INTEGRATION OF HEALTH MANAGEMENT INFORMATION SYSTEMS IN HEALTHCARE ORGANIZATIONS IN KENYA

CAROLINE KAWILA KYALO

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE CONFERMENT OF THE DEGREE OF DOCTOR OF PHILOSOPHY IN HEALTH SYSTEMS MANAGEMENT IN THE SCHOOL OF MEDICINE AND HEALTH SCIENCES OF KENYA METHODIST UNIVERSITY

OCTOBER 2018

DECLARATION AND RECOMMENDATION

This thesis is my original work and has not been presented for a degree or any other award in any other University.

Signature ……..…Date ……
Caroline Kawila Kyalo
HSM-4-4343-3/2014

This thesis has been submitted for examination with our approval as University supervisors

Signature ……Date …….
Prof. G.W. Odhiambo-Otieno (PhD)
Department of Health Sciences
Rongo University

Signature ……Date …….
Dr. George Ochieng Otieno (PhD)
Department of Health Management and Informatics
Kenyatta University

Signature ……Date …….
Dr. Wanja Mwaura-Tenambergen (PhD)
Department of Health System Management
Kenya Methodist University

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DEDICATION

To family members: Mr. Ben Kariuki, Ryan Kariuki and Chad Kariuki, Rhoda Kyalo, Kevin Kyalo, and Peter Kyalo, Mr. George and Mrs. Georgina Kyalo.

ACKNOWLEDGEMENT

My foremost gratitude goes to Almighty God for His Grace that is always the source of my strength, hope and encouragement through the many changing scenes of life. I thank my supervisors Professor George W. Odhiambo-Otieno, Dr. George Ochieng Otieno and Dr. Wanja Mwaura who have constantly maintained a positive outlook, believed in me even. Thanks to Dr. Peter Kihara who came in handy and helped me in refining my data collection tools and finally data analysis. Thanks to Dr. Geoffrey Serede, for always encouraging me to work hard and challenging me to create time to work on my thesis. My class mates Susan Mambo, Rosalia Kalani, Eunice Muthoni, Safari Agure, Susan Njuguna and Kagwiria Kiongora for having made our colloquiums very pleasant experiences. Equally important has been the support of the Department of Health System Management. I thank my family members, for their unwavering moral and material support for as long as I can remember. Special thanks to my respondents from Kiambu, Kitui and Mombasa County who took time to respond to my questionnaires, this study would not have been possible without them.

ABSTRACT

Global attention to health systems strengthening has led to different quality improvement approaches in developed and developing countries. The awakening realization that information is critical for health systems functioning has directed most countries towards strengthening their existing information systems or developing new ones. Despite efforts to improve on existing information systems, fragmented information systems have emerged hindering the efforts of addressing the concern of integrating health management information systems. An integrated health management information system has greater benefits for example enhancing easy retrieval of data, timely information sharing and evidence based decision making. The purpose of this study was to prescribe a model that will facilitate the Integration of Health Management Information Systems in healthcare organizations. The objectives of the study were; to establish whether the organization factor; technical factor; behavioral factor of care providers and leadership style influenced integration of Health Management Information System in healthcare organizations in Kenya. The study was anchored on the System theory but underpinned on performance of routine information system framework. Guided by the philosophy of logical positivism and interpretivism. A mixed method research design involving quantitative and qualitative designs was used to obtain information from three counties; Kiambu (peri-urban), Kitui (rural) and Mombasa (urban) in Kenya. A study population was 479 public healthcare organization. Multi-stage sampling technique was used to select organizations that participated in this study. A sample size of 144 public healthcare organizations was drawn using the Kothari formula of calculating sample size. In each healthcare organization selected, two self-administered questionnaires were used to collect data from 243 respondents who were either the in charges or health records officers. Data was analyzed using SPSS version 21 and summary statistics such as mean scores, standard deviation and inferential statistics namely correlation and regression results were used to present the data. The study results provided statistical evidence that a positive and significant relationship exists between the organization factor (r=.472**, P<.005), technical factor (r=.683**, P<.005), behavioral factor (r=.507**, P<.005) and leadership style (r=.731**<.005) and integration of health management information systems. Technology adoption was found to significantly moderate the relationship between technical factor and integration of health management information systems, while need for information timeliness was found to moderate organization factor, technical factor and leadership style. The integration of HMIS model proposed in this study was found to be fit because it explained up to (r^2 =.648) total variation in the integration of HMIS. The remaining beat of .352 is explained by the statistical error term. The std. error of .227 shows the model regression line deviates from the line of best fit. The study concluded that leadership style was quite significant in the efforts towards integration of HMIS and information timeliness was a very good moderator between the operation factors and integration of HMIS. The study recommends that; i) health system managers adopt the proposed design of data collection strategy emerging from the study findings ii) The extracted integration of HMIS model from the study findings composed of transformational leadership style, systems interoperability moderated by information timeliness and enhanced information culture should be adopted. Further studies can be done after the model is adopted to evaluate its performance.

