FACULTY OF COMPUTING AND INFORMATION MANAGEMENT

AN ADOPTION MODEL FOR ELECTRONIC HEALTH RECORDS SYSTEM IN HEALTH CARE FACILITIES: CASE OF SIAYA COUNTY, KENYA

BY

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DECLARATION

I declare that this proposal is my original work and has not been previously published or submitted elsewhere for award of a degree. I also declare that this contains no material written or published by other people except where due reference is made and the author duly acknowledged.

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This research project proposal has been presented for evaluation examination with my approval as University supervisor

Supervisor name	**Signature**	**Date**
Dr. Stephen Njenga	_____	22/11/2021

ABSTRACT

The electronic health record system offers a number of benefits which can be used to improve service delivery in the health care facilities that have implemented the systems. However, there has been a slow and stagnant adoption of EHR systems in health facilities across Kenya. The main objective of the study was to determine factors affecting adoption of Electronic Health Records systems in health facilities across Kenya and develop a model that could be used to inform implementation of the systems across the country. Siaya County was used as a case study. Collection of Data was done by administering a semi-structured questionnaire to the participants. Accuracy of data was ensured through checking the completed questionnaires before analysis. Analysis was done through the use of SPSS statistical tool. Correlation analysis through crosstabs was used to determine the relationship that might appear in the study. A statistical significance level of $p<0.05$ was used for the study. Frequency tables, graphs and charts were used to present the analyzed data. Results showed that a majority of the health facilities had between full and partially implemented EHR systems. The study showed that knowledge in ICT, Education level and healthcare perception were among factors that affected the implementation of EHR systems.

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DEDICATION

I dedicate this dissertation to my mother Angelinah Kasyoka, whose support and prayers kept me going, my father Paul Maiyuku, whose love for knowledge impacted and continues to shape me immensely, my daughter Taraji, who will grow to impact the world and Egeizarh whose encouragement that helped me finish this study.

ABBREVIATIONS AND ACRONYMS

EHR:	Electronic Health Record
EMR**:**	Electronic Medical Record
ICT:	Information Communication and Technology
SPSS:	Statistical Packages for Social Sciences
WHO:	World Health Organization

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CHAPTER ONE
INTRODUCTION

1.1. Background of the Study

Technology, since its invention, is rapidly developing to be one of the most crucial elements in the modern society especially in decision making the process. Technology poses a number of uses which can be used in the production, dissemination and communication of information (Chang & Gupta, 2015). This is one of the most essential elements of quality service delivery in the modern society and so as to ensure success in the performance of a particular organization (Jamoom et al., 2016). The quality healthcare is usually dependent on the adoption and utilization of proper systems which increase the level of efficiency and effectiveness of service delivery (Duncan et al., 2018). The electronic health record (EHR) is a system that is used in the management of health-related information. In essence it can be used in the formation, gathering and organization of a patient's information (Kim et al., 2015)

The electronic health record system offers a number of benefits which can be used in improving the level of health service delivery through improvement of the treatment benefits, increased access to patient information, fast delivery of healthcare, secure access to patient information and easy reconstruction of information through easy backup (Muthee et al., 2019). The quality of health care services is usually characterized with the manner through which services are offered, when they are offered, number of services available and documentation required. In health care delivery, quality is relative and must cut across all races, age and social status. Additionally, these services are affected ` by socio-economic conditions especially in relation to personal and population-based healthcare goals (Abdekhoda et al., 2015).

In developed countries, the adoption and usage of electronic health records systems has been implemented in a majority of the health systems. A majority of the healthcare practitioners in countries like the United States and the United Kingdom are conversant with EHR systems (Adler-Milstein et al., 2017). Nearly all hospitals (96%) in the United States have implemented certified EHR systems (Henry et al., 2016). According to Adler-Milstein, DesRoches, & Kralovec, (2015) there are still are a number of challenges which are mostly associated with the adoption of EHR especially in rural

regions however there has been significant growth related to the exchange of health information which is stimulating the adoption of these systems.

The quality of health service delivery especially in developing nations is still relatively poor due to a number of challenges. One major challenge especially in African countries is the poor health information systems largely due to the high costs of maintenance and procurement, lack of financial incentives, poor electricity supply, limited computer skills and access (Odenkule et al., 2018). A study conducted in Nigeria captured a number of challenges associated with the poor adoption of EHR e.g. low professional training, dissatisfied practitioners, inadequate technological infrastructure, poor policies and the government's indifference towards the adoption and promotion of EHR systems (Ojo, 2018). According to Alqahtani et al. (2017) there is a need to create proper design systems and implementation strategies that are instrumental in motivating adoption of EHR systems.

The Kenyan health system is guided by new the Kenya Health Policy Framework developed and effected in 2014. This framework's vision is to ensure the provision of quality healthcare services that are acceptable, accessible and affordable to all populations in the country (MOH, 2014). In this effect a number of activities have been implemented in order to attain these vision e.g. the rolling out of EHR in 646 sites across the country. However, this has been met with challenges like lack of expertise in the utilization of these systems, insufficient technological infrastructure, lack of centralized coordination, the inability to share data across systems and poor policies (Keny et al., 2015). Another study conducted in Kisumu captured challenges like a non-functional EHR structure, lack of training support for hospital management, non-user involvement, lack of a harmonized standard of enforcement, inadequate financial support and unreliable electricity (Isemeck et al., 2019). According to (Chirchir et al., 2021) the deployment of EHR needs to be spearheaded by the hospital heads and prioritizeexperience nurses.

1.2. Problem Statement

The adoption of EHR systems in Kenya has stagnated due to a number of contributing factors. Firstly, the country has made various steps to increase the adoption of these systems however, this is usually associated with suboptimal implementation and these processes are usually prone to compromises (Milka et al., 2017). Additionally, Keny et al., (2015) points out that the implementation of EHR is linked with a high failure rate and some of the systems are uninstalled as soon as they are implemented while those which are successfully implemented are not used to their full potential by the health practitioners. There has been a slow and stagnant adoption of EMR systems in health facilities across Kenya. For health facilities that have tried to adopt and implement EMR there has been a high failure rate (Chepkwony, 2015). Another study also shows that almost 19% of EMRs are uninstalled soon after implementation, and approximately 30% are not used to their full potential by the medical practitioners. "A major reason for this is the lack of a clear understanding of all the factors that are likely to affect EMR adoption" (Njoroge, 2014).

Currently there exist no proper models for the adoption of EHR. A study conducted (Chepkwony, 2015) aimed at determining the factors associated with EHR adoption. A total of 127 participants were captured in the study and both quantitative and qualitative approaches were used. The study concluded that resource availability and capacity building influenced adoption of EHR. However, no model was created from the study. A similar study conducted by (Chebole, 2015) concluded that adoption of EHR was greatly affected by capacity of the healthcare, perception of the health care and workload in the health facility. Similarly, the study did not produce a model but only examined the factors and how they affected the adoption.

Studies conducted are mainly in developed countries focus on associated barriers in a national context and mainly in an urbanized context. Data mining techniques like regression can be used to determine the adoption of EHR. There are few studies that use regression to predict the adoption of EHR given the factors that can influence its adoption (Chirchir et al., 2020, 2021).

This research proposed to have an in-depth examination and analysis of factors that may greatly affect the widespread and full adoption of EHR systems and develop a model that could be used to increase the adoption level of these systems.

1.3. Objectives of the Study

1.3.1. General Objective

The main objective of the study was to develop an adoption model for electronic health records system in health care facilities in Kenya

1.3.2. Specific Objectives

i. To determine factors that were associated with the adoption of EHR systems among hospitals.
ii. To establish an EHR system adoption model that captured the identified factors
iii. To validate the effectiveness of the proposed model

1.4. Research Questions

i. What are the factors associated with the adoption of EHR systems among hospitals?
ii. How would the EHR system adoption model capture the identified factors?
iii. What is the effectiveness of the proposed model?

1.5. Significance of the study

The proposed research will help inform EHR software developers and implementers on the factors that influence successful adoption of EHR systems. EHR systems adoption will also help improve the standards of health quality and ensure consistency in the provision of such services. It will also be instrumental in the development of policies that would ensure increased adoption of EHR systems among facilities in the country.

1.6. Justification of the Study

One of the major contributors to poor quality in the level of service delivery in Kenya is low levels of adoption of EHR. A majority of the health facilities in Kenya encounter

issues like long queues and patients dying before acquiring health services in the health facility. This can be reversed through the adoption of EHR systems.

CHAPTER TWO
LITERATURE REVIEW

2.1. Introduction

The adoption of EHR systems in the various health facilities in the society is linked to a number of factors which will be discussed in this section. This section will also provide literature on other studies which focused on the adoption of EHR systems in hospitals and the encountered challenges.

