005) moreover they take part in a major task in innovation dispersal, acceptance and use. Furthermore, attempts to appreciate the profits if ICTs is mystified by the disparity between implementation and use (Forman & Goldfarb 2005). Several health institutions accept a technology for the sake of it, except when it is regularly and correctly utilized, it will have a negative impact to the institution. One disadvantage of routine implementation exploration is the use of a twofold variable to adherence to usage of ICTs. In most survey based research focus has been on initial adoption; little attention has been paid to know how it is being used and for what purpose (Forman and Goldfarb, 2005). Moreover, how the studies operationalize the various determinant factors varied from study to study.

Finally, the diffusion model has been criticized for its linearity, suggesting that the innovation-decision processes follow one step to the other. Studies that have examined ERM systems implementation shows that this is not always the case (Hasanain & Cooper, 2015) confirms that maximizing the expected achievement of EMR adoption necessitates the collective and coordination of a series of top-down and bottom-up deliberations. Whereas dynamics at the 'management', such as sufficient supply, managerial matters, availability of skilled personnel, suitable dealer choice and a staged execution approach, are necessary elements of EMR deployment; in addition are clients at the operational point. Clients at the operational point have substantial influence to support or obstruct EMR accomplishment. Individuals who look for employing key technological transformation such as establishing EMRs and who disregard the requirements, expertise, and first choice of clientele, do so at their own risk. It is for that reason suggested that individuals looking forward to apply EMRs obtain a multifaceted approach that is up to date by understanding of the health services, automated systems, transformational administration, political science, public policy, health management, and human conduct.

## 2.3    Expanding DOI Constructs

To efficiently endeavor to fill up ICT operational gaps, there is necessity to integrate the application of diffusion of innovation theories with other theoretical bodies of knowledge. Change management becomes the most significant characteristic to administer the accomplishment of EMRs. Their incorporation into DIRKS and DOI expanded consideration of dynamics and methods that support diffusion and utilization of ICTs in contacting patient information.

### 2.3.1  Change Management Theory

Several researches have highlighted the significance of transformational administration while applying innovative system in whichever business (e.g., Carnall, 2007). The literature also points out the value of taking into consideration the notion of change management when implementing a innovative EMR arrangement in health institutions. (Carnall, 2007; Schmucker, 2009). Specifically, Hasanain & Cooper (2015) supports the fact that change management is necessary for EMR deployment and can facilitate in minimizing and prevailing over clients' resistance intensity. Several additional instigators have supported that the perception of change management require being carefully looked at when in search to implement a system such as EMR. Integrating not just the three-phased technique to implementation (pre-implementation, implementation, and post-implementation phases), in addition taking into consideration change management deliberations.

The publications concerning application of EMR systems and application theory as well underscore how personnel acknowledge and prepared to embrace transformation can be the justification to implementation accomplishment (Chmucker, 2009) particularly in view that EMR systems be capable of presenting  main transformation to work policies and competencies (Takian, 2012). People more often than not consider that change is complex, and frequently come with several unanticipated costs (Carnall, 2007). For instance, it is not unusual to view a number of resistance to change, not because of the change itself, other than the procedures and approaches embarked on to administer and achieve this transformation (Hostgaard & Nohr, 2004). Consequently, every EMR implementation framework requires to get into details how great to assume change as well as think about the change management perception (Hasanain & Cooper, 2015).

Several research have looked at matters concerning change and include recognized techniques to administer such changes successfully and correctly (Carnall, 2007; Keshavjee et al., 2006; Schmucker, 2009). Administering specific change, for instance, engage a number of stages, involving planning, controlling, and steady techniques. Two such models – coping cycle model (Carnall, 2007) and ADKAR Change Management Process (Hiatt, 2006) are discussed below.

**2.3.1.1 Coping Cycle Model**

The coping cycle model addresses the challenges that are experienced in implementation of EMRs systems and how those challenges are handled in managing change in an institution.

Carnall's (2013) Coping Cycle Model (Figure 2.1) depicts five major stages of how individuals react when they are faced with immediate changes. In the first step, *Denial,* suggests that when significant changes are first mooted, individual's initial response may be to deny the need for change. During the second step, Defense stage, as the realities of change become clearer, workers might start to take steps in a distrustful way. Carnall (2007) therefore suggested that permitting adequate time for workers to accept and appreciate the requirement for change, and to acknowledge this change, is a solution for reduce suspicious behaviors amongst workers.
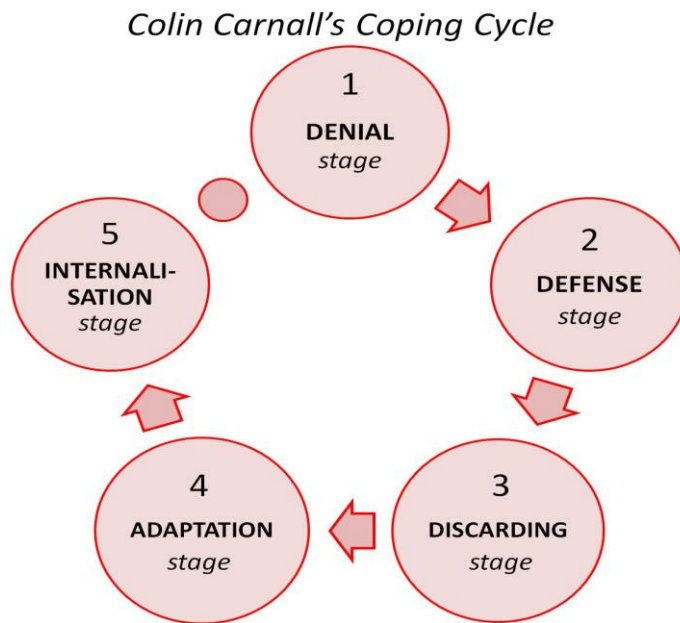
**Figure 2.3Colin Carnell's Coping Cycle Model.  Source: Carnall, 2016**

Long After workers have gone through the rejection and resistance phases, circumstances often turn out to be understandable and workers resolve, be converted into more optimistic. Consequently, workers repeatedly experience a decline in their fright of adjustment and agree to the truth that an adjustment will take place (Carnall, 2007). Carnall submit to this third phase as the *Discarding* step. Carnall uphold that administrators and organizers are able to maximize the discarding phase by agreeing to a moment for workers to reconstruct their operational uniqueness and put up their confidence as they fine tune to the new condition. The discarding phase is followed by an *adaptation* phase. Since transformation or innovative systems have at the moment been accomplished, persons start to assess and get used to the change in a constructive way.

Later the majority of the selected staff have become skilled to utilize the innovative arrangement, or able to work with the ongoing transformation, it is, in reality, ordinarily for a sense of resentment to occur. This sense of resentment does not come from refusing the adjustment, however, to a certain extent, emerge as the effect of mistake that surface

in the innovative arrangement or condition. For this reason, suitable and successful training and support must be obtained to guarantee that the innovative system or adjustment really becomes operational. Later on when employees have been occupied with and assimilate to the adjustment or new arrangement, persons can shift into the last phase - the *internalization* phase. In this phase, workers have a tendency to establish new interactions amongst themselves and the innovative change and start to act normally as they appreciate and become accustomed to the freshly employed change. Nevertheless, it cannot be taken for granted that all persons behaviour will go through these five phases in succession or precisely relating to a projected change. Carnall (2007) admits that not all persons will go all the way through these phases at the equal time or at the equivalent level of concentration.

Carnall's copying Cycle model was considered useful in understanding potential individual differences in reaction to EMR. (Boonstra et al., 2014; Carnall, 2007). In order to deal with behaviours successfully and to optimize the achievement of any projected change (such as EMR performance), a careful knowledge of change management perception is significant (Takian, 2012).

**2.3.1.2 ADKAR Change Management Process**

A major component of change management is people management. Based on analysis of research data from 900 organizations collected over a 10-year period, ADKAR aptly captures the issues involved in individual management as shown in Table2.3.

Successful change based on this ADKAR model is a sequential and cumulative process; one level builds on the next level. Underlying this model is the assumption that

effectiveness of organizational change management approaches are only as effective as methods for measuring success at individual level.

**Table 2.3: explanation of elements for transformation organization process**

| PHASESES | ELEMENT FOR TRANSFORMATION MANAGEMENT |
|---|---|
| **A** Awareness of the need for change | ▪ Management communications<br>▪ Customer input<br>▪ Marketplace channels<br>▪ Ready access to information |
| **D** Desire to participate and support the change | ▪ Fear of job loss<br>▪ Discontent with current state<br>▪ Imminent negative consequence<br>▪ Enhance job security<br>▪ Attachment and sense of belonging<br>▪ professional advancement<br>▪ Attainment of influence or leadership<br>▪ Motivation or reward<br>▪ confidence and reverence of management<br>▪ optimism in oppurtunity state |
| **K** Knowledge on how to transform | ▪ Training and education<br>▪ Information availability<br>▪ Illustrations and role models |
| **A** Ability to employ requisite expertise and behaviors | ▪ Training to apply appropriate skills stimulating new processes and tools<br>▪ Guiding<br>▪ Eliminating of obstacles |

| R | Reinforcement to maintain transformation | ▪ Motivation and rewards<br>▪ Remuneration changes<br>▪ Personal credit |

**Source: ADKAR Model by Hiatt (2006: 45)**

Based on this assumption, ADKAR proposes effective change management of people requires managing five key goals (Hiatt, 20062):

1. Awareness of the requirement to transform (why the change is required represented an individual's perception of the kind of the change, why the change is being made and the danger of not changing. Awareness also consists of information regarding the inside and outside drivers that shaped the requirement for transformation, at the same time what it contain for them.

2. Desire to contribute in and support the change match up the enthusiasm to support and employ in a change. Desire is eventually about individual choice preference, predisposed by the kind of transformation, by a person's own state as well as inherent stimulators that are distinctive to each individual.

3. Knowledge of how to change and what the change appear like stands for information, training and education essential to acquaint with how to transform. Knowledge involves information regarding behaviors, procedures, tools, methods, proficiency, responsibilities and technique that are required to employ change.

4. Reinforcement to maintain change in place or to carry on the change stands for inside and outside aspects that maintain a change. Outside support could consist appreciation and incentives that are tied to the recognition of the change. Inside

support could be an individual's internal fulfillment with his or her accomplishment or other benefits resulting from the change on an individual level.

Mapping of the five identified change management activities against change process and key change players in an organization, Hiatt (2006) found significant correlation; each change management activity plays a different role in the change process just as the primary players in an organization contribute differently as shown in Figure 2.4. On the basis of this significant finding, the study considered ADAKAR useful in understanding not only how individual factors and change management process impede or promote uptake of EMR at both individual and organizational level but also the potential role of the different stakeholders and the challenges experienced in the process.

**Figure 2.4: Mapping change management activities and Key players to ADKAR**

| | | A<br>Awareness of the need for change | D<br>Desire to participate and support the change | K<br>Knowledge on how to change | A<br>Ability to implement required skills and behaviors | R<br>Reinforcement to sustain the change |
|---|---|---|---|---|---|---|
| **Change Management Activities** | Communication | ■ | | | | |
| | Sponsorship | ■ | ■ | | | ■ |
| | Coaching | ■ | ■ | ■ | ■ | ■ |
| | Resistance management | ■ | | | | |
| | Training | | | ■ | ■ | |

| Change Management Players | | | | | | |
|---|---|---|---|---|---|---|
| Primary sponsor | ■ | ■ | | | ■ |
| Leadership coalition | ■ | ■ | | | |
| Managers and supervisors | ■ | ■ | ■ | ■ | ■ |
| HR and Training | | | ■ | ■ | |
| Project team | | | ■ | ■ | |

**Source:  Hiatt (2006: 46-47)**

## 2.4    Organizational Learning and knowledge sharing

Knowledge based approaches to innovation implementation and assimilation are also based on organization's ability to effectively respond to contextual changes. In a study aimed at developing a composite tool to measure the organizational context for evidence-based practice in healthcare, French et.al. (2009) established several attributes that served as antecedents for organizations climate for change. When they categorized the items, they found that they related well to both organizational absorptive capacity and receptive capacity as illustrated in Figure 2.5.

**Figure 2.5: Model of categories organizational capacity attributes**
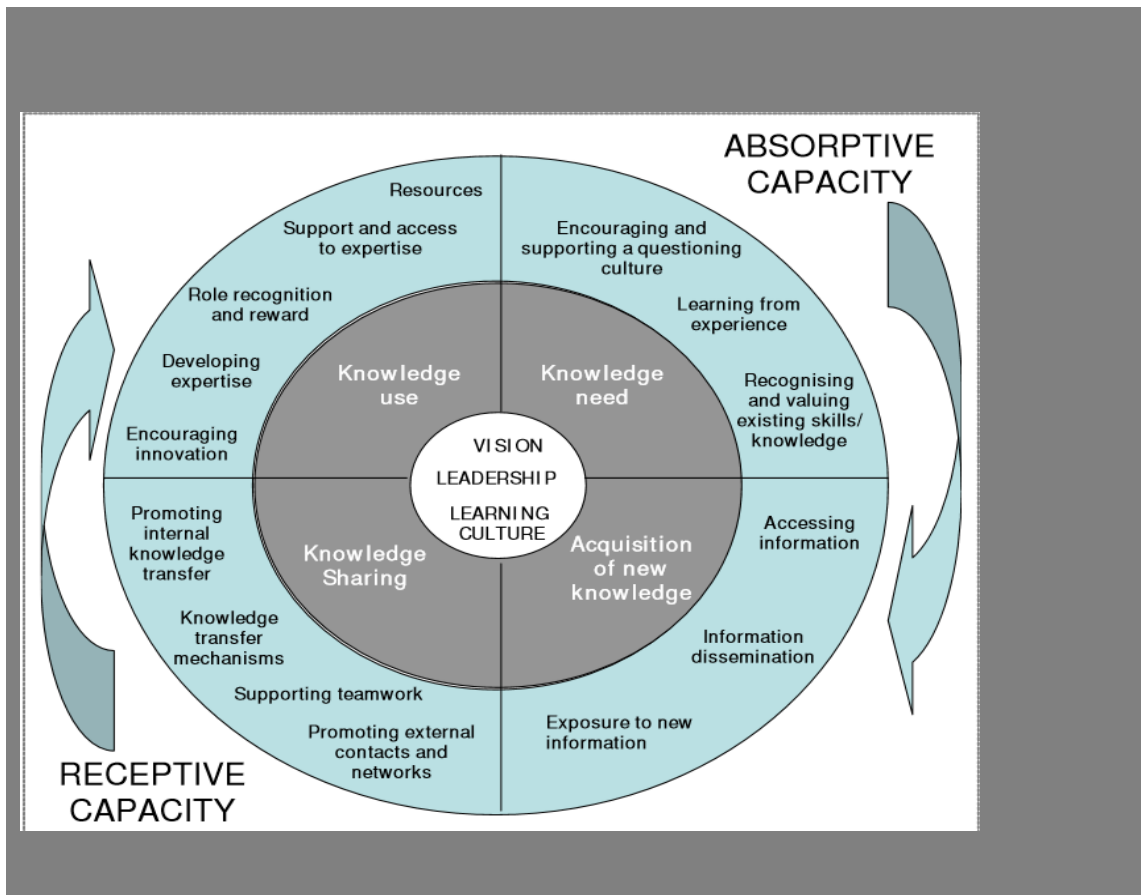


Source: French et.al. (2009)

The inner circle is the organizations' vision, leadership and learning culture. The middle ring shows four activities related to organizational capacity – knowledge edge need and capture and acquisition of new knowledge (absorptive capacity) on one hand and knowledge sharing and knowledge use (receptive capacity) on the other. The outer ring illustrates the organizational attributes contributing to each of the two organizational capacity dimensions.

On the basis of their evidence-based findings, the study premised that dimensions of organizational absorptive and receptive capacity are useful in widening understanding of adequacy of referral hospitals' organization infrastructure in supporting the application

of EMR in provision of health care services healthcare's. The preceding section expounds on these two theoretical dimensions.

### 2.4.1  Absorptive Capacity (ACAP)

Absorptive capacity (ACAP) as defined by Cohen and Levinthal (1990:9) is "the ability of an organization to recognize the value of new external information, assimilate it and apply it."To this end, absorptive capacity is seen as being important in defining the success of an organization in recognizing, capturing and exploiting external knowledge to produce a dynamic organizational capability. Zahra and George (2002) further conceptualize ACAP as a division of prospective and recognized absorptive ability. They explain prospective ability as knowledge attainment and absorption abilities, while recognized abilities as knowledge change and development capabilities.

There has been an argument that for a novel electronic system to be utilized, it requires that those who will be users of the system learn the system (Rotich & Munge, 2007). Individual learning can take place from the experts of the system or those who have used the system before or from the colleagues in the place of work. It may also take place as individual -learning which include availability to written materials or through acquired knowledge. Individual-learning is reliant on individual characteristics and ICT skills. At organizational level, this study equates learning to the four ACAP dimensions identified by Zahra and George (2002). These ACAP capabilities and their corresponding components are shown in Table 2.4.

**Table 2.4: Re-conceptualized Dimensions of ACAP and Corresponding Roles**

| DIMENSIONS/ CAPABILITIES | COMPONENTS | ROLE AND IMPORTANCE |
|---|---|---|
| Acquisition | Prior investments<br><br>Prior knowledge<br><br>Speed<br><br>Direction<br><br>Intensity | Scope of search<br><br>Perceptual schema<br><br>New connections<br><br>Speed of learning<br><br>Quality of learning |
| Assimilation | Understanding | Interpretation<br><br>Comprehension<br><br>Learning |
| Transformation | Internalization<br><br>Conversion | Synergy<br><br>Recodification<br><br>Bisociation |
| Exploitation | Use<br><br>Implementation | Core competencies<br><br>Harvesting resources |

**Source: Zahra and George (2002: 189)**

**Acquisition** refers an organization's vigor and swiftness to recognize and obtain externally produced knowledge demonstrated by the intensity, speed, and direction of their efforts. Thus the greater the effort, the faster the organization will build requisite capabilities. The way of building up knowledge refers to the pathway that an organization

takes in acquiring the outside information. Use of EMR is dependent on the hospital's capability to acquire the knowledge and skills of its functionality and application.

**Assimilation** denotes an organization's routines and processes that allow it to analyze, process, interpret, and understand the information obtained from external sources. In the case of this study, comprehension of EMR is considered essential if the hospital professionals and other stakeholders are to accept and use it. This implies that the hospital professionals, patients and other stakeholders need to understand the potentials and challenges associated with the EMR if they are to accept it and apply it in their routine healthcare operations.

**Transformation** relates to a organization's ability towards restructuring their daily activities to consent for combination of existing knowledge and the newly acquired and assimilated knowledge. In this study context, it can be seen as the ability to integrate acquired knowledge and applications of EMR to the health care operations in optimizing health service provision.

**Exploitation** is based on the routines that facilitates organizations with designs, arrangements, and technical device to process, expand, and control existing skills or to generate fresh ones by including attained and transformed knowledge into its functions in so doing supporting the utilization of knowledge above extensive period of time. With reference to this study, this would mean assimilation of the EMR in the provision of health care services.

In a different study that examined the important issues of absorptive capacity to an organization, Anatoliivna (2013) identifies three concepts in an organization that are related to absorptive capacity - learning, innovation and managerial cognition theories.

Anatoliivna (2013) depicts the recursive relationship between these three theories and absorptive capacity in a conceptual model shown in Figure2.6.

**Figure 2.6 Recursive relationship between learning, innovation and managerial cognition theories and absorptive capacity.**
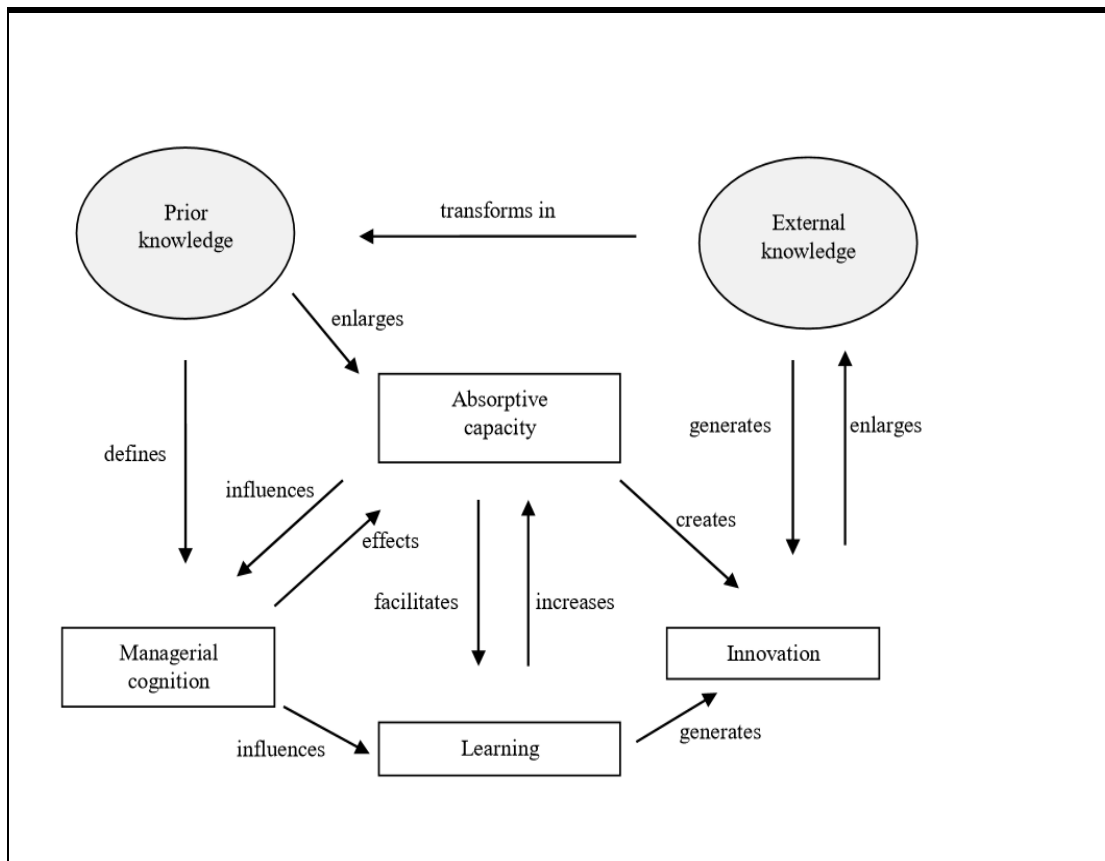


**Source: Anatoliivna, (2013: 192)**

The recursive relationship between learning, innovation and managerial cognition theories and absorptive capacity postulates that (1) increased *learning* increases an organization's knowledge base, which in turn increases its absorptive capacity thereby permitting more learning in that area. Innovation; (2) an organization's process of *innovation* is increasingly driven by its ability to adopt outside technological influences, which is a part of absorptive capacity; and (3) managerial cognition role of managers is to serve as information workers who absorb, process and disseminate information about

issues, opportunities and problems to others. The interplay between these three theoretical assumptions underscores the significance of learning and knowledge sharing in implementation and assimilation of an innovation such as EMR.

## 2.4.2  Receptive Capacity

Receptive context for change integrates features associated with organizational ability to embrace new ideas and its consequences. While absorptive capacity deals with an organization's ability to recognize the value of new and external knowledge and to assimilate it, receptive capability refer to an organization's ability to facilitate the transfer and use of the new knowledge. Leading characteristics associated with receptive organizations include assimilative capacity to new knowledge, strong leadership, strategic vision, risk taking, effective data capture systems (Greenhalgh, Glenn, Bate, Macfarlane, & Kyriakidou, 2005), teamwork (Anderson, 1997; Saranummi et al 2001;Whetton, (2005).

Offering a different perspective to characteristics of a receptive organization, Lucey (2005) cautions that not all promises for change emanate from external of the organization. Successful managers should therefore seek to anticipate market or environmental movement by initiating change within the organization. In other words, organizations must take up a pro-active rather than hasty move. One way of making thorough changes in organizations is through taking up what is called Business process re-engineering (BPR). Business Process Re-engineering moves away from the conventional emphasis on tasks and structures in order to focus on business processes. In effect, Business Process Re-engineering is a systematic method of lateral thinking which forces people to think beyond normal boundaries and structures.

## 2.5 Conceptualized Triangulation of EMR Implementation Theoretical Constructs

A theoretical framework originate from a triangulation of constructs drawn from a number of theories discussed above was used to guide the study. This is in line with Silverman (2011) observation that in qualitative study, researchers hardly ever begin with an entirely blank theoretical framework; there is always a preliminary list of important concepts with which the researcher is apprehensive and devoid of which it is hard to know what questions to ask the respondent. Miles and Huberman (as cited in Njoroge 2010) support this observation when they show that conceptual framework are just essential for qualitative research as they are for quantitative, and arguably more so. The aim of the study in this case was not to authenticate the framework but to direct the research as to what features are significant to look at and come out with possibly very different model depending on the research findings.

Therefore, the essentials emanating from the theoretical framework were principally used to:(1) Serve as a guide in determining what questions needed to be asked in order to obtain comprehensive data;(2) Provide a prior empirical-based insight into health workers perspectives to, and experiences with, EMR(3) Offer initial broad categories and themes for consideration at the data analysis stage. The conceptual framework primarily draws constructs from innovation diffusion and Design and Implementation of Records Keeping Systems complimented by those from change management and organizational learning theories.

Roger's (1995) diffusion model provides for analysis of several determinants of innovation diffusion including individual adopter characteristics, technological characteristics, communication channels, and social systems. DOI however does not adequately provide for all factors that influence innovation implementation in an

organization. Therefore, constructs advanced in change management and organizational learning theories were considered where such gaps were noted. From change management, the study considered two theoretical constructs to understand the potential differences in medical professionals and patients response to change – herein EMR: 1. ADKAR five individual change transition outcomes – awareness, desire, knowledge, ability and reinforcements. 2. Coping Cycle Model five major stages of human response to change–denial, defense, discarding, adaptation, and internalization.

To expand understanding of potential influence of organizational context, herein the referral hospitals, in accelerating or slowing the implementation of EMR in provision of healthcare services, constructs from organization learning theories were considered. In this case the organizational absorptive and receptive capacities were considered useful in exploring the Referral hospitals climate for change. Consequently, the study considered effective data capture, processing and utilization systems –acquisition, assimilation, transformation, and exploitation (ACAP) capabilities of MTRH and KNH in recognizing and assimilating new knowledge associated with the use EMR. And to understand the referral hospital's capacity to embrace new ideas and its consequences, constructs associated with receptive capacity such as strong leadership and strategic vision, risks taking were considered. Both absorptive and receptive capacity were premised as useful in understanding referral hospitals' ability to effectively absorb, assimilate and utilize acquired knowledge and skills  associated with EMR and which are prerequisite for fostering a coherent and dynamic implementation of EMR in provision of healthcare services.

Lastly, in order to achieve the study's aim of proposing  a systematic and sustainable EMR implementation framework for in the referral hospitals, DIRKS model was used in

drawing theoretical constructs that provide for planned EMR implementation, DIRKS model was considered appropriate. DIRKS model on managed strategic improvement of record keeping system provides comprehensive approach to system design that help to develop systems with adequate recordkeeping functionality that are specific to and that meet particular business needs of health institutions. This model has eight stages for managing strategic improvement of record keeping systems: Preliminary examination, Analysis of business activity, Identification of evidential requirements and record keeping requirements, Assessment of organization's accessible systems, Identification of approach for record keeping, Design of a record keeping system, Implementation and Review and Monitoring.

Figure 2.7 is a visualized study's conceptual framework showing the constructs drawn from the various theories. Previous studies have come up with different findings regarding the interrelationship between the various constructs. However, to allow for *a priori* assessment of these constructs influence on EMR and gain respondents 'own perspectives, this study did not impose any form of fixed order of interrelationship between the identified c

**Figure 2.7: Triangulation of the Theoretical Constructs**

COPINGCYCLIC MODEL

DIFFUSION OF INNOVATION DOI

Characteristics of the socio-political

Characteristics of the adopting client

Characteristics of the Business

Characteristics of the novelty

type of human reaction to change -Denial, Defense, Discarding, Adaptation, and Internalization

Assimilative ability to innovative knowledge, firm leadership, strategic vision, risk taking, effective data capture systems

RECEPTIVE CAPACITY

CHANGE MANAGEMENT

Awareness of the need for change

ACQUISITION Previous investments Knowledge, Speed, Direction,

ORGANIZATION LEARNING

EMRIMPLEMENTATION

ADOPTION

ASSIMILATION

Desire to contribute and sustain the change

ABSORPTION Interpretation Comprehension Knowledge

Knowledge on how to change

TRANSFORMATION Internalization, Adaption

ABSORPTIVE CAPACITY

A D K A

Capability to implement requisite proficiency & behaviors

EXPLOITATION Utilization, Implementation

Reinforcement to sustain the change

Preliminary investigation (Step A)

Analysis of business transanction (Step B)

Identification of recordkeeping needs (Step C)

Assessment of accessible systems (Step D)

Identification of approaches for recordkeeping (Step E)

Design of a recordkeeping system (Step F)

Implementation of a recordkeeping system (Step G)

Post-implementation review (Step H).

**DESIGN AND IMPLEMENTATION OF RECORDS KEEPING SYSTEMS (DIRKS) METHODOLOGY**

It is the study's assumption that the integration of constructs from the afore discussed conceptual bodies of knowledge can offer a profound consideration of the environment of both fixed and changing factors that control EMR execution in provision of health care services in public teaching and referral hospitals in Kenya. Table 2.7 is a mapping of the study objectives alongside the constructs drawn from the theories informing the study.

**Table 2.5 Mapping Research Questions to the theoretical construct**

| RESEARCH QUESTIONS | THEORETICAL CONSTRUCTS | | | |
| --- | --- | --- | --- | --- |
| | DIFFUSION OF INNOVATION | CHANGE MANAGEMENT [CM] | LEARNING & SHARING | DIRKS |
| 1) What kind of medical records systems exist in Teaching and Referral Hospitals in Kenya? | | | | STEP B, C |
| 2) To what extent do the accessible administrative, social-economic, regulatory and technological infrastructures support the application of EMR in teaching and referral hospitals? | Roger's DOI | - ADKAR<br><br>- Coping Cyclic Model | AKAP | STEP A, D |
| 3) How are EMRs used in offering healthcare services in referral hospitals? | | | | STEP B, C |

| 4) What challenges are met in the application and use of the EMR in the Teaching and Referral Hospitals? | Roger's DOI | ADKAR<br><br>- Coping Cyclic Model | AKAP | STEP C, D |
|---|---|---|---|---|
| 5) How can the challenges encountered in the use of the electronic medical records be prevailed over? | Roger's DOI I | - ADKAR<br>- Coping Cyclic Model | AKAP | STEP E |
| 6) What model can be proposed to improve the use of EMR in the provision of healthcare services in referral hospitals? | Roger's DOI | - ADKAR<br>- Coping Cyclic Model | AKAP | STEP E - H |

## 2.6 Chapter Summary

This chapter has examined theoretical models underpinning ICT and particularly EMR implementation. Review of this literature shows that just a small number of researches have been carried out before in investigating EMR adoption in Kenya. There are a number of conceptual bodies of knowledge and models that have been used to give details of the distribution, use and development of ICTs in Health Sector in Kenya. The innovation diffusion theory points out issues that affect ICT adoption such as communication channels, social and technological characteristics. On the other hand, during adoption and

use of EMRs in health institution, additional dynamic variables appear. They offer a dynamic change atmosphere that can either strengthen or weaken the innovation dispersion and use process. These involves among others; information requirement characteristics that control ICT utilization that affects demands on information systems, demand on additional information sources, information exchange supply and communication; change administration variables that can be clustered into motivation, training and technical support; and knowledge learning and sharing which includes the development of proficiency among the clients of the system. The preference of the Diffusion of Innovation theory as the prevailing theory directing this research is justified by its appropriateness and the ability to give details in usage objective as compared with other technology acceptance and use model. The use of these theories, their relationships and applicable researches that have used them were also highlighted in this research.

The next chapter addresses the research methodology and a technique used to explore utilization of EMRs in the provision of healthcare services to the public teaching and referral hospitals in Kenya and brings about consideration that will add to the development of a framework that would improve their implementation in accessing patient information by health personnel in Kenya.

**CHAPTER THREE**

**LITERATURE REVIEW**

## 3.1    Introduction

Literature review is an evaluative report of information found in literature related to selected area of study. Literature reviews are spread throughout various academic disciplines, and therefore one can adopt various approaches to effectively organize and write a literature review. Reviewing of literature will also make one to be aware of the current state of knowledge on the topic being examined (Creswell, 2013). Literature reviews, therefore, involves summarization, analysis, evaluation and synthesis of the documents. It gives insight into the existing problem and also points out any existing gaps. This review was guided by the study objectives given in chapter one, which helped in setting up the context of the study.

The reviewed literature in this chapter focused on the use of electronic medical records by health workers in the two public teaching and referral hospitals in Kenya and included relevant journal articles and books in print as well as electronic format which enabled review of different literature related to the study. This chapter presents an overview of literature relating to electronic medical records systems, different definitions and meanings of electronic medical records and the key features of such systems. This chapter also covers global, regional and national information programmes, particularly those pertaining to electronic medical records in public teaching and referral hospital. The chapter also presents the different ICTs and at the end of the chapter is a summary.

There are different literature reviews that can be applied in any given study. A commonly applied categorization identifies the following six types of literature reviews (Gastel, 2012):

**Argumentative Review** observes literature selectively in view to support or refute an argument, deeply imbedded assumption, or philosophical problem already recognized in the literature. The reason is to build up a body of literature that recognizes a contrarian perspective.

**Integrative Review** is regarded type of study that reviews, critiques, and synthesizes representative literature on a subject matter in an integrated way such that new frameworks and perspectives on the topic are developed.

**Historical Review** are focused on examining research throughout a period of time, often starting with the first time an issue, concept, theory, phenomena emerged in the literature, then tracing its evolution within the scholarship of a discipline. The purpose is to place research in a historical context to show familiarity with state-of-the-art developments and to identify the likely directions for future research.

**Methodological Review** evaluates and assesses the comparative methodological strength of a range of studies and illustrates how different methodologies (e.g., research designs, measures, samples) account for different outcomes.

**Systematic Review** form consists of an overview of existing evidence pertinent to a clearly formulated research question. Typically it focuses on a very specific empirical question, often posed in a cause-and-effect form. Electronic medical record is an area to explore to be able to understand the intrinsic in the establishment of the system. Therefore, systematic review is not the case for my area of study.

**Theoretical Review** is different types that concretely study the body of theories that have built up in regard to an issue, concept, theory, phenomena. The theoretical literature review help ascertain what theories previously exist, the relationships among them, to the extent to which the existing theories have been examined, and to develop fresh hypotheses to be examined. Theoretical review reveals that current theories are insufficient for explaining new or emerging research problems.

This study adopted the Integrative Literature Review approach in analyzing and synthesizing the literature. Richard J. (2016) points out that the integrative review is a distinctive form of research that generates new knowledge about the topic reviewed. It reviews, critique and synthesizes representative literature on a topic.

Torraco, R.J. (2016) notes that specifying the topic and purpose of integrated literature review leads the way to organizing and writing the review around a coherent structure for presenting the review and its findings. Because there is no standardized format for literature review as there are for sections of reports of empirical studies, authors of literature reviews do not have the benefits of following a well-established format to organize their articles, American Psychological Association (2010). Nonetheless, the author of the literature review begins by selecting a topic in need of review and a general understanding of what is known and not known about the topic. Well written literature reviews can be seminal touchstones in the development of a topical ( Torraco, R.J. 2016).

Callahan (2010, p 3001) notes that integrative literature review systematically trace much or even all of the literature on a selected topic back to its roots. Most important distinction on an integrative literature review is that it can be considered in and of itself a form of research that can stand alone. This because integrative reviews result in novel take – away such as a new conceptual framework or theory that defines the field reviewed.

In summary the integrative reviews plays a unique and important role in advancing science in that they are able to strike a balance between being evidence driven and yielding new, value added insights. In fulfilling this role they complement other approaches of advancing science.

The scope of the areas covered in this review is defined by the objectives of the study and the theoretical framework of the study. Gastel (2012) explains that any research at any level should review what others have observed or written on that particular topic. He further points out that reviewing of literature will also make one to be aware of the existing status of knowledge on the subject being examined. Thus, literature review provides an opportunity for having new ideas as well as knowing what other researchers have done in one's area. It also helps one to legitimize one's arguments and understand better, the disciplinary tradition within which one is working. This chapter therefore examines the views of many writers on the topic of electronic medical records, use of computers and provision of healthcare services to clients.

## 3.2 General Functions of Recordkeeping Systems

Shepherd and Yeo (2003) explain that organizations use records in the conduct of current business, to enable decisions to be made and actions taken. Records may be required for business purposes whenever there is a need to recall or prove what was done or decided in the past. The use of records is the primary means by which organizations can defend their action if they are called to account for their conduct. Institutions also use their records to react to obstacles made against them, whether in court of law or somewhere else, and to give good reasons for their actions and decisions in response to enquiries or in the public arena.

Recordkeeping systems therefore perform a range of standard recordkeeping functions; DIRKS methodology and manual (2001) identify these as:

- Registration. This entails capturing records by allocating them unique identities and attributing concise descriptive information to them, such as title and date.

- Classification: arranging records into class based on the business functions they document, as a way of assisting record control, retrieval, disposal and access in this case medical records.

- Indexing: setting up access points to assist record retrieval and this is electronic accessibility to patient records.

- Access and security monitoring: allocating and executing rights or restrictions that protect records against unauthorized or wrong use or access.

- Tracking: monitoring record utilization to make sure no inappropriate use happen and auditable record of use is sustained.

- Disposal: utilizing disposal schedules, relating disposal periods to records, prompting any required disposal actions, evaluating any previous use to conform or adjust disposal condition and maintaining an auditable record of disposition.

- Storage: properly preserve records in consideration of their type, use and worth for as long as they are lawfully required.

- Searching, retrieval and rendering: Making records accessible as business information resources selecting and providing records in response to user search requirements and wherever appropriate, allow records to be printed on demand.

- Reporting: Creating whichever reports considered essential by the organization.

- Managing records in any media: Organizing electronic records, scanned images, voice files, video clips, digital plans, databases, information from new applications etc.

- Administering electronic signatures and encrypted records, where suitable. A number of systems could only be needed to organize records in one format, while others will require to be capable of managing various formats.

- Integration with electronic applications: Incorporating with applications utilized for transaction of websites, database applications, workflows etc.

It has been established that upcoming systems that meet these standard offers the health institutions with recordkeeping system that present the formation and controls within which precise, liable and information-rich records are generated and preserved for health service use (Olok, 2015).

## 3.3. Current HIS Subsystems

There are various subsystems in HIS (Ministry of Health, 2014). These subsystems are categorized into three categories namely population based data, management information and health services based data as shown in Fig 3.1. The sub-systems exist with their own databases with no links to the centralized HIS thus creating disjointed information systems in the health sector.