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ABBREVIATIONS

CBS	Computer Based System
DOHA	Department of Health and Ageing
DHIS 2	District Health Information System 2
DHMIS	District Health Management Information System
DHMTs	District Health Management Teams
DHS	District Health System
EDI	Electronic Data Interchange
EMR	Electronic Medical Records
ESG	EMR Standards and Guidelines
ERP	Enterprise Resource Planning System
HIM	Health Information Managers
HIS	Health Information System
HMIS	Health Management Information Systems
HiTs	Health Systems in Transition
HIV	Human Immunodeficiency Virus.
HCO	Healthcare Organizations
ID	Identification Number
ICT	Information Communication and Technology
IS	Information System
IT	Information Technology
IoM	Institute of Medicine
IHMIS	Integrated Health Management Information System
IBIS	Internet based inter-organizational information system
IOS	Inter-Organizational Systems
LMIC	Low Middle Income Countries
MoH	Ministry of Health
MoHW	Ministry of Health and Welfare
NACOSTI	National Commission for Science, Technology and Innovation
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
PRISM	Performance of Routine Health Information System
ROWP	Regional Office for the Western Pacific
RHIS	Routine Health Information System
SERC	Science, Ethics and Research Committee
SDI	Standard Data Infrastructure
SPSS	Statistical Analysis Software Package
SOI	System of Interest
USA	United States of America
VCT	Voluntary Counselling and Testing
WHO	World Health Organization

DEFINITION OF TERMS

Management Information System is a collection of systems, hardware, procedures and people that all work together to process, store, and produce information that is useful to the organization

Health Management Information System: is a data collection system specifically designed to support planning, management, and decision making in health facilities and organizations (United State Agency for International Development [USAID], 2017)

Integrated Health Management Information System: is focused on organizing a healthcare delivery system that coordinates care and has synchronized functioning across the levels of care including linking the community care interface to the facility, as well as the collaboration among providers and provider organizations in the delivery of health services (Leatt, Pink & Guerriere, 2000).

Healthcare organizations: in this study they are the community units, dispensaries, health centers, sub county hospitals, county hospitals and county management teams. Newbold, (2010) describes them as large general hospitals, provide a wide range of acute care and other services spanning many parts of the continuum of care.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The emergence of global attention to health systems strengthening has led to different kinds of innovations to ensure quality improvement in healthcare service delivery. However the vision has not been fully achieved. Health system strengthening is defined by World Health Organization (WHO) as any array of initiatives and strategies that lead to better health through improvements in one or more of the health system's building blocks (World health Organization [WHO], 2007). The WHO framework for health systems strengthening identifies six attributes of a health system: a health workforce; health services; health financing; governance and leadership; medical products, vaccines, and technologies; and health information (Nutley & Reynolds, 2013).

Each building block of the WHO framework is important. However successful strengthening of the health system requires relevant, timely, and accurate information for improved performance. Therefore, this study proposes a shift from the fragmented information systems to integrated health management information system (IHMIS). According to Wickramasinghe and Karunasekara (2012), an integrated management information system helps an organization automate the flow of material, information and organizational resources among all functions within an enterprise on a common database, share common data and practices as they produce and access information in a real time environment. Four outcomes of having an IHMIS include provision of comprehensive information picture that integrates functions, departments, business units and hierarchical levels into a composite, action–response chain of events; provides a single, comprehensive database in which all business transactions are entered,

recorded, processed, monitored and reported; increases the speed of information transactions; and increases structural connectivity across units and activities. The goal is to provide real time information for decision making. An IHMIS is the foundation of a strong health system, because it facilitates informed decision making in each of the other five building blocks of the health system. This study was anchored on the information building block which was envisioned as a lubricant that connects all the other building blocks.

Globally the health sector is committed to building an IHMIS that supports them in working together for better health outcomes for the people they serve (WHO, 2007). To date integrated ERP systems have been introduced into large organizations, particularly in manufacturing, where they have been used to facilitate all aspects of business from sales through finances, production and dispatches. An integrated ERP systems is a software solution that spans the range of business processes that enables organizations to gain a holistic view of the business enterprise (Alvarez, 2007). An IHMIS embraces the same concept, allowing the integration of healthcare functions, divisions of levels of care in terms of information exchange and flow, and the integration of business functions as diverse as patient care, accounting, finance, human resources, operations, sales, marketing, patient information and even the supply chain.