2.2. Theoretical Framework

2.2.1. Factors Associated with the Adoption of EHR Systems

There are a number of factors which have been found to influence the level of adoption EHR systems in hospitals. These can be categorized into the user's perception of ICT, organization structure and culture, knowledge on ICT infrastructure, accessibility of the infrastructure, financial implications and change process which are discussed in this section.

2.2.1.1. Knowledge on ICT

The effective usage of EHR systems is associated with the users' knowledge on the usage of ICT most especially computers. In developing nations, there is a high level of digital divide that plays a significant role in EHR systems adoption in health care institutions (Dranove et al., 2015). EHR systems are composed of sophisticated software and hardware systems which require a certain level of knowledge on computers in order to ensure effectiveness in their usage. Few hospital personnel members have information and possess the technical capability to manure through these systems (Mennemeyer et al., 2016).

Despite the hardware being in place, inability to effectively use these systems could be linked to low levels of ICT. There have been efforts to implement IT programs for healthcare related courses in order to improve the practitioner's level of knowledge and skills on usage of EHR systems (Gagnon et al., 2016). However, EHR developers also overlook the required level of technical abilities which are required in order to increase the efficiency of operation of the systems (Kruse et al., 2016).

2.2.1.2. Accessibility of ICT infrastructure

There are a wide range of services which are offered by ICT infrastructures in order to improve the level of health service delivery in a particular health facility. ICT infrastructure must therefore be available in relation to the availability of hardware, software, and a network. The accessibility of these infrastructure would also be critical in determining the pattern of adoption of these ICT infrastructure (Gheorghiu & Hagens, 2016). The basic usage of EHR is associated with minimum specifications which are usually provided by the developers e.g. the computer specifications. Training in the usage of these systems is also required in order to improve the skills of health practitioners in order to improve their ability to access the systems (Henry et al., 2016). However, the effectiveness of the training exercise is dependent on the health practitioner's attitude. EHR system vendors also develop and roll out systems which are not vetted and unsatisfactory which can limit the level of accessibility (Adler-Milstein et al., 2017).

2.2.1.3. Perception of healthcare practitioners

The adoption of EHR systems is also influenced by the health practitioner's perception of the systems. Perception is mainly associated with an individual's level of awareness and preparedness to utilize or implement something (Abdekhoda et al., 2015). Other individuals are however influenced by technological self-efficacy "the belief in one's ability to successfully perform a technologically sophisticated new task". Perception focuses on an individual's judgements as opposed to skills possessed by a particular individual (Duncan et al., 2018).

Change is perceived to be good when it is associated with a minimal amount of time consumed in learning and adapting to the system (Chang & Gupta, 2015). Additionally, the selection of the appropriate EHR systems to implement is a daunting task as it has to be tested and fully implemented. Additionally, time is also required for the personnel to learn how to maneuver through the systems in order to ensure change in the level of service delivery (Odenkule et al., 2018). Another perception of is the level of system ability of the systems which is mainly associated with the level of security and privacy offered by these systems and their level of reliability (Gagnon et al., 2016).

2.2.1.4. Financial Implications

Financial implications are associated with monetary issues which are linked to the adoption of EHR systems. The costs associated with the implementation of these services are correlated with the extent to which EHR systems are adopted (Henry et al., 2016). In essence, it is critical for health facilities to have revenue to cater for the start-up and ongoing costs associated with the adoption of the EHR systems in the health systems (Mennemeyer et al., 2016). A majority of the health facilities in the world are incapable of catering for the associated costs of dealing with the associated costs of adoption of EHR systems (Jamoom et al., 2016). Costs associated with the adoption of EHR systems include the need to purchase and ensure the systems work effectively. Additionally, maintenance, support and license fees are critical in ensuring the adoption and usage of EHR systems (Isemeck et al., 2019).

2.3. Models Associated with the Adoption EHR systems

2.3.1. Diffusion of Innovation Theory

This theory was developed by Rogers (2003) in order to explain the manner through which new innovations and ideas are adopted and spread across populations. The theory states that diffusion is a type of communication which occurs over time among individuals in a particular social system. Once an innovation is introduced in a particular social setting, the people will either accept or reject judging by several factors. This theory mainly focuses on five key areas which include the description of the innovation, the decision-making process that is considered by the target population, characteristics of the people who are likely to adopt the idea, consequences of adopting the theory and the communication channels.

There are various steps which are associated with the adoption of a particular idea which includes:

1) **Knowledge-** the people are introduced to a new innovation however, they have little information about the new innovation, and they are unmotivated to seek more information about it.
2) **Persuasion-** the people begin to develop interest and seek more details about the innovation

3) **Decision-** they begin weighing the advantages and disadvantages of adopting the innovation. It is also at this stage where they choose to accept or reject the innovation.
4) **Implementation**-individuals begin to utilize the model in varying degrees while they also determine its usefulness and continue to search for more information about it.
5) **Confirmation-** a final decision is made to continue using the innovation as depicted in Figure 2.1

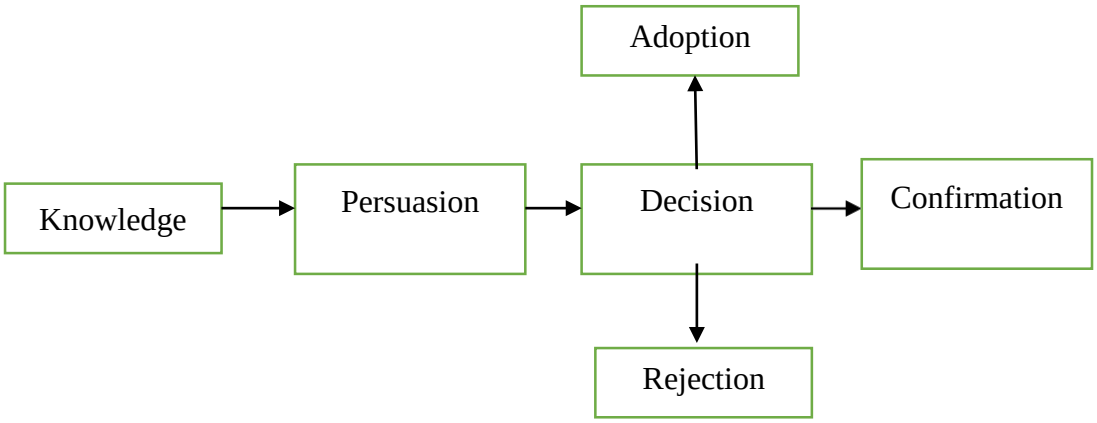

Figure 2.1: Innovation-Decision Process

The theory also classifies the individuals in the social system in relation to how they adapt to innovation. This theory categorizes the individuals in five classes which include the innovators, early adopters, early majority, late majority and the laggards.

1) **Innovators-** this is inclusive of the individuals that are willing to take risks, have financial liquidity, have access to scientific sources and other innovators.
2) **Early adopters**- these individuals have the highest risk degree of opinions and they also have high social status among peers. Most times they have leadership roles and are comfortable bringing new ideas on board. However, they are also discreet, and they use judicious ways in maintaining central communication.
3) **Early Majority**-These individuals take a substantial amount of time to adopt new innovations. They also have average social status; a limited number of contacts and they do not hold any positions of opinion leadership.

4) **Late Majority**-They adopt the innovations long after the early majority and they have a high level of scepticism towards a particular innovation. They also have little finance and contact.
5) **Laggards**-They are usually the last to adopt a particular innovation and they typically and they usually tend to focus on the traditions and have low social status, financial liquidity and contact. They are significantly resistant to change as shown in Figure 2.2

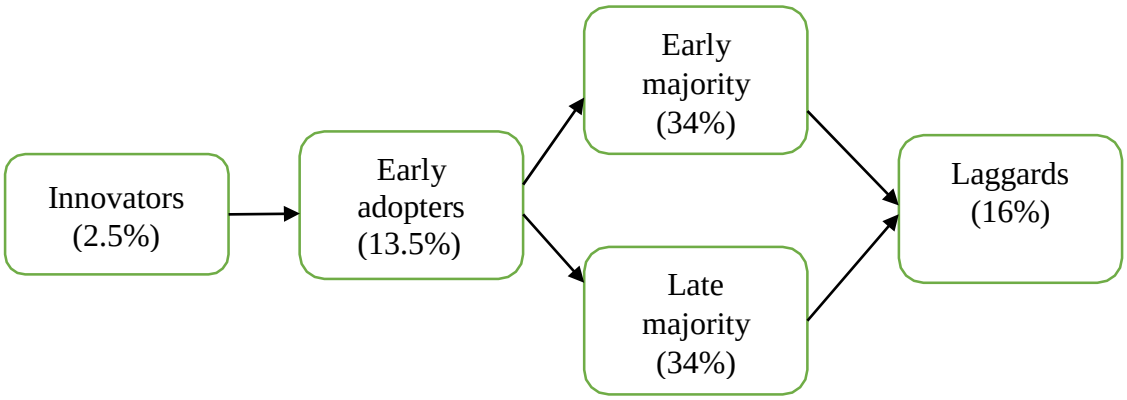

Figure 2.2: Adopter Categories

Limitations of the model

1) It was not developed to explicitly apply to adoption of new behaviors or health innovations.
2) It doesn't take into account an individual's resources or social support to adopt the new innovation.