**Fig 3.1HIS Sub-Systems Source: Kenya Health Sector M&E Framework (2014)**
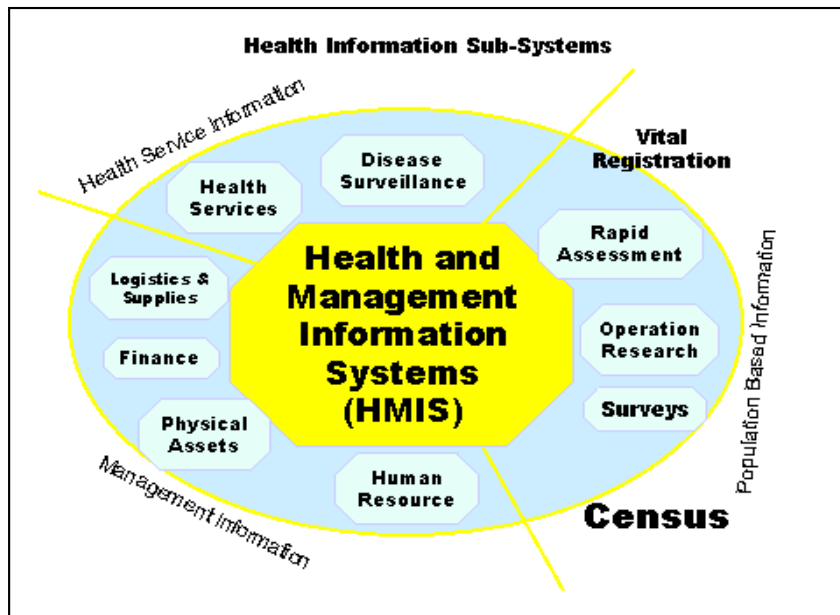


The health management information system consists of several data sources, namely:

- Data collection based on patient and service records and reporting from community health workers and health facilities

- Data generated through household surveys

- Registration of vital events (births, deaths and causes of death)

- Disease surveillance and outbreak notification

- Programme specific monitoring and evaluation

- Administration and resource management (including finance/budget, personnel and supplies)

Population based data include census, vital registration and surveys while management information covers administrative records, and health services and disease records as shown in

**Fig:** **Population- based Health and Disease Records**
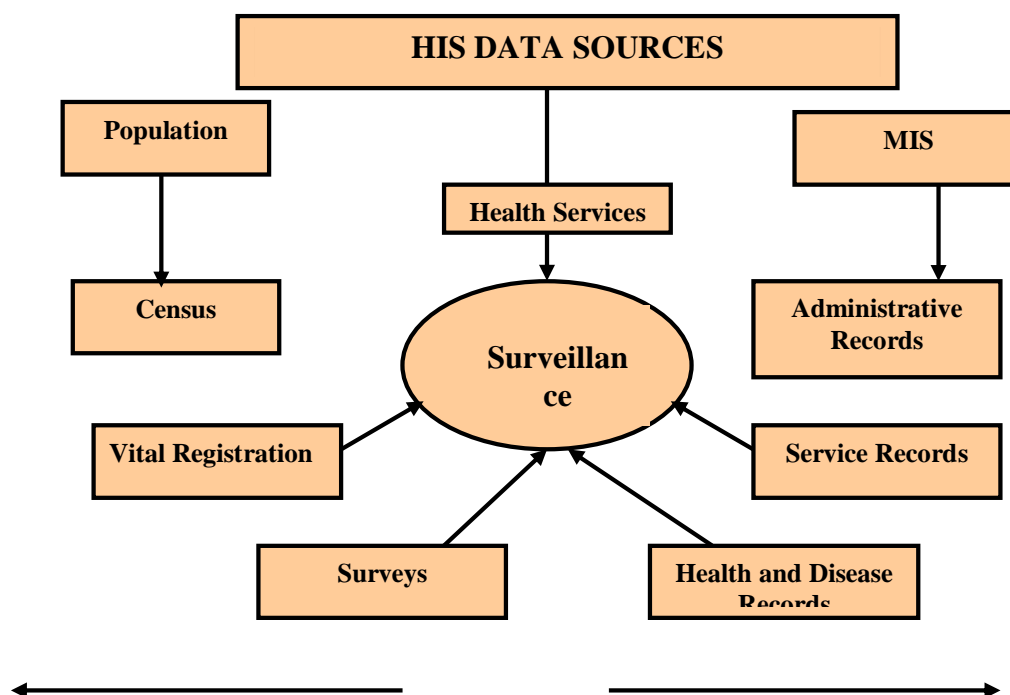


**HIS DATA SOURCES: - HIS documents (various)**

## 3.4    Ongoing and Planned HIS Strengthening Activities

Health Information System (HIS) in Kenya has been reviewed severally with a view of putting in place sound systems that (Wamae, 2015)

- Provides quantitative and qualitative data which is essential for identifying major health problems,

- Generates information which can be used to evaluate health policies for planning health programmes and the efficient provision and management of health services,

- Opens up continuous dialogue and coordination between those who collect data and the users of information with the aim of improving health services,

- Disseminates timely information to users, including those who work in research and health administration,

- Provides regular feedback to all personnel in the information system which helps to emphasize the important role each of them plays,

- Creates and maintain a health information data base at district and community levels, and

- Provides health information required for health planning, monitoring and evaluation of health programmes.

Assessment reports (Ministry of Health, 2014) on Health Information System identify priority actions required to strengthen HIS. These included instituting mandatory reporting from private providers and NGO facilities, building capacity for data collection at all levels, developing integrated harmonized data collection tools and conducting census of health providers. The achievements have been in the areas of harmonization and rationalization of the health sector data requirements and indicators, capacity building of Health Records and Information Officers, supply of equipment (including computers, digital mass printers, internet and communication). The strategies to improve HIS from various producers of health information include:

i) **Ministries of Health:-**

- Developing HIS Software system

- Developing Human Resource Database

- Reviewing the Financial Information System

- Developing the Logistic Management Information System

- Printing data collection and reporting tools

- Developing HIS policy documents and strategic plan

- Development of standards for Electronic Health Records (HER)

## 3.5. Health Information

The aim of the health information management function is to acquire, organize and utilize information to develop the health care and medical services performance, governance and management and support process (Polit & Beck 2012).

Providing health care services to the nation is an intricate undertaking that is extremely reliant on information. Hospitals depend on information regarding the science of care, individual's patients, care offered, outcome of care as well as its presentation to offer, organize and assimilate services. Similar to human resources and fiscal resources, information is a resource that has to be managed well by health care managers and leaders.

The development of health information management systems is dependent on a number of assumptions as spelt out by Najeeb (2001). These include:

- Health care will increasingly be information –driven service.
- Information is a key resource which is critical to the health of individual patients, the population in general and to the achievement of health institution.
- Health information systems should be observed on a continuum manner with patient-specific data (clinical) moving to accumulative data performance utilization etc. to information- based data (planning and decision support) to comparative, community data (strategy development)
- The quality of data and its change into information are crucial to the efficiency and effectiveness of all information systems. Prominence should for that reason be placed on information that has significance in decision-making, assessment, planning and policy development.

- The incorporation and absorption of technology into the daily life of health administrators and health specialists will unavoidably become a growing reality. Consequently the purpose of this research will be on where and how information technology can add to the improvement of health care in other words the management of patient medical records.

From the above discussion, it is obvious that the Health Information Systems has been recognized as a main challenge in the health-care system in many emerging countries as well as Kenya (Odenkunle, 2017). This study is anchored on the statement that recordkeeping system by utilization of new information technology is able of capturing, preserving and offering access to patient records over a period of time.

### 3.5.2   Users of Health Information

Ministry of Health, (2010) indicates that at each level of the health care system, users of health information have differing needs and use information. At the most basic level of *client – health worker interactions*, patient records are a vital source of information at the individual level, for reviews of care and norms, confidential enquiries and facility based audit reviews of provider practices. At the *facility level*, managers need information on patient profiles, patterns of admissions and discharges, length of hospital stay, use of medicines and equipment, deployment of different categories of health care workers and ancillary staff, costs and income. At *district, provincial and national level*, policy makers, planners, managers and other stakeholders use this information and data on locally relevant population profiles and risk factors in decision-making regarding allocation of resources to different facilities. Within the public health sector, such information is transmitted upwards through district and provincial levels to the national level where basic resource allocation decisions are made.

## 3.6    Medical Record

The phrase Medical record is utilized both for physical folder for each specific patient and for the organization of information which include the total of each patient's health history. It may include demographics, medical/surgical/family/social history, physician's notes, recordings and observations from bodily examinations, investigations etc. (Polit &Beck, 2012). Further, a medical record is a systematic documentation of a single patient's long-term personal medical history and care. Bearing in mind that they are extremely individual documents, there are several ethical and legal issues surrounding them such as the degree of third-party access and suitable storage and disposal.

### 3.6.1    Medical data in computers

Patient information can be accessed in different kind of records.  The various kinds of carriers that transport patient information are: Integers, which is a discreet number e.g. the number of cases of people.  This population can be human or a sample of specimen or age in years, etc., real's which is a measured variable such as temperature or a blood pressure, codes which are discernible like pain or a swelling or codes representing diseases or drugs, etc., and text which are usual language statements e.g. text in the case reporting, giving details of things or annotation in the form of events, explanation etc., and graphics and maps in the form of geographic information system diagrams, x-rays images, charts, etc.

Nearly all vital issues relating to the documenting of medical data in a computer and its appearance is the completeness, reliability and accuracy of different kind of data. These issues together make the value of data inspite of its type. Characteristics related to value of data include (Whetton, 2006)

1. Completeness: partial data can result in vagueness. Where reporting is not all the time clear; whether data are absent or are absent because they were just not recorded in the data collection sheet.

2. *Accuracy* is the capability to perform an assignment devoid of making mistakes. Variably it has been considered as the degree of compliance of a measure to a certain standard or accurate value. Whereas the previous meaning is related with correctness (the calculation of the error rate of data), the latter is characterized with compliance or precision.
Errors are first made during data collection either in observation or measurement. Conformity of data on the other hand, pertains to following standards or classification systems for data recording.

3. *Precision deals* with the degree of refinement or granularity by which measurement is expressed such as the number of decimal placed.

4. *Coding* of data involves first interpreting the data and then assign a code. Coding enforces data characterization of terminology, which is extremely important if the data is to be used by people other than data collection which is the case in all health indicators.

5. *Free text or* natural language gives the user the greatness liberty to express details. However, free text is essentially non-standardized, which makes computer processing difficult. Free text can be seen as the personal interpretation of observed facts. If some other user needs these free text data, he or she will read the text, interpret it and mentally reconstruct the medical object described from the interpretation. Therefore, semantically, free text has insufficient structures and is open to multiple interpretations. Such interpretation errors are unlikely to be reduced by computers.

Free text in health indicators may be used to describe the indicators themselves, the way they were calculated and the source information.

Based on the above attributes of quality medical data, several rules are encouraged to enable better recording of medical data in computers. These include:

- Acquiring data as close to the source of the data as possible.

- Recording data by obeying strict rules of standardized and coding;

- Storing original data and if possible, the human interpretations should also be stored but only if the raw data they are based on are also stored;

- Coding of data should be done only if there is no other way to present the data, and it should preferably be done by the person making observation;

- For all data entered there should preferably be an on-line feedback to the user to sign and possible deviations from what should be expected;

- Persons who enter the data should ideally benefit from this data entry either because they will use the data later on or because it will improve the quality of their work; and

- Authentication of data coding including the coders name and signature and time, stamping of data.

## 3.6.2 Computer based medical record

The increasing demand for well-structured and accessible patient data together with developments in computer science has sparked great interest in the development of electronic patient record. Computers are regarded as having the potential to improve

legibility, accessibility. The accrued advantages that they present in access and use of medical records has been documented in several works (Olok, 2015).They include:

- Instantaneous access to its content from multiple locations;

- Improved legibility of content as data is machine readable or type writer thereby reducing occurrences of mistakes caused data misrepresentation.

- Variety of views on data. As data is electronically stored in structured manner, it can be presented in different formats with built-in relations.

- Supports of structured data entry. Aside from data elements can being tagged as elementary or essential, there are inbuilt mechanisms that compels data entry officers to enter data before moving to a new data field. This ensures that the record is complete and usable in the future.

- Decision support. The ability to link data elements and generate new information based on inferences drawn from the complete and accurate medical records is useful in decision making at clinical trials and medical care.

- **S**upport of other data analysis. Medical research, epidemiological surveillance and disease trends analysis can be based on medical records. This type of analysis is not necessarily patient based as the need here is to generate information based on using data contents from a set of records. Such analysis have been useful in showing the relation between geographic location and a certain disease or disease and age group etc.

- Electronic data exchange and sharing care support. Different health institutions can easily share content of a medical record electronically without a need to move files between locations. Moreover, parts of a record can be copied to other locations based on definitions of needs and access rights.

- Maximize Cost-Efficiency. Centrally consolidating information, tracking down and maintaining paper-based records is minimized. EMRs also offer opportunities for almost instant information sharing thereby speeding up patient care and ultimately saving time and money for healthcare professionals (MoH & UoN, 2015)

EHealth technologies are one of the programs that have been widely implemented in health care organization ( Scott & Mars, 2013). Scott & Mars stated that eHealth is simply the application of ICTs to health services. In developing countries eHealth initiatives have been largely short term and unsustainable due to a number of barriers to such intiatives ( Murray et al 2011, Lau & Murray, 2015). Examples of these barriers include lack of knowledge, lack of support and lack of standardization. Despite several unsuccessful eHealth initiatives in developing countries, such initiatives have been successful in many developed countries ( Scott & Mars, 2013).

### 3.7 Development of EMRs

Electronic Medical Records first began to appear during the 1960s and from that time, have become increasingly available in many health organizations globally (Maclean 2006 in Hasanain, 2015).

In 1975 the computer stored Ambulatory record medical information system was developed and has been used by many health institutions internationally. Since the emergence of electronic medical records systems developers have been creating new computer stored ambulatory record medical information system on continuous basis. Many types of electronic medical records systems experienced some programmatic and technical problems such as nonstandard terminologies (Hasanain2015). Currently, the

most well-known and common models of health information systems are Health Leve7 and open- Electronic Health Records, Hasanain 2015.

### 3.7.1 Purpose of Electronic Medical Records (EMRs)

Mugo & Nzuki (2014) points out that EMR system are major case of a policy or project implemented in a healthcare service that can change long established patterns of work. EMR systems are generally implemented to take over paper-based health records that have been utilized in hospitals for several years. For a long time, these paper-based heath record systems have claimed large storage space and caused delays in provision of service to clients. EMR systems on the other hand, store patient information in an electronic system that can be utilized in real time and therefore can enhance and make easy the healthcare service delivery process (Boore, 2012). The name 'Electronic Medical Records system (EMRs)' takes diverse forms and can refer to similar types of Health Information Systems (HIS) (Boonstra & Broekhuis, 2010). One more commonly known form of HIS is the Electronic Health Record (EHR) (Boonstra, Versluis & Vos, 2014). EMR systems like EHRs can be utilized in a single organization; on the other hand, if the HIS is utilized on a regional or nationwide level and in an interoperable manner, then it is generally identified as an EHR system (Boonstra et al. 2014). In the circumstances of the present  research, the name EMR is used to refer to a HIS that consist of patient health history, investigation results, radiology films, prescription and allergy records, payment fee and financing details, patient admission information, and additional data required for the healthcare service delivery process within a single hospital.

Whetton (2006) points out that content of Medical Records permits health care providers to offer continuity of care to each patient. Planning patient care, communication that takes place between the health care practitioners inclusive of all health personnel that is part of

the patients wellbeing, taking into consideration the patients legal interests and also those of the health personnel responsible for a patient's health and putting into record the services and the procedures the patient undergoes are some of the bases that Medical Records serve. Moreover, the medical record may serve as a document to educate medical students/resident physicians, to provide data for internal hospital auditing and quality assurance, and to provide data for medical research. Personal Health Records combine many of the above features with portability, thus allowing a patient to share records with healthcare providers and health care systems (Hasanain & Cooper, 2015).

Hasanain & Cooper (2015) provides examples of benefits EMR can offer include the ability to access patient information at the point of care in a timely manner, increased flexibility and reliability of workflow, and improved productivity. Additionally, these systems help to ensure that patients' information remains confidential and secure and can only be accessed by authorized personnel (Thiong'o 2017). Finally, EMRs have been shown to decrease the number of practice errors, and to decrease the duplication of data due to the use of standardized medical terminologies within these systems. Thus, patient information can be safeguarded against manipulation or loss (Wamae, 2015).

### 3.7.2 EMR Infrastructure

Kenya has made tremendous steps in Information Communication Technology (ICT) as demonstrated by the growing number of telephone lines, Internet Service Providers (ISPs), the number of Internet users, broadcasting stations, mobile phones and the growing competition by mobile service providers, and development of National EMR standards. Wamae, Peter (2015)

EHealth infrastructure pertinently affects adoption of eHealth services. Qureshi et al (2013) in their study focusing on establishing the infrastructural barriers to eHealth implementation in developing countries, indicate that internet connectivity is vital for successful adoption of eHealth. In another study conducted in Kenya (Gatero, 2010), it was revealed that doctors are willing to conduct e-searches in order to access and share health information with their colleagues in others parts of the world. However, insufficient ICT resources limit them in performing the searches. According to a study conducted by Mugo and Nzuki (2014), pointed out that telecommunication infrastructure plays a key role in public health. Transmission of health information between health institutions, health institutions and patients, health institution and third parties such as insurance companies, patients and health institutions is negatively affected if telecommunication and internet penetration is low.

In order for electronic medical record to accomplish its clinical legal and administrative requirements, an information infrastructure must be in place to support the various data capture, storage, processing communication, security and presentation functions. The low rate of internet penetration and low bandwidth are among the challenges to eHealth adoption in Kenya.

## 3.8    Format of a Medical Record

Traditionally, Medical Records have been written on paper and in folders. These are typically divided into useful sections, with new information added to each section chronologically as the patient experiences new medical issues. Active records are usually housed at the Clinical site, but older records are often kept in separate facilities. The advent of electronic medical records has not only changed the format of medical records but has increased accessibility of files. The use of individual dossier style medical

records, where records are kept on each patient by name, illness and patient number originated from the desire to simplify patient tracking and allow for medical research (Fraser Hamish et al., 2005).

### 3.8.1  Administration of Medical Records

Medical Records are lawful documents and are subject to the laws of the country in which they are created. At the same time, there is great inconsistency in policies that oversee creation, ownership, availability, and disposal of Medical Records (Mugo & Nzuki, 2014)

**Accessibility**

In Kenya, just like in the United States, the basic rules governing access to a medical record dictate that only the patient and healthcare institutions have the permission to scrutinize the record. The patient, however, may approve for any person or entity to examine the record.

**Destruction**

In general, individuals in control of Medical Records are required to preserve those records for a certain period. In Kenya, comparable to Britain, Medical Records are needed as long as the patient still lives and lawful for as long as a complaint action can be brought forward.

Medical records are also utilized retrospectively after a patient's death to examine or probe illness amongst its people e.g. industrial or environmental diseases or even unethical handling of a patient by the doctors. This is of importance on policies concerning records disposition period. Usually, in Kenya, any documented information

should be preserved according to legal requirement for not less 10 years (MTRH Records and Information Management Policy, 2004).

## 3.9    Digital Health Records

There are multiple forms of health information systems. In spite of their distinctive characteristics and functionality, they are frequently erroneously interchangeably used in the literature. These systems are Electronic Health Records (EHR), Electronic Medical Records (EMR), and Electronic patient record (EPR). The defining distinction amongst these systems rests in their level of integration, automation and connectivity. Collectively, these factors dictate the choice made by different institutions on the type of technology they require in terms of service provision to their clients. In what follows is description of the three distinguishing features of EMRs.

Degree of integration of content can range from an automated record that acts as a replacement for an existing paper based record to an electronic health record, which includes total health information for an individual (including multi-media files) that could be made available in the support of clinical activities. Degree of integration of access on the other hand range from an automated file only available on an individual computer, through the records integrated across a facility, such as  common practice or a hospital to a fully-fledged national electronic record. The level of incorporation is dependent on the expected use of the record, and the point of automation and connectivity that technology is able to offer. Level of connectivity Table 3.1 is a summary peculiarity of these health systems based on the three proportions as offered by Whetton (2005).

**Table 3.1: Digital Health Records Distinction**

| Levels | Characteristics |
|---|---|
| Automated medical record | Data entered into a standalone computer from paper documents. The original documents and images are still stored and communicated using paper. This type of record does not alter the paper based system used by the organization. |
| Computerized patient record | Paper documents are scanned into a computer. They can be accessed by more than one person at a time in different locations within a facility. This level of record offers quicker and more efficient retrieval changing the basic structure of the paper system. |
| Electronic medical record (EMR) | Data entered directly into computer and X-ray, Pathology and pharmacy data can be integrated into the record. There may be paper back-up. There is increased access within the facility and between facilities. More advanced records may incorporate functions such as clinical decision support, result reporting and appointment scheduling. |
| Electronic patient record (EPR) | The level of integration enables a clinical data to be entered and stored electronically. The level of automation enables this record to operate across local/state/national/international |

| | boundaries. This level of record requires technologies for information data interchange. |
|---|---|
| Electronic health record (EHR) | This level of record represents a comprehensive longitudinal collection of an individual's health information, including both medical and non-traditional health and lifestyle related information with the consumer as the focus, around which the information is recorded. The level of integration enables data to be entered, accepted and viewed by healthcare providers. Data and information might be distributed over a number of sites or aggregated at a particular source. |

**Source: Whetton (2005).**

On the basis of these parameters - integration, automation and connectivity, Whetton (2005) points out that EMRs are automated patient records generated within a sole healthcare institution. Electronic Medical Record Systems brings together the storage and retrieval of single records with the help of computers. They are generally available on a computer network. This may include electronic medical records from several locations and/or sources. Along with the many types of data integrated in electronic medical records are patient personal details, previous treatment, drugs and allergies, and laboratory examination results, radiology images, payment records and professional advice by medics. It is pointed out that the huge volume and different sites of this data create the electronic health record the only practical way for availability (Olok et al, 2015).

By contrast, the EHR is founded on an accumulation of patient records held in EMRs. An EHR collects individual patient details on health conditions, information from main healthcare encounters, and episodes of care from other health institutions. The purpose of EHRs is to bring together a patient's previous encounters into an electronic medical record accessed at national level. Therefore, despite of where the patient gets diagnosed or treated, the medical professional has instantaneous access to a complete, efficient health record.

The techniques of keeping information have become more established and valuable to institutions as electronic technology progresses. Hospitals are no exemption as they have electronic systems to keep patient records and other vital information.

### 3.10 EMR Global Adoption Trends:  Current and Historical Insights

Health institutions around the world are ongoing in adopting Electronic Medical Records (EMRs) technology at a fast pace. Olok et al (2015) illustrates that although the challenges in assimilating information systems in countries in Africa and other emerging nations, a number of hospitals have effectively incorporated into clinical workflows. Electronic health is a necessary information sharing tool in healthcare management and delivery across the globe. In attempts to reduce  the costs, advance the quality and expand the right to use health services many emerging countries' governments lay much hope in electronic medical records (Nyella & Mndeme, 2010) and Information Communication and Technology based Health Information Systems (HIS) (Mosse & Sahay, 2005).

The accomplishment of Clinical Information Systems has been identified as a significant element of improving health care, and the degree of implementation of technologies in health care has been revealed to associate with decrease of challenges and mortalities in

hospitals. Though African nations are still far behind developed countries in the accessibility and utilization of EMRs, this review points that there has been a significant increase in the ease of use and operation of EMRs in Africa over the last ten years. This addition has been motivated by partnership between African institutions and international collaborators more often than not in the area of HIV/AIDS cure and care (Wamae, 2015).

Research on electronic Health in developing countries has revealed that electronic Health can be one key to offer improved way to healthcare services for patients and healthcare personnel, develop partnership between different governmental bodies, and add care quality (Cechini & Scott,2003; Khalifeh soltani & Gerami,2010; Mostafa et al.2010). Based to a survey carried out by the World Health Organization (WHO), electronic Health apparatus, amongst them Electronic Medical Record (EMR) systems, are seen as enormously valuable for 70% of the non-OECD countries (World Health Organization, 2006).

Present are a lot of examples of thriving e-Health developments together with health information networks, EMRs, telemedicine services, wearable and movable monitoring systems, and health portals" (European Union, 2005).

## 3.10 Functions of Electronic Medical Records System

Myriad of case studies evidence that EMRs improves quality in primary care is equivocal Mugo & Nzuki 2014), Makori, Musoke & Gilbert (2013), Hasanain & Cooper, (2015).The initiation of electronic medical records has not only altered the format of medical records but has expanded accessibility of patient records. Electronic medical records continue to transform the way that medical records are housed, accessed, used and managed. The extant literature shows that EMRs offer the capacity and promise to

increase the quality of care, to improve efficiency and effectiveness in the healthcare delivery process, and to reduce care related costs and as it has been envisioned, it appears EMRs has and is still growing steadily (Schoen *et al.,* 2012; Kevin, 2003).

In their remark, Schoen *et al.*(2012) state that health care systems across the globe are undergoing transformations to improve access and quality of care and the patient experience. Collaborating this, Keven and Dick *et al.* (1997, 2003) describe EMR as essential technology tool for health care, which modernize the management of medical information and contributing to high quality patient care and efficient patient management.

The benefits accrued from EMR are varied. At an organizational level, it is regarded as essential resource in offering effective health allied information services and cost-effective decision support system in enhancing the value of health services and patient care, and in combating illness at the same time advancing wellness. These include Patient billing, electronic ordering and receiving results, electronic prescribing of drugs, recording of clinical information and decision support software (Knaup, 2006; Jones *et al.*, 2012). From patient's perspective, the benefits of EMR include improved diagnosis and treatment, faster care and decision making responses from assigned professionals (Bates et al., 2003). Table 3.2 describes the potential capabilities of an ERM as summarized by Price, Lau, and Lai (2011).

**Table 3.2: EMR Capabilities**

| Functional Category | Description |
|---|---|
| Health information | Describes the patient information that is input into the EMR. Medical summary data are include (such as problem list, past medical and surgical history, and allergies) as well as Clinical documentation such as progress notes, vital signs |
| Laboratory management | Includes all phases in the laboratory workflow from ordering tests to reviewing results from external laboratories |
| Diagnostic imaging | Evaluates use of EMR throughout the diagnostic imaging workflow, form ordering to receiving results |
| Prescription management | Captures activities from prescribing to renewal processing |
| Referrals | Includes both office-generated referrals activities and incoming referrals (for specialists) |
| Decision support | Focuses on point of care reminders as well as chronic disease management tools related to individual patients between providers (including staff) |
| Electronic communication | Examines how the EMR is used to support communication activities |

| Patient support | Examines how the clinicians uses the EMR to engage the patient in his or her health |
|---|---|
| Administrative process | Focuses on scheduling, billing and management of papers (e.g. scanning). This includes outside access to scheduling (e.g. patient direct booking) |
| Practice reporting | Examines how clinicians use the data in their EMRs at the point of reflection including using pre-built reports in the EMR, using custom report and linking or sharing to external repositories |

**Source Price, Lau, & Lai (2011)**

Price, Lau, & Lai (2011) categorization of EMR functions provide two significant insights. (1) EMR systems span across multiple patient-care processes and departments supporting different stakeholder groups in their tasks. (2) Accordingly, these user groups have varying objectives and expectations from the EMR system.

**3.11.1 Apprehensions over the Use of EMRs**

Despite the high expectations and interest in EMRs worldwide, numerous empirical studies report myriad of challenges associated with their adoption and use; Davidson and Heslinga (2007) actually associate their relatively low overall adoption rate to mirage of problems. A study by Gatero (2010) revealed that the problems in health care services are due to lack of access to adequate and reliable information; there is little evidence that health care professionals in the country have better access to adequate and reliable

information. This is due to unsystematic harnessing of ICTs in bringing improvement and quality health care services

The preceding section examines some of these commonly cited impediments.

### 3.11.1.1 Cost issues.

While the need for EMR systems is felt in most third world countries, Ginneken (2002) observes that institutions lack financial and human resources vital for strategic policy making to either acquire, train, or accommodate informatics professionals to handle the design and implementation of system such as EMR. Due to inadequate funds and high costs of maintenance of EMRs systems, developing countries are not able to draw up maintenance plans to sustain the few computers and other equipment donated by philanthropists, argues Jayasuriya (1995). Adding their voice to cost implication, RWIF et al. (2006) argue about the sharp cost of and doubt about the value accumulating from implementing EMRs in the form of return on investment has a negative influence on its acceptance.

During a programme started by the Office of the National Coordinator for Health Information in USA, surveyors established that health workers who had accepted EMR grumbled that any addition in efficiency were balanced by diminished production as the technology implementation required Information Technology staff to sustain the system; in their opinion, cost savings may occur only in large integrated institutions and not in small physician offices adoption. In another study conducted by Harvard School of Public Health, inadequate capital for purchase was the number one reason most commonly cited as barrier to implementation of EMRs followed by concerns about maintenance costs (Teodecki, 2010).Parish and Colin (2004) further made it clear that majority software

systems involve regular renewal, over and over again at a momentous continuing cost. Various categories of software and operating system needed complete re-implementation regularly, which upset not only the financial plan but also workflow. Expenses for advancing and related failure testing can be predominantly high. Preparation of staff to utilize EMR system is also expensive, just as for preparation in the utilization of any other hospital system. New staff, permanent or temporary will also need training at the time of engagement.

### 3.11.1.2 Technological issues.

There are many types of computer system infrastructure and these include: Central processing unit or operating system, Input and output devices, Network be they be Local Area Network (LAN), a Wide Area Network (WAN), or a Wireless Local Area Network (WLAN), Internet technologies including intranet and extranets.

Shortliffe and Perreault (2001) cite lack of hardware and software standardization as one of the core challenges to EMR implementation. Owing to the complexity and different needs of each of the departments within the healthcare industry, maintaining technological standards is always difficult. As a result, each department usually implements its own technology pertaining to the needs of that department, which makes it impossible for systems within the hospital system to communicate. The lack of such standardization further makes it harder to automatically generate the alerts which are necessary for decision making (Tomasi et al., 2004).

Another technological impediment is Interoperability. Sharing patient EMRs require interoperable information systems within hospitals and across the healthcare system as a whole (Dell, 2010). Manalastas (2010) emphasize that without an interoperable EMR

infrastructure that allows for the integration, exchange and sharing of patient information among healthcare providers, delivery of service will continue to be fragmented, be prone to duplication and errors and remain uncoordinated. For example, poor functionality of data entry and data integration has been attributed to interoperability (Smelcer, et al. (2009).

Availability of reliable access to electricity is also essential in healthcare delivery development (Allen et al, 2007). Unfortunately, sustainable energy is a challenge for most countries in sub-Saharan Africa and other countries in the developing world (Rotich et al., 2003).Majority of these countries depend on hydroelectric dams as their main source of electricity. Two decades ago, Davidson et al., (2007) observed that this dependency on hydroelectric dams usually becomes a problem during dry seasons when the water level drops, therefore, leading to power rationing.

### 3.11.1.3 Performance Expectancy.

Performance expectancy is the degree to which an individual believes that using a system will help him or her attain so much in job performance. In the context of this study, it is taken to refer to situations when the healthcare workers believe that EMR system will enhance healthcare service provision to the clients. Performance expectancy has been shown to be a significant positive influence on behavioral intention towards technology adoption and use by many previous studies (Venkatesh and Davis, 2000; Venkatesh et al 2003; Gupta, Al-Awadhi and Morris, 2008; Dasgupta and Gupta, 2008; Jairak, Praneetpolgrang &Mekhabunchij, 2009; Cruz, Boughzala &Assar, (2004).Indicators of a performance expectancy system includes perceived usefulness, relative advantage, job fit, outcome expectancy or extrinsic motivation (Alabi, 2015).

Several studies have authenticated the influence of perceived usefulness to EMR adoption. In a study by Hasanain & Cooper, (2015), Mugo & Nzuki (2014), and Makori, Musoke & Gilbert (2013) established the importance of EMR as an important information sharing device in healthcare administration and delivery globally.

### 3.11.1.4 Privacy, Confidentiality and Legal issues.

The expanded flow of electronic information brings up important consideration about the personal and confidentiality of health information. Patient records, once kept on individual paper records in locked file cabinets or in EMR entity-controlled electronic format, would as an alternative be preserved on several computer servers of remotely-networked institutions. This move to electronic communication of patient data produce an atmosphere of healthcare data sharing that might be exposed to security breaches as well as people mistakes resulting in litigations (Anderson, 2007; Boonstra & Broekhuis 2010; DuToit, 2011). For instance, a study on barriers to the acceptance of electronic medical records by physicians, established fears of security bridge from unauthorized persons' access to data stored in the EMR systems (Boonstra & Broekhuis, 2010).

### 3.11.1.5 Competency issues

Omary *et al* (2010) and Mugo & Nzuki (2014) qualify low implementation of eHealth amongst developing countries to not having computer skills among the medical staff in nations that have incorporated development of ICT skills for medical staff, adoption of eHealth and real utilization is fairly high. Educating staff on essential skills increase knowledge and degree of self-confidence as clients are able to defeat technophobia at the same time linking usage to expected payback. Hasanain & Cooper (2015) further their argument that maximum utilization of Information Technology in line with the change in

health care needs Information Technology skills in the medical population. The connection between ICT skills and adoption of eHealth is discussed as well by Omary *et al* (2010) who indicates that insufficient ICT training in the health sector in Kenya clarify the little adoption of eHealth. Boore (2012) was of the view that individual health care experts who do not have the ICT training of manipulating the online health data end up taking a lot of time on the same. According to Hasanain (2015) further points out that the slow internet use amongst medical doctors in Pakistan was because of lack of appropriate technology and need of computer training. Devoid of sufficient ICT training, staff participation in choosing and establishment of ICT facilities becomes a problem and if it occur, it is simply to rubberstamp the professional's choice. This may lead to having eHealth technologies that are not extensively received or utilized adequately.

## 3.12 Electronic Medical Records adoption and challenges

An Electronic Medical Record (EMR), a computer system composed of the clinical data repository, clinical decision support, controlled medical vocabulary, order entry, and pharmacy module has become a growing subject of debate in the world today (Wamae, 2015). The Electronic Medical Record integrates patient information systems so that patient demographic, financial and medical information can be collected, accessed, transmitted and stored in a readily available digital format. Most importantly EMR technology allows physicians fast access to appropriate patient information allowing prompt diagnosis and treatment. It can thus be reasonably argued that to be able to retrieve patient's health record timely and efficiently, EMR systems should be adopted. This would to a great extent improve on the efficiency and effectiveness of services provided in the hospitals (Boore, 2012). Despite the fact that EMRs hold great prospects for the future, not many studies have been carried out on their adoption and performance.

EMR technology represents a movement from paper-based care activities toward outcome-focused, evidenced based processes. This shift can be an agent for change and improvement by eliminating confusing or illegible hand-written order documentation, minimizing transcription errors and fundamentally reducing clinical mistakes.

Globally, it is on record that there is resistance by both health providers and patients over computerized systems robbing them off of a personal connection between medical providers with physicians raising concerns over loss of control of the health care process The healthcare professionals have also been found to hold poor attitude towards e-health as an essential information sharing tool (Olok, Yagos & Ovuga 2015).

### 3.12.1 Crucial achievements in EMR Implementation

Achievements of an EMR system performance has been associated to the level it is utilized (Devaraj & Kohli, 2003). At the global point, the means to a thriving future for eHealth is collaboration at both national and international levels to develop well-managed eHealth solutions and to develop worldwide standards and policies. Furthermore, experience gotten from those countries who adopted electronic health before such as Denmark should be assimilated within developing countries. With this approach, the possibility of evading errors and challenges that were met or committed by early adopters are reduced thereby expanding the velocity of adoption by emerging countries ( Hasanain & Cooper, 2015).

Research in electronic health appears to be fragmented and so far few longitudinal studies have been conducted to indicate progression towards eHealth in developing countries. Fragmentation in eHealth research needs to be overcome through broad ranging studies, which offer standardized concepts that enable data to be collected across multiple points

in time. Studies involving several countries are also limited. Such studies could indicate areas of cultivating synergy by countries for instance in having interoperable systems.

Therefore, as part of future work, more studies need to be done, firstly to confirm the effect of the mentioned determinants in this paper in each developing country, secondly to find out other determinants of eHealth adoption and thirdly to show how developing countries' cooperation on eHealth strategies can affect the journey towards eHealth adoption by these countries. The analysis of the literature distilled and acknowledged various factors that come out to support and hold back EMR implementation efforts.

The evaluation of the past studies reveal a gap in this area in this lack EMR of implementation framework especially custom made to the requirements of a specific country has yet been developed. Fascinatingly, although many studies are in agreement that EMR implementation should be directed by an implementation framework, not any presently exists for Kenya. Nevertheless, whichever effort to build up such an implementation framework can help from considering implementation theories and implementation frameworks.

## 3.13 Implementation frameworks and theory

Hasanain & Cooper (2015) explains that theories of implementation from the available literature, which have been useful to several policy areas (e.g., health, education, housing, transport), can also be used to multifaceted policy approach, such as the implementation of EMRs.

Drawing on lessons learnt from the EMR implementation experiences of a number of countries reviewed in the above discussion in this chapter 3, the researcher would like to highlights the potential importance of theory for guiding implementation practice. Where

possible, findings from the literature are tied back to the circumstances of EMR implementation in public hospitals in Kenya

Effective implementation requires a combination of both top-down and bottom-up approaches. When applied to EMR implementation, the approach involves top-down decision-making regarding (resources, choice of a dealer, etc.), as well as acknowledging and harnessing the teamwork and proficiency of health experts and support staff who get involved with patients in hospitals and the EMR system in one way or the other. Consequently, recognizing both top-down and bottom-up influences on implementation would be seen important by any person looking forward to develop an EMR implementation framework.

### 3.13.1 Significance of an implementation framework

The objective of an implementation framework is to guide the adoption of a new system and offer reliability in explanation (Wamae 2015;  Hasanain & Cooper ,2015 and Boore ; 2012). Furthermore, utilizing an implementation framework is perceived as an important step to make it possible timely implementation (Jones & Smith, 2001). It has been pointed out that having an implementation framework is particularly important at the time of adopting new information technology (IT), because IT systems are always expensive and demands key transformation at different stages ( Cresswell & Sheikh, 2013; Kaufman, 2004). Prominently, frameworks can in addition assist reduce common errors in implementation of EMR systems.

Makori, Musoke & Gilbert (2013) confirms that the problems of IT management and implementation have been affected by a number of factors: costs and available resources, expertise levels and technical skills, the nature of technology, the nature of the

environment, and, ultimately, the organizational culture. Even though several implementation frameworks exist in literature, a number of them have same content (Carnall, 2007). Project management is one such area of commonality.

Hasanain & Coopers (2015) agrees that the implementation guide involves a number of phases perceived as important for a successful implementation such as resource allocation, timelines, exploitation tasks, and early planning of the entire system and records a number of steps to be pursued throughout the three phases of EMR implementation: pre-implementation, implementation, and post-implementation phases (AOHC, 2008). The three implementation phases cover preparedness, deployment, adoption, and sustainability matters.

Despite obvious benefits, the literature shows that EMR implementation is often accompanied by a number of challenges and sometimes failure due to the major changes that it requires (Hasanain & Cooper, 2015). Chan & Akay (2011) confirms that hospitals around the world have confronted a number of technical and human barriers to EMR implementation. Several published studies that focus on international EMR implementation experience identify a range of issues that can obstruct the implementation process and leads to ultimate failure ( Crema &Verbano 2013). Implementing a new computer system such as EMR, involves major changes to the way an organization manages its routine work Thite & Sandhu, 2014).

However, inspite of these failures and challenges, examples of successful EMR implementations are also available ( AOHC, 2008, Roper, Hall & LeBretia, 2011, WHO, 2006). Moreover, a number of authors argue that implementation framework can enhance the EMR implementation framework process and contribute to its overall success ( Cresswell & Sheikh, 2013, Cresswell, Bates & Sheikh, 2013). Aanesta and Jensen (2011)

maintain that using a predesigned implementation framework can assist in anticipating possible challenges that may arise and can therefore also assist in identifying possible solutions and procedures to follow. This process ultimately promotes and helps ensure the successful implementation of EMR systems in hospitals ( Aanestada & Jensen, 2011).

The current study develops an EMR implementation framework for public teaching and referral hospitals in Kenya. The literature offers several implementation framework such as Keshavjee et al (2006) framework that have already been established and used for EMR implementation in developing countries (Hasanain, 2015). However, implementation framework can vary from one setting to another, no fixed framework exist that can be deployed in every hospital worldwide (Aanestada & Jensen, 2011). In fact each health system is unique and is influenced by idiosyncratic historical, social, cultural, political, institutional and economic factors ( Boonstra et al, 2014).

To date no research has been undertaken specifically for public teaching and referral hospitals in Kenya ( Asumbi, 2016).

**3.14 Chapter Summary**

In this chapter, literature has been reviewed on use of Electronic Medical Records in the provision of Healthcare Services. The chapter provided a research synthesis on the independent variables in the study such as type of medical records, adequacy of infrastructure, knowledge and skills, utilization of medical records and challenges in application of Electronic Medical Records (EMRs) in Kenya. This has provided clarity on research questions one, two and four of the present study. The literature review also provided highlights on the challenges encountered that inhibit the adoption and use of EMRs.

