Assessing the Suitability of an Individualized Electronic Health Record Management System (IEHRMS) for Cardiovascular Care

BY

DADIAUS MOMANYI MISIANI

REG. No (P51/73015/2014)

SUPERVISOR: DR. CHRISTOPHER CHEPKEN

A RESEARCH PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE DEGREE OF MASTER OF SCIENCE IN APPLIED COMPUTING AT THE UNIVERSITY OF NAIROBI.

NOVEMBER, 2016
DECLARATION

I hereby declare that this project is my own work and has, to the best of my knowledge, not been submitted to any other institution of higher learning.

Student:  DADIAUS MISIANI  Registration Number: P51/73015/2014

Signature: .............................................   Date: ..........................................................

This project has been submitted as a partial fulfillment of requirements for the Masters in Applied Computing of the University of Nairobi with my approval as the University supervisor.

Supervisor:  DR. CHRISTOPHER CHEPKEN

Signature: .............................................   Date: ..........................................................
DEDICATION

This is for you, Mom. Thanks for always being there for me. My lovely wife Doreen Kathure, My friends Job Lelenguiya and Silas Magare, many thanks for persevering with me as my advisors throughout the time it took me to complete this research and write the report.
ACKNOWLEDGEMENT

First and foremost, I wish to take this opportunity to thank almighty God for the gift of life and for giving me strength and courage to complete this research on time. I also wish to express my sincere gratitude to all those who gave me encouragement and support towards the completion of this study. I am particularly thankful to my supervisors, Dr. Christopher Chepken and Dr. Evans Miriti for their patience and guidance in leading me through the research process, encouragement and support. I am deeply indebted to you for the help, suggestions and encouragement I received during the research and when writing this report.

Finally to all my friends and family members, colleagues and lecturers who have been involved in one way or the other in helping me move to this milestone, I say thank you this research project would not have been completed without you. May God reward you abundantly.
# TABLE OF CONTENT

## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DECLARATION</td>
<td>i</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>iii</td>
</tr>
<tr>
<td>TABLE OF CONTENT</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF ACRONYMS</td>
<td>viii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>ix</td>
</tr>
<tr>
<td><strong>CHAPTER 1:</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>1.0 INTRODUCTION</strong></td>
<td>1</td>
</tr>
<tr>
<td>1.1 Background</td>
<td>1</td>
</tr>
<tr>
<td>1.1.2 Cardiovascular Disease (CVD)</td>
<td>3</td>
</tr>
<tr>
<td>1.2 Problem Statement</td>
<td>4</td>
</tr>
<tr>
<td>1.3 Research Objectives</td>
<td>4</td>
</tr>
<tr>
<td>1.4 Research Questions</td>
<td>5</td>
</tr>
<tr>
<td>1.5 Justification of the Study</td>
<td>5</td>
</tr>
<tr>
<td>1.6 Significance of the Study</td>
<td>5</td>
</tr>
<tr>
<td>1.7 Assumption and Limitations to the project</td>
<td>6</td>
</tr>
<tr>
<td><strong>CHAPTER 2:</strong></td>
<td>7</td>
</tr>
<tr>
<td><strong>2.0 LITERATURE REVIEW</strong></td>
<td>7</td>
</tr>
<tr>
<td>2.1 Introduction</td>
<td>7</td>
</tr>
<tr>
<td>2.2. The EHR Landscape</td>
<td>7</td>
</tr>
</tbody>
</table>
2.3. Conceptual Model 2.......................................................................................... 7

CHAPTER 3: .............................................................................................................. 14

3.0 RESEARCH METHODOLOGY ........................................................................... 14

3.1 Design.................................................................................................................. 14

3.2 Quantitative Measures ....................................................................................... 14

3.3 Qualitative Interviews.......................................................................................... 15

3.4 Ethics ..................................................................................................................... 15

CHAPTER 4: .............................................................................................................. 16

4.0 ANALYSIS AND DESIGN .................................................................................... 16

4.1 Data Collection Techniques .............................................................................. 16

4.2 Data analysis ......................................................................................................... 16

Summary of the Comments ....................................................................................... 21

4.3. System Design ...................................................................................................... 22

User Login .................................................................................................................. 28

Main Parameters ........................................................................................................ 28

Emergency profile ...................................................................................................... 29

Reports sharing ........................................................................................................... 29

Dashboard................................................................................................................... 29

CHAPTER 5: .............................................................................................................. 30

5.0 RESULTS ............................................................................................................... 30

5.1 Patient needs and empowerment ....................................................................... 30

5.2 Medical decision support for medical professional .......................................... 31

5.3 Primary benefits and recommendations as perceived by the user .................... 31

CHAPTER 6: .............................................................................................................. 32

6.0 DISCUSSION, CONCLUSION, LIMITATIONS AND RECOMMENDATIONS ....... 32
6.1. Discussion ....................................................................................................................................... 32
6.2 Conclusion ....................................................................................................................................... 32
6.3 Limitations ....................................................................................................................................... 32
6.4 Recommendations .......................................................................................................................... 33
REFERENCES .......................................................................................................................................... 34
APPENDICES .......................................................................................................................................... 36
APPENDIX 1: QUESTIONNAIRE ........................................................................................................... 36

LIST OF TABLES

Table 4.1 Demographic of respondents ............................................................................................... 16
Table 4.2 Respondents access to Internet enabled mobile phones ......................................................... 17
Table 4.3 How often respondents search for CVD related information online ...................................... 17
Table 4.4 Language in which respondents preferred to receive the messages ........................................ 19
Table 4.5 Functionalities of the system in meeting respondent’s needs ................................................ 20
Table 4.6 Usefulness of IEHRMS .......................................................................................................... 20
Table 4.7 Patients’ perceived support from the IEHRMS (%) ................................................................. 30
LIST OF FIGURES

Figure 1. 1 Global Annual Death from Cardiovascular Diseases. Estimation by Centers for Disease Control and Prevention (CDC) .................................................................................................................. 4

Figure 4.1 The Sharing of health report through SMS and e-mail .................................................. 18

Figure 2 ........................................................................................................................................ 23
## LIST OF ACRONYMS