The potential benefits of successfully implementing integrated information system is large, and even critical to organizational performance and survival. IHMIS can potentially allow a healthcare organization to manage its business better with potential benefits of improved process flow, better data analysis, higher quality data for decision-making, reduced inventories, improved coordination throughout the supply chain, and

better patient care service (Seth, Goyal, & Kiran, 2015). Integrated system is a tool of change to improve services, facilitate work, promote governance and transparency and rationalize the organization process. Businesses have been quick to embrace ERP and as observed in literature reviewed. The ERP market is one of the fastest growing markets in the software industry and it will continue to be one of the fastest growing and influential players in the application software industry through to the next decade. This is despite the high numbers, approximately 60% of information systems implementation projects fail worldwide across the different organizations (Jan-Bert, Paul, & Joseph, 2014). Kucukyazici *et al*. 2008 estimated the failure rate for new HMIS implementation in healthcare organizations to be approximately 50% in developing countries

Health Systems in different countries have similar goals, however, they have become so complex, demanding the use of modern technologies to support their operations. Researchers agree that Health information systems (HISs) offer great potential for supporting healthcare delivery, particularly collaborative care delivery that is provided across multiple settings and providers (Baarah, Kuziemsky, Chamney, Bindra, & Peyton, 2014). Unfortunately many HISs have focused on digitizing data or processes on a departmental or healthcare provider basis instead of focusing on total service delivery improvement in the health sector.

The World Health Organization has severally pointed out that a good health information system brings together all relevant partners to ensure that users of health information have access to reliable, authoritative, useable, understandable, comparative data. It should also focus on issues such as patient focus, cost-efficiency, improved service

quality, adaptability to the organization context, and an integrated use of the information at both hospital and clinical level (WHO, 2007). However it has been a struggle to achieve this because of perceived risks by stakeholders (Faisal, Banwetm, & Shankar, 2006; Palvalin, Lönnqvist, & Vuolle, 2013; Sumner, 2000). The risks described are issues of organizational skill mix, management structure and strategy, lack of agreement on a set of project goals/objectives and lack of senior management involvement, software systems design application size, application complexity and failure of technology to meet specifications, user involvement and training, technology planning, project management (control failures caused by inadequate planning and tracking can contribute to unrealistic schedules and budgets and project failure) and social commitment to adopt to change.

There are strides made by the US healthcare system to reorganize health care providers and delivery systems through IHMIS with the aim of ensuring better health care as they address the issues of quality and cost of care. Integrated HMIS are supposed to increase communication and information-sharing across all levels of care by also ensuring that the community level is integrated into the main stream care delivery. This means loyal use of the information system is a prerequisite for success of IHMIS. Managers must be proactive and willing to recommend use of the system to other users and employees (Yen, Hu, Hsu, & Li, 2015). If achieved, coordination of patient care will be improved hence improving quality of care given at each level of care (Hwang, Chang, LaClair, & Paz, 2013).

South Africa attempted to implement IHMIS (the Limpopo system) with the aim of a) improving the accessibility of patient-related information to healthcare professionals

through improved handling of medical records and getting results of investigations more quickly, b) forming an integral part of a larger quality improvement programme c) improving management decision making through the availability of integrated management information and d) save costs through the identification of primary cost drivers at hospital level and the monitoring of mechanisms introduced to lower costs (Littlejohns, Wyatt, & Garvican, 2003). However there were problems faced during implementation which were attributed to: infrastructure problems related to difficulties identifying appropriate computer rooms, connectivity and reliable power; application problems related to the functionality and reliability of the system - because there were too many proposed functions to implement in one phase, some hospitals ended up trying to run the information system in a reduced form in parallel with separate pharmacy and laboratory systems. Poor organization of the implementation left users dissatisfied. The Limpopo system eventually failed to take into account the social and professional cultures of healthcare organizations and to recognize that education of users and computer staff is an essential precursor.

In India the HMIS initiative is an effort to employ technology to improve people's health with a mission to convince health workers at each level of government that good data can pave the way for better health care. The HMIS is designed to streamline and automate the data entry process. The system introduced new analytical tools and can also provide health workers with a clear picture of health conditions in their area as compared to other areas (Wave, 2009).