Many studies have been carried out in the developed countries and very few from African countries on adoption and use of EMRs, but there seem to be varied factors influencing technology adoption and use. This could be disparity in culture and technological developments in various health institutions and countries across the world. The review revealed that several studies have investigated adoption and use of electronic medical records from various perspectives: Social, technological, psychological and even environmental. These studies were limited in scope covering areas such as attitude of health workers, availability and accessibility to technology. Majority of the empirical and theoretical evidence were found in developed nations and even Asian continent. Also many of these studies had examined the challenges and barriers to technology use both from health institutional settings and other contextual setting. But few of these studies identified plausible solutions to these challenges. Therefore, this study sought through the survey research method, to understand adoption and use of electronic medical records in the two public teaching and referral hospitals in Kenya.

**CHAPTER FOUR**

**RESEARCH METHODOLOGY**

## 4.1 Introduction

This chapter discusses methods that were adopted in achieving the objectives of this research, which include research design, study population, sample techniques and data collection instruments, data collection procedures and data analysis.

The chapter begins with a discussion on choice of research design and the case study strategy with details on philosophical examination, including interpretivist philosophy and the qualitative research method. The chapter finally gives details on data collection techniques, analysis and ethical considerations as applied in this study.

## 4.2 Research Design

Research methodology is the collection of methods or rules by which a particular research is undertaken in line with the principles, theories and values that underpin specific approach to research (Rubin, 2001; Sadhu & Sigh, 1996). Alabi, (2015) points out that methodology is usually influenced by the paradigm on which the theoretical perspective for the study is placed. It is the blueprint of roadmap that researchers employ to render their work to open to analysis, critique, replication, repetition, adaption in choosing the research methods. The purpose of the research methodology is to provide underlying assumptions about the nature of the reality being examined, what constitutes valid research and which research methods are appropriate to a particular research endeavor (Gephart, (1999). These sets of beliefs and values are what is called paradigms (Guba, 1999) or research orientations (Tesch, 1990).

The success and quality of any research depends on a good organization. Consequently, the study used the Research Onion (Figure 3.1) as a framework for discussing the research methodology adopted. The research onion, as Bryman (2012) explains, illustrates several stages that must be covered when developing a research strategy. Each layer of the onion describes a more detailed stage of the research process. The research onion therefore depicts the progressive steps to be followed in research methodology. Its usefulness lies in its adaptability for almost any type of research methodology and can be used in a variety of contexts.

**Figure 4.1 Research onion**
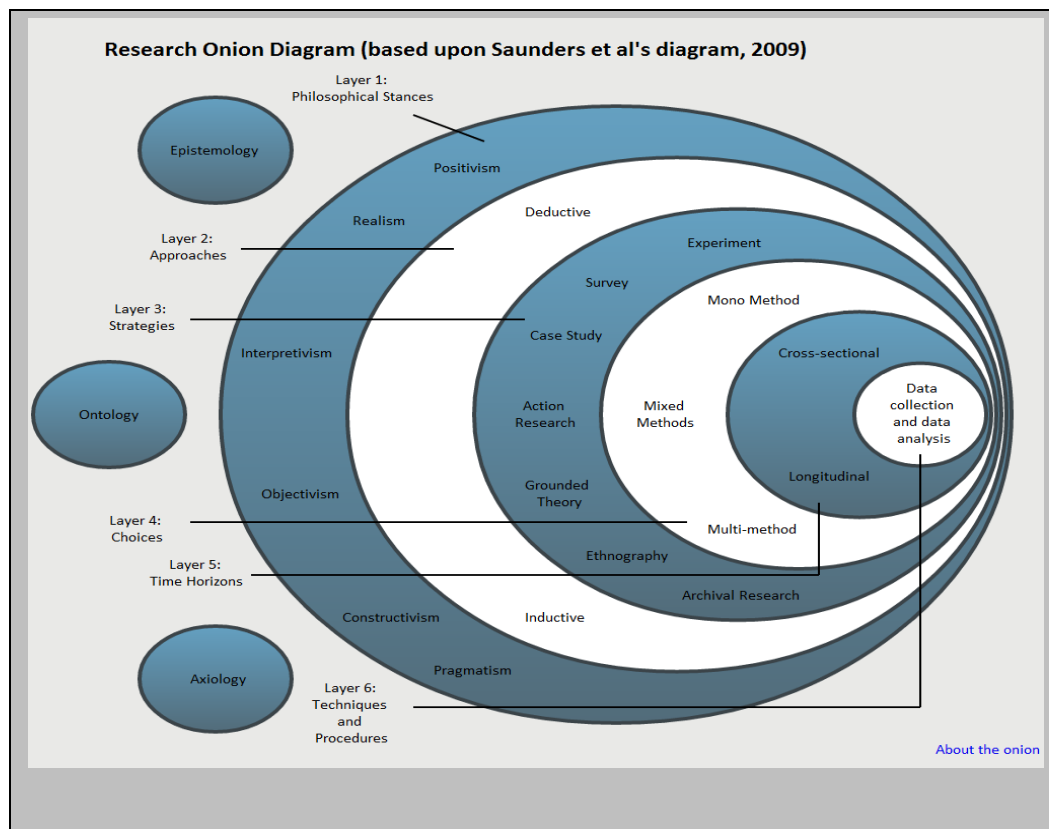
**4.2.1 Qualitative approach**

Qualitative research is a study process that investigates a social human problem where the researcher conducts the study in a natural setting and builds a whole and complex representation through descriptions and explanation and examination of participants (Andrade, 2009 in Ashah, H. Owano 2013). It can be used to explore, discover and understand people's beliefs and experiences, attitudes, behavior and interactions, with the researcher being the instrument or tool of research. It enables the researcher to understand human thought and action in social and organizational context.

According to Myers (1997) qualitative research allows the use of qualitative data like interviews, documents and participants observations in order to understand and explain social phenomena. Creswell (2007) assert that the assumptions that lead researchers to choose qualitative research include nature of reality, how a researcher knows what they know, role of value in research language of research and methods.

In qualitative research researchers' belief are represented by paradigms like post-positivism, constructivism, advocacy or participatory, and pragmatism, although each one holds different beliefs and views about knowledge. Post-positivist researchers take scientific approach to research and view inquiry as a series of logically related steps, believe in multiple perspective from participants as opposed to a single reality, use rigorous methods of qualitative data collection and analysis. The results of qualitative studies are written and presented in form of scientific reports.

As stated above this study employed qualitative approach (post-positivist orientation) to investigate in-depth issues to do with use of electronic medical records in accessing patient information in public teaching referral hospitals in Kenya.

## 4.3 The Theoretical Paradigm and Perspective

Taking Figure4.1 in its entirety, we see that research involves differing levels of abstraction from philosophical assumptions and interpretive frameworks that lay the foundation for the researcher to more specific approaches and methods of data collection, analysis, and interpretation. According to the research onion, the initial phases of the research process are the philosophy and theoretical orientations on which the study is premised. This represents the abstract ideas and beliefs that inform a research.

### 4.3.1 Philosophical Assumptions Underpinning the Study

Philosophy represents the abstract ideas and beliefs that inform a research. There are four major philosophical assumptions used in qualitative research: ontology (what is reality?), epistemology (how is reality known?), axiology (how are values of the research expressed?), and methodology (how is the research conducted?). These philosophical assumptions shape how researchers formulate the research problem and research questions of a study and how they seek information to answer the questions (Huff, 2009).

Philosophical assumptions are embedded within interpretive frameworks (Denzin & Lincoln 2011). Commonly cited frameworks include positivism, postpostivism; interpretivism, constructivism, hermeneutics; feminism(s); racialized discourses; critical theory and Marxist models; cultural studies models; queer theory; and post colonialism, transformative perspective, postmodernism, and disability approaches. The social constructivism, variably referred to as interpretivism framework, was chosen for this study.

**4.3.1.1 Social constructivism (Interpretivism)**

In this worldview, researchers search for individuals' perception of the world in which they exist and work thereby developing personal meanings of their experiences. These personal connotations are construed socially through interaction with others (hence social constructivism) and historically through past experiences and way of life for persons (Lincoln & Guba, 2000). Therefore, the intention of a researcher utilizing interpretive framework is to interpret the meanings others have about the world. In this study, the implementation of Electronic Medical Records in the provision of Healthcare Services to Public Teaching and Referral Hospitals in Kenya is observed from the perspective of multiple respondents.

Lincoln et al. (2011) rightfully point out that the philosophical assumptions of ontology, epistemology, axiology, and methodology take different forms depending on the interpretive framework used by the inquirer. The following sub-sections therefore provides an exposition of the four philosophical assumptions detailing how they are exemplified in the study and how they are linked to the interpretivism framework used in the study.

i) *Ontological* issue relates to the nature of reality and its characteristics. In this study, the multiple forms of evidence gathered are represented in the themes and in the actual words (verbatim) of different individuals signifying the different perspectives in line with use of ICTs and challenges experienced .

ii) *Epistemological* belief assumes that reality is an output of the subjective individual views of the respondents shaped by their individual experiences. Thus this study was conducted in the "field," that is the actual workplace of the participants so as

to enhance understanding of the participants views and experiences of the use of EMRs.

iii) *Axiological* assumption relate to the values researchers bring to a study. In qualitative inquiries, the researchers openly position themselves by actively reporting their values and biases as well as the value-laden nature of information gathered from the field. In this study, interpretation of status, context, facilitating and impeding factors to EMR implementation was construed from both the perspectives of the respondents (hence their actual voices presented in verbatim quotes) and the researcher's interpretation (informed by observations made and prior knowledge of the phenomena under inquiry). The reporting was purely based on the objectives of the study.

iv) *Methodological* beliefs relate to the research approach adopted. In tantrum with interpretivism lens, the study adopted an inductive approach in understanding EMR implementation in the teaching and referral hospitals: knowledge acquired from the theoretical and empirical literature reviewed were only used to provide a general understanding of potential influences of EMR implementation and not to restrict the research inquiry to specific variables. Emergent issues were inductively derived through multiple data collection methods that included interviews, observation and document analysis.

### 4.3.2   Research Approach

Saunders outline two types of research approaches: the deductive and the inductive approach. The deductive approach rests upon examining whether the phenomena under inquiry fits with pre-existing theory and expectation based upon previous research (Wiles,

Crow & Pain, 2011).This approach is therefore affiliated with quantitative methods which allows for hypotheses formulation and the statistical testing of expected results to an accepted level of probability (Snieder & Larner, 2009). The inductive approach on the other hand does not rely on an initial framework to inform the data collection. Instead, it allows the research to focus on issues as they emerge in the data collection (Flick, 2011).This approach is commonly associated with qualitative studies.

In conformity with social constructivism assumptions that advocates for interpretation from the users lived experiences and researcher's interaction with the unit of analysis, this study adopted the inductive approach. As earlier explained in chapter two, the conceptual framework developed was used as a frame of reference in establishing potential issues of interest in EMR implementation and understanding the emerging issues unfolding in the data collected.

Researchers can either choose to use the quantitative, qualitative, or mixed methods approach to inquiry (variably referred to as paradigm). Creswell (2003) describes these approaches as "plans and the procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis".  The choice regarding which research approach to choose is determined by the assumptions the researcher brings to the study procedures of inquiry, data collection, analysis, and interpretation methods used, nature of the research problem or issue being addressed, researchers' personal experiences, and the audiences for the study (Creswell, 2003).

The term paradigm has variably been defined in the literature. First used by Thomas Kuhn in 1962 to mean a conceptual framework or convenient model for examining scientific problems and finding solutions (Alabi, 2015), it has come to be accepted as the philosophical intent for carrying out research. It provides an integrated cluster of

substantive concepts, variables and problems attached with methodological approaches and data collection tools (Kuhn, 1977). Principally, it offers basic beliefs and dictates which influences what and how should be studied (Bryman, 2004). This study chooses to use the qualitative approach.

### 4.2.2.1 The Qualitative Approach

Following Creswell (2009:4) statement that "qualitative research is a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem", it can rightfully be concluded that qualitative methods are well-suited methods for obtaining insight and in-depth information. Consequently, in tantrum with the interpretive framework adopted for the study and the quest for rich and in-depth understanding of intricacies of EMR implementation, qualitative approach was adopted.

Many researchers associate interpretive frameworks with qualitative methods. In their defense, they cite several reasons such as: Use of rich reporting in qualitative approaches that are fundamental for holistic understanding of a phenomena or context as required by interpretive frameworks (Willis, 2007); The notion supported by both qualitative methods and interpretive frameworks that reality is socially constructed, complex, and ever changing (Thomas, 2003); their shared interest in achieving an in depth understanding of the interaction of people and their surroundings and the part they play in making the social fabric of which they are a part (McQueen, 2002 cited in Thomas (2003). Willis (2007) points out that people's behavior is considerably influenced by the surroundings in which it happens; therefore one is required to study that behavior in situations. All these arguments were well thought out in choosing the qualitative approach adopted.

Creswell (2007) asserts that qualitative methods can be used because of a need to study a group or population, identify variables that can be measured, or hear silenced voices. As noted by Chilisa and Preece (2005) IN Gori (2012), we conduct qualitative research because we need a complex detailed understanding of the aspect of the study. This can be achieved by talking directly with people, going to their places of work and allowing them to tell the stories unencumbered by what we expect to find or what we have read in the literature. These authors add that we conduct qualitative research when we want to empower individuals to share their stories, hear their voices and minimize the power relationships that often exist between a researcher and the participant in a study. In the context of this study, the interviews were conducted at the actual working environment of the health workers and their office setup.

Extending the significance of qualitative approaches, Straus and Tesch (1990) underscore the fact that qualitative methods can be used to better understand any phenomenon about which little is known. They add that qualitative approaches can also be used to gain new perspectives on things about which much is already known, or to gain in-depth information that may be difficult to convey quantitatively. Thus, we conduct qualitative research because the researcher wants to understand the contexts or settings in which participants in a study address a problem.

Thus the conjunction between the interpretivism theoretical lens and the qualitative approach was established to make enormous significance in the consideration of several social issues that relate to the study undertaken. Case in point: why ICTs and in particular EMR are not fully utilized in the health institutions following the initial implementation; what institutions and cultural factors influence EMR implementation in the public teaching and referrals hospitals in Kenya amongst others.

**4.3 Research Strategy**

Based on Saunder et al (2009) research onion, research strategy forms the third level of research process. Research design is the architectural plan (Polit & Beck, 2012), the structure (Babbie &Mouton, 2001) of a study showing a clear description of the various processes by which the research is to be undertaken, how the research is conceptualized and the steps to the actual conduct of the research. It helps the researcher to plan, structure and execute the research (Mounton, 1996:175). Thus Yin (2003:19) describes research design as an action plan for getting from' here' to 'there', where. 'Here' may be defined as the initial set of questions to be answered while 'there' is some set of conclusions or answers. The study adopted the qualitative multi-case research method. There are two schools of thoughts regarding case study as research methodology; those that consider it as merely a choice of what is to be studied (Stake, 2005) and those that consider it as a strategy of inquiry, a methodology, or a comprehensive research strategy (Denzin & Licoln, 2005; Merriam, 1998; Yin, 2003). In this study, the researcher choose to view it as an integration of both viewpoints. Consequently, it has been applied to denote methodology- a type of design in qualitative research, as well as an object of study, and a product of the inquiry.

Case study research is an approach in which the investigation explores a bounded system (a case ) or multiple bounded system (cases) over time, through detailed, in-depth data collection involving multiple sources of information (e.g. interviews) and reports where a case descriptions and case-based themes may be selected for study. It provides a means of understanding a research problem with greater clarity using few examples - sample (Kombo, 2006). Since it investigates contemporary phenomenon within its real life context, it is argued that a case study makes the understanding of the context possible and

can be used to achieve research aims and objectives through diverse data collection methods. Yin, (2003) in discussing the case study states that the case study permits a researcher to keep holistic and significant attributes of real-life dealings, examples being individual life cycle organizational and managerial practice, neighborhood transformation and so on. Adding to the advantages of a case study approach, Gilbert (2001) points out that case study permits for an in-depth management of the subject matter where a huge amount of detail about the application and the procedures being investigated can be understood in relation to a specific historical social background. As such, the case study attempts to derive constructs from the fields through in-depth examination to the phenomenon of interest. That is, categories and themes emerge from the experiences of the respondents (Lincoln & Guba, 1990; Walsham, 1995). It is not surprising that this research strategy is widely accepted in studies examining the use of electronic records because of interpretive stand (Bryman, 2012).

Taking account of the above mentioned characteristics of case study, this study undertook an extensive and intensive inquiry of specific issues relating to use of electronic medical records in provision of healthcare services to clients of Moi Teaching and Referral Hospital, Eldoret and Kenyatta National Hospital, Nairobi. The results for both case studies were compared and used in building a concrete understanding of the status and underlying issues pressurizing the implementation as well as assimilation of EMRs in Public Teaching and Referral hospitals in Kenya.

The case study research method is particularly well suited in establishing specific issues or situation encountered the use of electronic medical records in the provision of healthcare services to public teaching and referral hospitals in Kenya. This is very important for practical based problems where experience of the participant is important

and the context of action is critical. In this study, categories and themes emerged which were closely linked to the experience of the healthcare workers in the two Institutions. This process involved multiple participants often with heterogeneous interests at various levels of service provision.

The main limitations of the case study approach are that it is time consuming, expensive to conduct and produces massive quantities of data. There is always concern about the representatives of the particular case being studied and thus whether the findings can be generalized to other similar cases. Despite this, case studies allow for distinguishing characteristics of the cases under investigation to act as a springboard for theoretical reflections about contrasting findings (Bryman, 2001). Playing down this critic, Hancock (1998) adds that there is a common misunderstanding of the purpose of case study research, which is to describe a particular case in detail; being particularistic and contextual, it is the researcher who must decide whether or not the case being described is sufficiently representative or similar to their own local situation. Similarly, several authors (Zucker, 2001; Yin, 2003; Creswell, 2007) assert that in a case study, the investigator's goal is to expand and generalize the findings of the study. Therefore, if conducted properly, case study theoretical prepositions may be generalized without having to conduct investigations in several organizations. Through multiple methods of data collection such as interviews, observations etc., the case study approach "has a rich history of success in applied research and evaluation and is a particular powerful approach in situations where depth and richness of evaluation information (are) needed" (Lasonen &Finch 1995). Such is the nature of the context in which the current study was being undertaken.

In respect to the use of electronic medical records in the provision of health care services to the public teaching and referral hospitals in Kenya, it appears logical to take it since the utilization of electronic medical records in the offering of health care services by healthcare personnel in two public teaching and referral hospitals in Kenya were satisfactory representative of those experienced by other hospitals in Kenya. This is because the hospital Information Systems are similar in their structure and functionality particularly in regard to use of electronic medical records in all departments of the hospital.

## 4.4 Study Population

The study population is the total units that conform to a particular criterion or set study. It constitutes the entire group of people, events or things of interest that have at least one characteristic in common that a researcher wishes to investigate (Burns, 2000; Sekaran, 2006). It is thus defined in terms of content, context and time. This study's population constituted of National Teaching and Referral hospitals in Kenya. Teaching and Referral hospitals are defined as major hospitals that usually have full complement of medical services such as surgery, pediatric, obstetric, general medicine and genealogy. Patients in Kenya are often referred from level 4 and 5 hospital to referral hospitals when the health situation is more complex thus, requiring intensive solutions. According to Wamae (2015), Public Teaching and Referral hospitals in the country as per 2014 were only two in number

The target population constituted of Moi Teaching and Referral Hospital and Kenyatta National Hospital Medical Records staff totaling 188 and 230 respectively. Other respondents included the in charges of Medical Officers, Nurse Managers, Heads of Clinical, Pharmacy and Laboratory. The above health workers offered a 'bottom-up'

point of view on EMRs implementation. Key informants from the two hospitals include the Directors of the two referral hospitals/planning officers and the ICT in- charge.

## 4.5 Sample Design

Sampling is the practice concerned with the selection of individual observations intended to yield some knowledge about a population (Trochim, 2006). The individuals are selected in such a way that they represent the large group from which they were selected (Yin, 2003). It is therefore the selection of some part of some aggregate or totality on the basis of which judgment or inferences about the aggregate or totality is made (Babbie & Mouton 2001). Therefore using a sample in this research, the researcher might reasonably generalize the results back to the population from which they were chosen (Trochim2006).

The above perspectives of sampling draws attention to the purpose of sampling; selecting a study sample is an significant stride in every research assignment given that it is hardly ever practical, effective or right to study entire population (Marshall, 1996). The selection of a suitable technique depends upon the environment of the study. Different from the quantitative approach that intends to testing prearranged hypotheses and create generalizable outcome; qualitative research intends to offer explanation and understanding of intricate psychosocial matters and most valuable, for answering humanistic 'why' and 'how' questions (Marshall,1996).

Sampling in qualitative research is neither statistical nor purely personal. It is, or should be, theoretically grounded (Silverman & David, 2008). Advancing this position, Bryman (1988) posits that qualitative research follows a theoretical, rather than a statistical logic; the issue should be couched in terms of generalizability of cases to theoretical

propositions rather than populations or universe. Based on these perspectives of sampling in qualitative studies, study cases are often chosen because they illustrate some feature or process of interest to a study. The resulting practice has resulted in preferences for theoretical sampling which is concerned with constructing a sample that is meaningful theoretically. This implies building on certain characteristics or certain criteria considered helpful in developing and testing ones theory and explanation.

Purposeful or criterion-based sampling is a type of non- probability sampling that is frequently used in case study since it is thought to be a rich source of data of interest Patton (2002).

### 4.5.1 Sampling Procedure

This study used stratified purposeful sampling. This is purposeful sample that is stratified by choosing particular units or cases that differ according to major measurement techniques (Patton, 2002). Its core purpose is 'to capture major variations' even though 'a common theme may also emerge in the analysis' (Patton, 2002: 240).The first step involved stratifying the two Public Teaching and Referral Hospitals and their departments. The technique was to allow the members of staff in the two health institutions to be clustered into homogenous sub-groups or strata. Therefore, personnel working in the same department were clustered together since they have common characteristics.

Purposive sampling technique was then utilized in the second step to choose cases that have the vital information with respect to the objectives of the study. Cases or subjects were therefore selectively picked because they were informative or they possess the required characteristics. This sampling technique helps to increase utility of findings. For

this reason, the criterion for inclusion was that the departments chosen had to directly be using patient file/record either in electronic or paper format by providing services or supplies to the patient. Typically this involved purposive selection of a number of departments and their personnel who are end-users of the system and this include doctors, nurses, and allied healthcare staff. These are staff that are already utilizing EMRs on a day-to-day basis or potentially could. Medical Records Department was selected as the core department in this study. Staffs of different cadres were then randomly selected.

This study also consulted key informants who were purposively sampled to comprise the Directors of two public teaching and referral hospitals. This included the planning officers, Health Records and Information Systems Manager, ICT managers and Medical Officers in charge of Clinical departments, Clinical Officers in charge and Nurse manager in-charge of both outpatient and inpatient services. These are people who were hoped to understand the activities that are carried out in their area of service. By so doing, information rich segment of medical departments was obtained for in- depth study. Patton (2002: 230) asserts that:

> The logic and power of purposeful sampling lie in selecting *information-rich cases* for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry, thus the term purposeful sampling. Studying information-rich cases yields insights and in-depth understanding rather than empirical generalizations, emphasis in original.

## 4.5.2 Sample Size

Suri (2011) confirms that decisions associated with sample size which must be guided by the purpose of research, the overarching logic of sampling and pragmatic constraints. Suri further presents two main logic that relates to primary research: data saturation and data sufficiency.

Data sufficiency is guided by the researcher's perception of what constitutes sufficient data for achieving the research purpose. The researcher is supposed to ensure that the claims advanced in the study are sufficiently grounded in the evidence collected for analysis. To this end, Paterson et al (2011, p. 37) point the following as the principles that ought to guide the sample size of a study: the data should be sufficient to permit comparisons among selected dimensions and constructs; the reports should reflect the work of several distinct and independent investigators and the data should be sufficient to answer the research questions.

Odini (2008), Moorse (2000) and Koerber and Michael (2004) further points out that the key factor well thought out in determining the sample size is the requirement to maintain it adequate and to produce sufficient data until no new data emerge. This allows a researcher to draw from it exhaustive data at a reasonable cost in terms of time, financial resource and personnel. Consequently, like Mugenda and Mugenda (1999) affirms, the sample size depends on what the researcher needs to know, the reason for investigation, what determines reliability and what can be completed with accessible time and resources. That is, a suitable sample size for a qualitative research is one that satisfactorily responds to the research questions (Marshall, 1996; Patton, 2002). Baker and Mwangi (2006), examine that qualitative investigations typically focuses in depth on a comparatively small sample, even single cases (n=1). They argue that there are no specific

rules for sample size in qualitative inquiry. These observations were noted in this study, and accordingly, only a small sample size was necessary. Based on Slater (1990), the choice of the technique of selection of respondents in qualitative research depends upon the research objectives and the research budget. Slater further argues that qualitative research is concerned with in depth and thorough, not in breath. She states that useful qualitative study can be complete with as few as 20 interviews.

After stratification the researcher conveniently used the list of relevant cases from Human resource department to purposefully select information-rich as well as information- poor cases from each stratum interviewed and their experience shared with the researcher in order to find out how they used EMRs to access patient information. The cases were sampled using convenience and maximum participant variation strategy for purposive sampling in order to capture and describe central themes that cut across all the variations. The cases to be studied were conveniently identified with the assistance from human resource department of the two health institutions through provision of relevant list for health records departments from a target population of 419 using stratified and purposive technique. Core staffs in each division in the two hospitals were also considered. These included the Medical Officers in charge, Clinical Officers in charge, Nurse Managers, ICT Officer in charge and CEO of the two health institutions. The Information Communication Technologists and Chief Executive Officers of the two hospitals were specifically identified as planners and implementers in terms of resources required for the establishment of EMR in their institutions. On the basis of their responsibilities, these staffs were purposeful identified.

The technique allowed in-depth study and deeper understanding of a phenomenon and permits generalization enabling the researcher to learn a great deal about issues of central

importance to the purpose of the research (Patton 2002).The resulting sample size is shown in Table 4.1

**Table 4.1 Sample Sizes for each institution**

| Designation | Sample used MTRH | Sample used KNH | TOTAL |
|---|---|---|---|
| Medical Record Officers | 19 | 23 | 42 |
| Nurse Managers | 6 | 8 | 14 |
| Director/ Planning officers | 1 | 1 | 2 |
| Clinical Officers | 6 | 8 | 14 |
| Medical Officers | 6 | 8 | 14 |
| ICT Manager | 1 | 1 | 2 |
| Lab Manager | 1 | 1 | 2 |
| **Totals** | **40** | **50** | **90** |

The table above show the number of respondents from the entire population of the study involved identifying and defining the population.

The total sample of staff from the two public teaching and referral hospitals were 90.

Though Patton (2002) states that in purposive sampling the size of the sample is determined by informational consideration until no new information is forthwith coming, there are no rules for sample size in qualitative inquiry. It all depends on what

one wants to know, the purpose of the inquiry, what is at stake, what will be useful, what will have credibility and what can be done. In this study the researcher attempted to interview all the respondents from health records but reached saturation point at 10% of total population.

## 4.6 Data Collection

Creswell (2007) envisage data collection as sequences of consistent phases of data activities which includes locating a site or an individual, gaining access and making rapport, sampling purposefully, collecting data, recording information, exploring field issues and storing data as shown in Figure 4: 2.

Figure 4:2 Data collection activities
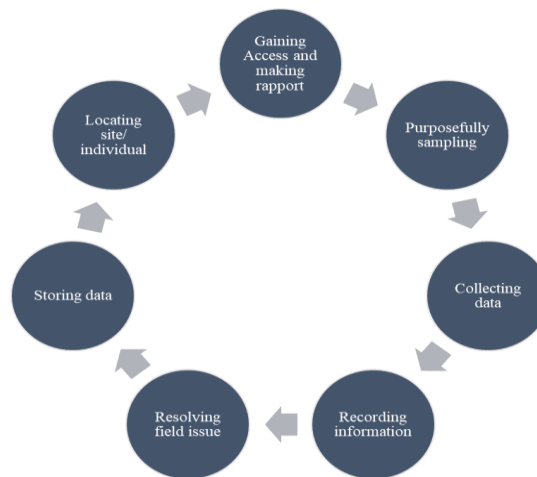
**Source: Creswell (2007)**

According to Creswell's visualization, the process of data collection begins with finding people or places to study, gain access to, and establish rapport with participants. This is followed by a process of determining a strategy for the purposeful sampling of individuals

or sites. A decision about the most appropriate data collection approaches then needs to be made. To collect the information, the researcher develops protocols for recording the data such as interview or observational protocols. Decisions' regarding storage of the data for each protocol and its protection from damage or loss then has to be made. The strategy used involved purposive sampling design of departments where data was collected from information rich individuals. The first stage was to have clinical departments that deal with medical records.

### 4.6.1 Data Collection Techniques

The approach taken to guide the research was a transformative procedure with a theoretical framework (Creswell, 2003). This facilitated in linking the research to the existing body of knowledge. Hence, the approach taken was from an inductive viewpoint. Consequently, the theoretical framework derived from the diffusion of innovation theory and DIRKS methodology was utilized to guide this research. The intend of the study in this case was not to validate the framework but to guide the research as to what basics are important to observe and with the intention to adjust or come up with a possibly a new EMRs Framework on the research findings.

Owano (2013) points out that researcher collect data to further their understanding of a puzzling phenomenon. In this study the research instrument employed influenced the procedure used. For the purpose of interview, the researcher approached the already identified respondents in person and requested them persuasively to be interviewed. An approved letter requesting for informed consent was presented to them.

A semi structured face-to-face interview was used in soliciting for information. The semi-structured interview technique is described as standardized open-ended interview (Patton,

1990 as cited in Alabi, 2015) where questions are prepared beforehand. Respondents were interviewed individually and notes transcribed. Other data collection methods involved recording the voice of the two Chief Executives Officers of the two health institutions.

### 4.6.2 Data collection Instrument

Semi-structured interview schedules and an observation guide were used to gather information. Three interview schedules were used in soliciting information from the various groups of respondents - the Records staff, the Clinicians and the Hospital Management (appendix 1, 2, 5 respectively). The open nature of the questions permitted probing into the responses, which improved the data collected.

Documentary sources such as annual reports, pamphlets and departmental reports were used to gather information and knowledge on the utilization of Electronic Medical Records in the two health institutions.

### 4.6.2.1 Interview

One of the most significant sources of case study information is the interview (Yin 2009). It is the most extensively utilized approach of qualitative research. Silverman (2011) confirms that with qualitative research interviews, the researcher seeks to understand something from the participants' point of view and to find out the meaning of their experiences. Interviews permit people to communicate to others a situation from their own point of view and their own words.

There are different types of interviews. The information acquired during interviews may be recorded through notes or can be taped and later written down. This study employed the use of semi-structured interviews. This type of interview utilizes a pre-determined interview schedule which researchers follow closely (Sofaer, 1999). Usually, semi-

structured interviews focus on a list of key themes or questions that the researcher wishes the participants to address. On the other hand, it permits participants to include new information but this is limited to the key themes. Their main purpose is to offer answers to carefully phrased questions.

The choice of semi-structured interviews was based on several considerations: First, it ensures coverage of key issues and areas that required to be tackled. The semi-structured interview format also offered flexibility for the professionals to talk about additional issues they consider as significant to an EMR implementation. The questions were open-ended so that participants could answer the questions in their own words and to take the questions to likely new areas, based on their knowledge and experiences while upholding fairly high degree of flexibility (Patton, 1990); secondly, the interview schedule ensured good use of limited interview time, made interviewing multiple health workers more systematic and comprehensive, and helped to keep interactions focused; thirdly, the inquiry begun with a prior set of constructs as elaborated in the conceptual framework presented in chapter two upon which pre-determined set of open questions were structured to address specific issues. Last but not least, this being a multiple case study several research assistants were used in the fieldwork. Therefore, to ensure consistency, comparability of interviewing style, and cross-case compatibility, semi-structured interviewing was used.

## 4.6.2.2 Observation

Observation was used as a complimentary data collection method to confirm or disapprove points made by respondents. Observation techniques are methods by which an individual or individuals gather first hand data on programs, processes or behavior being studied. Creswell (2007) notes that observing in a setting is a special skill that

require addressing issues such as the potential deception of people being interviewed, impression management, and the potential marginality of the researcher in a strange setting.

The observation involved watching and recording behavior of respondents in their work environment to understand how they carried out their assignments. Observation was carried out during interview session to confirm or disapprove points made by respondents. By openly observe operations and activities of utilization of medical records were possible to develop a holistic consideration of the circumstance within which the two hospitals operates. The research assistants were asked to observe and note the use of computers in the provision of health services to the patients, their engagement in the day to day provision of health services to the patients, their function in the day-to-day provision of service to patients and the level of use. The observations were guided by structured checklist (appendix B). The use of a checklist assisted to make sure that all research assistants were gathering the relevant information and with the suitable training, apply the same principle in the assessment. The respondents were made aware that some observations were being made. During observation, it was likely to counter check interview responses from participants. Observations also permitted the researchers to find out about things the participants or staff may have been ignorant of or were reluctant or not able to talk about in an interview or may not have been recorded such as nature and types of ICTs, frustration in use of fun soft, hardware and software being used, distribution of ICT tools and services.

### 4.6.2.3 Documentary review

Data was also generated through documents collected from the two health institutions. This method involved reviewing existing available documents and other pieces of written

information for themes. Existing records often provide insights into a setting and/ or group of participants that cannot be observed or noted in another way. These are record material not prepared for the purpose of evaluation or at the request of the inquirer but non-the-less contain pertinent information to a subject under investigation. In this study documents such as annual reports, strategic plans, policy documents and ministry of health reports, ICT training schedules were used to compliment the other data collection methods used.

The case study data collection gets its strength from the opportunity to use many different sources of evidence thereby allowing a researcher to address a broad range of issues. It also aids in covering lines of inquiring which help to address construct validity since multiple sources of evidence provide multiple measures of the same phenomenon.

## 4.7    Reliability and Validity of Research Instruments

Regardless of the type of research to be carried out, Reliability and Validity are concerns that are given serious deliberation in a study's conceptualization and the approach which the data is collected, analyzed and interpreted and how the findings are presented.  Several methods were utilized to improve the validity and reliability of research instruments for this study. The following section deals with reliability and validity:

### 4.7.1   Reliability

Reliability is a measure of consistency using the same instrument and whether it yields the same results. Golfshani (2003) points out that reliability is the steadiness, accuracy and precision of measurement. Golfshani (2003) further describe reliability as the extent to which results are consistent over time and an accurate representation of the total

population under study and if the results of a study can be simulated under the same methodology, in that case the research instrument is considered to be reliable.

Brink (2012) describes instrument reliability as the consistency and dependability of a research tools in measuring a variable, and the degree to which it can be depended upon to yield consistent result if used repeatedly over time on the same person or people.

Reliability in qualitative studies implies measurement that yields consistency using the same instrument over time. The main ways in which this study ensured the reliability was in maintaining records of interviews and observation and by documenting the process of analysis in detail. Denzin (1970) as cited in Owano (2013) explain that multiple and independent methods should be considered as important, if reaching the same conclusions have greater reliability than a single methodological approach to a problem. In addition, multiple viewing of data collected by the same person (researcher) or a different person was done to establish the reliability and rigor of the current study.

## 4.7.2   Validity Measures

Validity is the strong point of conclusions, inferences or propositions. Hammersley (1987) confirms validity is correct if it represents exactly those features of the study problem that it is anticipated to describe, explain or theorize. It refers to the accuracy or reliability of a measurement.

Validity refers to the extent to which an instrument measures what it is supposed to measure. In qualitative research, instrument validity is a quality criterion that indicates the degree of accuracy of a study (Polit & Beck, 2004).

There are four forms of validity that were dealt with in this study: face validity - the like hood that a question will be misinterpreted; content validity - whether an instrument

offers sufficient coverage of a subject; construct validity - which refers to conceptual foundations underlying a specific measurements; and external validity - this is concerned with the degree to which the findings of one study can be applied to other circumstances.

Using the pilot study, the validity of the research instrument were tested on a small sample of the population in order to find out if data collection instruments and field procedures worked the way they were meant to. A pilot study, according to Wiersma and Jurs (2005) is once first drafts of questionnaires and interviews are undertaken out with a pilot run. They recommend that a pilot run should be done with a limited number of participants typically between five and ten so that the researcher would be able to recognize the inaccuracy in the research instruments before going on to the field to collect the data.

This study carried out a pilot study that included face to face interviews with a sample of five health workers from Clinical, Nursing, Medical and Supportive Services of MTRH who helped to identify ambiguous, poorly worded questions in the interview schedule. Thus, the level of misunderstandings and misinterpretations that would have been encountered in the field during data collection was corrected early. The pilot study in addition tested the appropriateness and sufficiency of data collection instruments. These assisted in sorting out any inefficiency and assess the probable cost and duration of carrying out the study. The responses to the interview were also checked for consistency in terms of questions set out to respondents of different clusters. The result of the pilot study was used to refine the research instruments for the succeeding phases of the major fieldwork.

The investigator also employed face validity in determining the extent to which they measured or reflected the content of the concept in question. Bryman (2004) advices that this type of validity measure requires experts or experienced people in the field of

investigation to check the extent to which the measure reflects the concept concerned. The researcher requested departmental lecturers from the School of Information Sciences to act as judges and help in the determination of the extent to which each item in the interview schedule measure the variable it is designed to measure. The responses to the interview were also checked for consistency. During these discussions, additional information was gathered. The information gathered was used to polish and refine the research topic and also prepare appropriate research instruments. The information from the pilot study assisted to establish the reliability and validity of research tools as well as the information collected. Kerlinger (2000) perceive reliability as the accuracy or precision of a measuring tool.

The third approach was the use of methodological triangulation. According to Chilisa and Preece (2005), triangulation is a powerful tool that is used to reduce bias thereby improving the validity of the instruments. To achieve this, the study collected data from three groups of respondents - Hospital Management, Clinicians and Health Records staff at all levels on the same subject. This was geared towards the reduction of discrepancies during data analysis and improving validity.

## 4.8 Data collection procedures

This section provides information on how the researcher conducted the interview. Saunders, Lewis and Thornhill (2012) confirms that after the interview schedule pilot was tested, amended and the sample for the study has been selected, the next stage is to gain access to the sample.

In this study the researcher collected data with the assistance of two Research Assistants. After preparing a work plan, the researcher obtained research permit from the National

Council of Science and Technology. Due to the kind of research in the hospital setup, the researcher was concerned about the ethics oversight process. The researcher managed this process as follows. Initial ethics approval was obtained from the Human Research Ethics Committee at the two hospital and reported to the Chief Executive Officers (Directors) and informed them about the intention to conduct the research.

The response of those who were interviewed was written on paper and except for the two Chief Executives whose voices were recorded and transcribed for analysis and interpretation. During the interview, the researcher reminded the respondents the purpose of the interview. This had to be done because of the confidentiality of the information since hospitals deal with patient information. Respondents were assured that the information they gave would only be used for this research and that it would be handled with uttermost confidence thus clearing any doubts that the respondents may have had. Interviews ranged between 30 minutes and 1 hours and were recorded in hard cover books and immediately typed in computer.

## 4.9.    Field Study

The field study took place in two stages. The first stage entails the major fieldwork that covered a representative sample of three main categories of respondents including Medical Records, Medical Doctors i/c of Departments  and Nurses Managers i/c of Departments. Data was collected using a semi-structured interview schedules and observation forms. Second stage involved purposely sampled key informants who included the two Directors/ two Planning Officers / two ICTs Managers of the two Hospitals.

**4.1 0 Data Analysis**

Data analysis is the method of bring order, structures and meaning to the accumulation of information collected. Data analysis is perhaps the aspect of qualitative research that most evidently differentiates it from quantitative research. Patton (1990) describes qualitative data analysis as working with data, arranging it, breaking it into manageable units, synthesize it, determine what is significant, what is to be learned and choose what to inform others. He further points out that the qualitative researchers have a tendency to use inductive analysis of data, meaning that the vital themes come out of the data. Qualitative data analysis is first and foremost an inductive process of arranging the data into categories and recognizing patterns or relationships among the categories. Different from quantitative methods, main categories and patterns come out from the data, rather than being forced on the data before data collection. Qualitative data analysis search for common declarations on how categories or themes of data are interrelated and their implication. It involves recognizing coding, and categorizing patterns established in the data (Bryne, 2001). Qualitative data was in the type of text, written words, phrases or symbols relating or representing people, actions and events in the work atmosphere. Consequently qualitative analysis call for some creativity for the challenge is to put the raw data into coherent categories to study them in a holistic manner, and get a way to communicate this interpretation to others.