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EHR-Electronic Health Record</td>
</tr>
<tr>
<td>2</td>
<td>CVD-Cardiovascular Disease</td>
</tr>
<tr>
<td>3</td>
<td>EHRA-Electronic Health Record Architecture</td>
</tr>
<tr>
<td>4</td>
<td>EMR-Electronic Medical Record</td>
</tr>
<tr>
<td>5</td>
<td>HIV -Human Immunodeficiency Virus</td>
</tr>
<tr>
<td>6</td>
<td>ICT-Information and Communication Technology</td>
</tr>
<tr>
<td>7</td>
<td>IIEHRMS-Interactive Individualized Electronic Health Record Management System</td>
</tr>
<tr>
<td>8</td>
<td>ITU -International Telecommunication Union</td>
</tr>
<tr>
<td>9</td>
<td>LMIC-Low and Medium Income Countries</td>
</tr>
<tr>
<td>10</td>
<td>mHealth--Mobile Health</td>
</tr>
<tr>
<td>11</td>
<td>MOH-Ministry of Health</td>
</tr>
<tr>
<td>12</td>
<td>MPs-Medical Professionals</td>
</tr>
<tr>
<td>13</td>
<td>NCD-Non Communicable diseases</td>
</tr>
<tr>
<td>14</td>
<td>PHR-Personal Health Record</td>
</tr>
<tr>
<td>15</td>
<td>RCH-Race Course Hospital</td>
</tr>
<tr>
<td>16</td>
<td>SMS-Short Message Service</td>
</tr>
<tr>
<td>17</td>
<td>SOA-Service Oriented Architecture</td>
</tr>
<tr>
<td>18</td>
<td>SSA-Sub Saharan Africa</td>
</tr>
<tr>
<td>19</td>
<td>WHO-World Health Organization</td>
</tr>
</tbody>
</table>
ABSTRACT

This paper reports on a research study that aimed to obtain opinion on personalized electronic health record management systems for Cardiovascular Care Setting from two client points of view; medics and patients, concentrating on supposed benefits, patients empowerment and assisting patients in making the right choices.

This study on IEHRMS was conducted between 7th April 2016 to 30th September 2016. The methodological approach used was a client participatory design with an aggregate number of eighteen (18) members. (10 Patients with CVD and 8 Medical Experts (MEs). Quantitative and Qualitative research techniques were utilized. Twenty five (25) individuals were initially enlisted all dwelling in Eldoret town in Uasin Gishu County. Study participants were interviewed face-to-face with semi-structured, written interviews.

Based on research result, 83% of patients showed a high level of perceived support by the IEHRMS. In addition, an aggregate of fifteen (15) members (7 patients and 8 medics) would utilize the IEHRMS if they were enrolled. The essential advantages members saw were; instant sharing of medical reports by means of an email and SMS, patient empowerment and comprehensive information which shows advancement of ailments. Significant suggestions for enhancing the IEHRMS included: the implementation of chat room for patients and medics, contact list of medical specialist within particular locality as well as the overall design.

This paper raises important insights that are significant to healthcare professionals as well as policy makers. It provides a clear perception on the necessity of having an interactive web portal endeavoring towards assisting patients in making health related decisions as well as assisting medics provide support to patients seamlessly. The acknowledgment and readiness to utilize the IEHRMS underscores the potentiality of interactive electronic health record management systems in a developing country like Kenya. The viewpoints that must be considered for future IEHRMS advancement are utilization frequency, period (time) of use and specialized support. There is additionally a need to address barriers that might hinder its use like privacy issues, effect on patient time and users computing skills.
CHAPTER 1:  
1.0 INTRODUCTION

1.1 Background

Cardiovascular illness (CVD) is the main source of death with 17 million deaths worldwide from a sum of 57 million every year (WHO, 2011). 80 percent (80%) of all CVD deaths now happen in Low and Middle Income Countries (LMIC). While the CVD pestilence is decreasing in developed countries this is contrary to many LMICs. Because of its steady nature and requirement for continuous checking and treatment, CVD care takes large proportion of healthcare spending throughout the globe and it has been described as the healthcare challenge of the 21st century (Teviu, et al., 2012). CVD care is reported to reduce economic growth of a nation by 0.5% with every 10% increase in the rate of chronic disease (Norman & Binka, 2011). The management of chronic CVD is associated with increasing healthcare costs (Yusif & Soar, 2014). The expanding pervasiveness of CVD, combined with battling overburdened medicinal services requires management solutions like e-health services that can create positive results both clinically and financially.

The requirement for care in CVD begins early and increases with seriousness of the disease, influencing various dimensions like support for the family, financial issues and social aspects, this gets worse at extreme stages of a disease, therefore services that aim at helping patients are key.

The internet and mobile technology industry keeps on scaling quickly, with a sum of 3.6 billion special portable devices as toward the end of 2014. (GSMA Intelligence, 2015) Half of the total populace now has a versatile membership—up from only one in five 10 years ago. Technology advances has seen the use of mobile devices increase significantly in the recent years in African countries and the world at large. The introduction of mobile computing devices such as mobile phones, smartphones, tablets and personal digital assistants (PDAs), has greatly impacted many fields. (Lewis, Synowiec, Lagomarsino, & Schweitzer, 2012)

These devices have found their way into the health sector. Studies affirm that smartphones and other high-innovation gadgets seem, by all accounts to be progressively utilized by healthcare workers and accepted in different healthcare fields. (Mahadeen).
Studies have underscored the capability of electronic health record systems in the setting of growing middle class society. This is due to affordability of technology, internet accessibility, the advantages of adaptability, facilitated convenience and tailored services (Sandra Schaller, 2013). However, a viable implementation of e-health solutions all in all requires including every one of the stakeholders. An absence of client contribution frequently brings about ease of use issues and higher whittling down rates (Gemert and Nijland 2011) thus, structures for e-Health innovations stress the significance of ceaseless and precise assessments of e-Health service from the client's point of view ahead of schedule in the development process (Catwell 2012). The study here intended to include all clients right on time in the product development process so as to come with familiar user friendly and appropriate design. The general aim of the study was to come-up with an individualized health record management systems which was to be acceptable by all.

At present, the lion's share of internet-based, supportive intercessions for patients with CVDs includes websites or general instructive online programs. Few of published and evaluated studies are like the IEHRMS with respect to a combination of information support and connection functionalities for example Caregiver Stress Check System offered by Alzheimer's Association meant to assist caregivers in discovering answers and local support, however it doesn’t permit sharing of reports by an email or by SMS. Locally most electronic Health Record systems are intranet based and don't have features of sharing patient's wellbeing records. DHIS2 which is an apparatus for accumulation, approval, examination, and presentation of total and patient-based factual information does not permit simple sharing of particular patient information. In general the IEHRMS varied from other EHR systems by (1) Instant sharing of patient information (2) Tailored support to the patients as per information captured during treatment (3) an emphasis on patient empowerment/choice guide (4) Capturing the important role of medics.