2.3.2. Technology Acceptance Model

The technology acceptance model was developed as a way of examining the determinants of modern technology. This model was mainly an expansion of the theory of reasoned action which was developed by Ajzen and Fishbein's to describe all factors

which are associated with acceptance, usage and the factors that influence the usage of information technology (Priyanka & Kumar, 2013). This theory has two important attributes which include the perceived usefulness and perceived ease of use. Additionally, the model also states that there are some external variables which also influence the adoption of new technology like their attitudes, beliefs and intentions.

External variables are mainly inclusive of all factors that are outside the individual which have an impact on the attitudes of and usage of innovations e.g. training, experience with computers, the quality of the systems etc.

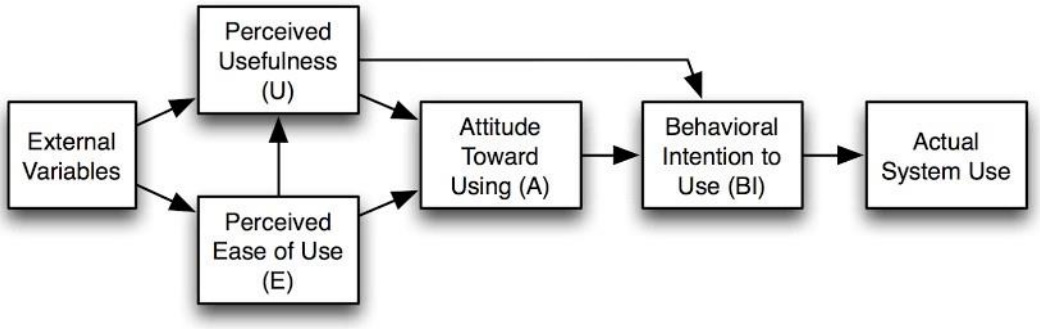

Figure 2.3: Technology Acceptance Model

Perceived Usefulness

An increase in access to information improves the level of human competence as it is associated with access to authentic information. However, access to authentic information is associated with the user's reluctance to accept or use available strategies to access information. In essence, perceived usefulness refers to the extent to which an individual believes that using a particular technique enhances their performance. In essence, the technology acceptance model depicts that value is critical in improving the level of performance

Perceived Ease of Use

This is the perception that a system user has in relation to how a particular system or innovation is in relation to its simplicity and freedom from complexity during its use. People are more likely to accept innovations that are easy to use compared to

complicated applications. Ease in the level of technology is also associated with an increase in access to information literacy. However, it is also critical to note that there are a number of factors which are associated with the ease of use of modern technology and they include factors like work experience, the extent to which an individual has been exposed or used technical instruments and the number of resources available to access such innovations.

External Variables

The technology acceptance model also states that there are several external variables which can be used in relation to the use of new skills. There are at least four classifications of variables which include organizational characteristics, system characteristics, user`s personal characteristics, and other variables.

Table 2.3-1: External Variables of Technology Adoption

Organizational characteristics	1) Competitive environment 2) User support 3) Internal training 4) Management support 5) Policy support 6) Organizational composition 7) Peer influence 8) Training and development
System characteristics	1) System design 2) System operation 3) System maintenance 4) System auditing 5) Access cost 6) Interface 7) User friendliness 8) Information quality 9) System quality 10) Cybersecurity
Users characteristics	1) Age 2) Cognitive ability 3) Information anxiety 4) Computer anxiety 5) Computer literacy 6) Level of education 7) Personality 8) Perceived playfulness 9) Self-efficacy 10) Tenure at work 11) Gender

	12) Experience
Other variables	1) Social influence 2) Need for change 3) Facilitating conditions 4) Cultural affinity 5) External computing support

Limitations of the Model

There are several limitations of the Technology Acceptance model which include

1) The theory does not reflect on the amount of effort that is needed in using a particular technology
2) The theory needs to consider more external factors especially in the realm of technology

2.4. Conceptual Framework

The adoption of EHR systems is linked to a number of factors some of which are not included in the existing models. The technology acceptance model for example mainly pays attention to the perception associated with the use of new technology while not considering the organization structure. The diffusion of innovation theory also does not capture the organization structure and accessibility of technology.

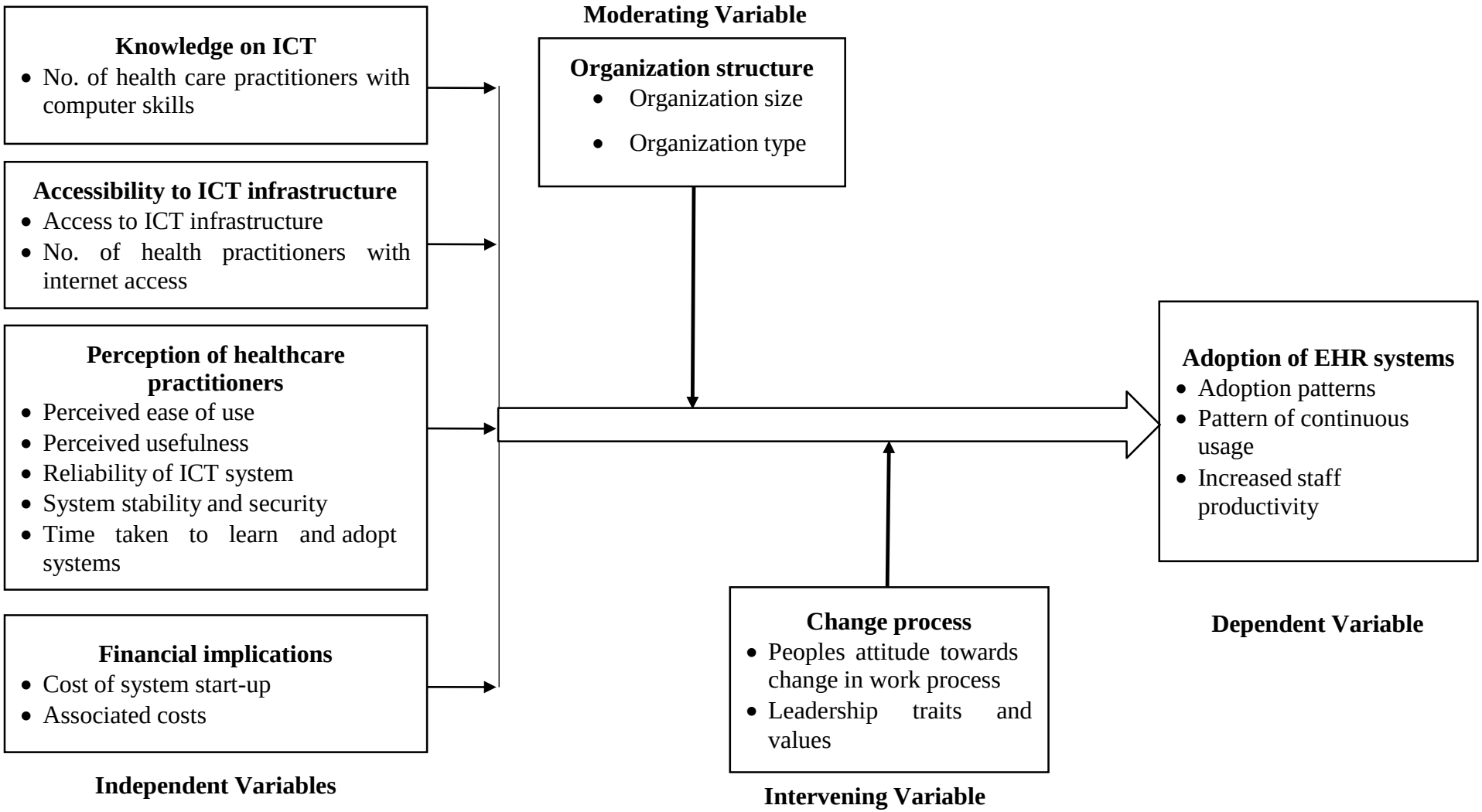

Figure 2.4: Conceptual Framework

2.5. Operationalization of Variables

Variable	Categories	Measures	Data
Knowledge on ICT	No. of health care practitioners with computer skills	Number of personnel	Quantitative
Accessibility of ICT infrastructure	Access to ICT infrastructure	Number of computers	Quantitative
	No. of health practitioners with internet access	Number of personnel with access to internet	
Perception of healthcare practitioners	Perceived ease of use	Ease of using computer applications	Qualitative
	Perceived usefulness	Benefits from use of EHR	
	Reliability of ICT system	Number system failures in a day	
	System stability and security	Number of system breakdowns and security breach incidences	
	Time taken to learn and adopt systems	Amount of time for training	
Organization structure	Organization size	Number of personnel	Quantitative and qualitative
	Organization type	Workload of the health facility	
Change process	Peoples attitude towards change in work process	Reception received by the EHR from healthcare practitioners	Qualitative
	Leadership traits and values	Involvement of management	
Financial implication	Cost of system start-up	Cost of ICT adoption	Quantitative
	Associated costs	Cost of ICT adoption	
Adoption of EHR	Use of her	Level of Adoption	Qualitative