The researcher utilized grounded theory methodology to explore social practice in the utilization of EMRs in the two health facilities.

**4.10.1 Coding Qualitative Data**

During qualitative research, a researcher put in order raw data into conceptual categories and generates themes and concepts which are utilized to analyze data. There are three

kinds of qualitative data coding. The first one is open coding which is performed during a first pass through collected data. Open coding brings themes inside the data. The themes are at a low level of abstraction and come from researcher's initial research questions, concepts in the literature and extra. Axial coding is a second exceed through data to identify basis and consequences, circumstances, relations, approach, procedure and identify for categories or concepts that group together. By the time a researcher is ready for this last exceed through the data, he or she has identified the major themes of the research project. Selective coding involves scanning data and previous codes, and facilitates an in-depth understanding of interpretation and definitions of the situations presented.

## 4.10.2 Designing grounded theory study

### A) An open beginning and research questions

Grounded theory studies are usually focused on collective processes or actions: they ask about what happens and how people work together. This demonstrate the influence of representational interactionism, a social psychological approach focused on the meaning of human actions. Grounded theory studies commence with open questions, and researchers assume that they may know little about the meanings that compel the actions of their participants.

**Table 4.2. Fundamental components of a grounded theory study**

| COMPONENT | STAGE | DESCRIPTION |
|---|---|---|
| Openess | Throughout the study | Grounded theory methodology lay emphasis on inductive analysis. Induction analysis progress from specific to the broad. It builds up new theories from various observations. |
| Analyzing immediately | Analysis and data collection | In a grounded theory study, the researchers do not wait until data are collected sooner than beginning analysis. In grounded theory study, analysis should begin rapidly and continue in parallel with data collection to permit theoretical sampling. |
| Coding and comparing | Analysis | Data analysis relies on coding-a process of breaking data down into much smaller components and labeling those components and comparing data with data, with case, event with event, code with code, to understand and explain variations in the data. Codes are eventually combined and related to one another-at this stage there more abstract and are referred to as categories or concept. |
| Memo-writing | Analysis | The analysis note down many memos throughout the research. Memos are about events ,cases ,categories or relationships among categories. Memos are exploited to |

| | | encounter and record the analysis's developing thinking, as well as the comparisons made. |
|---|---|---|
| Theoretical sampling | Sampling and data collection | Conceptual sampling is core to grounded theory design. .A Concept sample is based on coding, comparison and memo writing. Conceptual sampling is designed to serve the developing theory. Analysis raises questions, propose relationships, emphasize gaps in the accessible data sets and censure what the researchers do not yet know. As a result of carefully picking participants and by adjusting the questions asked in data collection, the researchers fill up gaps, explain suspicions, test their interpretations and put together the emerging theories. |
| Theoretical saturation | Sampling, data collection | Qualitative researchers usually try to find out saturation in their studies. Often this is taken to mean that the researchers are hearing nothing new from participants. In a grounded theory study, theoretic saturation is required. This is a slightly different form of saturation, in which all of the concepts in the substantive theory being developed are well understood and can be verified from the data . |
| Production of a | Analysis and interpretation | The results of a grounded theory study are expressed as a substantive theory, to facilitate as a set of concepts that are related to one another in a cohesive whole. Since in |

| substantive Theory | | most science this theory is considered to be imperfect dependent on content and never completely final. |
|---|---|---|

**Source: Sbaraini et al, BMC medical research methodology 2011, 11:128**

B) **Preliminary, Purposive Sampling (before theoretical sampling was possible)**

Grounded theory studies are distinguished by theoretical sampling, but this involves some data to be collected and analyzed. Sampling must therefore commence purposively, as in any qualitative study. The reason and supremacy of purposeful sampling lie in selecting *information-rich cases* for study in depth. Information-rich cases are those from which one can gain knowledge of issues of significance to the purpose of the study. Researching on information-rich cases yields insights and thoroughly understanding rather than empirical generalizations, emphasis in original.

A sample of 90 respondents comprising 81 medical staff and 9 key informants was drawn from a target population of 463 using stratified and purposive technique on the basis of their responsibilities. The purposive sampling strategy provides to the researcher the best possible access to the process of effectively implementing EMRs in the two hospitals. The researcher had in-depth interview of all sampled staff in sessions of half an hour. The interviews were semi-structured loosely on research questions. Interviews were hand written and professionally typed in a computer.

C) **Data Analysis**

**Coding and the constant comparative method**

All qualitative research studies are unique and therefore, require unique strategies for analysis. Coding is important to the advancement of a grounded theory. According to Charmaz K. (2006) coding is the essential link between collecting

data and building up an emergent theory to explain these data. Through coding, the researcher defines what is happening in the data and begin to deal with what it means. Coding take place in stages: in preliminary coding, the researcher creates as many ideas as possible inductively from early data. In focused coding, the researcher trail selected data of central codes throughout the complete dataset and the study. This requires judgment about which preliminary codes are most established or important, and which contributes most to the analysis. In theoretical coding, the researcher filters the final categories in their theory and relates them to one another. Charmaz's techniques captures actions or processes by using gerunds as codes ( verbs ending in" ing"); Charmaz furthermore gives emphasis to coding quickly, and maintaining the codes as similar to the data as possible**.** The researcher has provided a worked example of coding below.

**Memo – writing**

During the study, the researcher put in writing extensive case-based memos and conceptual memos. Following each interview, the researcher wrote a case-based memos revealing on what he learned from that interview. The researcher utilized these memos to document his opinion about how and when processes took place. In these memos, the researcher made comparison between data, cases and codes in order to uncover similarities and differences.

**Mapping concepts, theoretical memo writing and   further refining of concepts**

Subsequent to theoretical sampling, the researcher commenced coding theoretically. The researcher fleshed out each major focused code, examining the condition in which they appeared and relationship among them. At the time of writing, the researcher had reached theoretical saturations. The researcher was able to establish this in several ways. As the researcher was becoming gradually more convinced about his central

focused codes, he had re-examined the data to get all available insights concerning those codes. The researcher had sought rigorously for events or accounts not explained by emerging theory so as to develop it further to give explain all of the data.  The theory, which is expressed as a set of concepts that are interrelated to one another in a unified way, now accounts sufficiently for all the data the researcher had collected and presented as the findings of this study. The researcher had utilized these procedures to develop a comprehensive framework of the process of implementing Electronic Medical Records in public teaching and referral hospitals in Kenya.

The researcher applied this stage as a principle for synthesizing and developing the final coding framework through a process of abstraction, in order to derive all the detail from the data and ensure that the coded elements that might have missed are simply captured.

Example: the researcher sought to learn from the participants the type of records system that exists in the two hospitals. In relation to this, two main codes were developed: (1) manual (2) electronic as illustrated below:

**Open Coding**

- Manual
- Electronic

**Axial Coding Stage**

At the next axial coding, both main categories were evaluated interchangeably to determine different sub-categories. For example, the categories of Medical Records System were identified as follows:

**Manual Medical Records System**

- Clinical Notes

- Treatment notes

- Indexing

- Medical Library/Registry

- Daily Bed Return

**Electronic Medical Records System**

- Admission process

- Patient registration

- Tracking of patient

**Selective coding**

Information for Electronic Medical Records System category produced the following

sub- categories

- Automated/ Fun soft

- Registration

- Inventory

- Demographic data

- Billing

**Open Coding**

Second example on coding included research question No. 4 inquiring how EMRs were

utilized in providing healthcare services in referral hospitals.

- Patient Registration

- Retrieval of Demographic data

- Payment of Bills

- Drugs requisition

**Axial  Coding**

- Registration

- Billing

- Patient tracking

**Selective Coding**

- Clinical purpose

- Inventory

- Statistics

- Reports

**Open Coding**

The other example being research question 5 which solicited information on challenges

encountered in the use of the EMRs in the two institutions

- Slow Internet

- System failure

- Staff resistance

- Staff attitude

**Axial Coding**

- Inadequate training

- Insufficient facilities

- System malfunction

- Negative attitude

**Selective Coding**

- Age of Staff

- Inadequate computers

- Insufficient Internet

- Lack of Stakeholders involvement

This means the researcher was able to pick up data from its original textual background and placed in charts that comprise of the headings and subheadings that were drawn throughout the theoretical sampling.

### 4.10.3 Observation Analysis

The research Assistant was engaged by the researcher to assist in collection of observation data.

The research assistants were asked by and large to uphold the position of a distanced observer. The Research Assistants being familiar with the systems being used in the hospitals were able to notice the various activities performed at the time they were carrying out the interview sessions and therefore obtained more information on databases used and networking levels within the two hospitals. The field notes taken throughout the observations were input into the analysis process. Notes had been written as soon as a meaningful observation was complete.

Observation comments were taken expanded as recommended by Anton (1996) into two parts: descriptive notes taken during observation part and analytical notes taken during the analysis procedure. Descriptive notes documented ICTs in the two hospitals information systems and their usage. Analytical notes documented interpretations of what

was observed for example database usage, networking and ICTs usage (general computer use).

Based on the observations carried out, majority of the participant showed great confidence in the use of Fun soft system while other staff appeared to be less experienced. The researcher also noticed that the Doctors had Tablet Personal Computers to use during their daily rounds in the hospital and searching for information regarding medical information. The researcher also identified several computers and printers located at set aside spaces within the wards and clinical rooms in both hospitals. Many medical staff example clinicians and nurses were also observed to be using laptops, smart phones, tablets and other personal computers during ward rounds and in their offices. The use of new technology seems to have influenced patients' awareness that the EMR system was being used within the two hospitals and their and their understanding that hospital seemed to be integrated. It was also found out that when patients move around the hospital they are not asked same information at different service points. This seems to have given self-confidence to patients knowing that all their medical data is stored in the hospital information system and is easily accessible.(Researcher's field notes).

The researcher also observed that several tools were being used in the process of providing services to the patients: included the Fun soft system, clinical records, diaries, medical forms in paper format, and patient notes, however, the most noticeable tool being the use of computer and the fun soft Electronic Medical System. These tools help in admission process and ordered the communication between patient /clinician in terms of service delivery. The information these tools contain then are integrated in the Fun soft Electronic Medical System.

### 4.10.4 Document Analysis

This involved reading the available hospital documents such as annual reports, strategic planning documents, brochures, hospital magazines and websites. Other documents examined include:- procedure manuals and annual reports; these documents were analyzed by identifying themes from data sets that related to the theoretical framework and research questions. Information derived from the documents was compared with information from interview schedules and observation notes.

### 4.11 Ethical Issues

Creswell (2005) point out that regardless of the approach to qualitative research it faces many ethical issues that surfaces during data collection in the field and in analysis and dissemination of reports.

This study, like any other qualitative research, involved the use of people as subjects. The respondents were made to appreciate that the research was to determine the utilization of EMRs in their hospital and that the research was for academic purposes; therefore, it would not cause them physical or psychological harm.

Based on this background and understanding, among the issues considered were to protect the participants from their identity by use of codes to conceal their identity.      All responses were anonymised before analysis and the researcher took particular care not to reveal potentially identifying details of places and the staff of the two institutions. Individuals and their departments they work were hidden by use of codes.

The norms of science advocate the search for truth as the driving force behind the creation of new knowledge (Odini, 2008, Bumer, 2001). According to this view, prime objective of research must be to investigate for the reality. Reality therefore was sought through

collaborating with the respondents, establishing confidence and creating understanding with the respondents. During the analysis of data precautions was taken to avoid imposing researcher's beliefs about electronic records in health faculties or hospitals.

In addition to the above ethical considerations, other deliberations were taken before commencing the study. The researcher:

1. Required permission from the National Council of Science and Technology as the scientific authority in Kenya, to carry out research within the country in the two health institutions mentioned above. The National Council of Science and Technology issued a research permit to the researcher.

2. Sought permission from the management of the two hospitals to conduct research in their institutions.

3. Sought consent from the respondents to voluntarily participate in the research and assured them that their rights to privacy would be guaranteed and in cases of the respondent's unwillingness to give certain information, then their right would be treated with utmost respect. The respondents were informed in advance about the purpose of the study and the relevance of their participation in the study.

4. The respondents were informed that their privacy and nonidentity would be uphold regardless of information being unveiled during data collection process .The data collected would be used for the academic purpose only. The researcher maintained openness and honesty during the period of the study without changing any arrangement agreed beforehand.

**Chapter Summary**

The chapter has outlined the methods used in the study. This study utilized the Research Onion model (Figure 3.1) as a framework for discussing the research methodology adopted.. The interpretive approach was deemed to best fit the underlying assumptions of this study using multi-case strategy for the two study organization. The approach was selected so as excerpt similarities in the two health institutions and to try and establish areas of generalization. Semi-structured interviews formed the primary data collection methods for this qualitative study. Respondents were interviewed from their offices or working environment. The interviews were written down in text format and then analyzed through coding of data. In addition, secondary sources like observation and other documentary sources formed part of collection methods.

The chapter also addressed the ethical requirements, which were sorted out before beginning of the research including seeking informed consent from respondents before the start of any interview. The main themes included seeking:

- Permission to conduct research from the NCST, which is the scientific authority in Kenya.
- Permission to conduct research in the two hospitals
- Informed consent from the subject to voluntarily participate in the research and assuring them of their right to privacy,
- Confidentiality of information given by respondents including purpose and use of the information.

The study adopted the qualitative multi-case research method. Data analysis approach was within case analysis where the data was compared against the themes identified from the conceptual model using the grounded theory.,

**CHAPTER FIVE**

**DATA PRESENTATION, ANALYSIS AND INTERPRETATION**

## 5.1 Introduction

This chapter presents analysis and interpretations of data obtained through interviews and observations on the utilization of Electronic Medical Records in provision of healthcare services by the staff of Moi Teaching and Referral Hospital and Kenyatta National Hospital. Glesne (2011) as cited in Hasanain and Cooper (2015) confirms that data analysis involves considering and sorting out what has been observed and gained from the data and making good judgment of it in order to relate it to other studies. During these interviews, data collected from the transcripts were kept in computer using NVivo 10 software. With the use of the NVivo 10 software , the researcher was able to manage, sort and organize the qualitative data, locate words, phrases and segments of data so as to prepare extracts quotes from the interview responses.

The overarching purpose of this study was twofold: To identify the implementation issues arising from the adoption of EMRs at the two Teaching and Referral hospitals – MTRH and KNH; and to make recommendations that address the challenges experienced including proposing a framework for implementation of EMR at teaching and referral hospitals in Kenya.

The findings of the study have been presented and analyzed in accordance to the study objectives under the following headings: Types of Electronic Medical Records generated and managed, Medical Records System, ICTs infrastructure supporting EMRs, Medical records automation and performance of the system, Needs for information for clinical support, Information sources, EMRs usage, EMRs introduction to users, EMRs utilization

in the hospital, Impact of ICT on medical services, challenges of usage of EMRs and Recommendation for improvement.

To provide some level of anonymity, codes were used in reporting findings from the respondents in two Public Teaching and Referral hospitals as shown in Table 5.1

**Table 5.1. To provide some level of anonymity, codes were used in reporting findings from the respondents in two Public Teaching and Referral hospitals**

| DESIGNATION | HOSPITAL | |
| --- | --- | --- |
| | CASE1 | CASE2 |
| Record staff | CASE1-RS | CASE2-RS |
| Nurse Managers | CASE1-NM | CASE2-NM |
| Director | CASE1-D | CASE2-D |
| Clinical Officers | CASE1-CO | CASE2-CO |
| Medical Officers | CASE1-MO | CASE2-MO |
| ICT Manager | CASE1-ICTM | CASE2-ICTM |
| Lab Manager | CASE1-LM | CASE2-LM |

## 5.1 Demographic Information

The respondents of the study as tabulated in Table 5.1 included Medical records staff, Nurses Managers, Clinical Officers, Medical Doctors, and Lab Manager. The study also

consulted key informants on who were purposively sampled to comprise the Directors of the two hospitals and ICT manager. All the targeted respondents were interviewed.

The ninety interviewed respondents comprised Medical records staff, Nurse Managers, Medical officers, Clinical officers, ICT Manager, Laboratory Manager and the CEO.

Table 5.2 provides a summary of the distribution of respondents by category.

**Table 5:2 Distributions of respondents**

| DESIGNATION | MTRH | | KNH | | TOTAL |
|---|---|---|---|---|---|
| Medical Record staff | 19 | 47.5% | 23 | 46% | 42 |
| Nurse Managers | 6 | 15% | 8 | 16% | 14 |
| Director | 1 | 2.5% | 1 | 2% | 2 |
| Clinical Officers | 6 | 15% | 8 | 16% | 14 |
| Medical Officers | 6 | 15% | 8 | 16% | 14 |
| ICT Manager | 1 | 2.5% | 1 | 2% | 2 |
| Lab Manager | 1 | 2.5% | 1 | 2% | 2 |
| **TOTALS** | **40** | **100%** | **50** | **100%** | **90** |

The table above show the number of respondents from the entire population of the study involved identifying and defining the population. The total sample of staff from the two public teaching and referral hospitals were 90 and their response to the interview was

100%. The main department of focus was medical records department of MTRH and KNH that were concerned with the access, use and maintenance of medical records for the patients. In effect, most of the respondents were drawn from medical department.

## 5.2. Types of Medical Records Generated and Managed

The first objective of the study sought to establish the type of medical records systems existing in Teaching and Referral Hospitals. Inherent in this objective was a determination of the extent to which electronic medical records are utilized in the two hospitals in the provision of health care services. This would serve as an indicator of which medical records are automated and types of electronic medical records generated and managed in the two health facilities. Questions 12 in schedule I, question 7 and 8 in schedule II and question 14 in schedule III were used in soliciting the information.

### 5.2.1   Medical Records System

Interview responses from both CASE**1**and CASE **2** indicated that both manual and electronic records systems were in use:

> *In my opinion, we generate the records manually; retrieval is also manual though the initial details of the patient are entered into computer electronically for facilitation.***CASE1-**RS$_1$

> *The electronic system is fully utilized in the registration of patient in that when manual register were not available then the staff could use the electronic system to access patient information*.**CASE2-**RS$_1$

The respondents in **CASE1** pointed out that records systems in majority of the departments had been automated including finance, nursing, health records and information services,

pharmacy, accounts, supplies, human resource, security, public relations *"Automation has been done in Health records, pharmacy, finance and nursing. This helps us to know patient records, stock and revenue"***CASE1RS1**. They further reported that the cardiac clinic and AMPATH clinics had their records, including those outside the hospital, in electronic format.

The ICT manager **CASE2** reported that slightly below half of the hospital processes were automated

> 40% of the hospital processes are automated that included the finance back and front desk services that is registration and discharge payments, supply chain or procurements in the store is also automated, health information system is automated, Pharmacy and inventory are also automated**CASE2ICTM₁**

It was further reported that the hospital had gone ahead and digitized four million files but the server crashed which ended the digitization as part of the automating the patient records. Respondents from this hospital had however different views regarding extent of automation of the registration department. Those that considered it fully automated, and those that considered it partially automated.

> ..the system is not fully utilized because we still give the clients the attendance cards. I feel the clients should not be given the cards but the system should capture all their details so that we become paperless.**CASE2RS**

What is actually automated fully is the registration of the patients .The other services are still manual. Like the patients files, a doctor has to look at them physically before the patient is treated.**CASE2RS1**

The ICT manager further explained that the health records were the first to be automated because the hospital need to ensure that all patients in the hospital were registered. The cashier or finance department was next. At the time of data collection, the doctor module which was being prepared for procurement. More computers were to be procured as well as tailor model tablets for doctors.

In both **CASE1**and**CASE2**, clinical procedures were being done manually; the clinical notes were handwritten and creation of notes in the wards were still on paper. This was attributed to present state of the records - the bulk of the management of the patients' files was in paper format. The library section in **CASE2** was also not automated *"they have not automated any service in the Library section and there are no computers in the department for keying in any queries"***CASE2 RS1**.

Some of these systems are being interconnected:

A part from registration of patient on EMR system; Pharmacy and supplies are interlinked in their operation and dispensing of drugs, procurement of drugs and also for stock control purposes.**CASE1-RS$_2$**

A point incase cited was the example of demographic information which when entered into the computer system, the same information could be accessed on any computer across different departments and units within the hospital. The system would generate report on which and how many out-patients and inpatients were attended on a specific day and discharged in the hospital or transferred to other health facilities.

*We use computers to capture patient information if you want to know where the patient was in the hospital, you are able to capture that information using the computer. We use computer to access clients' information such as x-ray and laboratory results, pharmacy or the bills of the patient in the hospital.***Case2 NM**.

Fun Soft electronic medical records system was used in both hospitals. In **CASE1**it was the system was used the registration of patients, billing of the patient both outpatient and inpatient which were reflected in all other departments and sections of the hospital on the network. It was also used for requisition of patient supplies, the dispensing of drugs of the patient in the wards. At the time of data collection, the system at **CASE1**also generated invoices for services provided for example drug dispensed, patient statistics. The staff were able to print receipts after payments and print gate pass for clearing the patient out of the hospital after discharge. In **CASE2,** it was used further to generate a central registration for patients indicating the name of patient, age, I.D. No, the gender, next of kin NHIF status. Although the software did not show the number of NHIF, it captures the patients No., marital status etc. Fun Soft software was considered "*… good since one is able to access the patients information very fast provided the information were captured correctly"***CASE2**RS∗

Registration points are automated when the patient comes in the hospital, registration takes place using the Fun Soft System**CASE1- ICTM**.

We use Fun Soft for nursing services, registration of patients, supplies and billing and it's because management provided it to us. This helps us to check patient records, stock and revenue collection.CASE**1-NM₁**

The fun soft electronic medical system is utilized for booking of patients to the doctors' registration of patients, payments of services provided especially when the nurses capture the bills then post them to the accounts section for payments. CASE**2**-RS

Different information is captured by these systems:

When we talk of electronic medical information, it is registration alone. For its important to capture information of the patient like demographic data for without it the patient will not be recognized by system.CASE1RS**1**

…this includes Patient information concerning their demographic information such as patients physical addresses, age, next of kin, residence, telephone number, occupation are generated in the system. CASE1RS2

The automated system is used for generating admission, outpatient and discharge reports which covers the numbers of patients that were seen, the age of the patients and their demographic patient information.CASE2 NM2

It [the electronic medical records system] generates reports on the census of the patients in the wards, patient information or statistics, outpatient reports, inpatient reports example the number of patients seen discharged, died or absconded and the information reports of the patients going to theatre.CASE2RS 3

Table 5.4 provides a summary of areas within the two hospitals that are automated and using Fun soft system.

**Table 5:4 Summary of areas automated for case 1 &2**

| DEPARTMENT | RECORDS AUTOMATED | EXTENT OF AUTOMATION |
|---|---|---|
| Health Records | Patient demographic data | Registration of patients in all service points |
| Nursing | Ordering of drugs | Requisition forms |
| Clinical | Not applicable | Not applicable |
| Pharmacy | Dispensing of Drugs | Dispensing register |
| Finance | Charge sheet | Charge sheet |

### 5.2.2 Manual Records

In terms of print records, the interviewees from **cases1 &2** indicated that observation charts, cardex, fluid charts, barograms, head injuries, treatment sheets, consultation forms, recitation registers, and equipment registers are all in paper formats. Fluid charts and other forms are at wards level and were put on bed sides of patients and when the patients were discharged; these forms were then put in patient files and stored in central library of the hospital. The EMR system was used in charging of supplies and dressing on daily basis using nursing modules.

Respondents Case 1 & 2 indicated: *that the Fun Soft system only generated patient information where the patient numbers were used to provide the accessibility of patient files. Everything else was manual. For example, the patient clinical records were not available electronically.*

Overall the findings show that most of the services in Case**1&2** were automated example registration of patients, supplies, dispensing of drugs, generation of hospital statistics extra apart from a few department and units; the major one being the clinical module for the doctors. The findings also demonstrates that manual medical systems will encourage poor quality reporting due to excessive work load; lack of data quality assurance; lack of feedback mechanism ; poor data storage and utilization for decision making in some cases; limited capacity for information use and dissemination; lack of data sharing and immediate feedback in reporting process.

## 5.3. Medical Record System

Objective 1 sought to establish the types of medical records system existing in Case 1 and Case 2.The respondents from different departments and units in Case 1 who responded to question 7 in the appendix I and question 3 in appendix II indicated that there are both manual and electronic medical records system. Respondents interviewed from Case 1 records department indicated that the patient files were stored in paper form while patient information were in the form of bio-data or demographic information was in electronic format. The patient information includes names of patient, age, next of kin, their occupation etc. The files on the shelves were filed numerically where the numbers were generated electronically.

Based on the respondents interviewed in **Case 1** indicated that: *there are two medical records system in place; the manual and electronic systems. The patients' notes were still in paper form while the patient demographic information was generated electronically.* The respondent had indicated: *that the Fun Soft electronic medical records system covers registration of patients, admission, discharge up to pharmacy for charging and dispensing of drugs but clinical procedures were being handled manually. The bulky of management of the patient files is clinical, the clinical module in the electronic format was not activated because of the limitation of the current fun Soft system.* Therefore, patient notes are handwritten, x-ray and lab results, and prescriptions are all manual. Therefore, Case 1 records system are both manual and electronic.

The findings from the respondents from **Case 2** when asked on the medical records system in existence indicated the following: *"that the records systems that exist are both manual and electronic systems."* The respondents indicated that the Fun Soft electronic system being used in Case 2 is billing for the patients and the civil servant patients which reflects in other sections in the hospital before the patients receives the handwritten invoices by the accounts office. The laboratory and x-ray results were not transmitted electronically in the hospital but they are printed out and placed in the pigeon holes for the records officers to pick them for filing in patient files and pass them to clinicians for medications. The findings demonstrated that there were both manual and computerized systems that were in existence at Case 2.

These results imply that the two health institutions operates two records systems both manual and electronic medical records systems. This of course brings limitation in terms of accessing patient information and delays decision making in patient care.

### 5.3.1 Manual Records system

Patient information in many hospitals in Kenya is recorded on papers. Miller *et al* (2005) recognize the shortfall of these paper-based records as including illegibility, vagueness, incomplete data, inaccessible and data disintegration. Laerum (2003) points out that recording of patient information on papers hinder the continuity and quality of care for patients. As pointed by Currie and Finnegan (2009), these are the challenges that electronic medical records seeks to tackle. To be specific, Chaudry *et al* (2006) states that electronic medical records use would be prompt, completeness and accessible

A Case 1 RS indicated the following: *In my opinion, we generate the records manually and they are also stored manually, retrieval is also manual though the initial details of the patients are entered into an electronic Fun soft system to facilitate retrieval.*

The respondent from Case 2 indicated:

*We have manual system. Entering registration of cards, booking of patients' appointments is still manual. However, we still use EMR called Fun Soft for registration of patients..*

A Case 2NM was quoted saying: *The record systems that exist are in both manual and electronic systems. The fun soft is used for billing the inpatients and the civil servant patients which reflect in other sections in the hospital, before they have written an invoice by the finance/accounts sections. The results are not produced electronically but they are taken to the pigeon holes for the records officers to pick .The dispatch register are filled manually when the results are cancelled.*

*Fun Soft for registration where it starts with admission then to the ward and discharge.*

In other words the use of EMR systems requires a sufficient quantity of hardware

in practices, including computers, phone lines and internet connections. Lack of these 'basic' facilities/hardware needed to support EMR implementation are the issues that blocks the widespread adoption of EMRs. Further, in such practices, the start-up costs associated with setting up EMRs will be higher as more resources are needed.

### 5.3.2 Electronic Medical Records system

Wamae (2015) confirms that the application of electronic medical records has diverse advantages over paper records; these comprise: easy access to medical records from distant locations, enhanced speed and quick retrieval of records, possibility of unveiling nonstandard results and the abolition of hand written prescriptions, which minimizes the incidences of prescription errors. Further benefits are the real time access to patient records by multiple users and the capacity to perform data queries to inform decision making.

The respondents in Case 1 indicated that the electronic medical records system called Fun Soft is used for the registration of patients, billing of the patient both outpatient and inpatient which were reflected in all other departments and sections of the hospital on the network. The respondents from nursing department indicated that they use the Fun soft information system for requisition of patient supplies, the dispensing of drugs of the patient in the wards and for the billing of the patients.

Case 1 RS was quoted saying:" *we use computers to capture patient information; if you want to know where the patient was in the hospital, you are able to capture that*

*information using the computer. We use computer to access clients' information e.g. x-ray and laboratory results, pharmacy or the bills of the patient in the hospital".*

The respondents interviewed in Case 1 indicated that patient results for x-ray, lab and other tests are not generated electronically but billed using the Fun Soft system. The Case 1 ICTM indicated that the ICT system is operating in the hospital with several modules. The respondents was quoted saying that: *apart from electronic medical records system, we also had other systems: Clocking time management system which is able to monitor staff time in and out of the hospital, payroll management system for paying staff salaries, Nursing system used for schedules, Finance Information System for information reports, cash collection and also used for integration with NHIF etc.* The respondent indicated that the hospital first started with the hospital management information system (HMIS) in 2006 and later automated medical records system (AMRS) in 2010 and changeover to Fun Soft in 2013. Respondent indicated that these systems were in health records and information systems, nursing, Finance, Human Resource and also in security for clearance of patient after discharge.

The Case 1- ICTM was quoted saying that: *"the ICT department had not automated any services in the library section and there were no computers in the library for keying in any queries but indexing, revenue collection, admission and discharges have been automated"*

The respondents from Case 2- RS indicated that: *the registration process of the patients' information entered in computer system and once the information was entered in the computer, the patient is assigned a registration number and the same patient information is entered in the manual register and a file is opened using the assigned number.*

One RS from Case 1was quoted saying:

*" In my opinion, we generate the records manually, retrieval is also manual though the initial details of the patient were entered into computer electronically for facilitation".*

The following are some of the remarks from Case 2 respondents:

*"Sincerely, what is automated fully is the registration of patients. The other services are still manual; like files, a doctor has to look at the files physically on patient treatment. The only thing that is automated is the patient information (Bio-data)".*

The electronic medical records covers patients' information which could be searched and retrieved on the computers, pharmacy uses the system for drugs administration, finance receives payments from the patients for the services provided, and supplies have a system for ordering supplies within the hospital. The doctors' notes and the prescriptions are still manual. These results from the analysis indicate that the Case2 has two medical records systems, both manual and electronic systems.

The findings from the interview indicates that the electronic medical records systems generates outpatient reports, inpatient reports, admission reports especially the number of patients seen in the hospital, patient discharged, death and absconded, reports on patients going to theatre etc.

The changeover to electronic medical records is dictated by limitations in paper based records that comprise temporal, spatial, and monetary constraints associated with continued paper-based record accumulation and compression over time ( wamae, 2015).

Furthermore, paper-based systems have inadequate functionality; several people cannot easily view the same record at the same time (Hwang *et al*., 2009). Having electronic medical records can assist medical professionals in their decision-making and also

enhance working efficiency, therefore, improving medical care quality (Hasanain & Cooper, 2014).

In this study interviewees recognized the importance of an integrated Facility management System that can carry out capturing of all clinical data especially data at the clinic level across the two hospitals; consider the possibility of integrating the pharmacy systems and laboratory management systems with the patient monitoring systems to improve reliability of data and avoid redundancy of data held in several systems.

## 5.4 Organization Infrastructure Supporting EMR Implementation

Several parameters were used in addressing objective two of the study that sort to determined adequacy of the organization infrastructure in supporting the application of EMR in provision of health care services. The facilitating conditions and efforts that is the setup and preparedness of the two health institution to adopt EMRs. These were broadly categorized into three: Administrative, social-economic, regulatory and technological support systems. Research Questions sought out information to what extent do the existing administrative, social-economic, regulatory and technological support the application of EMR in referral hospitals?

**Table 5.5: Established themes relating to available EMR organization infrastructure**

| AVAILABLE ORGANIZATION INFRASTRUCTURE SUPPORT SYSTEMS | | | |
|---|---|---|---|
| **Administrative** | **Social-economic** | **Regulatory** | **Technological** |
| 1.Implementation process | 1.Organization environment | 1.policies | 1.Training |
| 2. Management support | 2.Government encouragement | 2.procedures | 2.Perceived usefulness |
| 3. Project planning | 3.Well trained staff | 3.Legal framework | 3.Quality of technology |
| 4. .Availability of Human resource | | | |

### 5.4.1 Administrative

### 5.4.1.1 Administrative Support System

Administrative support system was recognized as the main themes emerged from the analysis. The suitable and effective training and support should be offered to ensure that the novel system really works (Carnall, 2007). It is also important to have a manual book to assist the end-users on EMRs operations. This was found as a basic requirement in the management of the EMR system.

### 5.4.1.2 Financial Planning

An additional significant aspect of EMR managerial planning entails finances:

"The third challenge absolutely is cost." The study revealed that the two hospitals were going through challenges with their budgets due to insufficient allocation of budget from the Government and the actual cost of EMR implementation: *"The other problem is the underestimation of the budget from the Treasury. The two hospitals should have a very good financial plan and should have the exact required amount of budget for each of the multiple projects of the implementation. Otherwise you will run out of your budget."* (**Case 1 & 2D**)

*This view was confirmed by two other interviewees:*

*"There should be a suitable level of financial and human resources."* (**Case 1 & 2 ICTM**)

Finding from this study suggests that high ongoing costs in addition to the start-up costs, implementing an EMR system requires extensive commitment to system administration, control, maintenance, and support in order to keep it working effectively and efficiently. These costs include the long-term expenditures incurred in monitoring, modifying, upgrading and maintaining EMRs, which will be significant. As these costs are very high, there are inadequate financial resources to cover them, in the two public hospitals.

### 5.4.2  Planning the Implementation Process of EMRs

The major plan of an implementation framework is to provide direction on the adoption of a new system and give consistency in interpretation (Hanainan, 2014). In addition, utilizing an implementation framework is viewed as a critical step for making it easy for a timely implementation (Jones & Smith, 2001).

Therefore, the implementation framework consists of the following three phases:

**Readiness or pre-implementation phase**

This phase of the EMR implementation centers on the two health institutions readiness which take account of the engagement meeting phase, an assessment phase, and a Preparation and Planning Phase.

This entails planning the implementation budget and funding, data transfer activities, and choosing the right vendor for the EMR system.

**Implementation phase**

The implementation phase of the EMR centers on arrangement issues, such as managing EMR implementation tasks, recognize new reported requirements for the implementation and get ready the organization for the implementation. This phase also comprises extra tasks such as training and preparing staff to launch the new system.

**Post-implementation Phase**

Post-implementation phase also known as Adoption and maintenance where several activities are supposed to be performed when the new system is up and alive and being used in a hospital organization. Examples of the tasks include among others ensuring authenticating entered data by end-users and offering continuous support services to end-users as well as support services for leaders.

Therefore, Planning includes all features and concerns that interviewees from the two health institutions considered essential when planning to implement an EMR system, It integrates those characteristics that require to be put into consideration duration of the pre-implementation, implementation, and post-implementation stages. The interviewees

considered planning as indispensable to successful implementation and affirmed that poor planning is one of the key reasons that EMR implementation not succeed in the hospitals. One medical officer noted *"To be sincere here we have a major problem in planning. This means that we should plan first. We should do the planning before anything elset"* (**CASE1**MO). Another Clinical Officer stated:

*"If we do not have an implementation model plan, then the implementation process will not succeed fully" (***CASE2CO₂**).

## 5.5 Social-economic

## 5.5.1 Training

Interviewees expressed divergent opinions and detailed various experiences with training. For instance, an interviewee from Case1: M1 & C1 stated that not all end-users are trained: We are not trained because our clinical module is not procured,

Another MO from Case 2 stated that hospitals require to make sure that all end-users are prepared to utilize the new system:

*"One require to recognize if the workforce is prepared or not for the implementation and utilizing the new system. Their commitment, their knowledge, their IT skills, all these skills required to be in the staff. Every hospital that is planning to shift to electronic system they require to ensure first that the end users are well prepared in terms of training."*

The above interviewee made it clear that end-users require being prepared, in terms of their knowledge and skills, to be capable to utilize the new system. A number of studies recommend that hospitals demanding to implement an EMR system will require to

embark on end-user readiness assessment ( Hasanain &  Cooper 2014). An end-user readiness assessment would assist to establish the required level of training and which training approach would suit best (Aanestada & Jensen, 2011).

An interviewee from the private ward of Case 1 gave an explanation how training was critical to the hospital's EMR implementation process.

*"First of all there is no single person in private wing that does not have skills to use Fun soft and one will not be deployed to work in private wing of the hospital except they first take a training session on how to use the new system. Secondly, all supervisors or managers of each department also requires to ensure that all staff members in their Departments are able and have attained required training for using the new system"*

ICTM from Case 2 attested thus: *"At the moment we conduct a surveillance to know what troubles and challenges that end-users are facing when utilizing the Fun soft system. Majority of the time the single concern that the users are raised is the time concern in terms of accessibility."*

*ICTM further confirmed that after training sessions are carried out, the hospital conducts a surveillance process to identify any setbacks with the system and if users are experiencing complications engaging with it. Furthermore, the interviewee confirmed that time allocation is a concern when it comes to training sessions.*

Another interviewee from Case 1 made it clear that training was embarked on across an entire year. *"We carried out the training for a whole one year. We have a planned calendar, for example if one of the staff proceeded on a holiday and require a refresher training on how to use the system after leave such training sessions were accessible*

*throughout the period during that training year. Particularly for the personnel working in the reception areas of every department would require the updates of the EMR system"*

*Then interviewee added:*

*"The training sessions were not provided to the medical officers since the current system does not have the clinical module. The interviewee also pointed out that: " unique and customized training sessions specifically for the medical officers were yet to be offered. Medical officers above the age of 60 years were found to be resisting to utilize the new system. As a result, nurses were trained to use the system on behalf of the medical officers, examples undertaking data entry and other related tasks".*

Case 2 had provided serious thought to aspect of training to make sure that personnel have the right skills to use the system: The ICTM revealed that"

*"The hospital has in place an established Computer department that deals with all request of training for new staff and there is no personnel newly engaged who work in the hospital without being trained about utilizing the Fun soft system. And after every training session the staff requires an approval for accessing and utilizing the new system with being assigned rights to use the new system. The training period has three sessions; training sessions, testing sessions and live session. Training session is when the staff is required to go to training room and be trained as much as they want and utilize the computers and can do whatever they require in order to familiarize themselves about using this new system. This will assist them to reduce the fear of using the system.*

*The hospital still has a number of customized training sessions specifically for Medical Records personnel with diverse skills and abilities. Training phase was one of the main challenging and long phase of the implementation of the system."*

*Majority of the interviewees pointed out the significance of having focused sessions offered for medical officers:*

"The hospital requires providing one-on-one training sessions for the medical officers, since they're a major group in the implementation phase that by no means needs to be successful."

Another Interviewee said: "in addition the hospital needs to have a champion user. This champion user would be that ambassador of the Computer manager. These champion users must be involved in the implementation process."

The interviewee pointed out that the training phase had been a very challenging and extensive phase of the implementation phase. The two health institutions provided particular sessions for new employees, in which newly recruited personnel were put on test to determine whether they had the required skills to use the new system. Based on the previous interviewee's comments, it appears that the two hospitals had put great importance on the training aspect.

In **Case1** the respondents confirmed that there were constant medical education in the hospital where computer personnel directed other staff from other departments on the operations of the Electronic medical records system and specifically there was training on the operation of fun soft electronic system but not everyone across the hospital had been trained in the use of the system and the basic computer skills. The training was offered once at the time the system was being introduced but was not continuous.

The interviewees from **case1-MO** were quoted saying:

*We should have been included in  the training from manual to electronic system.*

*Need for training of all the staff on the use of the system to digitalize everything for the purpose of the system and everyone in the hospital.*

*One respondent indicated that when the system was introduced the developer of the system had two day training for some staff in the hospital in shifts.*

The findings of this study indicate that Electronic Medical Records are hi-tech systems and, as such, include complex software. A certain level of computer skills by both Clinicians and other users is required. Further, there are still some technical problems with EMRs, which lead to complaints from physicians, and they need to be improved. Therefore, barriers exist related to the technical complexities of the systems, the technical capabilities of the physicians and other users. Further, good typing skills are needed to enter patient medical information, notes and prescriptions into the EMRs, and therefore some users of the system lack them. The result of the current study proposes that as computer literacy levels increase, consequently staff preference for using EMR systems. Client acceptance is major factors for successes in EMR implementation, a lack of practice with using EMR system continue among array of professionals and administrative healthcare staff.