The motivation behind the pilot study was to acquire input from medics as well as from patients right on time in development process of IEHRMS, focusing on empowerment attributes, patient choice guide, probable benefits, most encouraging functionalities and suggestions for further improvement.
1.1.0 SMS Technology

Short Message Service is a communication method in which one person sends a short text message, or simply a text, to another via his mobile device. SMS is a fast, low cost and popular mode of communication found on every cellphone across most technologies, including CDMA, 3G and GSMS. SMS is a short message that can be sent from one cellphone to another, and pushed to the receiver’s gadget when sent. Some key favorable benefits of SMS comprise of; short messages of 160 characters, great interoperability amongst systems and technologies (GSM and CDMA); it is minimal effort and free for the recipient. (Talariax).

SMS messages have various qualities that make them extremely suitable for use in a healthcare environment. Some of these include: coordinate patient correspondence, privacy, and confidentiality, quick conveyance of messages and receipt of reactions/responses expediency for medics and patients. SMS technology additionally permits the dispatching of bulky messages at the same time, so reducing the cost of labor. (Koshy, Car, and Majeed, 2008).

1.1.1 Web Portal

A Web portal is an exceptionally composed site that unites data from assorted sources in uniform way. Typically, every data source gets its specific area on the page for showing data (a portlet); it can likewise be viewed as a library of customized pigeon-holed content. A Web portal aid in search navigation, customization, reporting and information amalgamation, and it also provides features and application integration which makes them appropriate for use in healthcare environment. Since healthcare industry is heading towards Stage 2 meaningful use attestation, web portals are turning into an "unquestionable must requirement” for enhancing patients engagement and encouraging significant patient correspondence too. (Steven &Michelle 2014).

1.1.2 Cardiovascular Disease (CVD)

Cardiovascular Disease (CVD) incorporates dysfunctional states of the heart and blood vein framework which include veins, capillaries and arteries that among different roles supply oxygen to all body tissues and organs, as well as key life-sustaining zones like the cerebrum and the heart itself (Oyeyemi and Wynn, 2014).

Cardiovascular illnesses now rank as the world's top cause of death, creating 33% of all death in the world. Roughly 17 million individuals succumb every year of CVD worldwide and this
number is projected to rise to 24 million by the year 2030. CVD is the main source of death in low and middle income countries (Donald 2013) and for the next ten years SSA is anticipated to see the biggest increment in death rates from CVD, cancer related illness, and other chronic illnesses (Aikins, 2010) The worldwide plague of CVD is ascending, as well as moving from high income countries to low income countries, mostly as a consequence of poor disease management, life expectancy increase as well as rapid change in life style by most people. (The University of Texas School of Public Health, 2012)

![Graph showing annual death from CVD](image)

**Figure 1.1 Global Annual Death from Cardiovascular Diseases. Estimation by Centers for Disease Control and Prevention (CDC)**

1.2 Problem Statement

The utilization of Information and Communication Technology (ICT) and its related services have grown quickly in the provision of healthcare services in the course of the recent years. Paper-based records are quickly being phased out and electronic health records (EHR) embraced in most high income countries. The use of EHR in as well growing in developing countries. As of now EHR are intended to remove the impediments associated with paper based health records systems and help patient in proper disease management (Soleng, and Wynn, 2011). The utilization of IEHRMS by cardiovascular ailment patients can possibly assist the patient in managing the disease as well as enhance clinical results and negligibly affect resource usage.
The present study developed a user-sensitive and electronic health record management system for CVD care: (IEHRMS). It expected to give focused and customized support to patients with CVD.

1.3 Research Objectives
The goal of the pilot study was to evaluate effect and helpfulness of IEHRMS from two client points of view (patients and medics), centering on patient empowerment, patient health choice guide, and the perceived advantages in the utilization of the system.

The definite objectives of the study were to:

i. To develop a platform for individualized personal healthcare services for CVD case.
ii. To assess the usefulness of the use of IEHRMS in the Cardiovascular Patient care at Racecourse Hospital in Eldoret town, Uasin Gishu County.
iii. To assess the effect on the use of IIEHRMS in the Cardiovascular Patient care setting at Racecourse Hospital in Eldoret town, Uasin Gishu County.

1.4 Research Questions

In endeavor to address the above goals, this research intended to answer the ensuing Research Questions (RQ)

i. Which features are suitable for EHRMS targeting CVD patients?
ii. What is the usefulness on the use of IEHRMS on patients as well as on medical experts at Racecourse hospital?
iii. What is the impact on the use of IIEHRMS in the Cardiovascular Patient care at Racecourse Hospital in Eldoret town, Uasin Gishu County?

1.5 Justification of the Study
An effective health information system should provide information in the right form, and at the right time. Such information is essential in guiding patient and medics make appropriate disease management decisions. This study aimed to identify functionalities of an effective electronic health record management system.
1.6 Significance of the Study
The system developed is highly useful as it can be used in other healthcare organizations especially in setting that requires long-term disease management. If adopted, it increases the chances of a message being impactful and effective. This in turn ensures better disease management.

1.7 Assumption and Limitations to the project
In this study, the following were assumed;

i. That the target population was to answer truthfully to the surveys conducted. Anonymity and confidentiality was preserved.

ii. That SMS and email are the best medium for communicating to large populations at a low cost.

iii. That the sample selected was representation of the population this study made inferences to.
CHAPTER 2:

2.0 LITERATURE REVIEW

2.1 Introduction

In April 2011 the Ministry of Health (MoH) published Kenya’s first National e-Health strategy (2011-2017); the justification was to utilize the growing ICT for healthcare. The strategy has five aspects of Implementation: Health Information Systems; Telemedicine; Information for Citizens; Electronic-Learning and Mobile-Health. The Electronic Health Record (EHR) is a key segment of e-health that is progressively being used in industrialized countries. Albeit African countries are as yet lingering behind developed nations in the accessibility and utilization of EHR (Kumar 2012) there has been a recommendable increment in the accessibility and use of EHRs in Africa. This expansion has been driven by cooperation between African institutions and international partners more-so in the area of HIV/AIDS treatment and care (Nucita 2010).

The deluge of EHRs in Kenya has been enabled by many reasons, key elements being the expanded accessibility of affordable cellphones, PCs and expanded access to the internet. The web accessibility in Kenya has grown enormously standing at 31.9 million, making Kenya the 21st most connected populace on the planet (ITU, 2014). In 2015, 58% of all cellphones that were sold in the country, assessed to be 1.8 Million devices, were smartphones. This represents an annual of growth of 112%, contrasted with only a 3.6% growth of feature/ basic phones.