2.6. Research Gap

In relation to the literature review, a majority of the studies which were conducted in developed countries mainly focused on the adoption of EHR systems and associated barriers in the national context. Studies conducted in developed countries also provided limited information on the extent of adoption of EHR systems in the hospital setting

and the associated the extent of improvement in the level of health service delivery in these settings. Additionally, a majority of the studies were conducted among hospitals in urbanized settings.

CHAPTER THREE
METHODOLOGY

3.1. Study Design

A cross-sectional study design was used to collect the data. This type of study design allows for the comparison of different population groups at a single point in time. The design was instrumental to the research as it provided the researcher with the ability to examine the relationship between the adoption of EHR and identified factors in a single snapshot.

3.2. Study Population

The study population was composed of individuals working in different health facilities spread across Siaya County. The respondents comprised of administrators, clinicians, nurses and ICT staff where available. The population was acquired from ten health facilities in Siaya County which included Siaya County Referral Hospital, Bondo District Hospital, Yala Sub County Hospital, Madiany Sub County Hospital among others.

3.2.1. Inclusion Criteria

1) All health practitioner who consented to take part in the study
2) All health practitioners who had worked in the facility for at least 6 months

3.2.2. Exclusion Criteria

1) All health practitioners who are unwilling to take part in the study

3.3. Sampling Procedure

Probability stratified random sampling was applied to select the respondents of the study from the health facilities. This was through the random selection of personnel from the departments in the health facility.

3.4. Sampling Frame

A total of ten hospitals were captured in the study which are presented in Table 3.1 below.

Table 3.4-1: Sampling Frame

Health facility	No of personnel
Siaya County Referral hospital	15
Bondo District Hospital	15
Yala Sub-County Hospital	15
Ongíelo Sub-County Hospital	10
Wagai Health Centre	8
Akala Sub-County Hospital	10
Nyathengo Health Centre	5
Rwambwa Sub-County Hospital	8
Bar Sauri Health Centre	8
Total	**94**

3.5. Sample Size Determination

The Fisher's formula (1998) was used in calculating the sample size of the study.

$$n = \frac{Z^2 pq}{d^2}$$

Where :

(n)=the desired sample size

Z=the standard normal deviate that provides 95% confidence interval of (1.96)

(p) =prevalence of adoption of EHR systems in hospitals (50% was used due to data limitation)

(q) =1-p

(d)=absolute precision (error bound) (0.05)

Hence:

$$n = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2} = 384$$

$$= 384.16$$

The population size is however lower than 10,000 hence the final sample estimate (n*f*) was calculated using the following formula.

$$nf = \frac{n}{1 + (\frac{n}{N})}$$

Where:

(n*f)* = the desired sample size (when population < 10,000)

(n) = the desired sample size (when population > 10,000)

N = population of health practitioners in Siaya county (101)

Hence:

$$nf = \frac{385}{1 + (\frac{385}{101})} = 81.9 \approx 82$$

A 10% attrition rate was included hence 82+8=90 respondents.

3.6. Data Collection

Data was collected through the use of structured Questionnaires that were filled by the study population. The questionnaire was structured into sections which will include socio-

demographic characteristics, knowledge on ICT, accessibility of ICT infrastructure, perception of ICT, financial implication, organization structure and change process.

3.7. Pre-testing

A pretest was conducted in Madiany Sub-County Hospital with a minimum of 10 respondents to check for the reliability and validity of the research instrument. Thereafter, the research instrument was subjected to further scrutiny to ensure completeness, the questions are comprehendible and to remove unnecessary questions.

3.7.1. Reliability

The Lee Cronbach Alpha test was conducted to check for the reliability of the questionnaire with the scale set at 0.7 for good reliability. The study captured a Cronbach's alpha value of 0.724 which meant that the questionnaire was reliable.

3.7.2. Validity

This was achieved through seeking expert advice and referring to other studies to ensure the data collection instrument captures all the objectives of the study. Secondly, an appropriate research design and sampling methods were used which ensured that the findings from the study could be valid. Additionally, current studies were used to ensure that the findings were compared with other up-to-date studies.

3.8. Data Analysis

Accuracy was ensured through checking the completed questionnaire before they are entered in SPSS software. Incomplete questionnaires were not be included in the during data analysis. SPSS was used for analysis from which descriptive statistics was achieved through frequencies and percentages while inferential statistics was attained through correlation analysis to determine the relationship between the variables. A multivariate analysis was used to determine the correlation of the variables. The level of statistical significance was set at $p<0.05$. Frequency tables were used to present the analyzed data.

Logistic regression technique was used to develop the regression equation and a ordered logit model was developed.

3.9. Ethical Consideration

Ethical review of the research, clearance, and approval to conduct the study was sought from KCA University and the health facilities in Siaya County through the ministry of health. The researcher would explain the purpose of the study to the respondent before the willing ones decide to participate. The participants were briefed about the benefits of the research. The participants were required to give a verbal and voluntary informed consent prior to participation in the research. Identity of the respondents was secured and no form of identification will be required.

CHAPTER FOUR
FINDINGS AND DISCUSSION

4.1. Introduction

The findings of the study captured the descriptive and inferential statistics of the objectives. Additionally, a model was also developed that explored factors associated with adoption of EHR.

4.2. Reliability Statistics

The Lee Cronbach alpha captured in the study was 0.724.

Table 4.2-1: Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	**N of Items**
.724	31

4.3. Response rate

The sample population of the study was 90 participants and the study captured a total of 88 participants. This translates to a response rate of 98%.

$$Response\ rate = \frac{88}{90} \times 100 = 98\%$$

4.4. Factors Associated with Adoption of EHR systems

4.4.1. Socio demographic Factors

The minimum age of the respondents was 23 years while the highest was 38 years and the mean age was 32.59 years

Table 4.4-1: Descriptive Statics of Age of respondents

	N	Minimum	Maximum	Mean	Std. Deviation
Age	88	23	38	32.59	3.918
Valid N (listwise)	88				

A majority of the respondents were male (n=54, 61.4%) who are diploma holders (n=51, 58.0%) with 6-10 years (n=57, 64.8%) of experience. A majority of the health facilities have fully implemented (n=50, 57.3%) EHR systems.

Table 4.4-2: Socio-Demographic Factors

Factor	Category	frequency	Percentage
Gender	Male	54	61.4
	Female	34	38.6
Education Level	Certificate	7	8.0
	Diploma	51	58.0
	Graduate	30	34.0
Years of experience	(1-5 years)	25	28.4
	(6-10 years)	57	64.8
	>10 years	6	6.8
What is the level of EHR system implementation in your health facility?	Fully implemented	50	57.3
	Partially implemented	38	42.7

4.4.2. Knowledge on ICT

More than half of the respondents rated their knowledge on ICT use as being good (n=35, 39.8%), computer applications use as good (n=32,36.4%) and internet usage as excellent (n=50, 56.8%). The respondents also deemed the usage of EHR as being easy (n=57, 64.8%).