### 5.5.2 Perceived usefulness

Introduction of EMRS and its Utilization in the Hospital

Having electronic medical records can support medical professionals in their decision-making and also improve operating efficiency, thus improving medical care quality (Ayers et al., 2009). Users' perceptions on technology can affect how a new technology is conceptualized and if it will be accepted and further used.

This study sought to establish how the Electronic Medical Records System was introduced in the two hospitals and its utilization.

### 5.5.3 Stakeholders involvement

The Medical specialist, Information specialist and other Stakeholders involvement is very important aspect to be considered at the time of implementing an EMR system. This was one of the emerging issue that was pointed out by the interviewee.

Respondents from **Case 1** were quoted saying: *"the system was introduced without my knowledge ,we were not consulted at any point but instead we were told to start using the system , some of us now are not conversant with the system and its now when we are learning it ."*

*I wasn't consulted on a personal basis though there was a team of people in our hospital who were in the committee representing us but I wasn't involved as a person."There are people in senior positions who were involved and consulted"*

*One **NM** in **Case 1** indicated that hospital heads were involved and consulted before the system was introduced .personally I wasn't involved.*

Hasanain (2014) was quoted *"People when are engaged to take part in something from the start, by the end of the project they will accept it. However, if you were developing and designing a system, example for three years, and individuals have no clue about what it is going on, and then unexpectedly you inform them that you're going to utilize that system, everybody will refuse to accept."*

Establishing Fun soft champions, as well as end-user involvement, were recommended as strategies to defeat or reduce the confrontation problem specifically, medical officers

'resistance. The earlier interviewee also pointed out significance of involving the users of the new system from the beginning to reduce the possibility of resistance.

The result of the research indicated that the staff at all the registration points were trained except those who were hired later underwent on- the-job training . The training was ongoing since there were new modules introduced or developed. Respondents from other departments in the hospital  pointed out that they were involved  in the initial stages where they were provided the processes and the procedures that they  were undertaking in their departments  which were captured and  customized and the staff were also  trained on the new system.

It was further learnt from research analysis that most of the departments in the hospital were involved in the initial training of the use of the fun soft, staff were involved in the basic training before the system was rolled out. There was also awareness training where majority of staff were informed of the new system. It was further noted that there were groups of staff who had no basic training on the fun soft system. These staff are not conversant on how the system works and its benefits though the hospital had a training centre where staff are supposed to pay for the same training. Further analysis of interview data indicated that the staffs from the ICT department continue training of staff in the fun soft system. Staff from different departments across the hospital were called in for training on the new system. It was also learned that Staff from clinical departments had not been trained since the clinical module had not been fixed. This analysis of the data indicated that since the initial training was  not comprehensive therefore  their limitation on the use of the fun soft system particularly when system fails to operate  its always the ICT staff have to be called to sort out even  the basics i.e. hanging of the computers hence delays of the service to the clients.

The respondents at Case 2 indicated that the hospital provided enough support on ICT training particularly on the functions of fun soft. There were staff who trained on electronic system and train other staff after they had acquired knowledge from the training.

One respondent was quoted saying: *"I was not consulted on a personal basis though there was a team of staff in the hospital who were in a committee representing different departments ,but I was not involved as a person . These were senior people who were involved and consulted".* The respondent pointed out that there is need to involve all staff before any system is introduced. Some respondents were not clear which system existed since the staff were not involved at the time the management were procuring the fun soft and they indicated that there was need to take all staff through short training on the fun soft system. There were no basic skills on data entry and no competitive skills acquired particularly on the use of the new system.

From the analysis the bottom line of the success of the fun soft system is to offer training to all staff and involve all users of the system in all phases that is from the initial stages when the system is being introduced until the last point; since the staff are the ones using the system.

**Case1 RS** was quoted saying:*" I am not badly off on ICT though whatever is helping me are the skills I acquired many years ago in college. My employer had not provided me with any training on ICT and use of fun soft. In fact I had a nasty experience in the way I was introduced to the system. No one was there to take us through the training but we were told to stop using the manual charge sheet on recording patient information and start using fun soft. Although I have not been trained by the hospital, the hospital has*

*been training other staff on the use of the system but in phase , therefore some of the staff are not conversant with the system".*

Other respondents noted that the introduction of the new system was not well done , the staff expected the management to be involved and have the staff trained but the time the system was introduced they were told to stop using the manual system and start using the new system – fun soft .

Some respondents; the Doctors and Clinical Officers indicated that they had not been trained and used the system since they have no clinical module .and therefore they are not involved or consulted.

The researcher's judgment is that offering successful training sessions for all possible users. These EMR enablers have been proven to be factors that can make easy implementation and potentially lead to accomplishment of EMRs.

The respondent from the nursing department indicated that they were involved and consulted in the design of the electronic medical records system.

Some respondents noted that they learnt of the new medical system when they needed patient information, therefore they did not know which system existed, and they also do not know how the system was introduced or how it works.

From the above analysis, it is noted that the Clinicians and other health workers were the main users of the system and therefore there was need for them to be informed and involved, educated about the system. The developer of the system and the management should have cascaded the information of the system to all hospital staff. It was also noted that in the two institutions, the clinician module had not been implemented and therefore EMR System is not fully implemented. The clinicians and other health workers must

perceive ICTs positively. Where there are challenges with technologies, they should seek to have those challenges addressed.

The two hospitals must also be in the forefront in raising awareness and use of ICTs in the provision of services to their clients by organizing seminars or conferences that bring together clinicians, Medical records personnel, hospital administrators and other policy makers. Respondents indicated that Senior Management of MTRH visited the Rift Valley General provincial hospital where the system was functional. The study findings had shown that most of the services in Case 1 and 2 were automated apart from a few department and units; the major one being the clinical module for the doctors. Different reports were also being generated by the electronic medical records system.

According to the interviewees if change of way of life required to go with a switch from the use of paper to an EMR system does not happen in the two public hospitals, this leads to sluggish adoption of EMR systems. The ambassadors to EMR adoption require to powerfully encourage the clients to the system to trust that the adoption will bring benefits and require to stimulate the other stakeholders to partake in the entire change process , The management therefore require to encourage the Clinicians and other users of the system to get a buy-in and attain a shared objective, for successful EMR adoption. Lack of proper planning for EMR implementation was seen as a major predicament that required to be considered at the beginning in CASE1. The interviewees from this hospital pointed out a number of aspects that require being included in the planning process. These features incorporated: policies and procedures, financial planning, vendor selection planning, and training.

**5.6 Regulatory**

**5.6.1 Policy and Procedures Planning**

Policy addresses the regulations of an organization that guide it to be reliable and compliant with the organization's direction, vision, and aims (Hasanain & Cooper, 2014). Procedures, on the other hand, are the clear instructions that require to be utilized with the intention to execute the policy as well as have timeframes for accomplishing policies. Majority of the interviewees pointed out to the value of policy and procedures planning. They revealed that, without proper planning for policy and procedures, EMR implementation is likely to be impracticable to accomplish. According to a RS2 from Case 2 was quoted saying:

*"If EMR implementation is not built on policies and procedures, it would be almost unattainable to automate it or implement any EMR."*

*"RS2 from Case 2 was also quoted saying: The Policies and procedures… these are the most essential part that many people overlook or don't really consider. If you don't have clear policies and procedures, then you don't have high quality arrangement about how to implement the system. Having policies and procedures would make the implementation more likely to be successful."*

Furthermore, some of the interviewees from **Case1** pointed out that policies and procedures must be accessible, feasible, and documented. For instance:

*"These policies and procedures must be available and the organization requires to know how to apply them."*

*"In order to implement such a system policies and procedures require to be accessible, documented, and understandable."*

One more interviewee **(Case2MO)** confirmed that they were facing challenges in implementing the hospital EMR system. One of the challenges they recognized was that a number of policies and procedures concerning implementation were not documented:

*"One of the many problems that we faced is that some of the policies and procedures were not documented and not written."* (Interviewee 6)

The existing literature recognizes Policy and procedures planning as one of the precedence for EMR implementation (Hasanain & Cooper, 2014). The value interviewees placed on policy and procedures planning support what a number of authors have also pointed out in the literature.

The results of the study indicate that there was lack of policy on implementation of EMRs in the two institutions. Furthermore, this points out that while respondents recognized the value of bottom-up control in implementing policies, all obstacles and enablers recognized have tendency to have a strong top-down control. Policies and procedures require being accessible, feasible, and understandable. For instance; they in the same way highlighted the possible harmful consequences of missing out policy and procedures in place. It is apparent that the two public teaching and referral hospitals require to effect these policies and procedures competently to the end.

### 5.6.2 Financial Consideration

The two FO from Case 1 and 2 indicated that an important aspect of EMR organizational planning involves finances. They were quoted saying:

*"Finances is a critical requirement for the implementation of EMR."*

The two public teaching and referral hospitals are facing challenges with their budgets owing to undervalue the actual cost of EMR implementation from the Government part. It was also discovered that EMR implementation entail the implementation of manifold projects where each element requires to be properly budgeted. EMR roll-out go along with the implementation of elements such as training of staff, hiring of staff, purchase of hardware and software etc:

The FO from Case 1 was quoted saying: *"The other challenge is the undervaluing of the budget. One have to have a very good financial preparation and one have to have the precise required amount of budget for each of the various projects of the implementation; Or else one will run out of your budge.*

This view was confirmed by two MOs from Case 2:

*"There should be proper level of financial and human resources."*

*"There are several barriers such as… mainly the price and cost"*

One of the interviewee articulated a similar view, but also pointed out that the budget requires covering the vendor's support service on an annual basis:

*"Yes, we have a budget for the implementation and support contract with the vendor. Every year there's a specific budget for this contract."*

Generally, the interviewees highlighted the requirement for sufficient financial plan for EMR implementation in the two hospitals. They also pointed out the need for taking into account other continuing costs that would go along with the implementation, such as support and maintenance.

Several authors have highlighted the importance of sufficient financial planning for EMR implementation. The major findings of the research from the two hospitals included poor consideration of financial approach for EMR funding and sustainability (Hasanain &Cooper, 2014, Wamae, 2015). The Government was providing insufficient funding to the EMR project in both hospitals.

The majority of Interviewees revealed that EMR implementation needs the implementation of manifold projects where each element needs to be properly budgeted. Generally, the interviewees pointed out the need for an sufficient financial preparation for EMR implementation in the two hospitals. They also acknowledged the requirements for taking into consideration other current costs that would accompany the implementation, such as support services. It has been exposed that the two public teaching and referral hospitals need to ensure that the financial preparation is sufficient enough which includes all foreseeable or expected initial, ongoing, and long-term operating costs. Several of these operating costs are more immediate, such as hardware and training, while others reflect long-term expenditures, such as maintenance, upgrades of EMRs and human resources required to run the system.

### 5.6.3 Staff Training

Interviewees articulated diverse opinions and narated various experiences with training. For instance, one of the interviewees from **Case1 MO** stated: *that not every end-user is trained. "The staff in medical and Surgical departments pointed out that they are part of the  hospital personnel and however,  they are yet to be trained to use Fun soft system"*

One **Case 2 MO** emphasized that hospitals require making sure that all clients are trained to use the system:

*"One require to know if the workforce is well prepared or not for the implementation and utilizing the system. Their dedication, their acquaintance, their IT competency, everyone of these skills require to be in the staff. Every hospital that is planning to shift to electronic system they require to ensure first that the clients are well prepared in terms of training."*

The same interviewee made it clear that clients require to be well prepared, in terms of their acquaintance and ability, to be capable to utilize the new system. Many studies propose that hospitals requiring to implement an EMR system will need to embark on a client preparedness assessment (Hasanain & Cooper 2014). A client preparedness assessment would assist to recognize the necessary level of training and which training strategy would suit best (Aanestada & Jensen, 2011).

Another interviewee from the private sector of **Case 1** clarified how training was vital to the hospital's EMR implementation process.

*"Foremost, there is no single person in private wing who does not have competency to use Fun soft and an individual will not be deployed to work in private wing of the hospital except they first take a training session with an IT staff to train them about how to utilize the system. Secondly, each supervisor or manager of each department too requires to ensure that each staff member in their Departments are able and have received required training for utilizing the system"*

***Case 2 ICTM*** *testified thus: "at the moment the department performs a surveillance to identify what troubles and challenges that clients are facing when utilizing the Fun soft system. Nearly all the time the only apprehension that the users are indicative of is the time concern in terms of accessibility."*

The Case 2 ICTM pointed out that subsequent to training sessions are carried out, the hospital carry out a surveillance process to establish any troubles with the system and whether clients are undergoing difficulties using it. More so, the interviewee confirmed that time is a challenge when it comes to training.

Another interviewee from **Case** 1ICTM pointed out that: *training was carried out across an entire year."We carried out the training for an entire year. The hospital has a fixed calendar, for example if one of the staff proceed on a holiday and need to remind themselves after leave on how to use the system such training sessions were accessible throughout the training year. Especially for staff in like the reception areas of every departments would require the updates of the EMR system..."*

**Case 1 ICTM** further stated: *The training sessions were not offered to the medical officers since the current system does not have the Clinician module.* The interviewee further pointed out that: *unique tailored training sessions specifically for the medical officers were yet to be offered. Medical officers above the age of 60 years were reported to be rejecting to utilize the system. At the same time as a solution, nurses were trained to utilize the system on behalf of the medical officers, with the task of data entry and other related tasks".*

**Case 1** have given considerable thought to parts of training to make sure that staff have proper skills to use the system: The **Case 1 ICTM** revealed that:

*"As IT department we receive requests of training for new staff and therefore all new employees who work in different sections within the hospital are trained about using the Fun soft system. And after having this training the staffs are assigned rights to use the system and only those that have the required skills. We have three different training environment; training environment, test environment and live environment. Training*

*environment is where a training room is provided to the employees for training session at any time and uses the computers in order to familiarize themselves about using this new system. This will assist them to reduce the fear of utilizing the system.*

*We also have some tailored training sessions especially for Medical Records staff with various skills and capabilities. Training phase was one of the most challenging and long phase of the implementation of the system."*

Most of the interviewees pointed out the value of having specialized sessions offered for medical officers: *"We need to provide one-on-one training sessions for the medical officers; since they're a determinant group in the success of the implementation phase.*

A different Interviewee said: *"we also need to have an ambassador of the system who will be a representative of the IT department. These champion users must all through be involved in the implementation process of the new system."*

The interviewee pointed out that the training phase had been challenging and extensive phase of the implementation. The two hospitals provided special sessions for newly engaged personnel, in which the new staff were tested to determine whether they had the required IT skills to utilize the Fun Soft system. According to the previous interviewee's suggestions, it is seen that the two hospitals placed a large emphasis on the training features.

Interviewee pointed out that users of the system require being prepared, in terms of their acquaintance and training, to be capable to utilize the new system. From the findings of this study it is possible that staff do not have the required knowledge and training to effectively utilize the new system. Equally, if the users of the new system are appropriately trained, they will be well placed to use the new technology and more ready

to engage with the go-live phase. Well-tailored training sessions exclusively for the medical staff should be offered. This also means to have some tailored training sessions particularly for staff with various IT training and capabilities. All Nurses should be trained to utilize the new system on behalf of the medical officers to embark on data entry and other related tasks.

## 5.7 Technological Support

These include the computers, Internet and Software required supporting the Electronic Medical Records in the two health institutions.

### 5.7.1 Technological resources

The interviewees considered technological resources as critical in the implementation of EMR system. Example interviewee from **Case2 MO** were quoted saying:

*"the system will not operate effectively without resources"*

*We need sufficient computers and software that runs our services" the clinical module is missing to make the Fun soft system fully operational.*

Interviewees from the two hospitals confirmed that there was need to ensure that the technological resources are accessible to enable the new system to operate. More so, the staff from the two hospitals pointed out that the main problem concerning the EMR implementation was to understand how to use the Fun Soft. This as well involves the constant development and updates of the EMR system.

Hasanain & Cooper,( 2014) notes that lack of acquaintance about and previous practice using new technology could harm the implementation process, to the point that it could

lead to unsuccessful implementation. There is also a requirement for proper training and education for the users the system in computer literacy.

Therefore; technological support considered the availability and sufficiency of all technical requirements and components including software, hardware, and networks. Overall majority of Interviewees were skeptical about the technological support systems for the EMR implementation. The interviewee from Case 1&2 indicated that: *the use of EMR systems requires sufficient quantity of hardware in practices, including computers, phone lines and internet connections. Some departments lack these 'basic' facilities needed to support EMR implementation…. this issue blocks the widespread adoption of EMRs… Further, in such departments, the start-up costs associated with setting up EMRs are higher as more resources are needed (*CASE **1&2ICTM***)*

### 5.7.2 Computer hardware and Software

The medical records staff and Hospital Management were asked to explain how the ICT infrastructure that supports electronic medical records was put in place, reasons for adopting the use of ICT and the areas where ICT was applied in the hospital (Research questions 5 and 6 in interview schedule 2).

The respondents from CASE1indicated that the hospital had local area network where all computers in the hospital are connected with one main server. Respondents across the hospital gave an example of Fun soft Electronic Medical Records System which had computers connected in both private wing 1 and 2, mother and baby, eye clinic, consultation clinic , sick child clinic , mother and child health, casualty and emergency and most of the wards. This system assisted in the registration of both inpatients and

outpatients in the hospital. All patients in the system can be tracked in terms of the services they have received and payment made for drugs and supplies.

> *We use computers to capture patient information if you want to know where the patient was in the hospital, you are able to capture that information using the computer. We use computer to access clients' information such as x-ray and laboratory results, pharmacy or the bills of the patient in the hospital.***Case1 NM**.

> *The electronic system is fully utilized in the registration of patient in that when manual register were not available then the staff could use the electronic system to access patient information.***CASE2-**RS₁

Interviewees from Case1&2 provided several reasons for the adoption of EMRs…

**Table 5.6:   Reasons for Adoption of EMR**

| Access | Effectiveness &Efficiency | Privacy |
|---|---|---|
| Internet services | | |
| Clinical information | Reduce duplication | Confidentiality |
| Financial information | Reduce waiting time | Secure |
| Nursing information | | |

Many studies have pointed out that EMR systems provide several paybacks to patients, to those who are end-users of the healthcare services, and other stakeholders of healthcare system (LHCQFL, 2008). EMR systems have further shown to advance and develop the

value and effectiveness of healthcare services (LHCQFL, 2008). Some instances of values the EMR systems can provide comprise the aptitude to access patient information remotely in appropriate manner, improved flexibility and consistency of work flow, and better output (Reidpath, 2009 as in Hasanain, 2014). Furthermore, these systems assist to ensure that patients' information would not be accessed by unauthorized persons and are secure. .Last but not least, EMRs has also revealed to minimize several practice errors and to minimize duplication of patient data while utilize of standardized medical terminologies within the system. This also protects patient information from exploitation or failure (Hasanain, 2014).

> *We use computers to capture patient information if you want to know where the patient was in the hospital, you are able to capture that information using the computer. We use computer to access clients' information such as x-ray and laboratory results, pharmacy or the bills of the patient in the hospital.Case2 NM.*

Fun Soft electronic medical records system was used in both hospitals. In **CASE1** the system was used in the registration of patients, billing of the patient both outpatient and inpatient which were reflected in all other departments and sections of the hospital on the network. It was also used for requisition of patient supplies, the dispensing of drugs of the patient in the wards. At the time of data collection, the system at **CASE1**also generated invoices for services provided for example drug dispensed, patient statistics. The staff were able to print receipts after payments and print gate pass for clearing the patient out of the hospital after discharge. In **CASES,** it was also further used to generating a central registration for patients indicating the name of patient, age, I.D. No, the gender, next of kin NHIF status. Although the software did not show the number of NHIF, it captures the

patients No., marital status etc. Fun Soft software was considered "*… good since one is able to access the patients information very fast provided the information were captured correctly"***CASE2**RS

> *Registration points are automated when the patient comes in the hospital, registration takes place using the Fun Soft System* ***CASE1- ICTM***.

> *We use Fun Soft for nursing services, registration of patients, supplies and billing and it's because management provided it to us. This helps us to check patient records, stock and revenue collection.***CASE1-NM₁**

> *The fun soft electronic medical system is utilized for booking of patients to the doctors' registration of patients, payments of services provided especially when the nurses capture the bills then post them to the accounts section for payments.* ***CASE2-RS***

*"some of the reasons for having new system are proper record keeping, accuracy in revenue collection* CASE**1-RS**.

**CASE2**respondents on the other hand was quoted saying:**.**

*Yes, the equipment we are using at the moment in our laboratory have that provision for storing patients information for sometime but that provision is limited and it requires a backup which means if we would have had a laboratory management system, it could be a very good backup to store those information that are easily retrievable. But after sometime the machine will erase to allow entering in of the patients' current biodata but they have provisions. I think ICT system if it would have been implemented which we hope is going soon to be implemented i.e. Laboratory Management Information System, it is a system that can access the results without delay and we can also relay patient*

*information directly to the clinicians and time management for the patients will be reduced; that is waiting time for the patient will be reduced* **(Case LM)**

Interviewees were pointing out that lack of basic facilities that is hardware and software needed to support EMR implementation blocks the widespread adoption of EMRs in the two hospitals.

### 5.7.3   Internet Connectivity

The Internet, and in particular broadband, provides a foundation upon which various EHealth applications are built. Applications and services such as telemedicine, data transfer, and access to health information are usually internet dependent. This is an indication of a health institutions' readiness towards embracing internet-based eHealth solutions such as telemedicine, searching of health information online by patients and clinicians, and the adoption of EMRS by health workers.

One Clinician from CASE1 was quoted saying: "*the new Electronic Medical Records Fun Soft is beneficial but there is a hitch, sometimes on many occasion the system is quite slow and but once we have entered in the information, the patient goes to the cashier who will log in the patients details and print the invoice which capture services offered".*(CASE1CO2)

The Records Medical Officer at MTRH said: "w*e use Fun Soft when registering and admitting patients and when we are taking the monthly report. It makes our work easier; it is also easier when it comes to retrieval of medical records".* (CASE1RS 4)

The respondent further said: *" it is faster accessing patients information using any computer in the hospital"*

The connection of all computers in the hospital saves time on accessing of patient information and reduces congestion particularly in the wards, Pharmacy and Supplies are interlinked in their operations and dispensing of drugs , procurement of drugs and also for stock control purposes. All computers have internet services utilized by all staff in the hospital apart from Mental Health Department of Case 1 .

A NM in Case 1interviewed said the following:

*" ICT infrastructure in Mental Health are lacking, there is no effort by hospital management to have this department connected to hospital network, we have made a lot of appeals to the management to spread out the services so that the patients in our department are not delayed in terms of service delivery but nothing has been done "*

This also means that not all the departments and units in the hospital are connected on the local area network. ICT therefore compliments their services to core service and functions of the hospital particularly in clinical services where electronic medical records were to be fully implemented.

One RS interviewed in Case 1 said the following:

*"we rely on LAN wireless however network failure is a great letdown to most of our creation of records activities, it takes time for a record to be created in case of network failure. This was one of the major problems experienced a cross the hospital where there were frequent power failures and therefore system being down always and this delays the services to the clients in the hospital".*

Respondents in Case 2 that answered the same question 5 and 6 indicated that :

"*the hospital had Local Area Network that connected all the departments and units in the hospital where the system had been installed and connected services and staff in different units in the hospital*".

The Interviewee further indicated that: " *the hospital had internet connectivity and therefore staff in the hospital could communicate using internet services,, there was easy retrieval of patient information , interlinking of different departments , the system stores back- ups for patient information for future references*".

ICT connectivity was in most departments in Case 2 apart from the central medical library and some theatres where the operations were still manual since they had no computers connected to other departments.

One RS from Case 2 was quoted saying:

"*In terms of accessibility of patient information in the hospital , because of use of ICT connectivity; it is faster to access patients information as long as the network was working , e.g. some patients come to the hospital without patient booking cards which were given for follow-up bookings; therefore the same patient information could be accessed through the computer from the central server by use of patient name though most of the occasions the network system is down or slow and therefore delays the accessibility of patients information*".

The responses from the two hospitals therefore points out that the EMR system reduces the staff and patients movement in the hospital searching for patient information; since the system connects all sections in the hospital and it was able to provide information on each patient. The respondent also indicated that they were able to access information on

when patients were admitted or discharged from the hospital and how many patients were seen in a particular day within the outpatient departments.

Internet continues to play a key role in public hospitals. According to Griffiths *et al* (2006) one of the most common functions of internet is that it provides all sorts of health related information through use of different websites. This can be of great benefit to staff of two hospitals who are able to identify the latest information regarding illnesses, treatments, and best practices in medicine.

### 5.7.4 Effective and Efficient Services

One Nurse Manager said the following: "*there is faster service delivery to patients due to ICT connectivity as compared to the case of manual system used before. tracing of patients details is much faster through querying the system*". The respondents indicated that if a patient happens to have lost a document, search could be done by using the name of the patient in order for the hospital staff to get the details they want. The ICT system with the help of the server stores the patient data for a long time, preservations of the patient's records are guaranteed unlike the manual records system and also information could be retrieved in case of an event such as disaster and space is also utilized.

Respondents from Case 1 indicated the usefulness of the ICT in the Hospital as follows:

*One MTRH said "There is LAN and wireless that connects services/staff in different units; It is faster in service delivery to patients as compared to the case where manual system was used. Tracing of patient details and records is much faster through queries".*

RS pointed out that: *"There is easy retrieval of patients' information, interlinking of different departments, it stores backups for patient/clients information and good for*

*future reference; If a patient happens to lose a document, search can be done by name in order for them to get the details that they want /require.*

*We rely on LAN Wireless. However network failure is a great let down to most of our creation of records activities. It takes time for a record to be created in case of a network failure".*

Respondents from Case 1 were quoted saying: *It stores data for a long time, preservation of records is guaranteed unlike in the manual system .*

*There is Internet and LAN available. Especially when we order something from the store we don't need to move physically.*

*Capturing patient information especially the patient files and other details of the next visit to the hospital. Creation of bills on which the user prepare the bill which are accessed by the accounts office.*

*It makes our work very fast and easier. It reduces the movement from department to department getting patient information.*

*You are able to search for a patient and its easily accessible and easily to be understood by anyone.*

*We have LAN. The same information keyed in QuickBooks can be accessed by anyone in the hospital who opens QuickBooks checking details of patients made easier because you don't need to move from department to department.*

A MO was quoted saying: "*The benefits has not been felt yet because there is still more to be done with Fun Soft. Only registration of patients is an area that I can say is fully automated which just entails capturing of patients biodata and nothing else. I belief there*

*are more benefits that the system will bring but as at now we are still using the manual system.*

*One Medical Records Officer pointed out that : It enables quick retrieval of patient's information .for example if you need to get the patients details like the next of kin you are able to see through the fun soft system. The details of the number of inpatients and outpatients can also be accessed through the reports from the system.*

**Case 2 ICTM** was quoted saying: "*We have internet cables, computer and wireless connections for our computers. This enables us to share information with our colleagues from other department and units within the  hospital.*

*We use the servers for storage of patient's records and rely on the networks for use of the records and transmitting information of the patients from one department /unit to the other.*

*It helps us get client information very fast unlike when we used to have the manual register. It also helps in sharing information with respective units in the hospital hence reducing up and down movements of staff.*

*We use Fun Soft system to capture patients information if you want to know where the patient is in the hospital you are able to capture that using the computer .We use computers to access clients information e.g. x ray ,lab, pharmacy, or the bill of the patient in the hospital*

Respondents from Medical Records Department were quoted saying: *In retrieving information ,we use computer to help us get  clients information for example if you need to know the  file number of a patient plus other details you just need to insert/type the patients name then other information will be displayed.*

*The electronic system captures information very well especially the registration of the patient and billing in which our unit does most with it. Accessing information is very fast using fun soft although much has to be done especially on the network which makes retrieval of the information of the patient a problem some times.*

A careful analysis of the responses from the two hospitals reveals that there existed ICT system in the two hospitals and patient information keyed in the system by hospital staff could later be accessed and used by staff in the hospital through the Local Area Network. The ICT connected most of the departments of the hospital which enabled quick retrieval of patients information anywhere within the hospital. The use of Internet services reduces staff time from moving from department to department in search of patient information. The staff were able to access patients bio- data easily but only when the internet was working. The central server in the two hospitals were used to store patients information or records but rely on the network to transmit the information to other users in different departments in the hospital. The only impeding factor is the frequent failures of the network and breakdown of the computers on the network.

Hasanain (2014) confirms that clinicians and other health workers with ICT skills are able to appreciate the possible benefits of ICT in execution and improvement of the various processes they are engaged in. Electronic Medical Records (EMR) are now introduced in most developing countries in European (Wamae, 2015). These systems allow for seamless flow of administrative as well as clinical data between various hospital departments such as outpatients, accounts office, wards, pharmacy, laboratories, and theatres among others depending on the units within a hospital. Health portals are gaining acceptance especially in dissemination of health information and structuring of web content.

The interview probed respondents to ascertain the need for information for clinical support and information sources.

**Case 1 NM pointed** out that:

*"Patient information to the hospital staff is important especially those in clinical areas since their achievements is based on their capability to access patient information and utilize it for improved service to the hospital clients".*

Similar to any other services the clinicians requires different types of information concerning every day activities. Among the objectives of this study was to establish the type of information needed and the type of challenges encountered in accessing this information. The examination of the data collected from the interview schedule was able to disclose the type of information that was required by clinicians who included doctors and nurses.

The respondents were asked instances where lack of patient records had caused them delay of provision of services to the clients and what happened. They were also asked which information sources they use and if they are easily accessible, adequate, and up-to date.

The findings indicate that there are several sources of information particular to clinicians: the use of tablets, personal smart phones, and the hospital protocol and also they do consult colleagues. The respondents indicated that tablets and smart phones were so fast to access the information. The patient information could still be accessed through patient files apart from the electronic medical information stored in the fun soft system. Information on paper records were not easily accessible due to misfiling at times and also the movement of patients files across the hospital. It was noted by respondents that the

Patient's files could easily be accessed by the clinicians and other staff in the hospital when it's fully automated. This means that the patient's information or record could be accessed by use of the computers which were already networked on the Local Area Network.

Majority of the respondents cited the delay of accessing the patients' information due to either misfiling or missing paper files. There were times when the computer hangs, electricity goes off which was most frequent and at times the network/internet was low and that means the patients information could not be accessed and causes delay in the provision of services to the patients or clients.

A number of respondents cited the problem of information access as one of the major obstacles to provision of quality services to the hospital patients. Further discussions with the respondent revealed they could still use the computers to access the internet and surf the areas of their specialization and access information. They also use books from Moi University Library which is well stocked to make reference to the areas of concern and update themselves in the areas of concern.

**Case 1 CO** pointed out tha*t the information sources at the School of Public Health library were not adequate because the number of users were high since we had undergraduate and postgraduate students using the same library. Other limitations of accessing the information were the internet sites where they were supposed to access the information were to be paid for and therefore became a limitation to access to information".*

The respondents also cited the login to the system by use of the password is an impending factor as much as the patient information is confidential. The systems are also slow and the frequent blackout was a hindrance to access.

Respondents were asked if sources of information for patients care were adequate and up-to-date.

**Case 1 MO** was quoted saying: "C*omputers have internet, therefore they were used to have access to emerging information in the area of medicine. There were also libraries within the hospital and School of Medicine, example training center library in the hospital, skills Lab at the school of medicine and the university library at the school of public health where the hospital staff particularly the doctors, clinical officers and nurses are allowed to borrow the books and other information materials*".

The respondents pointed out the use of information and communication technology (ICT) that offered opportunities and potential benefits to clinicians which include providing quality services to the patients in the hospital. Since the medical field was quickly evolving that is keeps on changing; therefore their sources are not a hundred percent adequate, but the adoption of ICT enables the hospital staff to be more responsive to the internet with customers' needs. It is important to note that respondent advocated the use of new technology for a better service to their clients.

It was found that emerging ICTs provide a lot of opportunities for improving access to patient information and communications to increase efficiency and effectiveness of various clinical procedures. These accumulating benefits drive these institutions to adopt and utilize the computers and other technologies like internet to access patient information. ICTs also make it easy and improve information processing and storage in the two health institutions. It was also observed that most hospital staff uses ICT which includes computers on the internet, tablets, laptops, I pads and I phones for communicating and accessing up-to-date information, storage and processing. Furthermore many respondents were of the opinion that ICT improve communication

among the hospital personnel, on the other hand, it was established that some departments and units in the hospital were not having computers and nor accessing the internet. This also means that some departments and units in the hospital are not using the electronic medical system fun soft for accessing patient information.

The respondents in several departments in **Case 1**were using the patients' files in paper format and therefore when files are misplaced or misfiled then causes delay to service provision to the hospital clients.

**Case 1 NM** stated that:

*Especially when we want to trace the file we go to the records department they go to the computer and confirm whether the patient was registered so that they can be able to trace the file.*

*For us the clinical notes for patients have not been included in the electronic register and therefore we always have to use the hardcopy to be able to access the records, therefore the records in electronic registers is only the name but not the clinical notes of the patient. The names of the patient, the age, identity card, that is the only information that is in the electronic but we have not reached where we enter the patient notes into the register.*

*Yes, basic information is captured but I get the rest of the information from the patient. But there is other information that the patient cannot provide like history of previous information. When the system is down, when the file is not there causes delay.*

Respondents further indicated that many times when patients who were being followed up, the clinicians refer to previous records and when then files misses then the patient meets the costs for repeated tests and other services such as research using the same files is affected negatively.

The channels that respondents frequently used in their everyday clinical work could be categorized into ICTs, printed materials that is paper records and face to face. The majority of respondent indicated the use of the following:

*"use of the internet, talking to the patients and having departmental meetings on adhoc basis. Frequent fluctuations and irregular internet service is a problem to be addressed by the hospital since the internet or use of ICT are the most preferred channel of communication".*

**Case1 LM** was quoted saying: *We have access to computers as Heads of Departments; it is possible to go to the internet and surf the area of your specialization and access information. And given that we are also a teaching hospital, we have a library which is well stocked by Moi University, so we are able to access it, also in our departments, we have some books".*

In Case 2 the finding s confirms the source of information and if the sources are adequate and up-to-date and challenges of delay (question 13 and 14 interview of schedule II and question 15 of interview schedule). A closer analysis of the findings indicated that delays occur when there was network failure which contributed to delay in registration of patients because they had to wait the ICT personnel to come and salvage the situation. In cases of power blackout the generators that were available only served the emergency areas and not all the units of the hospital. There was also delay of printing out the patients or clients information that had been registered in the system hence affecting the billing of the clients. The respondent noted that sometimes the services slow because the network that were frequently down and therefore so many delays. The findings show that the delay in delivering service especially when the system fails  the ICT staff takes long to respond

to queries hence cause the patients files to clinicians to pile and also the keying in of patients information manually and electronically is tedious.

The majority of respondents cited the difficulty to retrieve the information when the patient gave wrong names; the staffs are forced to key in the system for the clients name and start searching the file in paper format. A number of respondents cited cases of transposition of numbers and misfiling of patient's files in the library that cause the delays in the provision of services to the clients.

There are reported cases of files missing in file pockets in the library which was either intentional, misplacement of files or fraud. Therefore the doctor cannot attend to the patient until that particular file is found and this causes a lot of delay to the client.

One respondent from Medical Records Department was quoted saying:

*"there are cases where the system fails and whenever the information technology staffs are called in to fix the problem they don't respond very fast some even take an hour to fix the problem leading to delay. We cannot do anything but wait for them to come; sometimes we are forced to use the manual system to register the patients.*

The Respondent further indicated that:

*Delays occur when a patient has been referred to more than one clinic in the hospital and the file has not moved quickly to the next clinic where the patient had been referred to. This forces the patient to wait for his or her file before they are attended to.*

There were also cases of double registration of the patients' numbers confusing the user of the system, where more than one patient shares a number. This makes it difficult to retrieve the records forcing the patient to be sent back to registration point for their details

to be captured correctly. This leads to a lot of delay for the patient to be treated or attended to.

It was found out from analyzing that where the system is manual example when a file had been retrieved and there was no tracer card filled and put in the place of the patient in the file pocket then the tracing of the file becomes a problem and probably not easy to find then doctors lack history of the patients and they cannot be treated. The doctor may be asked to allow the patients to be seen using temporary file and it was not the patient to be rebooked. There are also staffs with long history to retrieving the patients' files and they are used to solve this problem.

**Case 2 MO** were quoted saying:

*"We rely on information sources from the accidents and emergency section where the patient was registered .We also relies on the ranges of the results from the forms. There are cases where you may need to refer to certain tests on whether we rely on the ranges based on different tests. It also goes with the reference on the tests that have different results based on client age. We refer on those forms which are created by Biochemistry laboratory experts. We also use reference material /books e.g. **Case 2** manuals and outline materials for pharmacy such as formulary".*

Regarding the source of information and if they are up-to-date, one respondent was quoted saying: *"that in the laboratory our sources of information are adequate because they give a lot of details concerning different tests conducted in the laboratory. In terms of up-to-date of patient's information, they are up to date for all patients and it is only updated when a problem had been identified".*

The respondent indicated that they use reference material or books as source of the information they require e.g. Case 2 manuals and online materials for pharmacy. The information was easily accessible because the information resources are put on the shelves and some are put on the internet where information can be accessed easily. The respondent pointed out that the information they get is adequate and up to date materials especially from the online sources they frequently refer to. It was also pointed out that they also had consultations among colleagues. The information is easily accessible because the information is from the workmates. The respondent further indicated that some information is hand written and therefore they are up-to-date and adequate in terms of use.

The majority of respondents argued out that:

 *the cause of delay are due to large number of files, less staff in records departments, misfiling, limited space for filing, lack of training in filing, manual numbering causing illegibility and printed characters too tiny to be ready.*

The results from the interview schedule indicate that the patients' files have adequate information on the patient and up-to-date except on the too sick patients.

Respondents from the two health institutions pointed out the information sources they regularly use some being manual and others electronic. The two hospitals had problems accessing patients' information causing delay in service provision/delivery to the hospitals clients.

Responding to other sources of information other than patient files and other available medical records, the majority of the respondent cited:

*Getting online information is timely and accurate. The information we get is adequate and up to date especially from the online sources that we refer to.*

The majority of respondents embrace the use of ICT in accessing emerging information in the field of specialization and therefore the two hospitals should implement complete Electronic Medical Records and use of internet for service delivery.

## 5.8 Challenges of Electronic Medical Records.

The objective 5 of this study was to determine the challenges encountered in application of the electronic medical records in the application of health care services at **Case 1**. The question 17 in the interview schedule I, 16 in interview schedule II and 18 and 19 in interview schedule III sought to determine challenges in establishing and use of EMR.

One of the objectives of this study was to find out the challenges encountered from the interview results from Moi Teaching and Referral hospital. The respondents pointed out about few computers in the hospital which are inadequate compared to the number of staff and available departments. The computers are not sufficient enough compared to the ratio of staff with machines available, other departments and units are not networked.

The respondents also indicated that there are new procedures that come up as new every now and then and they are not captured in the electronic medical records and therefore there is need for the updates of the system. This also means that with the new procedures that are not captured, the same procedures are missed out for payments or the procedures are not charged by the system and therefore need for regular reviews of procedures and charges.

The respondents pointed out the system being slow and frequent blackouts. They suggested that there is need to install the uninterrupted power supplies system to enable the staff to continue even when there are power black outs that are frequent.

The respondent from nursing department indicated that handling the internal supplies is a challenge with the new system thus the electronic medical records because supplies are not charged at the point of issue but at the ward level. The respondents also noted that the size of the patient file in paper format used were bulky  and therefore retrieval of the files is a challenge and also filing back is a big problem because of the unavailable space. The library is congested and therefore access to patient information becomes a challenge.

In their response during interview the respondent confirmed that the challenges included:

T*he hospital ICT department did not discuss with the stakeholders that is  staff were not sensitized  on the EMR system when it was  being introduced and therefore staff  did not own the system."*

*The same respondent noted that they did not have enough desk tops and in terms of maintenance of desktops; whenever they collapse, they are not repaired on time and therefore they delay the service.*

*We have fewer computers and sometimes they are always down*

The respondents also pointed out that networking was not done properly and therefore there are places where network keeps on collapsing and the staff failing to access the patient information and hence the delay to service delivery to the client.

A number of respondents cited the age of staff as an impending factor. They indicated that staffs that are mature in age are resistant to adopting technology, as professionals

they were trained to use paper work and adopting to use computers became difficult and that hinders accessibility to patient information.