2.2. The EHR Landscape:

Successful e-health projects have demonstrated that information and communication technologies facilitate the improvement and efficiency of the quality of health care. For example, the home care system for Type 1 diabetes clients was discussed by Bellazzi et al. (2009) with the goal of: (i) providing clients with an effective insulin treatment, (ii) obtaining a proper level of consistent and intensive care at home through tele-monitoring and tele-consultation services (iii) allowing economical monitoring, (iv) supporting continuous training of customers through tele-discussion (Bellazzi, Montani, Riva, and Stefanelli, 2011).
IDEATel (The Diabetes Education and Telemedicine) venture assessed the feasibility, efficacy, suitability, and cost-viability of telemedicine. The point of convergence of this intervention was the home telemedicine unit, which gave four core functions: (i) synchronous video-conferencing over standard phone lines, (ii) electronic transmission for glucose and circulatory pressure readings, (iii) secure Web-based messaging and clinical information analysis, and (iv) access to Web-based informative materials (Starren et al. 2012).

As indicated by Ball, Smith, and Bakalar (2012), giving patients a "dashboard" to oversee chronic health conditions permits the patient to have more control and the doctor to give an early intercession. The dashboard can help in creating an alert to and at the same time notify the doctor when a blood level, (for example, glucose) is anomalous. Norris et al. (2012) affirmed that a disease management system can enhance glycemic control, including screenings for foot sores and fringe neuropathy, in diabetic patients.

Conformity in medications can assist to prevent future problems and even deter the requirement for hospitalization. Furthermore, it is conceivable that if patients know they are being watched and observed by their medics or caregivers they will feel more impelled to follow the rules given to them (Green, 2012). Patients may even perceive their medics as "watchers" who are watching over them (Ralston, Revere, Robins, and Goldberg, 2004). At very minimum the patients can give information which the medic can use to track different health pattern markers, for example, weight and pulse.

Heisler et al. (2012) focused on a typical interminable condition, diabetes mellitus, and found that the most noteworthy indicator of patient adherence to treatment suggestions (self-management) was medic communication. The study asked partakers about data given by their doctors, for example, laboratory test result, treatment choices, and also medication side effects. In another examination of data exchange, Maly et al. (2009) went above and beyond and included therapeutic record sharing between the doctor and patient. Patients were given a duplicate of the latest progress note alongside a glossary of terms to help in their elucidation. Medical record sharing did not meaningfully expand office visit lengths, but rather enriched the nature of the visit. This was felt to be because of improved patient enthusiasm for their therapeutic records and general patient fulfillment.
Tang and Lansky (2015) concur with the usage of a glossary, expressing that notwithstanding access Health Record, patients require instruments to help them in deciphering and comprehending whatever is contained in a record. This helps in improving the “health literacy” of patients as by noted by by Lober et al. (2009). Grasping and appreciating the content of Electronic Health records including things like medications, infections, pharmaceuticals, and medical lingo. The Joint Commission on National Health Education Standards expounds on the need to comprehend by including competency to utilize the data to improve health (Nielsen-Bohlman, Panzer, and Kindig, 2014).

Tang and Newcomb (2010) likewise established that there is an enhanced fulfillment when patients are given summary of information after-visit with medic. Summary of information that contains data like laboratory results and tests requested, recent medications, medical sensitivities and instructive materials are paramount. Ralston et al. (2013) advised against sharing a lot of data, expressing that patients may not find access to a full medical record as useful compared to just a summary of it. Patients like printed copy of data because it gives them a sense of feeling that medics are well organized.

Graphs of pulse levels of several visits for hypertensive patients can be viewed as a "key influencer" by certain portion of the patients in terms of helping them continue taking remedial regimens.). The customization of information to a patient’s ailment not only personalizes and improves communication but also allows the patient to see the value of the numbers in relation to his or her own health status. Using a simple language at a level the patient can comprehend improves understanding as well as communication (The Joint Commission, 2009). Medics and caregivers are encouraged to take time explain to patients the action steps that are required and use several methods of communication so as to enhance understanding (Oates & Paasche-Orlow, 2009).
2.3. Conceptual Architecture and Schematic Representation of IEHRMS

The systems was designed as a combination of relevant information to enable delivery of a tailored electronic health management service, containing customized support though a customized Web portal that facilitates communication between medics and patients. The verdicts of review from Boots et al showed that consolidating customized data with communication are the most encouraging. The design of IEHRMS was realized by service-oriented architecture (SOA) grounded on the open source Web platform, Liferay. A rapid and iterative design process between the developer, medics and patients were integrated based on;

1. Patient focus group.
2. Interviewing four medics.
3. Reviews of current literature materials.

Prior to the final implementation and assessment of IEHRMS, the system was guided in a pretest by three (3) patients and two (2) therapeutic experts. In light of the pretest findings, the EHRMS was reviewed. Amendments were made on the following facets: improved interaction functionality for communication between patients and medics, the possibility of medics to share time bound medical reports with other specialists and some design features. In the course of the study, participant access to the IEHRMS was realized by means of a personalized individual record for patients and doctors. Major roles which were relevant for the IEHRMS include:

a). Patients account to view information about medical data and health status.
b). Medic account to capture and view historical health records as well as timely reactions to health status changes of patient.

The IEHRMS was customized and intuitive and gave two noteworthy functionalities
(1) Interactive and tailored arrangement of data and knowledge.
(2) Communication with medicinal specialists in CVDs arena.
The portal gave individualized, opportune, and situation-specific data to patients and medics based on an individual enlistment profile and electronic triage diary entries given out by the patient (that is, medication diary and history of disease). Patients received medical reports and tailored information via text message or email. IEHRMS aimed to enable close correspondence and collaboration amongst doctors and patients. Therefore, its objective was to empower and improve treatment as well the care of CVD patients.

### 2.3.1 Conceptual Architecture

The approach for implementing IEHRMS depended on the HYGEIAnet Reference Conceptual Architecture (HRA), which offers the essential framework for the reuse of modules, services, and interfaces. At the core tier / middleware level, the services comprises: Collaboration, patient clinical data, authorization and messaging, services.

The model used gives a sensible example of the connections between applications, end-client services and the core tier (middleware) supporting services. At the repository layer services and tools like archive, databases, Liferay services are tied together. Clinical data information sources were are to be integrated by Web/Open Data Base Connectivity [ODBC] and CORBA. On top,
the presentation/client tier layer furnishes the client with the methods for accessing IEHRMS support services.