Table 4.4-3: Knowledge on ICT

Factor	Category	frequency	Percentage
How would you rate your overall knowledge on ICT use	No knowledge and understanding	3	3.4
	Weak	8	9.1
	Good	35	39.8
	Very good	20	22.7
	Excellent	22	25.0
Computer office applications	No knowledge and understanding	3	3.4
	Weak	7	8.0
	Good	32	36.4
	Very good	22	25.0
	Excellent	24	27.3
Internet use	Good	24	27.3
	Very good	14	15.9
	Excellent	50	56.8
How easy is EHR to use in the daily operations of the health care facility	Fair	18	20.5
	Easy	57	64.8
	Very easy	13	14.8

4.4.3. Accessibility to ICT Infrastructure

The respondents strongly agreed (n=37, 42%) that computers were available and used on a daily basis disagreed (n=40, 45.5%) that a printer was available, agreed (n=33,37.5%) that a Local Areas Network was available and strongly disagreed (n=39, 44.3%) on computers having internet access. However, more than three quarters (n=85, 96.6%) had access to technical support staff as shown in Table 4.4

Table 4.4-4: Accessibility to ICT infrastructure

Factor	Category	frequency	Percentage
Computers are available and are used on a daily basis	Neutral	22	25.0
	Agree	29	33.0
	Strongly agree	37	42.0
A printer(s) is available and is used on a daily basis	Strongly disagree	15	17.0
	Disagree	40	45.5
	Neutral	20	22.7
	Strongly agree	13	14.8
There is a Local Area Network (LAN) that links computers together in one network	Disagree	9	10.2
	Neutral	18	20.5
	Agree	33	37.5
	Strongly agree	28	31.8
Computers have internet access	Strongly disagree	39	44.3
	Disagree	22	25.0
	Neutral	20	22.7
	Strongly agree	7	8.0
Have technical support staff, who guides on use of system and supports to resolve any system technical challenge	Yes	85	96.6
	No	3	3.4

4.4.4. Financial implications

The respondents agreed (n=38, 43.2%) that cost of purchasing hardware, agreed (n=27, 30.7%) cost of annual renewal fee for software licenses, neutral (n=57, 64.8%) staff training, neutral (n=44, 50%) system maintenance costs and neutral on data entry (n=53, 60.2%) had an impact on EHR system adoption.

Table 4.4-5: Financial implications

Factor	Category	frequency	Percentage
Cost of purchasing Hardware	Strongly disagree	24	27.3
	Neutral	26	29.5
	Agree	38	43.2
Cost of Annual renewal fee for Software licenses	Strongly disagree	24	27.3
	Disagree	11	12.5
	Neutral	26	29.5
	Agree	27	30.7
Cost for staff Training	Strongly disagree	13	14.8
	Neutral	57	64.8
	Agree	18	20.5
System maintenance costs	Strongly disagree	13	14.8
	Disagree	16	18.2
	Neutral	44	50.0

	Agree	11	12.5
	Strongly agree	4	4.5
Cost of data entry	Strongly disagree	7	8.0
	Disagree	6	6.8
	Neutral	53	60.2
	Agree	22	25.0

4.4.5. Perception of Healthcare Workers

More than half of the respondents strongly agreed (n=57, 64.8%) that they were willing to learn a new system, they were able to fix the system if something went wrong (n=51, 58.0%) and perceived computerized systems as being easy (n=57, 64.8%). They strongly disagreed (n=70, 79.5%) that they had fear of compromising computer security and more than three-quarters strongly disagreed (n=75, 85.2%) that using a computer system was a lot of work.

Table 4.4-6: Perception of Health Care

Factor	Category	frequency	Percentage
I am willing to learn a new system	Neutral	11	12.5
	Agree	20	22.7
	Strongly agree	57	64.8
I will be able to fix the system if something isn't working	Neutral	9	10.2
	Agree	28	31.8
	Strongly agree	51	58.0
Using a computerized system is easy and reliable and I am willing to use it during daily operations	Agree	31	35.2
	Strongly agree	57	64.8
I fear using the computer will compromise the security of data	Strongly disagree	70	79.5
	Neutral	18	20.5
Using a computer system is a lot of work	Strongly disagree	75	85.2
	Disagree	6	6.8
	Agree	7	8.0

4.4.6. Adoption of EHR Systems

Lack of necessary resources (n=38, 43.2%) and speed of data entry (n=55, 62.5%) somehow complicated the adoption of EHR systems.

Table 4.4-7: Adoption of EHR systems

Factor	Category	frequency	Percentage
Lack of necessary resources to invest and acquire an EHR system	No impact	6	6.8
	Minor impact	15	17.0
	Somehow complicated	38	43.2
	Difficult	29	33.0
The return on investment from the EHR is minimal	No impact	20	22.7
	Minor impact	39	44.3
	Somehow complicated	18	20.5
	Difficult	11	12.5
Lack of support from health care providers	No impact	17	19.3
	Minor impact	20	22.7
	Somehow complicated	22	25.0
	Difficult	29	33.0
Lack of support from health facility administration	No impact	9	10.2
	Minor impact	28	31.8
	Somehow complicated	45	51.1
	Difficult	6	6.8
Lack of proper security mechanisms and privacy issues	No impact	21	23.9
	Minor impact	38	43.2
	Somehow complicated	11	12.5
	Difficult	11	12.5
	Extremely difficult	7	8.0
EHR system that doesn't meet the health facility's needs	No impact	24	27.3
	Minor impact	31	35.2
	Somehow complicated	22	25.0
	Difficult	11	12.5
Health care providers do not have required skills to use an EHR system	No impact	20	22.7
	Minor impact	47	53.4
	Somehow complicated	17	19.3
	Difficult	4	4.5
Speed of data entry and capture on the EHR by the health care providers	Minor impact	22	25.0
	Somehow complicated	55	62.5
	Extremely difficult	11	12.5
Lack of expertise/skill in evaluating, comparing and selecting an EHR that addresses the health facility needs	No impact	11	12.5
	Minor impact	31	35.2
	Somehow complicated	28	31.8
	Difficult	18	20.5

4.5. Model Description

Ordered logit models are logistic regressions that model the change among the several ordered values as a function of each unit increase in the predictor. The log of the probability that Y has a value greater than the lower values given X is modeled. It is assumed that the same effect occurs for each level comparison of the ordered responses, so that the increase or decrease in odds for each unit increase in X is the same for the increment.

The cumulative logit model is as shown below;

$$logit[P(Y \leq j|X)] = \alpha_j + \beta X$$

4.5.1. Knowledge on ICT

Table 4.5-1 Multivariate analysis on Knowledge of ICT

Knowledge on ICT			**Multivariable**	
	Estimate	**Std.Error**	**aOR (95% CI)**	**P value**
level of EHR system implementation				
Partially implemented	Reference	Reference	Reference	
Fully implemented	-0.801	0.394	0.45 (0.20-0.96)	0.042
Age	-0.002	0.041	1.00 (0.92-1.08)	0.959
Sex				
Female	Reference	Reference	Reference	
Male	2.755	0.555	15.7 (5.64-50.6)	<0.001
Education Level				
Diploma	Reference	Reference	Reference	
Certificate	2.012	0.767	7.48 (1.70-34.8)	0.009
Graduate	0.036	0.369	1.04 (0.50-2.15)	0.922
Years of Experience	-0.200	0.284	0.82 (0.47-1.44)	0.481
Intercepts				
Excellen**t**|good	0.985	1.170		
good|verygood	1.697	1.171		
verygood|weak	4.675	1.247		

4.5.1.1. Do scoring tendencies differ by Knowledge on ICT?

1) Knowledge on ICT and level of EHR system implementation.

   Kruskal-Wallis rank sum test

   Kruskal-Wallis chi-squared = 0.42606, df = 1, p-value = 0.5139

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 0.514, hence we have no evidence to reject our null hypothesis. We are likely therefore to believe that there is no difference in scoring tendency among people with different level of EHR system implementation.

2) Knowledge on ICT and Sex.

   Kruskal-Wallis rank sum test

   Kruskal-Wallis chi-squared = 20.261, df = 1, p-value = 6.755e-06

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of <0.001, hence we have evidence to reject our null hypothesis. We are likely therefore to believe that there is difference in scoring tendency among Males and Females

3) Knowledge on ICT and Education level.

   Kruskal-Wallis rank sum test

   Kruskal-Wallis chi-squared = 12.957, df = 2, p-value = 0.001536

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 0.002, hence we have evidence to reject our null hypothesis. We are likely therefore to believe that there is difference in scoring tendency among people with different education levels

Inferential

For very one unit increase in the level of EHR system implementation variable the ordered log-odds of scoring in a higher category for knowledge of ICT decreases by 0.801 with the

other factors in the model being held constant. Male clients will have a positive scoring factor in a higher category for knowledge of ICT by 2.755. Clients with certificates are more likely to score in a lower category for knowledge of ICT decreases by 2.012.