The respondent also pointed out that some people do not have interest to use computers, they lack computer skills and at the same time there is inadequate supply of computers at their workstations. All this becomes a challenge to the new system of electronic medical records. Lack of continuous training of staff on the operations of the new system, lack of team work and lack of proper supervision are major barriers on the effective running of the new system of electronic medical records.

One key respondent at the Case 1 said that:

*Inadequate allocation of the funds, skills gaps in the core ICT department i.e. system administrators and programmers become the main challenge in the functioning of the electronic medical records i.e. the fun soft system.*

From the above analysis, it can be summarized that in **Case 1** there are several barriers to access to EMRs which includes frequent blackouts, inadequate supply of computers, lack of UPS and solar panels in case of blackouts, lack of adequate skills and continuous training on use of EMRs.

Responses from Case 2l when they were asked challenges encountered in accessing and use of electronic medical Records based on research questions 19 and 20 in interview schedule III and question 17 in interview schedule I indicated various factors.

Respondents pointed out the continuous use of paper patients file that causes delay to access to patient information particularly by Doctors. There was need to introduce the clinical module so that the Doctors could use or have easy access to the patient information without waiting for a long time for patient file in paper format. Respondents

as well pointed out that staff require training on ICTs and have a refresher course to help them continue to perform better and work as a team in the ICT environment.

Respondent cited:

*The failure of the server being rampant and system down time is high and there is need for the system developer and hospital management to address the problem.*

*Other Challenges: In case of network failure or low performance of server. Sometimes MODEMs are provided but not all sections of the hospital or ICT department is called most case delay coming to address the problem which delays services to the clients.*

*Inoperability due to delayed update of record is another problem.*

*Booking-system is not helpful, not able to generate list of files and other administrative reports required by the hospital management*

*Fun Soft- not helpful since supports only registration.*

*There is also challenge with the serve; they have to restart the server for them after power failure to continue working and this restarts all computers in the hospital and that lead to loss of data. The hospital has a challenge of Internet connectivity and network which affects the operations of work; there is delay in retrieval of files and access of files when the computers hang.*

*The current system is good, however in terms of accessing the patient records is a challenge due to fluctuations in network. Retrieval of records is also faster though the network also affects the retrieval more so when the connectivity is low.*

When the network goes down the staff at **Case 2** are forced to use the manual system that is paper records which was tedious work. The generators that are standby in case of power failure are not connected to computers. The staff is therefore forced to use paper file to access patient information which causes delay. There is need to upgrade the server because the rate at which it goes down is so high.

Regarding the functions of the EMRS the respondents suggested that there is need for hospital management to have consultation with lower level and middle level staff to be involved as users of the system. The hospital management should appreciate input from users on how to improve the system and utilize their creativity and knowledge on building a complete electronic medical records system.

The respondents also indicated that there were challenges of interoperability problem where marching of old files and new patients records; this also was a challenge to access and use of the patient records. There was also the incompatibility of x-ray system and other systems which delays and limits accessibility to patient's information.

A key respondent from ICT department cited ICT literacy level as being low due to staff resistance to change and also staff feeling that computers will face them out of the institutions. These staff are used to manual systems hence implementation of the electronic medical system is resisted. There were also challenges in inaccurate capture of data example the capture of spellings of names and surnames which are similar to many patients. There are many patient documents in paper format that causes the storage problems and therefore there is need for digitization to allow accessibility to the same patient's records yet there was lack of expertise in digitizing these records. **Case 2** has only 14 ICT staff about 50 wards, 24 clinicians, 45 departments and 4500 staff members, 2000 inpatients' bed capacity and 500,000 out patients and 100,000 in patients annually.

Respondents indicated that **Case 2** should have dealt with attitude of staff towards change at the initial stage to address staff attitude to change to allow the smooth running of the electronic medical records.

It has been established from above that the two health institutions has had challenges for the staff to access and use the electronic medical records. There are challenges of system being down most of the time with frequent power blackout. Interoperability of records old and the new, the incompatibility of the various systems in the hospital poses a challenge to the running of the new system in the two hospitals. The staff attitude also poses a challenge to the running of the new system.

Findings points out compounded challenges in terms of inadequate hardware, internet connectivity, power blackout and interoperability of old notes. This is an indication of insufficient budget allocation that the government needs to enhance for the two hospitals to be able to realize their implementation plans. There was also a suggestion from the interviewees the requirement to assess the hospital on ICTs resource needs by a qualified team. The evaluation should include among other things if the hospital has an electronic medical system or not, the performance of the software in operation, whether the human resources and manpower are prepared and competent to utilize the electronic medical system or not, if the infrastructure of the hospital are set for such implementation or not, as well as involving all stakeholders in the complete process of implementation.

### 5.3.8 Perceived usefulness of the Electronic Medical Records.

The aim of this section was to evaluate the level to which electronic medical records is addressing the information needs of the staff and the clients of the hospitals. Information access has been cited as the main problem faced by the staff in the two health institutions.

The focus has always been the use of the new information technology in medical field. The concern has not been much about access to the new information technology but it is all about the benefits derived from access that is the easy access to patient information. When respondents from **Case 1** were asked what to consider being the actual and/potential benefits of ICTs in the provision of healthcare services to the clients; their responses included:

*The staff stopped stealing hospital money because the new system produces a receipt for every payment made by the hospital clients.*

*Staff from the lab can send the results by indicating the payments,*

*Patient on discharge should produce all receipts and gate pass before leaving the hospital.*

*The system is fully utilized in that registration of patients in that when the registers (Manual) are not there the staff will continue working with the electronic system. The only challenge is that both manual and electronic registers are used and so they are forced to deal /work with both of them.*

The respondents indicated that there is wide accessibility of the patient information by all staff across the hospital and therefore patient can be treated anywhere in the hospital using same information in the new Electronic Medical Record system. This also means that it would be easy to manage patient records and in the near future it would be easy to track the patient files within the hospital and this also brings the end of cheating by cashiers on patient billing.

Currently, the system has to some extent asserted some positive impact since it is possible to register patients within the stipulated time possible and able to retrieve patient

information very fast so long as details of the patient are correct. The benefits of this system could be more if the electronic medical system is interlinked across all departments in the hospital in that the system could allow tracking of the patients across the hospital. One key respondent from **Case 1 RS** pointed out that:

*With a click of the button one is able to access patient clinical information for instance the total number of patients who were admitted in the hospital on a specific day. Other benefits include increased revenue base, the system has stopped a lot of leverages encountered in manual systems; we have an intelligent system that indicate the patient bills on discharge.*

The system also fastens services and eliminates bottlenecks that were associated with paper works and also create efficiency in form of every staff in the hospital providing services and makes hospital services at Case 1 to be one stop shop which saves time both for clients and staff.

The majority of respondents in **Case 1**noted that:

*We just register the patients; we admit using the system and retrieve information when patients do not have hospital numbers*

*The fun soft system would assist in improving provision of healthcare services to patients by providing efficient and effective services*

*Reduces human errors that were rampant with the manual system.*

The huge information available in the system can easily be accessed and used for research. Also the confidentiality and safety of the patient records are guaranteed using the electronic medical records. It was revealed that clients who forget their clinic cards

are helped by use of patient information available in the new system by providing names used on the date of hospitalization. Therefore, history of patient are easily stored and retrieved e.g. admission, hospitalization, drugs dispensed and past allergies etc. it is easier to trace patient files and tracking patient in the hospital per the dates of service provided unlike manual system. This has drastically reduced the movement of staff across the hospital and services to the patients are provided promptly and this has also reduced queues at the registration points and it was indicated that the time of serving the client at the registration point was 10 minutes per patient.

The study at **Case 1** has found that the electronic medical records through Fan Soft patient records have a lot of benefits both to the hospital staff and their clients; the benefits are enormous which includes easy access and retrieval of patient information and therefore prompt service to clients.

The study at **Case 2** also sought to establish the benefits of the electronic medical records. The study revealed that the new system would save on storage space utilization and would fasten on delivery of the service on the clients since the system is faster in service delivery to patients as compared to the case where manual system was used. Tracing the patients information was much faster through queries; there was interlinking of different departments which makes it easier for staff in various departments and units in the hospital to access the patients information from their remote area and also there was assured backup for patient information which was important for future reference where information could be retrieved in case of an event such as disaster. Respondents also pointed out on the benefits of the system on the reduction on the movement of staff from department to department in searching of patient information which saves time on both the staff and hospital clients. Some of the respondents said:

*If the patient does not have the TCA card which consists of the patient hospital number patient information could be accessed through the computers.*

*Is excellent, how we access our service has gone up*

*Yes it is across all departments in the hospital, that is why I was telling you it is both LAN and WAN, so we have inter-sectorial areas like finance, billing and even discharging of patients.*

*The modules that are functional are billing, finance and pharmacy and other areas like Nursing and supplies.*

The findings in this study also revealed that the benefits of the new system have not been felt fully because there is still more to be done with Fun Soft electronic system. The registration module of the Fun Soft is the only area fully automated which just entails capturing of patients bio-data and nothing else. There are more benefits that the system could bring to the users when some of the problems so far experienced could be addressed by the hospital management and the system vendor such as the rampant failure of the server. Resource management for performance is a widely conceived notion which has shown that managing of the available system to a higher degree can make an impact on service delivery to the hospital clients and even to the hospital staff. There is need for a good functional system serving the patients in all areas that could be automated moving away from file trace cards to databases tracing system and having online medical information that would assist in sharing information with respective units in the hospital hence reducing up and down movement of staff. The information based on interview results show that getting online information is timely, accurate and easy to access patient information and this also means that all sections to be automated and data captured at source. The respondents also indicated that fully automated system would reduce

duplication of patient registration and reduce staff work load and improve staff morals. It was clear from the interview that only two services in the hospital had been automated that is the registration and the billing and therefore there is need to automate other services in the hospital.

One respondent was quoted saying ;-

*"The speed of the electronic medical system was slow and the storage space limited and if sorted out the system would be good for us all."*

*Another respondent was quoted saying "I have never experienced the system limitations since I have no need to access or retrieve patient information from electronic medical records since we have no clinical module for doctors. We should have been included in the training when the system was changing from manual to electronic system."* It is clear from this analysis that not all staff in the hospital were involved in the introduction of EMRS system and not all modules were introduced in EMRS.

Many of the respondents as well pointed out that the new electronic medical records system was mostly being used by the nurses for ordering supplies and drugs and users indicated that retrieval was above 60% performance and access is also above 60% performance. The respondent indicated that fun soft system was efficient and with less complaints.

This results for analysis also indicates that the fun soft system do not allow editing of records by the system users especially on clients paying by the medical scheme excepts those with rights, there were problems on names editing which was not possible, there were also syntax problems where the system rejects units numbers with other entries and

congestion of data functions. The system uses current dates in terms of clinical dates and also there were lack of out-patient and inpatient integration.

The system could not detect the duplications once the patients were registered in the system due to example similar surnames and having several patient hospital numbers unlike the manual system. This information means the hospital ICT staff and the system vendor should work together to address the staff complaints for the efficient running of the system and in the interest of hospital clients. The respondent also implied that the electronic medical records system was not meeting user's requirements due to wrong design and implementation. The respondents revealed that there was lack of stability and system documentation and therefore, with right ICT solution would shorten turnaround time on the service to the patient which improves health care service delivery and finally low cost of running business.

With the results from the analysis the respondents had indicated that the fun soft system which is an electronic medical records system does not capture all outpatient data but only bio-data. Also the coding is inadequate since the clinicians do not use world health organization (WHO) terms but the statistician uses these terms to check the diagnosis and therefore they do not get the information due to different terminologies used by the Doctors.

In verbatim reporting the following is what they said:

*If the system is working well, it is fast; sometimes it takes long when the system is down and when we have to go for the files in the library*

*Yes. When the patient is not giving clear information about where he/she was last treated the new system would assist in accessing patient information*

*Like in our place here is just to register patients, their contacts and next of kin;*

*just registration only.*

The findings of this study implies that since the Doctors were not involved in the design and implementation of the system therefore the terms they use were not in the system. Some respondents pointed out that some users of the system who are the hospital workers were not involved nor educated in the system since it was made by the hospital management but not cascaded down to others like the doctors. The interview results gave a conclusion that the system is not all inclusive and therefore there is need that every person in the hospital must be educated on the system especially the clinicians and computers should be available in every office or clinical rooms across the hospital.

**5.9 Recommendation for Improvement of Electronic Medical Records.**
Research question 5 sought information from the participants how challenges encountered in the application and use of the electronic medical records is overcome? Suggest ways to improve the management, access and retrieval of electronic records to support the provision of quality healthcare service to the hospital clients. The purpose was to establish ways of improving the existing fun soft electronic medical system which could improve service delivery to the hospital clients.

Respondents from the Case 1 suggested that: *First is to train all the staff in ICT, second is to fully automate the current system and finally is to provide more computers to the staff*

*What I feel is to fully automate the departments, provide computers and above all train us in the use of ICT.*

*The management should supply more computers as at the moment we only have two and one is not working, and bigger filling area as the library we are using now is small*

*They should format the database to avoid double registration*

*Transfer of this service to full electronic system to avoid paperwork.*

*Increase on the number of servers and space*

*As per now what I would like to see introduced is digitization so that paperwork can be reduced to minimize space and also improve service delivery.*

*Increase the computers, some of us have never trained so the hospital can train us*

*Increase the space in the library*

*Yes, maybe if they could provide filing space because they are many; increase the size of servers*

On their part some CPUs that are slow and delays the retrieval of electronic records should be removed or upgraded in terms of speed. The respondents also suggested that the system programmers should train all the hospital staff on the use of the electronic medical records system and the system should be able to capture all the services in the hospital and they should also acquire better CPUs with bigger memories, strong and faster servers. The respondent pointed out that acquiring of the equipment that are required to run the system should be supported by the government funding since the computer systems and maintenance are expensive example the servers; since the hospital requires

bigger servers that can generate adequate information. The respondents went ahead to suggest the need to train all the staff working in the hospital, address the problem of power surge by installing powerful generators that are connected to all the computers across the hospital and connect bigger storage system to enable quick searches and retrieval of patients information.

The respondents observed that for the hospital to improve on service delivery to the their clients; there is need to acquire more computers to be distributed to all divisions departments, sections and units across the hospital, need for digitization of the old patient records in the archives to enable easy accessibility and to minimize paper work and storage problems. Respondents further suggested that there is need for a backup system in case of the system collapse then there was data for the hospital to continue. Respondents advised that the hospital should embrace full and complete automation of all services in the hospital; that is the hospital should introduce the electronic system in all the units of the hospital and the system should conform to the standards of each and every unit and the products should not vary from unit to unit since the hospital is ISO certified. Further the system should be all inclusive where we have all modules for services provided to hospital clients' example the clinical modules for both the doctors and clinical officers for clerking of the patients using the system.

The security and confidentiality of the patients' records is important, it was argued that the hospital should improve the networking of the system, have proper backup and sufficient technical support example ICT technical staff that are available on 24 hours basis.

The hospital are required to put in place the system that have security that is damp proof with strong firewalls. The respondent observed that the hospital should regularly pay for

internet services and at the same time continue to build ICTs infrastructures and new constructions should have plans for ICT services. The respondents also felt that the hospital management should appreciate personal development of staff and ensure continuous training of all the staff.

Furthermore, the respondents suggested that internet services should be upgraded to be faster so that the discharges of patients to be faster, efficient and effective. The respondent pointed out the need to update privileges or rights assigned for administrative purposes, there were omission on the new staff example on accessing the reports that have a holistic team approach. Respondents noted the delay in the patient file retrieval which means the Doctors had to wait longer to see their clients and therefore Fun soft should be improved on to eliminate paperwork and should accommodate more patient information.

From the above discussion, there is need for the Case 1 to implement all modules as required by the services provided by the hospital, train all staff in the hospital on use of electronic medical records, increase funding to purchase more computers to person ratio and lastly expand the new system to have a seamless EMR in the hospital and eventually across the country.

In **Case 2**, the respondents expressed their views in different ways:

*To have all the records in the system and to frequently train employees on how the system works.*

*They have visited all other hospitals like Nairobi Hospital and felt that if they can automate the hospital system, they will end up using less effort in doing their work. The hospital should embrace technology fully to curb the many challenges they are facing.*

*Improve on the serve; goes down every time and then hence affecting the service.*

*Training of staff on ICTs since most of them learns from the job.*

*All staff should taken for training. Allow staff to rotate to other departments to understand the operation of other units.*

*To fully automated their system because now there is a mixed up of operations i.e other departments have been automated whereas others have not been automated.*

*To improve the ICT system such that we have a reliable network. To have power backup system (UPS).*

*Have a backup system, the management should sponsor or organize for training for staff on IT and the new system, the qualified IT personnel should be employed by management who are able to manage the entire system.*

The respondent gave recommendations for improving the management, access and retrieval of electronic medical systems. It was noted that some respondents lacked skills to effectively access patient information on the Fun soft system that was being used in the hospital as the electronic medical system; therefore they suggested training on the system for all staff working in different departments and units in the hospital. The respondents also noted that staff working in the coding indexing section does not have the module that cover their activities on coding, therefore, the ICT personnel need to have an electronic ICD code in the new electronic system for easy coding and indexing. The respondent also suggested staff rotation to other departments for them to understand the operation of other units within the Fun soft system. The respondent suggested the hospital management to upgrade the new system so that they have stable and reliable network and install power backup system due to frequent blackouts with the electricity.

The respondents suggested that the hospital management should consult the staff before introducing any new system to the hospital. There is an urgent need to introduce clinical module so that the doctors could use or get patient information without getting or waiting for a long time for physical file of the patient and this means the hospital should purchase more computers for the clinical rooms and train all staff so that staff can work as one team in an ICT environment.

One respondent was quoted saying; - *"the bottom line of success of the fun soft electronic medical system was to train the staff on it and to involve the users of the system in all phases of the system; that is from the introduction or initial stages where the system is being introduced until the last stage because the staff are the users of the system"*. It was indicated that majority of the staff were told to start using the new system without being introduced to the system at the beginning when the hospital management and the system vendor entered the agreement. Therefore the respondents suggested for consultation with all cadres of staff to be involved as the users of the system. One respondent said *"we have a big problem with the system due to lack of users involvement example, the system cannot generate the required reports by the hospital units and the departments, therefore the hospital management should appreciate input from staff who are the users of the system"*. Management should seek ideas from internal staff from the departments and also motivate them and utilize their creativity and knowledge. Respondents expressed need for the hospital to develop and implement an ICT policy; the policy on health records management to guide input of patient information system. The respondents further suggested digitization and interoperability should be addressed especially for the old records. The respondents observed the need to build capacity in use and maintenance of the system at departmental level. The ICT staff took a long time to come and address any technical problem when it occurs at the departments. The respondents also observed need

to have a contact person assigned for each department in case of system failure or computer breakdown.

Most respondents indicated that the hospital should have complete computerization for easy sharing of information by all levels of staff within the hospital and at the same time the hospital should have periodical updates on new skills in computers to all the staff. It was noted that respondents lacked skills to effectively seek information. There was also need to increase number of computers and printers across the hospital. Respondents expressed need to have a link between out and in patient information and improve on editing of data to avoid delay to access patient information on computer systems.

The respondents suggested for a user friendly software for easy accessibility on patient information and requested for involving staff in developing new systems for easy acceptance of the system in the hospital. The respondents recommended the use of best development practices in the development of new systems and the need for a robust ICT solution for daily services and re-engineering services for quality enhancement to give customer value for their money. This will reduce the patient waiting time and the hospital would have a full functional system.

The respondent recommended the need for system to have radiology lab tests to be posted on the computers for easy accessibility and fast service delivery to the hospital patients. There is also need for continuous system evaluation to improve on the system based on client needs.

The respondents from theatre department complained of the department being neglected and had fewer computers compared to the total number of theatres and they requested have the ICT personnel on the ground to service and maintain the computers in the theatres.

The respondents advised that the hospital management should link all the departments in the use of electronic systems for easy communication example Labs, Radiology and Clinical departments where they can access electronic records. The hospital should provide infrastructure necessary for the new system and the computers should be fixed or stationed where many people can access and utilize those computers.

The respondents preferred the hospital clients or patients who come to the hospital to have been sensitized so that they could register online before coming to the hospital. The respondent suggested that the hospital should embrace international best standards to be at par with other countries in the area of electronic medical records and therefore the hospital should invest heavily in automation of medical records.

One respondent recommended that since the hospital deals with huge medical records therefore there is need to narrow implementation to departments module by module and see lessons leant instead of the entire hospital. Communication system (outlook) should be interactive and working. The respondent also recommends for a system that capture data on referrals of patients and their counties for issue of billing and charging. The above analysis indicates that the Case 2 should train staff, provide enough computers, involve staff in the implementations of Electronic Medical Records systems and have strong ICT technical staff to provide help services on the Fun Soft system.

**Summary of Findings**

This chapter analyzed data and presented the findings on the research questions that were investigated. The findings indicate that there are both paper and electronic records in the hospitals. The finding revealed that there were various sources of information used among which the Internet emerged as the most consulted source of information especially for accessing patient information.

The findings confirmed that the health workers utilized a wide range of ICTs to enhance service delivery to their clients with Internet being the most heavily consulted or used to access electronic medical records.

Health workers access their electronic medical records from their remote areas that is their clinical rooms, offices, labs, stores, pharmacy and anywhere in the case of IPad and smart phones. They regard ICTs as their main working tool for accessing patient information and service delivery.

ICT skills emerged as a requisite for health workers to use the EMRs for patient information since there are those who needed assistance to access patient information using ICTs.

## CHAPTER SIX

## DISCUSSION OF FINDINGS

### 6.1    Introduction

The meaning, purpose and relevance of the findings of any scholarly r esearch are revealed in the discussion chapter. According to Hess (2004)(as cited in Alabi (2015) the fundamental aim of this chapter in a thesis is to discuss the similarities and differences between the results of a study and previous findings for objective clarifications and confirmations that would reinforce the importance of the current study.

The following forms the discussions: medical records system in use, electronic medical records generated and managed by the two institutions; applications and use of information communication technology in managing medical records; the extent of the current usage and level of adoption of EMRs in provision of health care services; potential challenges and prospects of utilization of EMRs, and finally propose a framework of enhancing the use of EMR in referral hospitals.

The following section discusses the findings based on the objectives of the study.

### 6.2 Type of Medical Record Systems

Lippeveld T. et al. (2000) points out that the function of a health information system is to bring together data from all the different subsystems, to share and disseminate them to many different audiences for health information, and to ensure that health information is used rationally, effectively and efficiently to improve health action. A strong health information system is an essential component of sound programme development and implementation, and is a prerequisite for strategic decision-making. Results on type of

medical records systems existing were based on interview data presented in sections 5.3.1 and 5.3.2

The findings demonstrated that there were both manual and computerized systems that were in existence. In the records departments, the respondents indicated that files were stored in paper form while patient information were in electronic format which includes, names of patients, age, next of kin, their demographical information including occupation etc. the files on the shelves were filed numerically using the terminal digits filing system where the numbers were generated electronically.

The findings are consistent with a study by Murray and Frenk J (2000). At each level of the health care system, users of health information have differing needs and use information in different ways. At the most basic level of client–health worker interactions, patient records are a vital source of information, whose utility is not confined to the individual level. Record reviews can be used to ascertain the extent of conformity with agreed norms and standards of care. Confidential enquiries and facility-based audits review provider practices in order to determine to what extent care could be improved and the degree to which deaths were avoidable and the potential policy implications of such avoidable factors.

At the facility level, managers need information on patient profiles, patterns of admissions and discharges, length of hospital stay, use of medicines and equipment, deployment of different categories of health care workers and ancillary staff, costs and income.

The results from two institutions also indicate that registration process of the patient involve patient information entered in computer system and once the information was entered in computer; the patient was given the registration number and the registration

number was entered into a hard cover register and a file opened using the same number. The respondents indicated that patient records were generated manually and they were also stored and retrieved manually through the initial details or patient information were electronically stored.

The electronic medical record system called Fun soft is used for the registration of patients, billing of patient both outpatient and inpatient which was reflected in all other departments and sections of the entire hospital on the network.

The patient results were not produced electronically but billed using the Fun soft electronic system. The doctor notes were in paper form handwritten by individual doctors.

The ICTM of both Cases 1and Case 2 indicated the type of ICT system operating in the hospital was Fun soft. The respondents indicated that apart from electronic medical records system, we had other systems i.e. clocking in time management system which is able to monitor time in and out of the staff, we also had payroll management system for paying of staff salaries. We had Nursing system used for nursing schedules, we also had finance system for finance reports, cash collection and also used for integration with NHIF etc. However, the different subsystems outlined above rarely interact or are used by disease-specific programmes in different ways; as a result different figures are available depending upon the information source used and there is no standard system for ensuring overall consistency and coherent reporting.

The advent of information technology and the use of electronic data transmission are often presented as a solution to this problem but their reach is currently restricted in most developing countries to few institutions.

Case 1 first started with Hospital Management Information System in 2006 and later Automated Medical Records System in 2010 and later changed over to Fun soft in 2013.

The goals of having Case 1 convert to AMRS were to:

- Prepare Case 1 to enter the world of electronic record keeping.

- Provide an accurate account of the patient information within the system.

- Have patients identified by using the newly assigned Universal Identification Card.

- Decrease the number of duplicate patient records

- Replacing previously used medical identifiers

- Correcting the name and/or spelling of the patient

The Fun soft electronic systems is connected in different departments of the hospital including Nursing, Health Records and Information Services, ICT, Finance, and Human Resource and also in security for the clearance of patient after discharge.

The respondent from Health Records Department further indicated that the Fun soft electronic system covers registration of patient, admission, discharge to other departments like finance, pharmacy for charging of drugs but clinical procedure is still being handled manually. The bulky of management of the patient information was clinical, the client module was in the system but it had not been activated; therefore patient notes were handwritten. Request for X-ray, laboratory and pharmacy prescription were all manual.

One important finding from the study is that the introduction of technology is not necessarily the answer to a weak health information system. Where the will and capacity to manage paper-based systems exists, the introduction of computers is likely to be well

managed and fruitful. In the absence of such a supportive environment, computers alone do not provide the solution. The need to manage health information more effectively and efficiently in the two health institutions is by use of computers where the records is under control of the consumer and is stored and transmitted securely.

## 6.3 The application and use of information communication technology in managing medical records in Case 1 and 2.

The second objectives sought to establish the adequacy of infrastructures in the two hospitals that sustain the function of electronic medical records in the provision of health care services. The study was also informed by Rogers's innovation diffusion theory (1995) and DIRKS Model as discussed in section 2.2 and 2.4 of this study. The two models highlighted the part played by each of those particular theories and models.

The ICT diffusion model demonstrates the connections among variables that influenced the extent of the study.

Stage H of the DIRKS model covers review and monitoring. This is the final stage of a new records system. The objective is to make sure new record keeping system continue to work properly to meet the requirements of the organization. The following observation may prove pertinent in this research:

The DIRKS approach has tendency to be top down communication on the development of the system and can be experienced by some client as authoritarian and inflexible. This also confirms the communication about the introduction of the electronic medical record system at the two hospitals. The communication was from senior management of the hospital to the lower cadre of the staff on the implementation of EMRs. This kind of communication may be unavoidable where risk management is the dominant driver for

change. Nonetheless, it can be mitigated where conscious measures are taken to prevent alienation, examples by means of focus groups and other techniques of client engagement. In the case of the two health institutions, it was important to involve the medical record staff, computer staff, clinicians and other stakeholders to give their suggestions for the enhancement of the existing medical records organization.

On the stage A of DIRKS Model, had to encompass the whole organization. There are advantages to undertake stage A across the whole organization where the implementation of EMRs should be undertaken across the whole hospital if the resources permit. Everything else can be carried out by focusing on sub units, in this case all the departments in the hospital that are involved with the use of patient files in one way or the other are engaged to suggest or recommend for any improvement of the existing record system, this confirms the need to involve all the staff across in the two hospitals.

A strategy that includes quick wins is more likely to build a momentum for change. One module successfully installed would sharply a rose the demand for the total completion of whole project of the record system in the two hospitals. In targeting effort, one can look for priority and or risk areas. The DIRKS manual does say that one of the options to consider at stage F is to develop and implement a new record system for the risk area of the organization. The most heavily scrutinized and regulated areas and those that are process driven are at least likely to give cause for concern. This confirm the respondents in both Case 1 and Case 2 pointing out that ICT is a core service and core functions of the hospital particularly in clinical service where medical records were to be fully implemented. The connection of all computers in the hospital saves time on accessing patient information and reduces congestion particularly in the wards at the time of

discharge. Pharmacy and suppliers were interlinked in their operations and dispensing of drugs, procurement of supplies for stock control purposes.

This actually improved the service delivery in these service areas in the two hospitals.

In Case 1& 2 respondent confirmed that the hospital had internet service and therefore the staff in different units and department in the hospital where the system had been installed and connected services; there was easy retrieval of patient information and interlinking of different departments. The findings further confirm that most of the departments in the two hospitals are connected on the internet that enabled quick retrieval of patient information anywhere within the hospital without moving from department to department in search of patient information. While working within the framework of DIRKS methodology, record keeping professional with the expert of information technology professionals could make progress in building up the automated medical records system module by module. The study was also informed by Avgerou and Walsham (2000) that the potential value and effectiveness of the transfer process of the new technology is dependent on the local socio-organizational conditions and the ability of the organization to adopt ICTs in order to address the local priorities. It has been well established by researchers in information sciences that the contextual factor play an important role to influence the ability of the organization to adapt and effectively apply technological innovation (Barrnet 1999, Allen 2000, Avgrou 2000). The conceptual framework explains the relationship amongst variables that influences the diffusion and utilization of ICTs in accessing information for patients in the two referral and teaching hospitals in Kenya and focus attentions to variables that should be scrutinized.

Njoroge (2010) validates the above statement that the most important evident feature in all the four components of the diffusion theory is the importance of the adopters, the

individual or department that require the utilization of the ICT in its function. The implementation is the individual level decision of that department or unit within the hospital to utilize the new electronic medical records system whereas diffusion is the collective number of implementation choices. Diffusion research is then apprehensive with finding patterns across a large number of adopter decisions.

It centers on five essentials:

- The quality of an advancement which may manipulate its acceptance.

- The way decision making are made when individuals think about implementation of a new initiative, product and or practice

- The attributes of individuals that make them likely to accept an innovation

- The costs for individuals and society in accepting an innovation and

- Communication channels used in the implementation process.

It was observed from these findings that acceptance and utilization of an automated medical records system enhances increased efficiency and effectiveness and the two health institutions were able to capture and access the patient information by use of the Fun soft system. For example the registration and identification of patient a cross the hospital is made easier and easily accessible. The patient information is accessed on those computers connected on the internet within the hospital. This also means that the staff time for moving from one department to the other looking for patient files is reduced and at the same time waiting time for the patient to receive the treatment and other services is reduced. Therefore, there is need for the two health institutions to utilize the fun soft medical information system in all departments within the two hospitals to enhance the services to the clients in those departments within the hospital. The two hospitals should therefore increase their budgets in terms of purchase of new computers to be able to

connect the entire hospital on the internet and use of Fun Soft to utilize patient information and provision of quick service to their clients.

To understand the characteristic of individual department and staff that influence them probably to accept an innovation therefore the study sought to:

**6.4 Investigate reasons for adopting the use of ICT and the areas where ICT was applied in the hospital.**

The third research question required to identify to what level the two hospitals are utilizing ICTs to access patient information to provide services to their clients. This study was informed by Roger's innovation diffusion theory (1995), the Whetton (2005) change management, peansupap and walker model (2005) as discussed in chapter 2. The models draw attention to the part played by each of these particular theories and models. The major aspect in the parts of diffusion theory is the significance of the adopter. Implementation is the individual level decision to utilize new technology while diffusion is the growing implementation decisions made by the adopter. It brings out factors that influence diffusion and utilization of computer systems from the information requisite, individual adoption decision and change within an organization. To be capable to identify the attributes of persons that make them possibly to allow an innovation, the study required to examine basis for accepting the use of ICT and the sites where ICT was applied in the hospital.

The finding indicates that the two health institutions had Local Area Network (LAN) where all computers in the hospital were connected with one main server to enable the staff in the two hospitals to be able to access all health information about their clients. Respondents in the two hospitals gave an example of Fun Soft Electronics Medical

Records System which had computers connected in all departments mostly clinical areas like patient wards. This system assisted in the registration of both inpatient and outpatient in two hospitals and all patients in the system could be traced in terms of the service provided to them and payment made in terms of drugs and supplies. It was revealed that the connections of all computers in the hospitals saved time on accessing patient information and reduces congestion particularly in the wards.

All computers connected had internet service utilized by all staff in the two hospitals apart from the Clinicians /Doctors who had been left out of the connection due to inadequate facilities in terms of hardware and software. The findings agree with Gatero (2010) who found out that the focus of diffusion on organizational level tend to observe the influence of external factors on the innovation process, such as the deregulation of an industry or infrastructure conditions that are unique to country or society. Such a context –free "view innovation does not adequately consider" the embedded nature of technology in products, service and organizational practices, therefore the contextual factors play an important role in influencing the ability of organization to adopt and effectively apply technology innovations. From the findings; it was evident that clinical module require forms that were well designed with tick boxes to capture all the clinical information from the patient. This has remained a challenge to the two hospitals which not only require extra facilities over other departments but expertise to accomplish the exercise. The demand from the departments that had not adopted the use of the fun soft electronic medical record system was very high. This also confirms Forman and Golfarb (2005) statement that the enlist models of ICTs diffusion were epidemic. The model presumes that the diffusion of new technology is alike to that of an infection disease, the procedure is self-perpetuating. Non-adopters adopt a new technology when they come in contact with adopters and gain knowledge of the new technology over time. The number of users increase leading to an

increased probability of any given non-adopter learning about the technology and this enhance the rate of diffusion. When more people adopt the number of non-adopter reduces which diminish the rate of diffusion. The process is self-propagating and once in progress will only come to end when all potential users approach to use the new technology. The departments within two hospitals such as clinical department will sooner or later are connected and use the new fun soft electronic medical record systems.

It was experiential that adoption and use of ICTs enhances improved efficiency and reliability and consequently the staffs in the two hospitals were able to respond to the demand of the clients on time since the staff access patient information at their remote site. The electronic medical records systems reduce the staff and patients' movement in the hospital since all the departments are electronically connected and it was able to provide accurate information on each patient. The respondent from Case 1 and 2 indicated that with the use of the new electronic system they were able to access information on how patient were admitted or discharged, how many patients were seen at a particular day within the outpatient department. It was furthermore noted that ICTs improved quick delivery of services consequentially in customer satisfaction. Additional attributes of ICTs involved expediency in service delivery as well as reducing on business running cost example cutting down paper consumption and storage space in the two hospitals.

The two hospitals will therefore be able to provide quality service in terms of reduced waiting time and clinicians making well informed decision based on the availability of patient information through quick access. The findings indicates that majority of the staff interviewed have overwhelming interest to utilize the ICTs in the hospital. Therefore, based on the above, the two health institutions will realize their objectives of providing quality services to clients by use of new technology. Other characteristics of use of ICTs

in the two hospitals involved convenience in service delivery as well as enhanced quick delivery of services, resultant in customer satisfaction. Example, the patients will be able to register for their clinics before traveling to the hospital.

## 6.5 Existing medical records system at Case 1 and 2.

Medical records is a compilation of medical data relating to a patient which includes demographics, social history, recordings and observation from physical exams, tests, laboratory results extra. Fraser SF, Hamish et al (2015) advance the above argument that the information contained in medical records allows health care providers to provide continuity of care to individual patients. The medical records also serves as a basis for planning patient care, documenting communication between health care provider and any other health professional contributing to patients care. The advent of electronic medical records has not only changed the format of medical records but has increased accessibility of patient files. The increasing demand for a well-structured and accessible patient data and combination with development in computer science sparked great interest in the development of electronic patient record. Computers have the potential to improve legibility, accessibility and structure which made it essential requirements for provision of health care services. According to Munge (2006) medical records therefore underpin the proper functioning of all information related systems in hospitals environment due to their information content. This makes the maintenance of good medical record keeping systems of particular significance within the context of any health system. The need to find new ways of structuring, managing, sharing and utilizing health care information is important. Findings in section 4.3.4 and 4.5.4 indicated that the two hospitals have taken keen interest on developing an automated system using the new information communication technology.

Whetton (2005) points out that an electronic medical record (EMR) can be a powerful tool to make health care delivery more effective and more efficient. Efficient provision of these services depends on largely on the availability of and access to medical records by the hospital staff, clients, and other stakeholders.

The finding from the two health institutions revealed that there was both manual and electronic medical records system in existence. Respondents interviewed indicated that the patient files were stored in paper format in which patient information were in the form of bio-data or demographic information in electronic medical format. Respondents from both Case 1 and 2 indicated that there were two medical records systems in place that was manual and electronic system.

The manual medical records system had its own failures such as delays to accessing patient information due to either misfiling and missing paper patient files while it's faster to access patient information using the electronic medical records since patient information could be accessed on any computer across in the two hospitals.

The finding agree with the literature from the government of Kenya, Health Sector Reform (2008) that many challenges facing contemporary health care systems originate in the way the system have traditionally provided services and managed the ever increasing amount of information generated in the process. These methods are inappropriate for the contemporary health environment with its emphasis on consumer-centered service delivery, continuity of care across the service, evidence centered-based into community care and preventive programs. There was need to find new ways of structuring services and managing the information generated hence the great emphasize for electronic medical records.

Whetton (2005) in his study found out that the degree of integration is dependent on the perceived purpose of the record and the level of automation and connectivity that technology is able to provide. Although, the finding show that the staffs in the two hospitals are provided with inadequate computers and others ICT devices, the departments connected to the internet and use Fun soft are able to provide a quick and enhanced service delivery. It will be prudent therefore, that the two hospitals to run a complete electronic medical records system that will enhance service delivery to their clients. Running manual and electronic services at the same time amounts to some section of the hospital providing delayed services to its clients, especially in the areas where the facilities are inadequate.

## 6.6. Types of Electronic Medical Records generated and managed:

The developed theme on Medical Records automation and types of EMRs generated and managed was answered by analyzing the responses to structured interview questions 7 and 8 in schedule II, question 12 schedule 1 and question 14 in schedule III. The aim was to get information from the hospital and staff which medical records were automated and types of electronic medical records generated and managed in the two health facilities.

Findings of the study in section 4.3.4 and 4.5.4 showed that respondents from both Hospitals indicated that registration points were automated; when the patient comes in the hospital registration takes place but other services were still manual. Patient information concerning their demographic information including patient physical address, age, next of kin, residence, telephone numbers, patient names, occupation were generated in the system. When all the demographic information was entered in the computer system then the same information could be accessed on any computer across different departments and unit within the hospital. The system would generate report on

how many outpatient and inpatient were attended on a specific day. The system could generate reports on patient admitted or discharged in the hospital or transferred.

The respondents in the two hospitals noted that the new system was in almost all the departments. We had Fun Soft Electronic Medical System in Finance, Nursing, Health Records and Information Services, Pharmacy, Accountants, Supplies, Human Resource, Security, Public Relations but clinical procedures were being done manually. The clinical work was done manually because the bulk of the management of the patient files was in paper format. The clinical module was in the system but it had not been activated in the sense that the clinical notes were handwritten, creation of notes in the wards were still on paper. At the time of interview the system was able to generate invoices for any services provided, drugs dispensed, patient stationeries and staffs were able to print receipts after payments and prints gate pass for clearing the patient out of the hospital after discharged.

One respondent was quoted saying:

"We use *Fun soft for registration, nursing services, supplies and billing and it's because management provided it to us. This help us to check patient records, stock and revenue collection.*"

Information based on interview results shows that observation charts, cardex, fluids charts, care plans, diabetes charts, barograms, head injuries , treatment sheets charts, consultation forms, registers, recitation registers, equipment registers are all in paper formats. Fluids charts and other forms were at ward level and were put on bed side of patients and when the patients were discharged; the forms were all put in patient files and stored in central library of the hospital. The new system was used in charging of suppliers and dressing on daily basis using nursing modules.

Respondents indicated that the Fun soft system only generated patient information whereas the patient numbers were used to provide the accessibility of patient files but everything else was manual. The patient medical records were not available electronically.