Figure 2.3.1 System Conceptual Architecture
IEHRMS conceptual architecture is centered on;

- CORBA interfaces for messaging, information acquisition and patient identification.
- Light Directory Access Protocol (LDAP) for security administrations, client profiles, patient clinical data, and healthcare resources.
- Structured Query Language (SQL) (for retrieving essential data and keeping up new ordering).
- Extensible Markup Language (XML) (to sustain the collected clinical information in a reliable way).
CHAPTER 3:

3.0 RESEARCH METHODOLOGY

3.1 Design

The pilot study on IEHRMS was conducted at Racecourse hospital based in Uasin Gishu County, Eldoret town. A research design comprised of dynamic end-user participants. A semi-structured as well as written interview was embraced. The creation of questionnaire was based on research questions. The questionnaire comprised of instruments for evaluating the apparent helpfulness of the IEHRMS with respect towards end users using it, supposed benefits and apprehensions, as well as suggestions of both patients and medics. The content of the introduction included a point by point clarification of elements and functionalities of the system.

The IEHRMS was semi-functional; it was accessed by the moderator, using a dummy record and mock data representing a formal patient. In view of the individual profile, the IEHRMS functionalities were demonstrated and expounded to both the patients and medics. This method has been recommended in past studies on eHealth interventions. (E-health evaluations Norman, K.L. 2009).

3.2 Quantitative Measures

3.2.1 Usefulness: Attitude toward Using by patient and medical experts

The mentality toward utilizing the IEHRMS was surveyed by means of the item "I feel that IEHRMS is a noble idea" and expectation to use by the item, "If I had a chance or access, I would utilize IEHRMS." Both were appraised on a 5-point Likert scale (1=strongly agree to 5=not agree at all).

3.2.2 Usefulness: Decision Aid (patient, Professionals)

The researcher used "do you think IEHRMS help you in choosing good health/wellbeing decisions" to quantify impression of the IEHRMS with regard to decision/ choice support. In view of the five (5) items, the planning for decision making was rated on a 5-point Likert scale (5=a great deal, 1=not at all).
3.2.3 Usefulness: Perceived Benefits to both patients and medics
The advantages to both user groups were evaluated by means of particular things that were appraised on the five (5)-point Likert scale (1=strongly agree to 5=not agree at all). The questionnaire pieces things were gotten from current literature additionally from pretest output of the IEHRMS.

3.3 Qualitative Interviews
Notwithstanding the quantitative information, the apparent helpfulness was investigated through a semi-structured interview aiming end users' recognition on advantages, significant concerns, and further needed functionalities and enhancements. The basis was to survey the effect on users' impression of the IEHRMS. The semi-structured, written interviews were conducted for a period of roughly thirty (30) minutes.

3.4 Ethics
In view of the interview guide designed for the purpose of the study, all questioners/ interviewers were trained in advance before the actual study. The pilot study was done between 15/08/2016 to 19/08/2016. All members were apprised on aim as well the scope of the study, and gave their informed consent for partaking the study. Data collection plus analysis was conducted solely using anonymized information.
CHAPTER 4:
4.0 ANALYSIS AND DESIGN

4.1 Data Collection Techniques
Data was gathered throughout the development process and analysed using IBM I2 analyst’s notebook and Microsoft excel applications: Patients were recruited from Racecourse hospital. Eligibility criteria for patients included: a) A person with CVD (as per World Health Organization) Cardiovascular diseases (CVDs) are ailments that affect the blood supply routes and vessels, the heart, or both - illnesses that influence the circulatory system b) No less than 18 years old and c) Can speak write and read English d) Able to use internet enabled phone.

Eight (8) medics were enrolled from Racecourse Hospital Suitability criteria for doctors encompassed: a) qualified individual in CVD treatment as well as care, b) Working at Racecourse Hospital.

4.2 Data analysis

4.2.1 Demographic of respondents
The table below (Table 1) shows the demographic of the respondents. Samples of eighteen (18) respondents were selected. (10 CVD patients and 8 medical professionals). 3-5 users were sufficient to evaluate an e-health system eight (8) users or more users of each type are required for dependable measures Hartson (2000). Fifteen (15) of the respondents were randomly selected from a population of 46 patients. The sample consisted of five (5) males and five (5) females from urban area of Uasin Gishu County. From the sample of 15 selected, 10 patient’s participants responded to the study, approximately 69%

Table 4.1 Demographic of respondents

<table>
<thead>
<tr>
<th>No.</th>
<th>Gender</th>
<th>Age</th>
<th>Residential area</th>
<th>Attending Clinic Racecourse Hospital</th>
<th>Professional status</th>
<th>Duration with CVD (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>M</td>
<td>56</td>
<td>Elgon View</td>
<td>Yes</td>
<td>Retired</td>
<td>6</td>
</tr>
<tr>
<td>02</td>
<td>F</td>
<td>43</td>
<td>Kapsuswa</td>
<td>Yes</td>
<td>High School Teacher</td>
<td>3</td>
</tr>
<tr>
<td>No.</td>
<td>Gender</td>
<td>Age</td>
<td>Residential area</td>
<td>Attending Clinic Racecourse Hospital</td>
<td>Professional status</td>
<td>Duration with CVD (years)</td>
</tr>
<tr>
<td>-----</td>
<td>--------</td>
<td>-----</td>
<td>------------------</td>
<td>--------------------------------------</td>
<td>---------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>03</td>
<td>F</td>
<td>39</td>
<td>Race Course</td>
<td>Yes</td>
<td>Business</td>
<td>4</td>
</tr>
<tr>
<td>04</td>
<td>M</td>
<td>51</td>
<td>Kapsoya</td>
<td>Yes</td>
<td>Police Officer</td>
<td>5</td>
</tr>
<tr>
<td>05</td>
<td>F</td>
<td>33</td>
<td>Elgon View</td>
<td>Yes</td>
<td>Banker</td>
<td>2</td>
</tr>
<tr>
<td>06</td>
<td>F</td>
<td>31</td>
<td>Race Course</td>
<td>Yes</td>
<td>Part-time employed</td>
<td>2</td>
</tr>
<tr>
<td>07</td>
<td>F</td>
<td>29</td>
<td>Kipkenyo</td>
<td>Yes</td>
<td>Self Employed</td>
<td>1</td>
</tr>
<tr>
<td>08</td>
<td>M</td>
<td>28</td>
<td>Kapsoya</td>
<td>Yes</td>
<td>Accountant</td>
<td>2 1/2</td>
</tr>
<tr>
<td>09</td>
<td>M</td>
<td>33</td>
<td>Race Course</td>
<td>Yes</td>
<td>Banker</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>M</td>
<td>41</td>
<td>Kamukunji</td>
<td>Yes</td>
<td>Pastor</td>
<td>3</td>
</tr>
</tbody>
</table>

Mean

**Patient characteristics**

F female, M male,

4.2.2 Respondents access to internet enabled phones

The table below shows the patient respondents access to their mobile phones. Based on the analysis, it is clear that 94% of the respondents owned an internet enabled phone.