The odds of fully implementing EHR systems were significantly lower for clients who were weak in ICT knowledge [aOR= 0.45 (95% CI 0.20-0.96)]. Male clients were significantly higher likely to have higher ICT Knowledge [aOR= 15.7 (95% CI 5.64-50.6)]. Clients with only certificates as the level of education were approximately 7 times more likely to be weak in ICT Knowledge [aOR= 7.84 (95% CI 1.70-34.8)]

4.5.2. Accessibility to ICT infrastructure

Table 4.5-2 Multivariate analysis on Accessibility to ICT infrastructure

Accessibility to ICT infrastructure			**Multivariable**	
	Estimate	**Std.Error**	**aOR (95% CI)**	**P value**
level of EHR system implementation				
Partially implemented	Reference	Reference	Reference	
Fully implemented	0.766	0.349	2.15 (1.09-4.30)	0.028
Age	-0.078	0.038	0.92 (0.86-1.00)	0.042
Sex				
Female	Reference	Reference	Reference	
Male	1.260	0.468	3.52 (1.42-8.95)	0.007
Education Level				
Diploma	Reference	Reference	Reference	
Certificate	1.570	0.794	4.80 (1.06-24.9)	0.048
Graduate	0.566	0.320	1.76 (0.94-3.31)	0.077
Years of Experience	-0.094	0.272	0.91 (0.53-1.55)	0.729
Intercepts				
disagree|neutral	-1.845	1.087		
neutral|Stronglyagree	-0.146	1.078		
Stronglyagree|Stronglydisagree	1.385	1.080		

4.5.2.1. Do scoring tendencies differ by Accessibility to ICT infrastructure?

1) Accessibility to ICT infrastructure and level of EHR system implementation.

Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 5.3203, df = 1, p-value = 0.02108

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 0.021, hence we have evidence to reject our null hypothesis. We are likely therefore to believe that there is difference in scoring tendency among people with different level of EHR system implementation.

2) Accessibility to ICT infrastructure and Sex.

Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 3.4985, df = 1, p-value = 0.06142

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 0.061, hence we have no evidence to reject our null hypothesis. We are likely therefore to believe that there is no difference in scoring tendency among Males and Females

3) Accessibility to ICT infrastructure and Education level.

Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 1.085, df = 2, p-value = 0.5813

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 0.581, hence we have no evidence to reject our null hypothesis. We are likely therefore to believe that there is no difference in scoring tendency among people with different education levels

Inferential

For very one unit increase in the level of EHR system implementation variable the ordered log-odds of scoring in a higher category for Accessibility to ICT infrastructure increases

by 0.766 with the other factors in the model being held constant. Male clients will have a positive scoring factor in a higher category for Accessibility to ICT infrastructure by 1.260.

Clients who have fully implementing EHR systems were twice as likely to score higher in Accessibility to ICT infrastructure [aOR= 2.15 (95% CI 1.09-4.30)]. Male clients were four times more likely to score highly in access to ICT infrastructure compared to their female counterparts [aOR= 3.52 (95% CI 1.42-8.95)]. Clients with only certificates as the level of education were approximately 5 times less likely to score highly in access to ICT infrastructure [aOR= 4.80 (95% CI 1.06-24.9)]

4.5.3. Financial implications

Table 4.5-3 Multivariate analysis on Financial Implications

Financial Implications			**Multivariable**	
	Estimate	**Std.Error**	**aOR (95% CI)**	**P value**
level of EHR system implementation				
Partially implemented	Reference	Reference	Reference	
Fully implemented	-0.167	0.426	0.85 (0.37-1.97)	0.695
Age	0.608	0.093	1.84 (1.56-2.25)	<0.001
Sex				
Female	Reference	Reference	Reference	
Male	1.883	0.756	6.57 (1.69-35.66)	0.013
Education Level				
Diploma	Reference	Reference	Reference	
Certificate	-5.321	1.225	0.00 (0.00-0.05)	<0.001
Graduate	0.588	0.449	1.80 (0.75-4.4)	0.190
Years of Experience	-0.339	0.367	0.71 (0.34-1.46)	0.355
Intercepts				
disagree|neutral	17.234	2.762		
neutral|Stronglyagree	23.517	3.462		
Stronglyagree|Stronglydisagree	23.742	3.474		

4.5.3.1. Do scoring tendencies differ by Accessibility to Financial Implications?

1) Financial Implications and level of EHR system implementation.

Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 0, df = 1, p-value = 1

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 1.000, hence we have no evidence to reject our null hypothesis. We are likely therefore to believe that there is no difference in scoring tendency among people with different level of EHR system implementation.

2) Financial Implications and Sex.

Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 19.557, df = 1, p-value = 9.765e-06

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of <0.001, hence we have evidence to reject our null hypothesis. We are likely therefore to believe that there is difference in scoring tendency among Males and Females

3) Financial Implications and Education level.

Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 0.041077, df = 2, p-value = 0.9797

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 0.980, hence we have no evidence to reject our null hypothesis. We are likely therefore to believe that there is no difference in scoring tendency among people with different education levels

Inferential

For very one unit increase in the level of EHR system implementation variable the ordered log-odds of scoring in a higher category for financial implications decreases by 0.167 with the other factors in the model being held constant. Age has a positive factor in scoring for financial implications by 0.608. Male clients will have a positive scoring factor in a higher category for financial implication by 1.883.

The odds of scoring higher for financial implication significantly increase with increase age [aOR= 1.84 (95% CI 1.56-2.25)]. Male clients were seven times more likely to score negatively on cost related factors in the adoption of EHR systems [aOR= 6.57 (95% CI 1.69-35.66)]. Clients with only certificates as the level of education had significantly no knowledge of cost related factors in the adoption of EHR systems [aOR= 0.00 (95% CI 0.00-0.05)].

4.5.4. Perception of healthcare practitioners

Table 4.5-4 Multivariate analysis on Perception of Healthcare Practitioners

Perception of healthcare practitioners			**Multivariable**	
	Estimate	**Std.Error**	**aOR (95% CI)**	**P value**
level of EHR system implementation				
Partially implemented	Reference	Reference	Reference	
Fully implemented	-0.677	0.389	0.51 (0.23-1.08)	0.082
Age	-0.266	0.049	0.77 (0.69-0.84)	<0.001
Sex				
Female	Reference	Reference	Reference	
Male	-0.863	0.439	0.42 (0.18-0.99)	0.049
Education Level				
Diploma	Reference	Reference	Reference	
Certificate	2.644	0.874	14.1 (2.57-83.1)	0.002
Graduate	1.411	0.392	4.10 (1.93-9.02)	<0.001
Years of Experience	-1.001	0.385	0.37 (0.17-0.76)	0.009
Intercepts				
agree|neutral	-12.783	1.798		
neutral|Stronglyagree	-11.646	1.718		
Stronglyagree|Stronglydisagree	-8.427	1.583		

4.5.4.1. Do scoring tendencies differ by Perception of healthcare practitioners?

1) Perception of healthcare practitioners and level of EHR system implementation.

Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 1.0678, df = 1, p-value = 0.3014

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 0.301, hence we have no evidence to reject our null hypothesis. We are likely therefore to believe that there is no difference in scoring tendency among people with different level of EHR system implementation.

2) Perception of healthcare practitioners and Sex.

Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 17.897, df = 1, p-value = 2.331e-05

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of <0.001, hence we have evidence to reject our null hypothesis. We are likely therefore to believe that there is difference in scoring tendency among Males and Females

3) Perception of healthcare practitioners and Education level.

Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 11.229, df = 2, p-value = 0.003645

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 0.004, hence we have evidence to reject our null hypothesis. We are likely therefore to believe that there is difference in scoring tendency among people with different education levels

Inferential

For very one unit increase in the level of EHR system implementation variable the ordered log-odds of scoring in a higher category for Perception of healthcare practitioners decreases by 0.677 with the other factors in the model being held constant. Age has a negative factor in scoring for Perception of healthcare practitioners by 0.266. Male clients will have a negative scoring factor in a higher category for Perception of healthcare practitioners by 0.863. For very one unit increase in the years of experience variable the ordered log-odds

of scoring in a higher category for Perception of healthcare practitioners decreases by 1.001 with the other factors in the model being held constant.

The odds of scoring higher on Perception of healthcare practitioners significantly decreased with age and years of experience [aOR= 0.77 (95% CI 0.69-0.84)] and [aOR= 0.37 (95% CI 0.17-0.76)] respectively. Clients with only certificates as the level of education had significant higher odds of scoring negatively on Perception of healthcare practitioners [aOR= 14.1 (95% CI 2.57-83.1)] with graduate clients scoring lower [aOR= 4.10 (95% CI 1.93-9.02)].