The respondents also indicated that there were a few areas in the hospital that had complete patient records automated which include cardiac clinic and AMPATH clinics at Case 1. However; numbers or names input in the system display history of the patient in terms of encounter with the health facility and all details such as abscondees and cleared bills were captured on the system. The statistical office also generated a report at the end of each month.

The study findings had shown that most of the services in Case 1 were automated apart from a few departments and units, the major one being the clinical module for the doctors. However; different reports were being generated by the electronic Medical Record System.

In Case 2 respondents indicated that the different services had been automated and the system generated admission, outpatient and discharge reports which covers the number of patients that were seen, the age of patients and their demographic patient information. The system was fully utilized in the registration of patient in that when manual register were not available then the staff could use the electronic system to access patient information.

The study found out that the electronic medical records system generated the reports on the census of patient in the wards, patient information or statistical outpatient reports, inpatient reports example the number of patient seen, discharged, died or absconded and the report of the patients going to theatre. From this study, it was revealed that the clinical

module had not been introduced and therefore, there was need to introduce this module so that the clinicians could use or access patient information without waiting for the physical or paper file of the patient for a long time which delay service delivery to the clients.

One key informant from ICT Department at Case 2 pointed out that 40% of the hospital process were automated which included the finance back and front desk services; that was registration and discharge, payments, supply or procurement services at the stores were also automated . Health Information system, pharmacy and inventory were also automated. Based on medical services, health records was the first to be automated ensuring all patients in the hospital were registered then moved to cashier or finance and the next would be the Doctors' module which was yet to be procured. There were arrangements in place for more computers to be procured and tailor-made tablets for doctors for clinical or ward rounds.

At each level of the health care system, users of health information have differing needs and use information in different ways. At the most basic level of client–health worker interactions, patient records are a vital source of information, whose utility is not confined to the individual level. Record reviews can be used to ascertain the extent of conformity with agreed norms and standards of care. Confidential enquiries and facility-based audits review provider practices in order to determine to what extent care could be improved and the degree to which deaths were avoidable and the potential policy implications of such avoidable factors.

At the facility level, managers need information on patient profiles, patterns of admissions and discharges, length of hospital stay, use of medicines and equipment, deployment of different categories of health care workers and ancillary staff, costs and

income. At district level, planners and managers use this information and data on locally relevant population profiles and risk factors in decision-making regarding allocation of resources to different facilities.

In conclusion, it was found from the above discussion that the two hospitals had only automated patient registration and nursing module for charging supplies and dispensing drugs. The finance department was able to charge using the same system for any services provided to the clients. Findings revealed that the two hospitals were yet to implement the clinical module for doctors to access complete patients information. There is need for a three tier system that will be able to generate reports from all departments and sections of the two hospitals. There is also urgent need for tick forms for data collection and generating reports for various users in the hospital. A good electronic record system generates reports at end of every task. The module to generate clinical reports as part of medical records required is missing in the existing electronic medical record system.

## 6.7 Need for information for clinical support and information sources.

Wilson's general model of information behavior (2006) in Njoroge, (2010) demonstrates that information need is the motivating force behind information seeking behavior. The model points out that the user will go for the suitable system or source of information to fulfill an information need. The suitable system or source could entail or be assisted by use of ICTs. This could imply that a user will accept an innovation if this innovation is seen to make it possible the satisfaction of information need. Therefore, the health workers maintain to use the innovation because they have had positive results from utilizing the innovation. Whetton, (2006) points out that in the day - to - day operation of health services; a great deal of health-related information is generated about organization, department, health professionals, and consumers. This includes personal and clinical

information pertaining to individual patients as well as administrative, financial, and management information relating to organization. This information needs to be stored securely but made accessible to relevant individuals needing or seeking access, continues to increase, as does the number of locations where information is stored. The increasing interconnectedness of health systems within the health institutions means that much more of this information is now available to many more individuals within and across an organization.

Findings had shown that patient information to the hospital staff is important especially those in clinical areas since their success depends on their capability to access patient information and utilize it for improved services to the hospital clients. Similar to any other service, the clinicians have need of various types of information concerning their daily operations. One of the objectives of this research was to establish the type of information essential for health workers and the challenges they come across in accessing such information. The analysis of the data collected from the interview schedules was able to bring out the type of information that was required by clinicians who included doctors and nurses from Case 1 and 2.

The findings demonstrated that the staff from the two health institutions are involved in various specific health activities and hence need a wide range of information to undertake their daily assignments. Their information needs were mainly relevant information on their areas of specialization including patient care and treatment. Therefore, as the results indicate, the various activities generate varied information needs, which are influenced or determined by the health worker's specialized areas and daily activities. This study confirms the findings of a study by Haine et al. (2010) in Owano, (2013) in which they established that:

*Researchers and clinicians, even those in the same college, often have very different information needs, with clinicians requiring quick, concise information and researchers requiring more in-depth information.*

The results also confirm investigation carried out by Otike (1997) on the information needs of lawyers, where he established that their information needs were: "*greatly influenced by the nature of the work they do"*. In the case of this study, this can be alluded to the diversity of areas of specialization in the respective service areas in the two health institutions. The information needs of the staff wholly depended on current and relevant information, including new development in their areas of specialization. The health workers particularly the clinicians will require information to be able to administer treatment and take care of the patient. The information needs of the health workers from the two health institutions are adequately met since the information sources are readily available.

## 6.8 Sources of information consulted

The respondents were asked what information sources they use and if they were easily accessible, adequate and up-to-date.

The findings from Case1 indicated that there were several sources of information particularly to clinicians, example the use of tablets, personal smart phones, the hospital protocols and also they do consult colleagues. The respondents indicated that tablets and smart phones were so fast to access the patient information required. The patient information could still be accessed through patient files apart from the electronic medical information stored on the fun soft system. Information on paper records were not easily accessible due to sometimes misfiling and also the movement of patient files across the

hospital. Patient information could easily be accessed by the clinicians and other staff in the hospital when it was fully automated this means that the patient information or record could be accessed by use of the computers which was networked on the local area network.

The majority of the respondents cited the delay of accessing the patient information due to either misfiling or missing paper files. There were times when the computer hangs, electricity goes off which was most frequent and at times the internet was slow and that means the patient information could not be accessed in paper files and causes delay in the provision of services to the patient or clients. A number of respondents cited information access as one of the major obstacle to provision of quality services to the hospital patients. Further discussion with the interviewees exposed that they could still use the computers to go to the internet and surf the areas of their specialization and access information. They also use books from Moi University Library to make reference to the areas of concern and update themselves. The information sources at the library are not adequate because the numbers of users of the library are high since the library was being used by undergraduate, postgraduate students and staff. Other limitation of accessing the information were Internet sites where they were supposed to access information are to be paid for, therefore becomes a limitation to access to health information.

The respondents also cited the login to the system by use of the password was an impending factor as much as the patient information was confidential. The systems were also slow and the frequent black out was an impediment to access to health information.

Respondents were further asked if sources of health information for all patients seen in the hospital were adequate and complete. They indicated that computers had internet connections, therefore was use of new emerging information technologies. There were

also other libraries within the hospital apart from Moi University Library example Training Centre library in the hospital, Skills Lab at the School of Medicine and University Library at the School of Public Health where the hospital staff particularly the doctors, clinical officers and nurses were allowed to borrow the books, periodicals, journals and other available information materials.

The respondents from Case 2 pointed out that they access health information using the internet services provided by the hospital; there was connectivity across the hospital where most computers in different departments were connected on the internet. Other respondents further pointed out the use of other technologies example use of personal Tablets, Mobile Phones, Laptops apart from the Nairobi University Library specifically School of Health Sciences.

The respondents from Case 2 also indicated that these resources provide adequate information in terms of the staff requirements in their area of specialization. However, respondent cited the frequent power blackout and low internet services as the main limitation.

One respondent was quoted saying:

*"The Internet services had not been there for the last two weeks due to nonpayment"*

This study revealed that the power blackouts and low internet services were common challenges to staff that hinders provision of quick and quality services to their clients.

From the above discussion, respondents from the two hospitals pointed out that the utilization of computers and other new technologies present opportunities and impending benefits to clinicians which include providing quality services to the patients in the hospital. Since the medical field was quickly evolving and keeps on changing, therefore

these sources were not hundred percent adequate, but the adoption of ICTs enabled staff from the two health facilities to be more quick to respond and work together with customer needs. It is important to note that respondents advocated the use of new technology for better services to the clients.

The findings indicate the majority of the health workers from the two institutions use the internet to access information in electronic journals, to know what has been published and to keep in touch with peers and friends through emails and social networks like Face book and LinkedIn. Thus, the Internet is the most useful in accessing electronic journals, both current and retrospective, although print copies are also used.

These findings concurs with the views of Royall et al. (2005) who observed that the Internet constitutes a new and attractive channel for accessing the latest in health services. The Internet therefore, offers the health workers the immediate access to a wide variety of health information. The two hospitals should ensure the availability of internet services to all departments and sections of the entire hospital and to address the power blackout by installing the power generators and solar systems.

## 6.9 EMRS Introduction to Users

Whetton, (2005) confirms that organizations are evolving entities. There are times, when an organization experiences quite rapid change. Without some planning and management, rapid change can be disruptive to the organization and its members. In today's environment, rapid and dramatic change is occurring more frequently and information technology is increasingly involved in organization change. Theories and strategies of change management are shaped by assumptions about an organization and its members. One way of categorizing this is as follows:

- *Empirical- rational: assumes that people, once they realize that that it is their interests to do so, will accept change. Strategies within this category emphasis communication and rewards.*

- *Normative - reductive: adopts a cultural approach to understand and managing change. A basic assumption is that people are social beings guided by cultural norms and values. Change management seeks to redefine existing norms and values.*

- *Power - coercive: assumes that people will essentially do what they are told, or can be made to do so. Strategies focus on authoritarian, top-down approaches and the use of sanctions for non-compliance.*

- *Environmental-adaptive: based on the assumption that, although people oppose change, they will adopt to new circumstances. Strategies within this category focus on 'building' a new organization as people move from the old structures to the new ones.*

While some assumptions and ideas may seem more attractive than others, all may be successful when used appropriately. Elements common to most theories include:

- *The human factor, in that it is important to work with people who are involved in the change process*

- *The dynamic nature of change and its impact on all systems within the organization*

- *Embedding the change into the structures of the organization*

- *The importance of communication*

- *Change involving technology, which may involve a long learning curve, pointing to the need for incremental change.*

Health enterprises with a traditional hierarchical structures are often slow to adopt information technology (Anderson 1997, Sanummi et al 2001, Tanverrdi & Iacono 1998). Whereas the more teamwork - oriented organization is more receptive to the introduction of information systems (Whetton, 2005). Yet, traditional, hierarchical organizations do successfully implement changes, including the introduction of information systems, if strategies are planned to match the particular characteristics of the organization.

Findings of the current study based on question 18 in the appendix 1 of the interview schedule further revealed that the Departmental Heads had meetings on the introduction of Electronic Medical Records System though the lower staff had no meetings to discuss about the introduction of the new system. According to Rogers's theory of innovation, diffusion is the process by which an innovation is communicated through certain channels over the time among the members of a social system (Rogers 1995). The channels are the ways through which a group or organization communicated the innovation on other individuals, groups or organization. The channels can be either mass media or interpersonal. Interpersonal channels are more efficient in informing and changing attitudes towards shifting a new idea and this also influence the decision to adopt or reject a new idea.

The staff of Case 1 indicated that there were continuous medical education forum where staff were introduced on the new system but not all staff were trained on the use of EMRS. The respondent suggested continuous training for the staff on the use of the new system for both old staff and those joining the hospital. The ICTM from Case 1 indicated that when the new system came on board, the program had two day training for the staff

working at the registration point only which means other staffs were not trained at these sessions. There was need for continuous or ongoing training on the job since new modules were being introduced or being developed.

In Case 2 staff, it was established that staff were told to start off using the new system without proper communication and training, only few were trained. According to the Rogers theory viewpoint; prospective adopters of innovation must be trained about innovations, be influenced as to the merits of the innovation. A person search for information at various stages in the innovation decision process in order to reduce doubt about an innovation expected cost. This personal innovativeness theoretical perspective means that every person adopts innovations at different levels. This also means that persons who are inclined to being innovative will adopt an innovation earlier than those who are less predisposed. Novel ideas that are simple to understand are adopted faster than innovations that require the adoption to develop new skills and understanding. Therefore, there is need to have continues training of staff in both hospitals. The field of change management focuses on understanding and enabling the change process. Discussions of change management include theories that seek to understand and explain organization change and approaches and tools to facilitate successful management. Whetton (2005) points out that current thinking is that planned stage needs to be understood and tailored to fit the specific needs of an organization with its cultural, economic and political context which also emphasizes communication and rewards.

Change involving technology which may involve a long learning curve pointing to the need for incremental change. This also means that there is need for an integrated approach to the introduction of  the new system since the whole hospital set up includes a network of all departments and units that coordinate their work to form a complete system.

Therefore, some departments should not be left out in the process of the introduction of the electronic medical record system fun soft. Both the clinicians' and medical record system should be a 4 tier system that starts with the patient registration, nursing services, the medical doctors, pharmacy and procurement and supplies connected in the network to complete the cycle. This also means that all staff from those departments are involved and trained from the introduction and use of the new electronic medical record system. It is significant to understand that Health Information Systems have people as components parts and therefore the two health institution should involve its staff at all cadres in the introduction of the Electronic Medical Records; Fun soft.

## 6.10 Challenges encountered in the application and use of the electronic medical

### Records.

Challenges that could hold back the implementation of EMR in public teaching and referral hospital in Kenya are presented in the table below together with potential solutions. Information about these challenges and their solutions could be helpful for developing a procedural framework that can assist EMR implementation.

**Table 6.1: Challenges encountered in the application and use of the electronic medical Records.**

| Challenges | Solutions |
|---|---|
| Lack of ICT management capacity and support | Preparing, Educating and d training of primary user of EMR |
| Inadequate servers and connectivity | Sufficient computers connectivity |
| Frequent electricity interruptions | Backup power system i,e Solar system and generators |
| Inadequate computers | Increase the funding for EMRs |
| Lack of backup plans in down time or Poor Maintenance periods | Develop working procedures in case of abrupt breakdown

Allocating adequate finances for regular maintenance in implementation budget |
| Inadequate infrastructure for EMRs | Increase funding , Sufficient computers connectivity |
| Interoperability challenges | Digital scanning of the archives, scan old records |
| Internet connectivity | Upgrades of Computer system, |
| Security fear in accessing and using EMR system | entail access passwords

Frequent easement and monitoring computer system security levels

Protection of patient information transmission |

| Resistance to use EMRs | Staff involvement in decision making and implementation, training on usage. |
|---|---|
| Low Funding | Adequate budget from Government and Public-Private Partnership |

The fifth objectives sought to examine the challenges encountered in the application of electronic medical records in the provision of health care services at the two hospitals. The findings maintain the evidence of the earlier scholars who pointed out that the new information and communication technologies have brought in openings for improving access to medical records to improve efficiency and effectiveness in provision of health care services to the hospital clients. Hasanain, (2014) observed that the apparent ICT benefits have provoked many institutions and organizations to accept and invest in this technology. However, understanding the advantage of ICTs is not clear as a result of the differences between adoption and usage (Forman and Goldfarb, 2005). Various institutions adopt technology on the outside but unless it is regularly and appropriately used, it will not have a positive impact and may even have a negative impact. However, the staff from the two hospitals cannot make frequent use of ICTs unless they are informed of the possible benefits of ICT to improve the health care services they provide to their clients and have requisite ICT skills to engage in health services. Predominantly, not all staff were trained from both the institutions.

The findings revealed that a bigger number of respondent accepted that their departments have computers assigned with Fun soft electronic records system utilized on a daily basis for provision of health care services to their clients which are networked internally and connected to the internet. The challenge facing the health workers in the two health

institutions is need of proper ICT skills and training; hence, they requested for continuous training in ICTs. Training boost awareness and confidence level as users are capable to overcome fear to use the EMRs and as a result; optimal use of IT towards the transformation of healthcare services.

The other challenges that were encountered included inadequate or lack of services like Internet connectivity. Respondents from Case 1 reported slow network that may prevent staff from registering patients which bring delay causing patients to wait for a long period to receive the services. There were frequent reports of server down and unpredictable Internet connectivity, poor infrastructure, ICT capacity and low bandwidth that frustrate staff from accessing and retrieving the patient records. The time taken to switch between the main power and standby generators was long and therefore the time laps interrupts the access to patients' information and data entry.

Further, discussion with the respondents indicated that the budget short fall was also the limiting factor in terms of provision of enough computers that could cover all departments and having infrastructure in every place in the hospital. The next problem pointed out by the respondents was the few computers and slow internet connections particularly use of the fiber optic connection to reduce number of routers and interruptions. The respondents also noted little attention paid to maintenance and therefore in most cases respondents reported that several computers were nonfunctional. These findings should be treated with a lot of seriousness it deserves specifically when such computers are used to determine ICT diffusion and its utilization in Case 1. This observation was maintained by the same findings the respondents indicating the huge short fall by the hospital concerning adoption and use of Fun soft record system was the poor maintenance offered to existing ICT equipment in the hospital. This could be coupled with the small budgets allocated to

the hospital each year; therefore, this leads to poor maintenance of the existing health information system predominantly the electronic medical records in the hospital. However, the hospital personnel must have a broad initiative and enthusiasm to make use of the ICTs and the new medical record system, given that they could enroll for classes to improve their skills in the use of ICTs and EMR.

Attewell (1992) and Love et al (2001) confirms that the rate of adoption and use of ICT by employees in any institution was affected by the training offered. This is maintained by research findings Njoroge (2010) that puts forward that more technology is not what organization needs. Indeed the level of computer usage is often very low among firms that own one computer, what was most needed was raising the skills and overall capacity of staffs working in the hospital to access and use new technologies as well as upgrading their skills.

Respondents pointed out the problems of accessing the old patient information in old patient records. The patients come for a revisit and recovering of old notes was almost impossible. Electronic medical records would allow hospitals to access past records instantaneously. Several EMR systems currently offer integrated portal or individual health records systems which access patients and third parties to access medical records with a protected user name and password. Various institutions have already been successful in implementing the integrated organized systems. Previous paper medical records must be incorporated into patients' electronic medical records by scanning the records and retaining them as images.

Case 2 had its own challenges reported by the respondents interviewed. The respondents pointed out the inadequate ICT infrastructure in the hospital and therefore, several departments had no computers and internet use. It was generally acknowledged that the

accessibility of a wide range of computers and internet connection and communication services in the hospital was imperative in that it permitted the hospital staff to access the patient information at their remote point that was, in their clinical rooms for doctors and provide proper services according to the patient specific needs and expectation.

Consequently, there was a variety of reasons why the Case 2 staffs were not fully exploiting the possible use of ICTS in accessing patient information. These reasons vary widely from one department to the other; among them is lack of training for staff working in the clinical areas where they attend to the patient every day, lack of ICT infrastructure to be able to connect every department, sections and units of the hospital; high cost of Information Communication Technologies and internet connectivity, slow internet access owing to the weak server for the whole hospital. The respondents also pointed out the diverse computer programs that hospital personnel were using that were outdated technology. These issues fell under the hospital management domain which required to be addressed to facilitate the exploitation of the new Fun soft medical records system in the hospital.

Case 2 respondents also pointed out the limitations of accessing the old paper medical records. To attain accessibility, efficiency, patients' security and cost savings assured by EMR, previous paper medical records preferably were to be integrated into the electronic medical records. The digital scanning processes involved in conversion of these physical records to EMR were expensive. Case 2 had its first scanning process but which was stopped since it was expensive and its server broke down.

The two health institutions had facilities-based challenges ranging from access facilities, which are either inadequate or poor and unavailability resources, to that of coping with technological advancement.

As outlined above, the upward flow of information appears to be associated with an absence of data analysis and use, particularly at the lower levels where the data originate. Data are provided by the lower levels of the system and most often analyzed at the top of the pyramid – if analyzed at all. The information system seems to stop at the stage of data production – diligent recording and reporting of health data is associated with weak analysis and comments on the findings. This is most striking in the context of the two health institutions. There is need for the institutions to have a three tier system that generate the required reports for decision making which is lacking with Electronic Medical Records in place.

# CHAPTER SEVEN

# SUMMARY OF MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

## 7.1 Introduction

Sampson (2012) in Alabi (2015) speculates that the aim of the conclusion chapter in PhD thesis is to present key elements of the knowledge resulting from the research, priorities for future work from the study and contribution to existing literature. Consequently this chapter provides conclusions and recommendations of the study. This research carried out a study on the Framework for the Implementation of Electronic Medical Records in Public Teaching and Referral Hospitals in Kenya

The following research questions were addressed: What kind of medical records systems exist in Case 1 and Case 2, how adequate is the infrastructure at the two hospitals to support electronic medical records? To what extent is electronic medical records utilized in Case 1 and Case 2 in the provision of healthcare services to patients? What types of knowledge and skills have been developed to support electronic medical records? What challenges were met in the application and use of the electronic medical records in the two referral hospitals? How can the challenges encountered in the application and use of the electronic medical records be overcome?

This chapter is organized around the themes of the research questions, key variables of the theory underpinning this study and the broader issues around the research problem. The study was guided by the Roger's Diffusion of Innovation Theory (DOI) and Design of Information and Records Keeping System Model (DIRKS).

**7.2 SUMMARY OF FINDINGS**

The empirical findings of the study are analyzed and summarized below on the extent of use of electronic medical records by health care workers in the two hospitals. The section first summarizes the demographic findings. This followed by Medical records System, utilization of Electronic Medical Records and recommendations for improvement.

**7.2.1 Demographic profile of Respondents**

The findings revealed that the respondents were 47.5% from Medical Records Staff while an equal number of 47.5% were Clinicians. Responses from these categories were immense as they confirmed that the establishment and sustainability of the electronic medical records in the two hospitals is a success story and need to be enhanced.

**7.2.2 Electronic Medical Records System**

According to the study findings, for the two hospitals to offer the quality health care services to their clients; they require to completely adopt and utilize the ICTs in particular the Electronic Medical Records. The Electronic Medical Records would allow the two hospitals not just to be able of accessing patient information across the hospital but also offer the clinicians and other hospital staff the utilization of information from their point of service and for this reason high quality service to the hospital clients. The use of ICTs would save on time and space in terms of records access, storage and ease of use.

**7.2.3 Information Sources**

It was established that the hospital staff and particularly the medical staff consulted different information sources for their daily services to their clients. The most currently used information sources among the primary sources of information were the journals,

manuals, reports, standard operating procedures and formulary. The tertiary sources included the use of internet among others. The findings confirmed that the utilization of internet and digital media like I pad, Laptops, Smart Phones etc was on the rise as compared to print media and colleagues. This rise in use of the new media, with an increase of social networking sites raised the need to utilize the Internet for immediate access to patient information within the two hospitals.

The Internet as infrastructure in the two health facilities was found to ease access since one could access information stored online from a wide variety of Internet enabled devices from one area of the hospital to the other at the staff own convenience.

The findings established that the information resources available to the hospital staff met their information needs, indicating the level of adequacy and availability of the sources. This attribute calls for continuous improvement particularly the ICTs infrastructures and Internet services across the two health institutions since their use would contribute positively the provision of quality services to their clients.

**7.2.4 Access and Utilization of Electronic Medical Records**

One of the major findings in respect to access and utilization of Electronic Medical Records was the fact that the Medical Staff viewed ICTs as their basic tool in providing quick and quality healthcare services to their clients. Therefore, the two hospitals management should ensure the availability of the ICT tools across all Departments and Units. They should ensure that every staff should access a computer, in addition to accessing the Internet services. The ICTs should be adequate to cater for all staff even those newly employed in the hospital.

### 7.2.5 Hospital wide ICT policies, patient Information access and use

The study findings established that, the two hospitals were in the process of drafting the regulatory framework regarding the utilization of the Electronic Medical Records; however, most medical staff only knew of the available access restrictions on use of patient information on the computers. Medical Staff were not in any way involved nor informed of the draft policy. They were of concern of restricted accessibility to patient information since the patient information is confidential and the restriction was also to safeguard against risks related to loss and misuse. The policy is necessary as it would assist the ICT personnel in the maintenance of the security and integrity of data stored in many data stores across the two hospitals. The medical staff recommended for the involvement of all stakeholders in the drafting of the ICT policy.

The study established that staff were only allowed to access patient information by use of password and had only access to use ICT for official purpose. They were expected to protect their password as well as e-mail account when accessing and exchanging patient information with colleagues. There was also restriction on the use of face book to minimize social interaction amongst staff.

### 7.2.6 Challenges experienced by Medical Staff

Study findings also revealed the inadequate training as a challenge, therefore there is need for continuous training for all staff and those who join the institutions later. The findings revealed that the two hospitals did not have adequate computers for the hospital staff and therefore there was need to keep all staff abreast with new skills required. This included continuous training in computer and ICT skills so as to equip the staff with the right skills that will assist them in utilizing patient information adequately. There was also need to

enhance on the connectivity of Internet services or infrastructures particularly the increase of bandwidth, reduce downtimes on the Internet service and therefore increase the speeds of access. When all of the above are done then the services provided by the two health facilities would improve.

### 7.2.7 How to develop the access and use of Electronic Medical Records

The findings confirmed that the two health institutions did not have enough computers and other accessories for use by the health workers as much as they embrace the use of EMRs for quality healthcare services. On the other hand, there was inadequate Internet connectivity and bandwidth which require the ICT personnel to improve across the hospital with suggestions of use of wireless communication within the hospital. This will go a long way to reduce the downtimes on the Internet service and enhance speed of access to patient information

There was need to have continuous update on ICT skills to keep up with new development in technology and new services to their clients. This was found to be impeding factor to quick access to patient information, where staff are required to be assisted on retrieval of patient information. The two hospitals are required to invest so much in continuous training for both updates and training newly recruited staff.

### 7.3 CONCLUSIONS

This section presents conclusions of the study. The conclusion covers the following areas: Information sources; access and utilization of Electronic Medical Records; Hospital Wide ICT Policies and challenges experienced by medical staff.

### 7.3.1 Information Sources

The findings in this research had shown that the medical staff appreciates the use of ICTs in the provision of quality services to their clients. The ICTs are utilized to access the patient information and for better information management. Information had been found to be the most critical element in both health facilities and the medical staff regards ICTs as a tool for the provision of quality health services to their clients.

The two hospitals had relied on manual and automated information systems to access patient information. However, this was changing due to high demand of the use of ICTs and quick access to patient information by medical staff. The research findings indicate that the access to and availability of patient information by use of ICTs translates to quality healthcare services to the hospital clients. This explains the high demand of the utilization of Electronic Medical Records and need for adequate ICTs infrastructures in the two hospitals.

The two health institutions can realize diffusion of ICTs among health workers by ensuring that every medical staff has access to a computer, in addition to providing other ICT facilities like the use of Internet and other digital media which the study revealed that they are on high rise compared to print media. The Internet, was found to be the necessary tool used by Medical Staff in the two health facilities, while Internet was found to enhance access to patient information since the staff could access patient information stored online from hospital wide Internet services at point of connectivity

### 7.3.2 Access and Utilization of EMRs

The study established that, information needs of hospital staff play a significant role in the diffusion and utilization of ICTs. The research disclosed that the individual health

institutions will adopt a novelty if it was seen to facilitate the satisfaction of an information requirement and maintain to utilize the novelty because they have had a positive result. Consequently, information access, processing and dissemination were found to be the most influencing factor for the utilization of EMRs in health institutions. The need for efficient and effective information systems to access patient information was the pushing force for the use of EMRs in the two health institutions. The Senior Management of the two health institutions influence and support was also found to be the motivating factor in the adoption and exploitation of EMRs. The continuous training of medical staff on the use of ICT was necessary for the improvement of access to Electronic Medical Records. The study further established from the qualitative study that the necessary facilitating factors for the use of Electronic Medical Records Were: Availability and access to internet, adequate bandwidth, hospital wide internet connectivity, steady power/ electricity supply, technical support, regular staff training on the use of Electronic Medical Records, institutional policy on use of ICT and Senior Hospital Management support. The findings seem to indicating to infrastructural factors such as bandwidth, internet connectivity, stable electricity supply and technical support as the most common issues influencing adoption and use of electronic medical records in the two public teaching and referral hospitals in Kenya. The study concludes that non supportive environment as witnessed in the limited bandwidth, unsteady power supply, lack of readily available technical support and inconsistent training amongst medical staff are impeding factors for the use of electronic medical records in the two health facilities.

### 7.3.3 Hospital Wide ICT policy

The overall findings of the study showed that ICTs policy that regulates its use is a necessary requirement in organization particularly a health institution. The health staff

points out the need to enshrine ICT policies in regard to accessing patient information and its use as this is important to safeguard the confidentiality of patient information and other risks pertaining to improper use of ICTs. This requires all stakeholders to be involved in the development of these policies to cut across all services in the two health institutions.

### 7.3.4 Challenges experienced by Medical Staff

The fifth objective sought to address the challenges encountered in the utilization of Electronic Medical Records. The challenges included:

- Inconsistent staff training on ICT skills as to equip staff with the right skills that will assist them in utilizing patient information adequately;
- Lack of hospital wide policy on use of electronic medical records,
- Low budgetary allocation that covers the initial set-up costs and perceived connection ongoing costs of ICT and need to enhance connectivity of Internet services,
- Low bandwidth; long downtimes on the internet service,
- Inadequate budgetary allocations for acquisition and installation of electronic medical records, poor culture of using electronic medical records.

The findings points out that most of the challenges were internal in the two hospitals and this could be addressed through proactive senior hospital management interventions.

The study therefore concludes as follows:

The two hospitals were facing financial challenges and therefore being government facility top management should request for Government support to address some of these challenges. Access to capital for initial investment and sustenance could also involve Public-Private partnership and donor funds could also be resourceful in raising funds

necessary for purchasing hard ware and software and other IT infrastructure required. This would also addresses the economic challenges to EMR adoption, to increase the speeds of access to patient information; improve on ICT infrastructure in terms of number of computers and connectivity with the implementation of fibre optic cables is necessary.

There is need for the government of Kenya to address the high rates of connectivity and servicing of Internet, to reduce the rates to manageable costs. This would go a long way in increasing access to patient information, encouraging the use of ICTs by health institutions and at the same time speeding up the diffusion of ICTs in health institutions.

Technical and time requirement challenges are more user related and can be addressed by training health workers and involving them in the complete process of establishing and implementing the EMR system hence ensuring a positive buy-in. To realize the full potential of EMR adoption, joint effort will be required by both management and other stakeholders. Therefore, letting representatives of user groups participate in all processes of establishing EMR and implementation process is a key thing.

There is urgent need for top management of the two hospitals to influence policy in management of EMRs.

Communication and training of staff: Communication will help the users of the system to understand the processes of introducing an EMR system and their involvement. The entire user groups would require training or hands on the EMR system before use and regular updates on skills. Induction and orientation of all new staff either employed or under placement would be necessary in enhancing user's acceptance. These trainings would address the technical and technological challenges faced by users of the system. Putting into consideration of DIRKS system development processes and Rogers Innovation

Diffusion theory could assist in establishing and adopting of EMR system in the two hospitals.

## 7.4    RECOMMENDATIONS

Arising from the findings and conclusions of this study, the following recommendations can be made:

### 7.4.1    Institutional factors

**Recommendation1**: **Sustainable and adequate budgetary support.** The study findings indicate that the two hospitals are not getting sufficient financial assistance that would make possible complete adoption and use of EMR in accessing patient's information in the two hospitals. There are challenges for the two institutions in receiving sufficient funds for acquiring of ICT resources needed to implement EMRs. Implementation of EMRs infrastructure is expensive and this demands for increased funding for the two hospitals.

In light of this, the study recommends that the Government should allocate sufficient funds for supplies and regular maintenance. Therefore, Steps must be taken to ensure sustainable and adequate budgetary support system development, scalable-up / roll out and operations. This should also include ICT infrastructure-wide array of computers and internet connectivity and communication services across the two hospitals.

**Recommendation2: Strategies for the Development and Implementation of Policies.**

The two hospitals should develop strategies for the advancement and execution of policies to steer on the diffusion and utilization of EMRs. These approaches should be acted upon according to the following deliberations: That in order to support greater distribution of ICTs and use of EMRs in the hospital environment, it is important to come

up with a framework in terms of policy. Secondly, policy deliberation on how to train hospital staff and stakeholders on ICT skills. This would give confidence to individuals to utilize ICTs and EMRs to access the patient information; and further to allow them to make best use of the benefits of accessing ICTs.

**Recommendation 3: ICT Implementation Plans.**

If ICTs and specifically use of EMRs are to include a positive impact on the hospital operations then ICT plans need to be maintained in the two hospitals strategic plans particularly those that target medical records or patient information. In this direction, ICTs based on the ICT policy and strategic plans would be incorporated as vital tools for the delivery of quality health care services to the two hospital clients.

### 7.4.2  Human Resources and Capacities building

**Recommendation 1:** The two hospitals to encourage their staff utilize ICTs and EMRs; therefore there is a critical need to improve the hospital staff proficiency by making sure that the two hospitals develop the ICT skills through training, seminar and workshops to continually making best use of ICT so as to gain quality health care services to the two hospital clients. This approach should be adopted by the two hospital management. The training of hospital staff boost awareness and confidence level as well as being able to overcome technophobia while relating usage to expected benefits. To be able to enhance access to information the following should be undertaken: develop framework for ICT skills formations. The role of ICT department in these two hospitals should be strengthened to advance basic ICT skills and developing framework to support higher level of ICT skills formation that includes marketing, organizational, security, trust and

management skills in addition to training ICT skills by education institutions. This will assist to reduce the ICT impediments to the improvement of health care service delivery.

**Recommendation 2:** The two hospitals should mount free training on ICTs skills and specifically electronic medical records and their applications in the health facilities.

### 7.4.3 Develop an institutional legal framework for electronic medical record

The health institutional policy particularly governing electronic medical records in Kenya remains unambiguous and yet they have legal implications on the hospital overall performance. Therefore the two hospitals have no authority for recourse in electronic disputes.

**Recommendation 1:** The legal framework need to be developed by individual health facilities, it is extremely important that this initiatives is followed up to ensure timely and suitable new developments in the healthcare services.

**Recommendation 2:** The government to come up with sufficient legal framework and capacity; both human and infrastructure to be able to handle national ICT security network, network security, cybercrime and to have a link with other international organization to combat cross-border ICT crimes which entails developing an electronic security government structures. The national ICT policy in Kenya has no clear mechanism for electronic medical records protection for example evidential value of electronic records and specific areas not addressed yet to be addressed by the government for example in Kenya's electronic transactions bill 2007 and information communication Bill 2008, (Njoroge,2010).

7.4.4 **Increased bandwidth accessibility. The respondents complained about the slow access to patient information through the internet.**

**Recommendation 1:** The two hospitals to install the fibre optic infrastructure and through setting up of a countrywide fibre optic backbone by Kenya Data Networks (KDN).

**Recommendation 2:** The government should also address the problem where users are restricted by the high connectivity rates; therefore the Government should lower rate on connectivity and use of internet.

**Recommendation 3:** Most of the respondents indicated the use of other ICTs devices to access medical information, therefore the government should encourage the use of computer based and mobile phone based technology services through tax reduction and tax incentives to service provider example internet services.

**7.4.5 ICT Deployment**

A significant number of the hospitals' staff from the two health facilities was not fully exploiting the potential of ICTs to improve on their services. The study findings revealed that the two hospitals had not connected all the departments and sections on the internal networks and internet telecommunications. In Case 1, example the mental Health department had not been connected and the clinicians example the medical officers and consultant had not been provided with the computer hardware and software to utilize the fan soft electronic medical system. Case 2 faced the same challenges where the medical officers and consultant were not provided with the facilities to access the electronic medical records. Example; in the Case 2 theatres where the hospital had 24 theatres only 10 computers had been connected to the hospital electronic medical records. The staff

from the same department did not have the capacity to derive benefits from the use of ICTs in terms of Knowledge and skills.

The current systems were limited to the record staff, the nurses, the finance and the supplies staff.

**Recommendation 1:** The hospital management therefore has a big role to play in ensuring that staffs in all departments and sections use ICTs adequately to access the patients' information services. In this regard; the two hospital management should consider the following issues: increase the use of computers in their hospital operations, use technologies to enhance the patients' services and social networks that exist and those that are often used as source of health information.

**Recommendation 2:** The two hospitals should invest adequately in ICTs which would likely yield gains in the provision of quality health care services to the clients, invest in learning and organizational change and put in place clear measures to enhance stable networks and enhanced transactions.

**Recommendation 3:** The two hospitals should be able to manage the change process from the manual paper records to computerized electronic medical records. This will necessitate informobilization a concept based on social-technical system theory, whose focus is on concurrent processes of technological and social change on the joint optimization of human and technical processes within the target group (Whetton, 2006). The findings had indicated the problem of old age clinicians who resist the use of computers in the provision of their services to the clients.

**Recommendation 4:** The hospital management should ensure the application of computers in the provision of health care services where the doctors and consultant would

come to appreciate the capability of ICTs and more importantly they learn to integrate them into their own specialized services they provide. The above will ensure that the use of computers in two hospitals have optimal impacts in the provision of health care services.

## 7.4. 6 Information Sources

The study sought to establish the information sources used by the medical professionals. The findings indicated that the medical professionals in the two hospitals had problems in accessing health information relevant to their areas of specialization. The information systems and other ICTs devices that would provide for their information needs were not adequately available in the hospital.

The vital benefit associated with the use of computers and ICTs devices is the increase in access to patient and health information. As shown from the findings the two hospitals had plans to purchase tablets and I Pad for the clinicians to access health information which in turn reduces uncertainty and increases the health information updates. Information updates will generally lead to better decision making and improve the quality of services to the two hospitals clients.

**Recommendation 1:** Before the implementation of use of ICTs by the clinicians, the information needs of the clinicians should be identified in order to provide the system that meets their needs. There are many ICTs resources in the market that are of potential use to clinicians. However, its use to access health information has direct impact on the quality of services they provide to their clients. Any software application should be developed only after an accurate assessment of clinicians' information needs. The lack of health providers in content creation and the software development may make much of the

system lie unutilized. To have a continuous development of the content of the clinicians' module and other modules for other health care providers, an incremental approach needs to be followed, with the updates that meet their information needs. The health care providers' ownership and participation in the development of information system will ensure acceptance of use and continuity, while the management administrative approach will in most cases bring down the system even before its utilization without guaranteeing its future sustainability.

**Recommendation 2: W**hen dealing with information needs of the health care providers, the implementation should have a balance between the specific groups needs i.e. demand-side factor and supply-side factors. The supplier-side factor involves the adequate budget, the right skills and sufficient access to the ICTs resources, which will allow the utilization of the computers and other ICTs devices in the hospital. It is therefore important that the two hospitals facilities to address this concern as urgently as possible. The right approach would be need-driven but not the hospital to load it on the hospital staff in the planning of the interventions since the later has never worked but has presented the awkward picture of the hospital management. The two hospitals should think far more about the drivers that make an organization want to use ICTs such as the need for patient information. In any given institution particularly in developed countries is that utilization depends on varied reasons such as social, economic, political, cultural and organizational factors. Those factors need to be addressed heads on to enhance the use of ICTs in the two health institutions. Supportive institutional policy will set base on the establishment of ICTs use. Therefore, before implementation of health information system; studies should be carried out fast to establish the purported users information needs and current information systems gaps.

In this study ,the information needs considerations, need for change management, training and sharing information and factors influencing diffusion and utilization of ICTs and related devices in the hospital environment have been discussed.

**Recommendation 3:** Due to the potential use of computers and the electronic medical records in the hospitals in enhancing the provision of quality services to the clients, it is the opinion of this researcher that the findings of the study be part of important contribution to the area of use of electronic medical records in the provision of health care services to the two hospitals clients. Further, this new knowledge may have practical implication for the establishment of electronic medical records utilization strategies to the health care facilities in Kenya.

## 7.5 Contribution and Originality of the study

The originality of this study is reflected in a number of ways. Previous studies have investigated on Medical records in manual/ paper records (Munge, 2005) and determinants of technology adoption and use decision based on Technology Acceptance Model (TAM), Adoption and Use of Electronic Instructional Media among Academics. These studies, in terms of scope, examined the relationship between the combination of academics' individual characteristics and attitudes towards technology adoption and use (wario, 2014 in Alabi, 2015). The present study used a combination of DIRKS and DOI models to understand the factors influencing technology adoption and use. The originality of this study, furthermore, lies in its ability to establish the best predictors of technology adoption and use in health institutions context of public teaching and referral hospitals in Kenya.