**Table 4.2 Respondents access to Internet enabled mobile phones**

<table>
<thead>
<tr>
<th>Do you own an internet enabled phone?</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>17</td>
<td>94%</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>6%</td>
</tr>
</tbody>
</table>

4.2.3 How often patient respondents preferred use their mobile phones on internet to research CVD related issues

The table below shows how often respondents use internet through mobile phones to search for CVD related materials online. 50% of the respondents check information frequently, 30% prefer once a week, 10% twice a day and another 10% preferred once a day. The analysis of the data
showed that most people search information online. This was attributed to the fact that they needed a lot of information to guide them on how to manage their condition.

**Table 4.3 How often respondents search for CVD related information online**

<table>
<thead>
<tr>
<th>How often do you check internet to search for health related information</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once a day</td>
<td>10%</td>
<td>1</td>
</tr>
<tr>
<td>Twice a day</td>
<td>10%</td>
<td>1</td>
</tr>
<tr>
<td>Once a week</td>
<td>30%</td>
<td>3</td>
</tr>
<tr>
<td>Once a month</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>As frequently as possible</td>
<td>50%</td>
<td>5</td>
</tr>
</tbody>
</table>

**4.2.4 The Sharing of health report through SMS and e-mail**

From the analysis, 80% of the patient respondents were interested in receiving SMS tips on how to manage their conditions while 50% were only interested in email and 80% of the respondents interested in both email and SMS. Further analysis revealed that 70% of people were interested in receiving lab results by an email while 50% preferred receiving lab results via SMS. 90% of patients were interested in Graphs of blood pressure levels, weight glucose level via an email.

**Figure 4.1 The Sharing of health report through SMS and e-mail**
Table 4.4 Language in which respondents preferred to receive the messages

<table>
<thead>
<tr>
<th>Language</th>
<th>respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>8</td>
<td>80%</td>
</tr>
<tr>
<td>Swahili</td>
<td>2</td>
<td>20%</td>
</tr>
<tr>
<td>Native language</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

The table above shows the language the respondents preferred to receive the healthcare messages from IEHRMS. English language was highly preferred over Swahili language by 80% of the respondents. No respondent selected a native language as their preferred language.

4.2.5 Perceived benefits of using the system IEHRMS.

Table 5: How patients respondents perceive the easiness of using the system

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Response Percent(PR)</th>
<th>Response Count (PR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definitely Yes</td>
<td>70%</td>
<td>7</td>
</tr>
<tr>
<td>Yes</td>
<td>30%</td>
<td>3</td>
</tr>
<tr>
<td>Not sure</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Definitely No</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>answered question</td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

Patient Respondents

The table above shows how patients respondents perceive easiness at which to use the IEHRMS. Majority of the respondent 80% found it easy to use IEHRMS. No respondent selected not sure or no
4.2.6 Functionalities of the system in meeting users’ needs

Table 4.5 Functionalities of the system in meeting respondent’s needs

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Response Percent (PR)</th>
<th>Response Count (PR)</th>
<th>Response Percent (MER)</th>
<th>Response Count (MER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>50%</td>
<td>5</td>
<td>63%</td>
<td>5</td>
</tr>
<tr>
<td>Agree</td>
<td>20%</td>
<td>2</td>
<td>16%</td>
<td>1</td>
</tr>
<tr>
<td>Not sure</td>
<td>30%</td>
<td>3</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0%</td>
<td>0</td>
<td>21%</td>
<td>2</td>
</tr>
</tbody>
</table>

answered question 10 8

PR – Patient Respondents

The table above shows rating on how respondents perceived the functionalities of the system. 50% and 63% of patients and medical experts respectively strongly agree that the IEHRMS has functionalities that meet there expectations, 20% and 16% of patients and medics agree whereas 30% of patients were not sure and only 21% of medics strongly disagree that the system has all the functionalities required.

4.2.7 Usefulness of IEHRMS

Table 4.6 Usefulness of IEHRMS

<table>
<thead>
<tr>
<th>How useful do you perceive IEHRMS</th>
<th>Response Percent (PR)</th>
<th>Response Count (PR)</th>
<th>Response Percent (MER)</th>
<th>Response Count (MER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very useful</td>
<td>70%</td>
<td>7</td>
<td>75%</td>
<td>6</td>
</tr>
<tr>
<td>Somewhat useful</td>
<td>20%</td>
<td>2</td>
<td>25%</td>
<td>2</td>
</tr>
<tr>
<td>Not very Useful</td>
<td>10%</td>
<td>1</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Not at all Useful</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
<td>0</td>
</tr>
</tbody>
</table>

answered question 10 8

PR – Patient Respondents, MER – Medical Experts Respondents
The table above shows the participants responses on the usefulness of the IEHRMS. 80% of patient respondents and 75% of the medical experts respondents found the system to be useful. 20% and 25% of patients and medics respectively found the system somewhat useful and only 10% of patient respondents found the system not very useful.

**Summary of the Comments**

The following comments were given by respondents on areas of consideration.