4.5.5. Adoption of EHR systems

Table 4.5-5 Multivariate analysis on Adoption of EHR

Adoption of EHR systems			**Multivariable**	
	Estimate	**Std.Error**	**aOR (95% CI)**	**P value**
level of EHR system implementation				
Partially implemented	Reference	Reference	Reference	
Fully implemented	1.091	0.372	2.98 (1.45-6.24)	0.003
Age	-0.043	0.042	0.96 (0.88-1.04)	0.301
Sex				
Female	Reference	Reference	Reference	
Male	1.716	0.452	5.56 (2.33-13.8)	<0.001
Education Level				
Diploma	Reference	Reference	Reference	
Certificate	2.031	0.842	7.62 (1.50-42.2)	0.016
Graduate	0.838	0.385	2.31 (1.10-5.00)	0.030
Years of Experience	0.906	0.361	2.47 (1.23-5.12)	0.012
Intercepts				
complicates|difficult	2.384	1.188		
difficult|minor	2.880	1.188		
minor|none	7.005	1.404		

4.5.5.1. Do scoring tendencies differ by Adoption of EHR systems?

1) Adoption of EHR systems and level of EHR system implementation.

   Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 7.2833, df = 1, p-value = 0.00696

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 0.007, hence we have evidence to reject our null hypothesis. We are likely therefore to believe that there is difference in scoring tendency among people with different level of EHR system implementation.

2) Adoption of EHR systems and Sex.

Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 9.2919, df = 1, p-value = 0.002302

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 0.002, hence we have evidence to reject our null hypothesis. We are likely therefore to believe that there is difference in scoring tendency among Males and Females

3) Adoption of EHR systems and Education level.

Kruskal-Wallis rank sum test

Kruskal-Wallis chi-squared = 5.2346, df = 2, p-value = 0.073

Using a Kruskal-Wallis we can test for a difference (null hypothesis). The Kruskal-Wallis test gives us a p-value of 0.073, hence we have no evidence to reject our null hypothesis. We are likely therefore to believe that there is no difference in scoring tendency among people with different education levels

Inferential

For very one unit increase in the level of EHR system implementation variable the ordered log-odds of scoring in a higher category for Adoption of EHR systems decreases by 1.091 with the other factors in the model being held constant. Age has a negative factor in scoring for Adoption of EHR systems by 0.043. Male clients will have a positive scoring factor in a higher category for Adoption of EHR systems by 1.716. For very one unit increase in the years of experience variable the ordered log-odds of scoring in a higher category for Adoption of EHR systems increases by 0.906 with the other factors in the model being held

constant. Certificate and graduate clients have a positive scoring factor in a higher category for Adoption of EHR systems by 2.031 and 0.838 respectively.

The odds of scoring higher on Adoption of EHR systems significantly increased with the level of EHR system implementation [aOR= 2.98 (95% CI 1.45-6.24)]. Male clients were almost six times more likely to score negatively on adoption of EHR systems [aOR= 5.56 (95% CI 2.33-13.8)]. Clients with only certificates as the level of education had significant higher odds of scoring negatively on adoption of EHR systems [aOR= 7.62 (95% CI 1.50-42.2)] with graduate clients scoring lower [aOR= 2.31 (95% CI 1.10-5.00)]. The odds of scoring higher on adoption of EHR systems significantly increased with years of experience [aOR= 2.47 (95% CI 1.23-5.12)]

4.5.6. Overall model

Perception of healthcare practitioners			**Multivariable**	
	Estimate	**Std.Error**	**aOR (95% CI)**	**P value**
level of EHR system implementation				
Partially implemented	Reference	Reference	Reference	
Fully implemented	1.249	0.490	3.49 (1.36-9.44)	0.011
Age	0.407	0.094	1.50 (1.26-1.83)	<0.001
Sex				
Female	Reference	Reference	Reference	
Male	4.244	0.760	6.97 (1.73-14.3)	<0.001
Education Level				
Diploma	Reference	Reference	Reference	
Certificate	1.622	1.388	5.06 (0.31-17.2)	0.242
Graduate	1.256	0.516	3.51 (1.31-10.1)	0.015
Years of Experience	1.346	0.463	3.84 (1.60-10.0)	0.004
Knowledge of ICT				
Excellent	Reference	Reference	Reference	
Very good	-0.942	0.537	0.39 (0.13-1.09)	0.079
Good	-2.257	0.844	0.10 (0.02-0.52)	0.007
Weak	-4.205	1.878	0.01 (0.00-0.49)	0.025
Financial Implications				

Agree	Reference	Reference	Reference	
Strongly agree	-2.611	1.275	0.07 (0.00-0.88)	0.041
Neutral	-3.694	0.854	0.02 (0.00-0.12)	<0.001
Strongly disagree	-10.20	1.532	0.00 (0.00-0.00)	<0.001
Intercepts				
complicates|difficult	15.03	2.593		
difficult|minor	15.86	2.629		
minor|none	21.86	3.108		

4.5.6.1. Validation of the developed model

LR statistic = 0.35313, df = 5, p-value = 0.5523

The goodness of fit test on validation data also suggests (p = 0.5523) that the developed model sustains its ability to describe Adoption of EHR systems on EHR system implementation satisfactorily. The analytical results amply reveal that the developed model remains to be generalizable and acceptable

4.6. Discussion

4.6.1. Factors Associated with Adoption of EHR systems

4.6.1.1. Socio-Demographic Factors

A majority of the respondents were male who were graduates with 6-10 years of experience. A majority of the health facilities had fully implemented EHR systems. The bivariate analysis revealed that gender, age and years of experience were all correlated with the adoption of EHR. A study conducted in Nigeria focused on the identification of factors that influence the adoption of ICT among nurses. The study implemented a cross-sectional study design that captured 305 nurses. The study revealed factors such as age, designation of the nurses, gender, years of experience and ownership of a personal computer as being instrumental in the adoption of ICT (I. Ojo et al., 2021). Adane et al. (2019) focused on capturing the roles of EHR in the provision of quality healthcare services. A qualitative approach was used through the collection of data through databases such as PUBMED and

Google Scholar. The results revealed that sociodemographic factors such as age and education level of physicians had a critical impact on adoption of EHR.

4.6.1.2. Knowledge on ICT

The respondents rated their knowledge on ICT use, computer applications and internet usage as excellent. The respondents also deemed the usage of EHR as being easy. A study conducted by (Popela et al., 2019) revealed that knowledge on the health management system, ICT infrastructures and technology was instrumental in the adoption of electronic patient record management systems. Another study also notes that there is significant information and communication changes that can be used in improving the adoption of new technologies. One major barrier linked to increased adoption of EHR is linked to low levels of knowledge on technology. The study also noted that there is a need to ensure proper identification and training of professionals to meet the needs and expectations of health facilities (Postolache et al., 2017). Another study conducted in the United States sought to estimate the nationwide adoption of EHR among nursing facilities and identify the factors linked to the adoption. The study implemented a cross-sectional survey design and surveyed individuals in the nursing facilities. An increased level of innovation was associated with higher odds of sending, integrating and searching for electronic information. The study also noted that there is an increased level of innovation and awareness of technology that fostered further adoption and effective usage of EHR systems (Vest et al., 2019).

4.6.1.3. Accessibility to ICT infrastructure

The respondents noted that computers, printers and Local Areas Network were available but noted that the computers did not have internet access. However, more than three quarters had access to technical support staff. (Jayaseelan & Pichandy, 2020) explored the adoption of EHR system and its usage in improving the healthcare process in India. A systematic review was used in the collection of data used in the collection of data. Results from the study revealed that accessibility of ICT and electronic data was instrumental in the adoption of EHR systems. Another study conducted in South America that sought to determine the adoption of EHR systems in the health facilities in the country. All facilities

were surveyed to determine their EHR status. Results from the study revealed that their decision support systems and problem list documentation were significant barriers in EHR adoption

4.6.1.4. Financial implications

The bivariate results showed that cost of purchasing hardware, cost of annual renewal fee for software licenses, staff training, system maintenance costs and neutrality on data entry had an impact on EHR system adoption. (Y.-G. Kim et al., 2017) sought to explore the adoption of EHR systems in health facilities in South Korea. The study captured barriers such as the cost of purchasing (48%) and the ongoing cost of maintenance (11%). A similar study was conducted in Moi Teaching and Referral Hospital (MTRH), Eldoret, Kenya. The study utilized a descriptive cross-sectional design that captured 279 nurses. The results captured a positive relationship between EHR adoption technical factors (F $(1,277) = 116.036$, $p < 0.01$). The study also revealed the role of investments in ICT infrastructure in improving the adoption of MTRH (Chirchir et al., 2020a).