This study empirically examined the use of electronic medical records using qualitative method approach. Other studies conducted here in Kenya and Botswana ( Odini, 2010; Alabi, 2015) have used either quantitative or mixed method approach. The qualitative method approach enabled the researchers to conduct in-depth investigation into the area of research.

The study also provides empirical baseline data as managerial guidelines for policy formulation on driving and promoting electronic medical records adoption and use in public teaching and referral hospitals in Kenya and other health care institutions in Kenya.

### 7.5.1 Contribution to Theory

Theoretically, this study provides additional insight into understanding of users' behavioral intentions towards technology adoption and use in public teaching and referral hospitals and other healthcare facilities environment in Kenya. The study therefore; contributes to existing literature on use of technology and its adoption particularly to different users in the healthcare facilities, facilitating conditions and technology adoption and use. The study established that the facilitating conditions and behavioral intentions were predictors of technology adoption and use. In addition, this study established the relationships between healthcare service provision experience as a moderating variable on the independent constructs (performance expectancy, effort expectancy, social influence, facilitating conditions, compatibility, trialabilty and observability) of the DIRKS and DOI and technology adoption and use. This is the major contributions of this study that could direct future research. The study positioned work experience within the healthcare context by examining different cadres in the two health facilities. The DIRKS model can be extended by adding other health care facilities as an additional construct to predict technology use in any context setting.

**7.5.2 Contribution to Policy**

The Policy makers in Health care services may find the outcome of this study useful in developing a framework for information policies that address technology adoption and use in healthcare services. In hospital environment the study may assist the management to develop institutional policies on integration of electronic medical records into healthcare services.

**7.5.3 Contribution to Practice**

This study provides information on the factors that influence healthcare services adaption and use of electronic medical records. The study found that the need to access and utilize patient information were the strongest determinant of adoption and use of electronic medical records in healthcare facilities. The findings could help the two hospitals to develop strategies that can foster adoption and use of electronic medical records and improve the provision of healthcare services to their clients. This study makes a contribution towards a framework for understanding the facilitators and inhibitors of technology adoption and use among the healthcare workers and provides recommendation on how these challenges can be addressed to improve healthcare services to the patients. The findings of this study may be used by health care workers in the hospital setup to align their roles to change in provision of healthcare services brought forth by the information communication technologies.

**7.5.4 Contribution to methodology**

This study contributes to methodology by using the grounded theory to establish the strongest predictors of adoption and use of electronic medical records in public teaching and referral hospitals in Kenya. Grounded theory becomes the most appropriate

methodology in data analysis that helps in empirical exploration of the influential factors of technology adoption and use among the health workers. This methodology is an approach that could hold relevance to EMR implementation with public teaching and referral hospitals in Kenya. This study also contributes to methodology by using the qualitative approach to confirm the factors influencing adoption and use in provision of healthcare services.

### 7.5.5 Proposed Electronic Medical Records Implementation Model

Respondents gave several suggestions on design and implementation of electronic medical records in the provision of healthcare services to patients at the two public teaching and referral hospitals in Kenya. The proposed framework identifies three main factors found to be pertinent from this study, namely: health information needs factors, organization factors and learning/training factor that all converge in the continuous use of EMRs by health care workers and other stakeholders in accessing patient information.

**Health information needs factors**- The findings of this study established the information needs as a determining factor in the utilization of ICTs by health workers. The need for information determines how information is to be accessed and therefore is the driving force.

**Organization factors** which involve the two hospitals to improve ICT infrastructure, carry out a training needs assessment for human capacity development, improve budgetary allocation and develop ICT policy.

This research used a theoretical approach and model to present empirical evidence regarding use of electronic medical records in provision of healthcare services.

The Proposed Electronic Medical Records Implementation framework presents a full sequence of activities which leads to establishing of electronic medical records system in a hospital set up. The design phase followed a stepwise process, first revising the information generating process based on the information needs for every service provided in the hospital, and then planning for the required resources to manage the information system. It calls for a consensus-building approach involving a wide range of user groups. First the participants must agree on standard comprehensive package of health care services and resource management activities that had to be performed in every service provided across the entire hospital. For each of these services and activities, essential indicators would have to be defined. Relevant data collection instruments would be revised or newly designed if necessary with the assistance of the experts in the service area. Then the participants must agree upon reporting procedures and data flows within the health services system. This system model has heavily borrowed from the DIRKS methodology; DIRKS is about building more efficient and accountable business practice through the design and encouragement of good recordkeeping a cross an organization. The proposed framework diagram below put in light various stages of the process of design and implementation. The sequence of information is relatively most complete and therefore; the model presents full range of influencing factors and mechanisms as explained earlier in the research paradigm: cognitive, social and environmental, and it integrates most of mentioned earlier research perspectives.

The proposed model applies to a wider range of information users in the healthcare service provision. The researcher hopes also, that it presents concepts of information system design and implementation and its possible conditioning factors in more clear way. The sequences intertwine and support each other; each one is full of crossroads and loops until they find closure in solving the problem or making a decision. The model

proposed here hopefully stimulates discussion and further theoretical and empirical studies, with the aim to construct a comprehensive and universal model of establishing an electronic medical records system in a healthcare facility.



*Figure 7.1: Proposed Electronic Medical Records Implementation Model*

Figure 7.1 provides a graphic representation of the proposed model for enhancing utilization of ICTs in the public and teaching hospitals in Kenya. The literature review and study results have shown that continuous utilization of ICTs is sustained by the dynamic factors after the initial adoption which is pegged on the technological factors.

- **Assess the current system**: This highlight the importance of end users, therefore any effective EMR implementation framework should ensure that the needs of the

end users are adequately addressed. This assessment should include first, whether the hospital has an electronic system or not, the efficiency of the software in use, whether the human resources and manpower are ready and qualified to use the system or not, if the infrastructure of the hospital is ready for such implementation or not, as well as finance. By providing a baseline assessment, a situation analyst helps the coding team to understand the needs, resources and conditions relevant to planning interests. The information needs assessment should be a bottom -up, demand-driven approach, such that it begins with appreciating the needs of the staff in the hospital as they would express them. The design and development of an information system should identify sources of patient information, services, accessibility and the seeking behavior of health workers. The information system should include how to generate, capture and process patient information. The assessment phase aims to assist in evaluating gaps in the current situation of the health care in the organization seeking implementation. Therefore, when designing an information system, it is prudent to align the technological system with the existing health information system. Another critical factor is IT skills. The health workers ought to possess a set of competencies to realize the gaps existing between existing and desired IT skills and understand the capabilities of ICTs for accessing and manipulating information.

• Preliminary investigations and analysis of business – consider user needs as early as possible. Engage users in the design and in implementation process.

•Identification of evidential needs.  Study current workflows. Failure to understand user processes can lead to workarounds, user resistance and loss of efficiency. This also involves user feedback at every stage of implementation. Usable designs are only accomplished with constant feedback from users.

•Revise instructions, guidelines and training materials. This involves understanding unique needs of local setting of issues comprehensively, understanding individual job responsibilities, level of education and perceived shortcomings of current education practices.

Standardize learning objectives and competences, curricula and job roles across the hospital.

Develop a map of IT role skills needed and learning activities. Improving education for workers and building workforce capacity.

- Test the design and instruments. Determine their functionality, use, user friendliness, flexibility, scalability and sustainability. This also includes assessing software performance vs. user needs, evaluate software linkages, data flow and sharing mechanisms, evaluate interoperability of existing software, determine existing infrastructure and its use, assess capacity of users plus effectiveness and efficiency of systems.

•Finalize the design and instruments by rethinking and redesigning processes to ensure a clear centered practice. This activity provides opportunity to plan organizational changes in daily workflow based on the improved features and functionality of new EMR. This exercise should be a center-wide initiative with representation from all areas of care and operational support.

•Training staff

It is important to identify and develop the skills, training and competencies consistent with hospital activities, languages and health systems that will be needed to realize the full benefits of these technologies. The maturity of the domain and the demand on expertise require standardized training and certification of professionals. Focus here is

to ensure that the end-user receives the required training and be familiar with using the new system, preparing, educating and training the staff to use the EMR.

• Start using available data : To assess the data capturing capabilities - Ability to capture

Complete and relevant information on treatment, care and support as minimum, technical capabilities for each software, interoperability with other systems and data storage and ownership. Primary data must be an objective because it takes place with the source in front of the documenter.  System Developer must address issues of medical staff with data stored at different levels of detail according to the interested use of that information.

• System implementation

It is at this phase that the project team also reviews the go-live stage of the EMR system. The advanced review includes other authorities such as training and preparing staff team. During this period the project should ensure that all requirements are available and ready. After ensuring the availability of all requirements, the executive sponsor gives the final approval for the go-live step.

• Review and monitoring

This stage involves establishing a monitoring process where users can report the results of their instructions with the system and suggest changes in a fluid way and evaluate the extent to which the desired outcomes have been reached.

• Culture of evidence based decision making established.

The EMR system should avail for life time patient records, and ease of summarizing and analyzing clinical information for assessment of trends and evidence-based patient management. Electronic Medical Record Systems (EMRs) to provide the necessary information for patient management, by automating the patient data capture and implementing of basic decision support for the clinician. This will improve patient care

and management of resources. EMRs should also provide quality aggregated data for Hospital Information Management Systems (HIMS) for better planning, health intelligence responses, and overall management.

- Adoption and maintenance (post-implementation) phase the AOHC (2008) report states that during the post implementation phase a number of tasks need to be undertaken when the new system is being used in a healthcare organization. Examples of such a task include ensuring validating entered data by end-users and providing continuous support to end-users as well as support for leaders.

The proposed model also recognizes the importance of information needs a major motivating factor in the utilization of ICTs to access patient information in the two hospitals. It highlights the fact that the motivation to seek patient information is a product of information needs, the necessary search paths that may be utilized by medical staff and other health workers to satisfy their information needs must be identified and addressed. This would involve not only acquiring ICTs but exploiting them to develop an information system that will align with the existing information system and link the user to information resources. This provides support for the design of information system and information management and this would be a starting point for health workers in the implementation of ICTs in hospital set up.

Finally, this study found out that the new information communication technologies have opened new opportunities for improving access and utilization of health information to enhance efficiency and effectiveness in provision of quality health care services to hospital clients. However, to increase the uptake of ICT and EMR system in the two health facilities, there is need for proper planning that involves all stakeholders in terms of training, change management and the execution plans. This will involve demonstrating

the importance of using EMR to all staff in the two health institutions, providing knowledge and skills to all staff which will enable all stakeholders to use EMR products, improve on infrastructure and provide reliable power. To avoid the common mistakes done during an implementation process, user needs and expectations should be incorporated in decision making. This also assists in easier acceptance and implementation of changes by the users of the system. There is also a substantial learning curve for Electronic Medical Records System. It is important if the users of the system have specific training based on their area of operations; example Clinicians are the primary users of Electronic Medical Records performing data entry such as patient bio data orders, progress notes and extra. Therefore; they should be familiar with computers during their training. On the same note, the medical records staffs have different backgrounds of training mainly high school grades. A specific training programme may be useful for them before they start to use the system. Therefore; it is important for the two hospitals to critically address the issues pointed out which will improve on the usage of EMR by the stakeholders in accessing patients information.

**7.5.6 Suggestions for Further Research.**

This study focused on the use of electronic medical records in public teaching and Referral Hospitals in Kenya. The study was limited to two public teaching and referral hospital in Kenya; that is Moi Teaching and Referral Hospital and Kenyatta National Hospital. This study has revealed several issues that require further research regarding the following:

i) Establishment of complete medical informatics in health institutions that will involve all health services provided in a hospital set up. These will include all services example

clinical, nursing, labs, stores and procurement, Human resource and finance apart from medical records.

ii) Further study require to be carried out to assess other barriers to EMRs implementation that have not been addressed in this study, these vary from one public hospital to another depending on organizational factors example; size of the hospital, geographical location among other factors. Interventions required may also vary from facility to facility, for there is no "one size fit all" EMR system implementers and change managers need to choose and decide on relevant interventions based on their actual conditions and situations.

iii) ICT Skills came out strongly in the study. It is recommended that further research be undertaken in the area of ICT training needs requirements in terms of identifying training gaps for all health workers in public teaching and referral hospitals in Kenya in order to improve their access to specialized information and to establish whether the skills should be imbedded as part of working conditions.

v) ICT policies was also seen to be a barrier in the use of electronic medical records by healthcare workers; there is need for further research in this area to identify the need for ICT policy in implementing EMR systems as this could enable individual health institutions to develop specific policies tailored to their needs., .

vi) Further research is to be carried out on developing strategies for implementation of policies that guide the diffusion and utilization of ICTs in healthcare facilities in Kenya.

vii) Internet came out as the best tool for accessing health information in the two hospitals. Therefore; further research should be carried to focus on the level of internet connectivity in all public hospitals in Kenya.

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**APPENDICES**

**Appendix A**

Use of Electronic Medical Records in the provision of Healthcare services to Public Teaching and Referral Hospitals in Kenya.

**Interview schedule**

Dear participant,

We conducting a research on the use of Electronic Medical Records in the provision of Healthcare Services to Public Teaching and Referral Hospitals in Kenya and weare requesting you to spend a few minutes to answer a few questions and be assured that your response will be treated with utmost confidentiality.

The research sets out to examine the nature of existing medical records management systems at the two Public Teaching and Referral Hospitals in Kenya, to analyze the application and use of Information and Communication Technology in managing medical records at the two Hospitals, establish the extent of use of electronic medical records for the provision of health care services; examine the level of managerial support and sustainability of electronic Medical Records at your institutions and establish challenges experienced in the use of electronic medical records in your Teaching and Referral Hospital. The outcome of the research will document the extent to which Electronic Medical Records are utilized and propose a framework for enhancing the use of Electronic Medical Records at Referral Hospitals in Kenya.

Raphael Wanyonyi Namaru

PhD Researcher

**APPENDIX 1**

**INTERVIEW SCHEDULE FOR THE MEDICAL PROFESSIONALS**

Serial No. _____          Interview Date_____

Department/Unit_____          Interview Time_____

---

**SECTION A: PERSONAL INFORMATION**

1. Please indicate whether you are          Male

   (Tick one Box)                          Female

2. Age_____

3. Your Designation_____

4. Position_____

5. Please indicate your highest level of **Educational achievement (Tick one box)**

Certificate   [  ]          Diploma [  ] Graduate[  ] Post graduate   [  ]

6. What          is          your          area          of          medical

   specialization_____

   _____

   __

**SECTION B: INFORMATION NEEDS AND INFORMATION SOURCES**

---

7. Which medical record systems exist in your Hospital? Manual ( )

   Electronic ( )

**8.** Which type of records are available to you for the day to-day services to your clients?_____

_

    a) A- X-ray

    b) B- Lab

    c) C- Patient notes

    d) Any other --- Specify etc

**9.** How are the records managed currently in terms of:

  Storage ------------------------------------

  Retrieval ---------------------------------.

**10.** Is there any time you use computers in the following aspects of medical records in your daily service to patients:

Capturing -

Access -

Retrieval –

Kindly explain how_____

**11.** What benefits have this system in terms of capturing, accessing and retrieval information for your clients?_____

**12.** In which areas are medical records  automated_____

a) Do you encounter some situations where you need more patient information/records to enable you continue with clinical work?

b) If yes,

c) please explain?_____

d) What mechanism do you use in trying to address these situations?

_____

_____

13). which information sources do you use? Please list them according to their usefulness and frequency of use

a). Is the information easily accessible wherever you need it?

_____

If yes, please explain

_____

_____

b) If No. do these problems affect the way you conduct your clinical work?

If so, in what ways? _____

14) Are your sources of information for patient care

-adequate

-Up-to date

15) Which problems have you so far experienced in the use of Electronic Medical Records?

a) How do you rate your competencies and skills on the use of electronic medical records?_____

_____

c) Has the Institution provided an opportunity to you to acquire ICTs training?

_____

_____

16) What retrieval approaches are provided by the system to access medical records?

Passwords

Open (without passwords)

Encrypted

17) Which limitations have you experienced in the use of Electronic Medical Records? if any_____

18) How was the electronic medical records system introduced in the hospital and were you in any way consulted? Or

19) Were you in any way involved in the initial stages in the design and implementation of this system? Explain_____

20) What do you think was not done as required at the time of establishment?

21) What recommendations do you propose to improve management, access and retrieval of electronic medical records system?

_____

_____

**APPENDIX 2**

**INTERVIEW SCHEDULE FOR THE MEDICAL RECORDS STAFF**

Serial No._____          Interview Date_____

Department/Unit_____          Interview Time_____

**SECTION A: PERSONAL INFORMATION**

   **2)** Please indicate whether you are                    Male

(Tick one Box)                                        Female

  3)Your Designation_____

  6) Position_____

  7) Please indicate your highest level  of  **Educational achievement (Tick one box)**

    Certificate  [  ]        Diploma [  ] Graduate[  ] Post graduate  [  ]

**SECTION B: INFORMATION NEEDS AND INFORMATION SOURCES**

(3) What medical records system do you have in place?_____

4. What are the benefits of this system in terms of retrieval and accessing information for

your clients?_____

5. What ICT infrastructure have your hospitals put in place to support electronic medical

records? (LAN, WAN, Wireless etc) Explain_____

6. Of this infrastructure, what do you directly use for records management?

(For creation, capturing, maintenance, use, storage, retrieval and transmission)

7) What medical records services are automated? _____

8) What type of reports does your electronic medical records system generate?

_____

9) To what extent is electronic medical records utilized in your hospital in the provision

of health care services to patients? Explain_____

10. How effective is your current records system in terms of retrieval and accessing

information for your clients?

Retrieval_____

Access

11. What retrieval approaches are provided by the automated system to access medical

records_____?

12). Does the organization provide opportunities for ICT training for Medical Records

staff? _____

13).What ICT skills and competencies have you acquired_____

14).Are there instances where lack of patient records has caused delay of provision of

service to the client? What happened?

15) Do you experience delays in retrieving patient files? _____If yes, please explain

how you handle such delays_____

16) What other challenges do you encounter when handling medical records?

_____

17).What do you consider to be the actual and/or potential benefits of ICTs in the

provision of healthcare services to the clients? _____

18). what would you like to see changed or introduced to improve access and use of

medical records at your hospital? _____

19. What recommendations do you give to improve management, access and retrieval of

electronic records? _____

**Appendix III**

**<u>INTERVIEW SCHEDULE FOR THE HOSPITAL</u>**

**<u>MANAGEMENT/POLICY MARKERS</u>**

Interview Date_____

Interview Time_____

**1. General Information**

Name of the Institution_____

Department_____

Designation /Position of the interviewee

_____

How long have you been in this position?

**SECTION B**

2). Does your institution use ICTs to support the core clinical and administrative

functions? _____

8) When did the hospital adopt the use of ICTs to support its function? _____

9) How was the electronic medical records communicated and introduced in the

hospital?

10) What were the reasons of adopting the use of ICTs?

11) Which areas are the ICTs applied in the hospital?

_____

_____

12) How have you prioritized Medical Records in your approach to ICT use?

13) Do you think information systems and services are useful as a clinical decision support tool for the provision of healthcare services?

_____

If so, please; explain _____

14) Does your organization have ICT Policy?

 If yes, how has the policy assisted in the development and implementation of Electronic Medical Records?

15) Do you have a web site? _____

If yes, what purpose does the web site serve your organization in regard to Medical Records?

_____

16) Does the hospital embrace complete Electronic Medical Records?

a)If yes, what are the strategies in use_____

b)If not, which plans does your organization have in place to establish and implement complete Electronic Medical Records _____

17) What skills have you developed for your staff to support electronic medical records?

18) What percentage of your staff has acquired the relevant ICT skills for utilization of Medical Records?

19) In which areas are Electronic Medical Records being utilized in the Hospital?

20) What are the benefits of use of Electronic Medical Records in terms of access, retrievability and maintenance?

21) 2What are your institution's sources of funding for establishment and sustainability of Electronic Medical Records?

22) What percentage of the total budget is allocated to ICT?

23) What challenges have you faced as an institution in embracing ICT?

24) What have been the challenges in establishing and use of Electronic Medical Records?

25) What recommendations would you give to improve the use of ICTs for accessing and utilization of clinical information to support the provision of quality healthcare services to Clients?

**APPENDIX B**

**<u>OBSERVATION GUIDE (For the Researcher)</u>**

Objective: To examine the nature, types, distribution, and accessibility of ICTs and how they are being utilized to access health information in the study area.

Date: _____

Time:From_____

To_____

Department/Unit_____

    1. Nature and type of ICTs

- ICT infrastructure

- Nature and types of ICTs available

- Application and use of ICTs available

- Hardware and software being used

2. Distribution of ICT tools and services

   - In the library

   - In departments/units

   - In the wards

   - In consultation rooms

   - Accessibility of ICTs by Medical professionals

3. Nature, types and availability of ICT tools and services in the library.

   - Internet facilities

   - E-mail services

   - Electronic Databases available

   - Accessibility of the services by the Medical Professional

   - Automation of the services.

**APPENDIX C**

**Coding Process**

**RQ1- What kind of medical records systems exists in Public Teaching and Referral**

**Hospitals in Kenya?**

| Book | Page | Designation | Response | Open Codes 🟦 | Axial co 🟨 |
|------|------|-------------|----------|------------|-----------|
| Case 1 | 3 | Case 1 NM | *Admitting and discharging* are done online going *electronic…daily bed returns* is done *manually* | • Manual<br>• Electronic | • Adm<br>and<br>disch<br>patie<br>• Daily<br>retur |

| | 7 | Case 1 NM | *computers were brought two weeks ago. Initially a records officer did* manual *and now uses a* computer.... *there are* computer systems *but always hand most of the time.* | • Manual<br>• Electronic | • Patie<br>regist |
|---|---|---|---|---|---|
| | 21 | Case1NM | Both...*some patients information profile is* electronic. Ordering and discharging online. | • Manual<br>• Electronic | • Patie<br>regist |
| | | | | | |
| Case 1 | 3 | Case1RS | We have no system in the library we still use manual system. *They have not automated any service in the library section and are* no computer in the department for keying any queries. | • The hospital library section relies only on manual system | • Clini<br>notes |
| | 6 | Case 1RS | *We use* terminal digit and straight numerical system. They have Fun Soft system in the pediatric emergency *unit though they are not using it in the coding and indexing unit.* They have not automated the indexing, collection of names, admission and discharge. | • Terminal digit<br>• Straight numerical system | • Index<br>Regis<br>and F |
| | 9 | Case 1RS | Fun Soft EMR. The registration of the patient only is the only one that is fully automated. It retrieves the number and allow the patient to make payment. | • Manual<br>• Electronic | • Regis<br>of pa<br>• Track<br>patie<br>• billin |

| | 35 | Case 1 RS | We have Fun Soft which is used for patient registration.<br><br>Sincerely, what is automated fully is the registration of patients. The other things are still manual. Like the patient files, a doctor has to look at them physically before a patient is treated. The only thing that is automated is the patient information in their biodata. | • Manual<br>• Automated | • Patie... regis... |
| | 39 | Case 1 CO | The recorded system that exists are both manual and electronic system. The Fun Soft is used for billing the in patient and the civil servants' patients which reflects to the other section in the hospital before they have written an invoice by the finance sections. The results are not presented electronically but they are taken to the pigeon holes for the records officers to pick. The dispatch requite is filled manual when the results are collected. | • Manual<br>• Electronic | • Elect... syste... for b...<br>• Treat... resul... not autor... |
| | | | | | |
| Case 2 | 1 | Case2 RS | Computerized. Funsoft is used in registration to access patient number to assist in a follow up. | • Computerized | • Regis... of pa...<br>• Track... patie... treatr... |

| | 7 | Case 2 RS | *Both manual and electronic files are stored. Files are in paper format while patient details are in electronic format for example, age, next of kin, demographic information and occupation.* | • Manual <br> • Electronic | • Regis of pa is in electr form <br> • Treat detai pape form |

**RQ4-How are EMRs utilized in providing healthcare services in referral hospitals?**

| Book | Page | Designation | Response | Open Codes 🟦 | Axial codes 🟨 |
|---|---|---|---|---|---|
| Case 1 | 3 | Case 1 NM | *Capturing, accessing, retrieval of patient information for example tracking of patients is done online.* | • Capturing <br> • Accessing <br> • Retrieval | • Tracking treatmen progress |
| | 7 | Case 1 NM | *Computers are currently used for charging and ordering consumables for only two weeks.* | • Charging of treatment | • Billing <br> • Procum and sup |

| | | | | | |
|---|---|---|---|---|---|
| | | | | • Ordering of consumables | |
| | 21 | Case 1 NM | *Use of computers in billing*. *Treatment is not provided online…only patient profile is done online* | • Registration of patients<br>• Payments of bills | • Billing |
| Case 2 | 3 | Case 2 RS | *Not fully utilized in that they still open physical file for use by the doctors despite the fact that clients file are opened at the computers from the reception.* | | |
| | 6 | Case 2 RS | *It is not fully utilized. There is still manual system. They are indexing information which they are unable to manipulate. Most of the work is manual. They just facilitate the retrieval. The data coded information in the computer is used by other people but not in the department.* | • EMRs are mainly used for retrieving patient information | • No full utilizati EMRs<br>• Relianc on pape records day to d operatio |
| | 9 | Case 2 RS | *The system is fully utilized in the registration of patients* in *that if the manual register is not there the staff will continue with the electronic system*. *The only challenge is that both manual and* | • The system is fully utilized for Registration of patients | • Relianc on pape records backups |

| | | | | | |
|---|---|---|---|---|---|
| | | | *electronic registers are used so tat they are forced to deal with both of them.* | | |
| | 13 | Case 2 RS | *It is well utilized because the patients are served only after the system has captured or registered them. However, in cases where network fails, the IT people, are relied upon to fix the problem before entering them in the system.* | • Patients cannot proceed to treatment unless their details are captured into the system | • Paper records filled pr being entered the syst |
| | 17 | Case 2 RS | *To a small extend because after keying in the patients details in the system, they again have to register and fill the card manually.* | • The system is fully utilized for Registration of patients | • Reliance on pape records day to d operatio |
| | 32 | Case 2 RS | *The system is not fully utilized because we still give the clients the attendance cards. I feel that the clients should not be given the cards but the system should just capture all those details. The only thing that has been full automated is the registration of patients.* | • The EMRs is only utilized for registration of patients | • Use of derails t effort to automat hospital function activitie |

| | | | | | |
|---|---|---|---|---|---|
| Case 1 | 8 | Case 1 RS | *Used by management researchers in planning and national policy formulation* | • Planning<br>• National policy formulation | • Patient informa... entered the EMI do not facilitate treatmer process serve as collectic |
| | | | | | |
| Case 2 | 5 | Case 2 RS | *Automation is across... rights is given to only three people. Rights of backdating, waiving, editing, finances is done at different rights.* | • EMRs have been utilized across almost all departments | • Only fev users ha been gra differen levels o EMRs r |
| | 9 | Case 2 RS | *All services we provide are automated except clinical module because of resources and resistance.* | • EMRs have been utilized across almost all departments | • There ar EMRs modules clinical purpose |
| | 8 | Case 1 RS | *Used by management researchers in planning and national policy formulation* | | |

| Case 2 | 8 | Case 2 RS | *We just use it when registering and admission of patients and when we are filling the monthly report. It makes our work easier; it is easier when it comes to retrieval of medical records.* | • The EMRs is utilized for admission registration & reports | • Allows retrieva medical records |

**RQ5-What challenges are encountered in the use of the EMR in Public Teaching and Referral Hospitals?**

| Book | Page | Designation | Response | Open coding | Axial C |
|------|------|-------------|----------|-------------|---------|
| Case 1 | 4 | Case 1 NM | *Slow internet: system is down most of the time.* <br><br>*Attitude: resist use of new technology due to age. People are not techno survey due to lack of facilities.* | • Slow internet <br>• System failure <br>• Resist <br>• Attitude | • Inad train <br>• Resis <br>• Insuf facili |
| | 8 | Case 1 NM | *Hanging of the system, e.g. now three days not able to order consumable online* | • System failure <br>• System delays | • Inad train |

| | 16 | Case 1 MO | *Underutilization* because *there are many people in the hospital who do not know about it.* | • Reliance of paper-based system | • Inad… train… |
|---|---|---|---|---|---|
| | 22 | Case 1 NM | *There are changes every time on the system* and *we are not informed e.g. this morning we were not able to use fun soft* *Desk tops computers are not enough*; *each ward or unit should have at least four desktop computers.* | • System functiona lity | • Inad… train… |
| | 42 | Case 1 MO | *Personally, no experience with the system* but I have heard other *users complain about system hanging* e.g. *microbiology lab not having a computer yet all operations are computerized.* | • System failure | • Inad… train… |
| Case 1 | 15 | Case 1 RS | *Sometimes that service is slow because you have to enter so many details. The clients are very many and at times you get tired by registering* the patients since *we have few computers* and we handle nearly/roughly 250-300 patients /people per day. | • System failure • System delays | • Resi… • Too work… regis… |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | • Negative attitude | |
| | 18 | Case 1 RS | *There is delay in delivering services especially when the system fails, the IT staff takes long to respond to queries, hence causes files to pile. Lack of inadequate training hence a problem in retrieving information. Keeping information in both manual and electronic system hence tedious.* | | • System failure<br>• System delays | • Inade train<br>• Slow due malf<br>• Too work regis |
| | 27 | Case 1 RS | *When the network is down, we are forced to go/use the manual system which is very tedious. Power blackout also affects us since the generator does not work on the computer. We are forced to go to the manual system in order for a patient to be admitted.* | | • System failure<br>• Power outages | • Too work regis using syste |
| | 37 | Case 1 RS | *Double entry of patient's number confusing the users of the system. You may find at times that more than one patient share a number. This makes it difficult for us to retrieve the records forcing us to refer the clients to the registration desk for details* | | • System delays | • Retri infor due corre |

| | | | | | |
|---|---|---|---|---|---|
| | | | *to be captured clearly and correctly. This leads to a lot of delays for the patients to be attended or treated.* | • Mix-up in the system | |
| | 42 | Case 1 CO | *We experience a lot of problems in the network. The server is always up and down. The system speed is at times very slow thus affecting our services.* | • System delays | • Slow due t malf |
| Case1 | 4 | Case 1 RS | *When power is off, we can't do anything since the system is computerized.* <br> *The system hangs 2 to 3 minutes but not all computers i.e. when the CPU has a problem.* | • System delays <br> • Power outages | • Slow due t malf |
| | 15 | Case 1 RS | *System is always slow, few computers, blackouts at times but have generators picking immediately* | • System delays <br> • Power outages | • Slow due t malf |
| | 19 | Case 1 RS | *When there is no power no access to patient information* <br> *Sometimes the system fails to operate i.e. today in the morning when there was in power* | • System failure <br> • Power outages | • Slow due t failu |

**INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)**

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471//2/3
Reference: IREC/2013/166
*Approval Number: 0001377*

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET
13th March, 2015

Mr. Raphael Namaru,
Moi University,
School of Information Sciences,
P.O. Box 3900-30100,
**ELDORET-KENYA.**

INSTITUTIONAL RESEARCH &
ETHICS COMMITTEE

**1 3 MAR 2015**

**APPROVED**
P. O. Box 4606-30100 ELDORET

Dear Mr. Namaru,

**RE: FORMAL APPROVAL**

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

*"The Use of Electronic Medical Records in the Provision of Healthcare Services to Public Teaching and Referral Hospitals in Kenya."*

Your proposal has been granted a Formal Approval Number: *FAN: IREC 1377* on 13th March, 2015. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 12th March, 2016. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

| cc | Director | - | MTRH | Dean | - | SOP | Dean | - | SOM |
|----|----------|---|------|------|---|-----|------|---|-----|
|    | Principal | - | CHS | Dean | - | SON | Dean | - | SOD |

# INFORMED CONSENT FORM
## VERBAL AUTOPSY OF NEWBORN DEATHS AND STILLBIRTHS

This Informed Consent Form is designed to ask questions to women who had stillbirths (baby born dead - did not cry, move or breathe at birth) in order to understand the potential causes of this outcome. Verbal autopsies are performed as part of a research study collecting information that would help improve the health of pregnant women, new mothers and their babies.

**Study Title:** Using ongoing newborn intervention trials to obtain additional data critical to maternal, fetal and newborn health in a harmonized way: the AMANHI* study
**Name of Principle Investigator(s):** Prof Fabian Omoding Esamai
**Name of Organization / Study Site:** Department of Child Health and Paediatrics, Faculty of Health Sciences, Moi University,
* AMANHI: Alliance for Maternal and Newborn Health Improvement

## PART 1: Information Sheet

I am [NAME OF FIELDWORKER] working for [NAME OF RESEARCH INSTITUTION]. As you know, my study team and I are conducting research to collect information necessary to help improve the health of women and babies in your community. I am visiting your household after being informed that you had a stillbirth (baby was born dead). I extend my deepest condolences to you and your family. We would like to understand more about why you had a stillbirth in order to attempt to prevent stillbirths from occurring in the future. I am going to give you information and invite you to participate in an interview about the events around your pregnancy and delivery. Your participation is voluntary and you may refuse to join or withdraw your consent anytime without any penalty. Before you decide, you can talk to anyone you feel comfortable with about this interview. If there is anything you do not understand, please ask me at any time and I will explain. If you don't want me to continue, please let me know and I can come back at another time of your choice.

### Purpose of the Research
We would like to understand why stillbirths occur in order to investigate preventative measures. For this reason, we are conducting verbal autopsies to collect information on the factors that could have led to this death. Verbal autopsies for stillbirths are being undertaken at 11 locations in 8 countries.

### Type of Research Intervention
This research will involve one interview.

### Participant Selection
We are inviting all women who had a stillbirth (baby born dead).

### Voluntary Participation
Your participation in the verbal autopsy is entirely vountary. It is your choice whether to participate or not. You will not be penalized in any way should you choose not to participate. You may change your mind later and stop participating even if you agreed earlier.

Version 11/11/2012

# MOI TEACHING AND REFERRAL HOSPITAL

Telephone: 2033471/2/3/4
Fax: 61749
Email: director@mtrh.or.ke
**Ref:** ELD/MTRH/R.6/VOL.II/2008

P. O. Box 3
ELDORET

13th March, 2015

Mr. Raphael Namaru,
Moi University,
School of Information Sciences,
P.O. Box 3900-30100,
**ELDORET-KENYA.**

**RE:    APPROVAL TO CONDUCT RESEARCH AT MTRH**

Upon obtaining approval from the Institutional Research and Ethics Committee (IREC) to conduct your research proposal titled:-

*"The Use of Electronic Medical Records in the Provision of Healthcare Services to Public Teaching and Referral Hospitals in Kenya ".*

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.

**DR. JOHN KIBOSIA**
**DIRECTOR**
**MOI TEACHING AND REFERRAL HOSPITAL**

CC    -    Deputy Director (CS)
      -    Chief Nurse
      -    HOD, HRISM

**INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)**

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471I/2/3
Reference: IREC/2013/166
*Approval Number: 0001377*

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET
13th March, 2015

Mr. Raphael Namaru,
Moi University,
School of Information Sciences,
P.O. Box 3900-30100,
**ELDORET-KENYA.**

INSTITUTIONAL RESEARCH &
ETHICS COMMITTEE
**1 3 MAR 2015**
APPROVED
P. O. Box 4606-30100 ELDORET

Dear Mr. Namaru,

### RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-
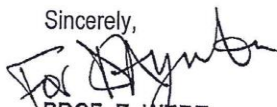
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Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc   Director   -   MTRH      Dean   -   SOP      Dean   -   SOM
     Principal   -   CHS      Dean   -   SON      Dean   -   SOD

KNH/R&P/FORM/01

**KENYATTA NATIONAL HOSPITAL**
P.O. Box 20723-00202 Nairobi

Tel.: 2726300/2726450/2726565
Research & Programs: Ext. 44705
Fax: 2725272
Email: knhresearch@gmail.com

## Study Registration Certificate

1. Name of the Principle Investigator/Researcher
   RAPHAE WANYONYI NAMARU

2. Email address: raphaelnamaru@gmail.com   Tel No 0723 736828

3. Contact person (if different from PI).....................

4. Email address: .....................   Tel No. .....................

5. Study Title
   The use of Electronic Medical Records
   in the Provision of Health care services in
   Public Teaching and Referral Hospitals in Kenya.

6. Department where the study will be conducted ......Health Records
   *(Please attach copy of Abstract)*

7. Endorsed by Research Coordinator of the Department where the study will be conducted.

   Name: MUSINA P.W.   Signature ..........   Date 17/02/15

8. Endorsed by Head of Department where study will be conducted.

   Name: For MARGARET MBUGWA   Signature ..........   Date 17/2/14

9. KNH UoN Ethics Research Committee approval number P629/10/2014
   *(Please attach copy of ERC approval)*

10. I Raphael W. Namaru _____ commit to submit a report of my study
    findings to the Department where the study will be conducted and to the Department of Research
    and Programs.

    Signature ..........   Date 17.2.2015

11. Study Registration number (Dept/Number/Year) Health Records/ 011 / 2015
    (To be completed by Research and Programs Department)

12. Research and Program Stamp _____

All studies conducted at Kenyatta National Hospital **must be** registered with the Department of
Research and Programs and investigators **must commit** to share results with the hospital.

Version 2: August. 2014

**UNIVERSITY OF NAIROBI**
**COLLEGE OF HEALTH SCIENCES**
P O BOX 19676 Code 00202
Telegrams: varsity
(254-020) 2726300 Ext 44355

**KNH/UON-ERC**
Email: uonknh_erc@uonbi.ac.ke
Website: www.uonbi.ac.ke

**KENYATTA NATIONAL HOSPITAL**
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/353        Link:www.uonbi.ac.ke/activities/KNHUoN        28ᵗʰ October    2014

Raphael  Wanyonyi Namaru
IS/PGL/07/2009
Dept. of Library, Records Management and Information Studies
Moi University
ELDORET

Dear  Raphael

**Research proposal – The use of Electronic Medical Records in the provision of Healthcare Services to Public Teaching and Referral Hospitals in Kenya  (P629/10/2014)**

This is to inform you that the KNH/UoN-Ethics & Research Committee (KNH/UoN-ERC) has reviewed and **approved** your above proposal.  The approval periods are  28ᵗʰ  October  2014 to 27ᵗʰ   October 2015.

This approval is subject to compliance with the following requirements:

a) Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
b) All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH/UoN ERC before implementation.
c) Death and life threatening problems and severe adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH/UoN ERC within 72 hours of notification.
d) Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH/UoN ERC within 72 hours.
e) Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
f) Clearance for export of biological specimens must be obtained from KNH/UoN-Ethics & Research Committee for each batch of shipment.
g) Submission of  an *executive summary* report within 90 days upon completion of the study
This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/or plagiarism.

For more details consult the KNH/UoN ERC website **www.uonbi.ac.ke/activities/KNHUoN.**

Protect to discover

## TIMETABLE FOR TRAINING FUNSOFT HMIS  CHAMPIONS *AT KNH*

| | DEPARTMENT | SECTION | DAY | DATE | TIME |
|---|---|---|---|---|---|
| 1 | FINANCE | Billing, Receivables,cashpoints | MONDAY | 23-2-2015 | 9am-1pm |
| | | Expenditure,votebook,treasury ,ledger | MONDAY | 23-2-2015 | 2pm-5pm |
| 2 | PHARMACY | | TUESDAY | 24-2-2015 | 9AM-1PM |
| 3 | NURSING | A&E, Clinics,Wards | TUESDAY | 24-2-2015 | 2pm-5pm |
| 4 | SUPPLY CHAIN MANAGEMENT | Procurement | WEDNESDAY | 25-2-2015 | 9am-1pm |
| 5 | HEALTH INFORMATION | | WEDNESDAY | 25-2-2015 | 2pm-5pm |
| 6 | SUPPLY CHAIN MANAGEMENT | Store and Inventory | THURSDAY | 26-2-2015 | 9am-1pm |
| 7 | FAREWELL HOME | Health information, Billing, Farewell attendants | THURSDAY | 26-2-2015 | 2pm-5pm |
| 8 | TECHNICAL SERVICES | Maintenance | FRIDAY | 27-2-2015 | 9am-1pm |
| | | Laundry | FRIDAY | 27-2-2015 | 2pm-5pm |

Monday 23 —
24 —
26 —
27 —