<table>
<thead>
<tr>
<th>Theme</th>
<th>User</th>
<th>Sample Quotes from participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PERCEIVED BENEFITS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquisition of individualized information</td>
<td>PR</td>
<td>&quot;Instant access&quot;</td>
</tr>
<tr>
<td>Empowerment</td>
<td>PR</td>
<td>&quot;easy access of records with just a link&quot;</td>
</tr>
<tr>
<td>Overview of weight, Glucose and Blood Pressure graph</td>
<td>PR</td>
<td>&quot;It enables me to see how and when changes occur in the course of the disease.&quot;</td>
</tr>
<tr>
<td>Improved interaction with medics</td>
<td>PR, MER</td>
<td>&quot;Very good way of sending information by doctor&quot;</td>
</tr>
<tr>
<td>History data of the patient (Allergy, medication)</td>
<td>MER</td>
<td>&quot;...good info especially for first timers to the clinic, the overview of history data is very important.&quot;</td>
</tr>
<tr>
<td>Improved preparation for follow-up visit</td>
<td>MP</td>
<td>&quot;easy to track patient records&quot;</td>
</tr>
<tr>
<td><strong>MAJOR CONCERNS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data security</td>
<td>PR, MER</td>
<td>&quot;I have concerns, the patients Feels always monitored.&quot; &quot;what if my phone get lost, people will access to my data&quot; &quot; will mobile operators have my data&quot; &quot;The data I am entering is very personal data.&quot;</td>
</tr>
<tr>
<td>Increased administrative effort</td>
<td>MP</td>
<td>&quot;There will be a lot of work if the system will not be integrated into existing IT systems of the hospital.&quot;</td>
</tr>
<tr>
<td><strong>RECOMMENDATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients need to input some data</td>
<td>MP</td>
<td>&quot;it will be good to allow patients to capture some data as well , and have an alert on physician end &quot;</td>
</tr>
<tr>
<td>Chatroom for doctors and patients</td>
<td>PR, MER</td>
<td>&quot;It would be good to have chat to allow doctor chat with patient&quot;</td>
</tr>
<tr>
<td>Medication summary entries</td>
<td>PR</td>
<td>&quot;Would be good to have an overview about the entries for medication for patients as well.&quot;</td>
</tr>
</tbody>
</table>
Emergency hotline | PR,MER | "include emergency phone numbers and contacts of other medical experts who can assist the patient on reports"
Upload function for documents | MP | "It would be good to include medical records, blood parameter, etc. – so that all medics are aware of the current medical status and examinations."
Medical history parameters | MP | "Do not share all medication, in case of misdiagnosis patient might cause trouble"

| Table 8: Comments summary. |

4.3. System Design
The system was developed with the following technologies;

1) The back-end of the application is based on Liferay open source framework (SOA architecture), open source Web platform for developing server-side scripting codes.
2) The front-end of the application is based on HTML5 and CSS.
3) Apache web server for hosting the application.
4) Use of a SMS Short code service – for sending and receiving messages.

Open source technologies were chosen because of their low cost, ease of acquiring the software and their stability due to a robust support through the active developer community globally. In addition the use of open-source technology solutions is relevant for the developing countries as they demand less financial input, flexibility and wider support for its stability and viability.

4.3.1 System features
LOGIN

User logins in using user name and password. For the purpose of the study, the researcher created one account which the researcher used to demonstrate to users.
Figure 2
After successful login, user is taken to home page.

Figure 3

Figure 4

Figure 5
Figure 6
Figure 8
Figure 9
4.3.2 System Overview

This system enables medics to capture and share medical information instantly.

User Login

The system enables a user to login using created user name and password as shown in Figure 2.

Main Parameters

After successful login user is taken to home page that contains the following main parameters as shown in Figure3, 4 and 5:

i. Dashboard that contains graphs that are generated from diary entries captured by medical expert.

ii. Emergency profile measurements that captures contact details of next of kin of patient or person who can be contacted in case of an emergency.

iii. Reports contain analyzed reports which can be shared with patient or another hospital.
Emergency profile
This function enables the user to capture data on the following and shown in figure 6.

i. Allergies.

ii. Medical conditions.

iii. Medication.

iv. Data captured from medical devices.

Reports sharing
This functionality as shown in figure 8 enables medical experts to share medical reports with patients via an SMS or email.

Dashboard
This contains generated graph features which are helpful in increasing awareness to patients in terms of knowing how they are managing their weight, blood pressure and glucose level.
CHAPTER 5:

5.0 RESULTS

A total of eighteen (18) participants (10 patients; 8 medics) partook in the study of which four (4) of the MPs were medical doctors, three (3) Nurses from a patient support and one (1) counsellor.

Ten (10) patients aged between 28 to 56 years, took part in the study. The average age of participants was 38 years. 50 % of the patients were male. The Sharing of health report through SMS and e-mail graded as very relevant by 50 % of the patients and rated as relevant by 30 %, while a further 10 % had picked undecided with just 10 % picking less/not essential.

5.1 Patient needs and empowerment

Patients demonstrated a high level of perceived, individual support from the IEHRMS (normal mean = 2.2; SD = 0.9 on a 5-point Likert Scale from 1=’I totally agree’ to 5=’I disagree’; the provision of individualized data on CVD treatment as well the charts were seen as the most helpful functionalities (Table 9). Additionally, most of the patients voiced the need for a chat room module within the IEHRMS and specialized support for those less capable in utilizing the system. Patients highlighted one issue that is pertinent for the everyday utilization of the IEHRMS: A summary of quantitative personal diary entries.

Table 4.7 Patients’ perceived support from the IEHRMS (%)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients’ perceived support by IEHRMS (in %)</td>
<td>60</td>
<td>40</td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1 I totally agree (%)</td>
<td>2 I agree (%)</td>
<td>3 Undecided (%)</td>
<td>4 I rather disagree (%)</td>
<td>5 I disagree (%)</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------</td>
<td>---------------</td>
<td>-----------------</td>
<td>-------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Measuring trend, weight and blood pressure</td>
<td>70</td>
<td>20</td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Report sharing</td>
<td>60</td>
<td>30</td>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

5.2 Medical decision support for medical professional

Medics indicated that the IEHRMS covers relevant information that is needed in management of CVD which is typically exceptionally hard to get (longitudinal information about the sickness, disease duration, medication history for instance Allergies, Medication, Condition and Measurements).

Altogether, 100% of the medics reported that the IEHRMS gives pertinent data which assist in guiding the appropriate medication and 50% expressed that IEHRMS promptly contributes to setting up contact with another medic. Notwithstanding, medics highlighted the requirement for further, extra functionalities inside the IEHRMS: upload functionality for attaching reports and enhanced collaboration functionality.

5.3 Primary benefits and recommendations as perceived by the user

The major perceived advantages and focal points of the IEHRMS for patients were: 70% perceived instant relaying of individualized data on diary form as crucial trailed by a detailed graph overview of the course of the disease at 60%. In general, eight (8) of the patients expressed that the IEHRMS is a decent idea and would utilize the IEHRMS in the event that they are enrolled. The worries about the IEHRMS were protection and information security (40%).

From the medics’ perspective, the usefulness of the system include; enhanced connection with patients (60%), enhanced collaboration with different specialists particularly on sharing of reports required in the treatment and care of CVD patients (60%), empowerment of patients (40%).
CHAPTER 6:

6.0 DISCUSSION, CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

6.1. Discussion
This report described the participation and viewpoints of patients and medics for an Individualized Electronic Health Record Management System (IEHRMS) prior to implementation stage. The study intended to add value to scientific research by giving new understandings into the advancement of e-Health systems used in cardiovascular setting from two critical client viewpoints. This was significant for the additional improvement and take-up of electronic health record in the cardiovascular care setting. Besides this was especially applicable against the environment of growing middle class which is willing to utilize web and versatile electronic gadgets in managing CVDs.