4.6.1.5. Perception of Health Care Workers

The results showed that the respondents were willing to learn a new system, they were able to fix the system if something went wrong and perceived computerized systems as being easy. They also had no fear of compromising computer security and disagreed that using a computer system was a lot of work. According to (Hossain et al., 2019), there is a need for policymakers to encourage the usage of EHR systems among physicians. The study also revealed that there is a need to deal with negative challenges such as improving technical knowledge, provision of training, perception and poor infrastructure. Similarly, a study investigating the individual characteristics physicians towards EMR adoption employed a field survey among 217 physicians. Issues such as computer self-efficacy, perceived risk, and perceived service level were critical antecedents of perceived ease of use and adoption to EHR systems (Tsai et al., 2019).

The adoption of new systems in any organization is associated with an effective change process. The change process is a daunting task for many organizations and must therefore

take place smoothly in order to improve the level of adoption of the EHR systems (Henry et al., 2016). This change process would be associated with a shift in the working styles of the healthcare practitioners which could be met with resistance. This can also result with an increased level of unwillingness to adopt and make changes in the hospital setting. Other uncertainties which are linked to the change process include lack of incentives, resistance, lack of leadership and poor organizational culture (Milka et al., 2017).

4.6.2. Proposed Model for EHR

The assessment of the model was achieved by the use of Lipsitz Test which captures the goodness of fit test for ordinal response logistic regression models based on the Hosmer-Lemeshow test. It involves binning the observed data into equally sized g groups based on an ordinal response score. The analytical results amply revealed that the developed model was generalizable and acceptable. A similar study conducted by Chirchir et al. (2020) capture a strong relationship between the dependent and independent variables and revealed technical factors as being critical in the adoption of EHR. The study also revealed that change process factors explained 41.0% variation in EHR adoption, R2 = 0.410. This implied that 41.0% of change process factors could be justified by EHR adoption Additionally, change process factors positively and significantly predicted the adoption of EHR, $\beta = 0.571$, $t(279) = 13.886$, $p < 0.01$. This implies that change process factors predicted a magnitude of 57.1% on EHR adoption. Chirchir et al. (2021) also stipulated that the heads in care practice needed to work to lead the activity on adoption of EHR. These study findings indicate that technical factors positively and significantly predict EHR adoption,($\beta 1=0.611$, $t(279) = 10.772$, $p<0.01$) which implied that technical factors predict a magnitude of 61.1% on EHR adoption.

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CHAPTER FIVE
CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

This section provides the conclusion and recommendations captured from findings in the study. There is also the provision of suggestions for future research.

5.2. Conclusion

In sum, the study revealed how the adoption of EHR was critically influenced by a number of factors. These factors included socio demographics details (age, sex, education level and years of experience), practitioners' knowledge on ICT, Accessibility to ICT infrastructure and change management through involvement of the hospital administration and building health practitioners skills. The odds of fully implementing EHR systems were significantly lower for clients who were weak in ICT knowledge. Secondly, male clients were highly likely to have higher ICT Knowledge. Clients with only certificates as the level of education were approximately 7 times more likely to be weak in ICT Knowledge.

5.3. Recommendations

1) New studies should be conducted that focus on the development of EHR models that can be used to capture the extent of adoption in other rural regions.
2) Other studies should focus on providing information on models while comparing different facilities in rural and urbanized regions

5.4. Contribution to Knowledge

The study has explored several relevant factors in the adoption of EHR systems and has developed a model that health facilities can use when adopting a EHR system. The model will be instrumental in ensuring that there is full adoption of EHR systems. In comparison to diffusion theory model which doesn't foster participation, the study explored very specific factors and the responses where from the primary EHR users who are the health care practitioners.

The Technology Acceptance model is focused on user perception about a system while the developed model found out that apart from perception, financial implication, accessibility of ICT infrastructure and knowledge on ICT also played a huge role when it comes to adoption of EHR. Findings captured from the study can be used by healthcare facilities to diagnose the failure of their EHR implementation. The study finding can also be used as a guide in shaping of policies and guideline for EHR system implementation across the country. Similarly, other studies solely focus on the association between the different variables where this study captures the odds through which each independent variable influences adoption of EHR.

5.5. Suggestions for future research.

The study focused on examining the factors that influence adoption of EHR and develop a model that can guide in adoption of EHR. The following areas can be considered for future research:

1. Government policies and their impact on the adoption of EHR.
2. How facility type (Public/Private/Faith Based) and facility workload influence adoption of EHR.
3. The scope of the research can be expanded to cover all facilities across the country
4. How patient acceptance affected the utilization of EHR.
5. How interoperability between systems and choice of EHR influenced the adoption of EHR.

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APPENDICES

Questionnaire

SECTION A: SOCIO-DEMOGRAPHIC FACTORS			
1.	Gender	Male	
		Female	
2.	Age		
3.	Level of education	Certificate	
		Diploma	
		Graduate	
		Postgraduate	
4.	Year of experience	<1 year	
		1-5 years	
		6-10 years	
		>10 years	
5.	What is the level of EHR system implementation in your health facility?	Fully implemented	
		Partially implemented	
		Not implemented	
6.	If not implemented, is there a plan to implement?	Yes	
		No	

SECTION B: KNOWLEDGE OF ICT						
Please give an assessment of your general understanding of the below ICT operational area. Use the following scale to rank the level of knowledge: 5 = Excellent, 4 = Very good, 3= Good, 2= Weak, 1= No knowledge and understanding						
		1	**2**	**3**	**4**	**5**
1.	**How would you rate your overall knowledge on ICT use**					
2.	**Computer office applications e.g. Word processor, Excel spreadsheets etc.**					
3.	**Internet use e.g. Use of computer browsers to access web pages**					
Rate how easy it is to use EHR in your daily operations. Use the provided scale: 5 = very easy, 4 = Easy, 3 = fair, 2 = difficult, 1 = very difficult						
		1	**2**	**3**	**4**	**5**
4.	**How easy is EHR to use in the daily operations of the health care facility.**					
5.	**Any other comments regarding knowledge of ICT**					

SECTION C: ACCESSIBILITY TO ICT INFRASTRUCTURE						
To what extent do you agree with the below statements on the use and integration of ICT and ICT infrastructure in the daily operations in the health facility. Use the following scale to rate: 5= Strongly agree 4=agree 3=Neutral 2=Disagree 1=Strongly disagree						
		1	**2**	**3**	**4**	**5**
1.	**Computers are available and are used on a daily basis**					
2.	**A printer(s) is available and is used on a daily basis**					
3.	**There is a Local Area Network (LAN) that links computers together in one network**					
4.	**Computers have internet access**					
5.	**DO you have technical support staff, who guides on use of system and supports to resolve any system technical challenge?**			**Yes**		
				No		
SECTION D: FINANCIAL IMPLICATIONS						
Specify your level of agreement on the following cost related factors in the adoption of EHR systems in your health facility. Use the following scale: 5= Strongly agree 4=agree 3=Neutral 2=Disagree 1=Strongly disagree						
		1	**2**	**3**	**4**	**5**
1.	**Cost of purchasing Hardware**					
2.	**Cost of Annual renewal fee for Software licenses**					
3.	**Cost for staff Training**					
4.	**System maintenance costs**					
5.	**Cost of data entry**					
SECTION E: PERCEPTION OF HEALTHCARE PRACTITIONERS Rate the extent to which perception affect use of computer. Use the following scale: 5= Strongly agree 4=agree 3=Neutral 2=Disagree 1=Strongly disagree						
		1	**2**	**3**	**4**	**5**
1.	**I am willing to learn a new system**					
2.	**I will be able to fix the system if something isn't working**					

3.	**Using a computerized system is easy and reliable and I am willing to use it during daily operations**					
4.	**I fear using the computer will compromise the security of data e.g. Viruses**					
5.	**Using the a computer system is a lot of work e.g. entry of data**					

SECTION F: CHANGE MANAGEMENT

Rate how the following factors have EHR implementation in your health facility. Use the following scale : 5 = extremely difficult 4= difficult 3=somehow complicates 2 = minor impact 1 = no impact at all

		1	**2**	**3**	**4**	**5**
1.	**Lack of necessary resources to invest and acquire an EHR system**					
2.	**The return on investment from the EHR is minimal**					
3.	**Lack of support from health care providers**					
4.	**Lack of support from health facility administration**					
5.	**Lack of proper security mechanisms and privacy issues**					
6.	**EHR system that doesn't meet the health facility's needs**					
7.	**Health care providers do not have required skills to use an EHR system**					
8.	**Speed of data entry and capture on the EHR by the health care providers**					
9.	**Lack of expertise/skill in evaluating, comparing and selecting an EHR that addresses the health facility needs**					