The outcomes from this study demonstrated the promising aspects of the IEHRMS with regards to users’ empowerment as well as in improving communication between patients and medics. This outcome is of extraordinary significance, as the IEHRMS was intended to supplement and not substitute existing Electronic Health Record Management Systems. From the patients' point of view, the actualized graphs components are useful in expanding their mindfulness on how they are dealing with their weight, circulatory strain and glucose level. One of the central points that added to this insight was usefulness of giving texts to the patients which bolsters the discoveries by Brodaty et al. (2010) where clients felt that SMS and email correspondence are extremely valuable in getting medicinal reports.

6.2 Conclusion
The results of the study showed that the IEHRMS can possibly meet various requests and needs of patients with CVDs in a locally established CVD care setting. The apparent advantages and readiness to utilize the system, together with growing number of individuals using the internet and smartphones frequently, stress the capability of customized and electronic health record management systems in helping patients manage the diseases as well as in empowering them.
6.3 Limitations
In spite of the fact that the study gave vital and new understanding in the part of electronic records in the management of the CVDs, there are sure impediments that must be considered. The principal disadvantage was reflected in the fairly little number of members. In any case, the quality of this study was that diverse client points of view (patients and medics) were incorporated. The second impediment was that IEHRMS was not conveyed and utilized for generous timeframe to gage its viability, despite the fact that a demo was given. As delineated in the introduction and method areas, the purpose of this study was to include the client's viewpoint right on time in the development of the IEHRMS.

6.4 Recommendations
More perspectives ought to be considered for future IEHRMS improvement, for example, the rate on the use of the system, period of use and in addition technical support as well as training. There is likewise a need to tackle barriers that might hinder the reception and adoption, for example, computer literacy skills, end users privacy matters and effect on patient time.
REFERENCES


Can you please spare 10 minutes to let us know your views about how you see the IEHRMS.

Please only take part in this survey once and only if you have been taken through the system overview.

Introduction
I am a student from University of Nairobi. I am working with Racecourse Hospital in Eldoret to research patient and medical professionals views about Individualized Electronic Health Record management System.

We are asking you to tell us about your ideas. We will use the information to help inform what happens in the future.

Your involvement is purely on voluntary basis All information will be kept confidential and your name will not be recorded. We will not be able to link your responses back to you. Your participation will remain anonymous such that no personal information concerning you will be made public either during or after the completion and release of the results of this study. The responses will be destroyed once the study has been completed.

Thank you for participating in this study.

Dadiaus Misiani

PLEASE COMPLETE THIS SECTION BEFORE YOU FILL IN THE QUESTIONNAIRE:

I confirm that I am over 18 years of age and that this is the first time I am filling in this survey. My participation is voluntary and I may choose not to answer some questions or to stop answering the questionnaire at any point without giving a reason. I confirm that I have read and understood the above information.

*Please place an X in the most appropriate box.*

- Yes, I will participate
- No, I do not wish to participate
SECTION 1: Background Information

1. Name (optional) .................................................................
2. Please enter your telephone number (optional) ....................... 
3. Occupation.................................................................
4. Among the following devices which one do you own?
   - Internet Enabled Phone
   - Computer
   - Tablet
   - Mobile phone and Computer
   - All
   - Neither of the above

5. Have you ever used internet?
   - Yes
   - No

6. How easy or difficult do you find it to use the Internet?
   - very difficult
   - difficult
   - neutral
   - easy
   - very easy
   - I don’t know; I don’t use the Internet

7. How often do you check internet to search for health related information?
   - Once a week
   - Twice a day
   - Once a week
   - Once a month
   - As frequently as possible
   - Neither of the above
SECTION 2: IEHRMS

8. Do you think you would use IEHRMS if you were offered the opportunity?

☐ yes, definitely
☐ yes, probably
☐ I don’t know yet
☐ no, probably not
☐ no, definitely not

9. What do you expect from IEHRMS if you need (more) care in the future? To what extent do you agree with the following statements?

To what extent do you agree with the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>I Don’t Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. is easy to do</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b. is easy to learn</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c. is reliable</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d. works well</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>e. is a pleasant way to interact with health-care professionals</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>f. fits easily into my daily routine</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>g. is something my family or friends would like to do</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>h. makes it easier to access my records</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

10. Do you have any worry on about the security of your record?

☐ Yes  ☐ No
11. How do you agree with the following statement. IEHRMS has all the functions and capabilities I expect it to have? (Choose one)

- I totally agree
- I agree
- Probably true
- Probably not true
- I totally disagree

12. How do you prefer to receive your health related?

- Health Tips Via SMS
- Health Tips via Email
- Lab Results SMS,
- Lab Result Email
- Charts and Graphs

13. Tell us what you think should be included or excluded from the system?

1
2
3
4
5

14. Do you have any of the following long term health conditions?

*Please X all that apply*

- No health conditions
- Atherosclerosis
- High blood pressure
- Peripheral arterial disease
- Heart disease
- Valvular heart disease
- Diabetes
- Problems related to alcohol or drugs
- Chronic bronchitis or emphysema
- Metabolic disorders
- Eating disorders
- Over weight
- Anxiety or depression
- Smoking cessation
- Back problems and/or arthritis
- Stroke
- Rheumatic heart disease
- Stress
- Migraine headaches
- high blood cholesterol
- Effects of stroke
- Other
- Vascular disease
- Prefer not to say
Finally, we would like to know a bit about you to compare your answers to other people's responses.

16. Are you?  
- Female  
- Male  
- Prefer not to say

17. What year were you born?  
- [ ] 1965  
- [ ] 1966  
- [ ] 1967  
- [ ] 1968  
- [ ] 1969  
- [ ] 1970  
- [ ] Prefer not to say

18. What is your highest level of education?  
- [ ] No academic qualification  
- [ ] Left school at Primary School  
- [ ] Left school at High School  
- [ ] Vocational Qualification (e.g. technical college)  
- [ ] Degree  
- [ ] Masters degree  
- [ ] Prefer not to say

19. How confident are you using computers?  
- [ ] Very confident  
- [ ] Confident  
- [ ] Fairly confident  
- [ ] Not confident  
- [ ] Prefer not to say

20. Where do you live?  
- [ ] Eldoret Town  
- [ ] Another town  
- [ ] Village  
- [ ] Near Racecourse Hospital  
- [ ] Prefer not to say

*Thank you for your time, Please hand back the form when done filling it.*