Other developing countries (Kenya, Uganda, Malawi and Iran) have adopted a web-based system to provide them with information for decision making (DHIS, n.d)

website. DHIS2 is a free open source software that can be tailored to integrate health information management activities. Unfortunately, DHIS2 has turned out to be inefficient in provision of management information (Raeisi, aghaeiannejad, Karimi, Ehteshami, & Kasaei, 2013; Vincent *et al*., 2014). A study done across five Sub-Saharan African countries i.e. Ghana, Mozambique, Rwanda, Tanzania, and Zambia, found that in these countries, there are some elements that limit utilization of DHIS2 and reduce effectiveness of healthcare services management because the focus is to submit complete and timely reports to MoH but with limited analysis of data to inform planning, decision-making and monitoring and evaluation of health service delivery at that level (Mutale *et al*., 2013).

1.2 Statement of the Problem

Despite the Ministry of Health rolling out its Health Information System policy in 2010 and even adopting DHIS2 the same year, 8 years later, after the policy stated that integration of health management information systems in healthcare organizations in Kenya was a priority, the step to the next level of the actual integration has not been taken. This can be attributed to the fact that the policy document did not stipulate how integration would be done. DHIS2 which was envisioned to be a tool that could support information sharing but it has turned out to be inefficient in provision of management information (Raeisi *et al* 2013; Vincent *et al* 2014). In addition the community unit which forms Tier 1 of Kenyan health system, was not integrated as a subsystem of DHIS2, hence the health information system as it currently operates, does not take care of all subsystems in healthcare organizations in Kenya. Donors still run parallel (silo) information systems collecting disease-specific data deviating from World Health

Organization recommendation to shift from disease specific information systems to holistic information systems (WHO, 2008).

Ninety five percent of public healthcare organizations are still collecting data using paper based tools (Sherburne, 2010). IT infrastructure in healthcare organizations in Kenya is quite weak and not supportive of health management information systems, therefore fragmentation of the information systems continues to rise. Patients are still suffering from wrong diagnosis, wrong financial bills and lost files due to use of inadequate or lack of reliable information while receiving healthcare services. To benefit from data collected, its exchange must be enjoyed by all stakeholders at all health system levels of care (Baarah *et al.*, 2014). This study set out to investigate why fragmentation of HMIS was still on the higher side despite the HIS Policy pronouncement. Therefore this study sought for statistical evidence on whether organization factor, technical factor, behavioral factor, leadership style and the moderating factors (technology adoption and information timeliness) had influence on integration of health management information systems in healthcare organizations in Kenya.

1.3 Purpose of the Study

To prescribe a model that will facilitate the Integration of Health Management Information Systems in healthcare organizations into building a is single, comprehensive data warehouse where all business transactions will be entered, recorded, processed, monitored and information disseminated to relevant users.

1.4 Study Objective

1.4.1 Broad Objective

To establish operational factors influencing integration of health management information systems in healthcare organizations in Kenya

1.4.2 Specific Objectives

The study aimed to fulfill the following specific objectives:

i. To establish whether the organization factor influences Integration of Health Management Information Systems in healthcare organizations in Kenya
ii. To determine whether the technical factor influences the Integration of Health Management Information Systems in healthcare organizations in Kenya
iii. To establish whether there is a relationship between the behavioral factor of care providers and Integration of Health Management Information Systems in healthcare organizations in Kenya
iv. To determine whether leadership style plays a role in the Integration of Health Management Information Systems in healthcare organizations in Kenya
v. To establish whether technology adoption and information timeliness moderates the relationship between the operational factors and integration of Health Management Information Systems in healthcare organizations in Kenya

1.5 Hypotheses of the study

A hypothesis is a suggested solution for an unexplained occurrence that does not fit into current accepted scientific theory. The key functions of the hypotheses were to derive predictions about the results of future experiments, and then performing those experiments to see whether they support the predictions. For hypotheses to be termed as scientific, they are supported or refuted through carefully crafted experimentation or observation (Bradford, 2015). The study tested the following hypotheses:

H_{o1}: Organization factor does not influence integration of HMIS in healthcare organizations in Kenya

H_{1}: Organization factor significantly influences integration of HMIS in healthcare organizations in Kenya

H_{o2}: Technical factor does not influence on integration of HMIS in healthcare organizations in Kenya

H_{2}: Technical factor significantly influences integration of HMIS in healthcare organizations in Kenya

H_{o3}: There was no significant relationship between the behavior factors of healthcare providers with integration of HMIS in healthcare organizations in Kenya

H_{3}: There was a significant relationship between the behavioral factor of care providers and the integration of HMIS in healthcare organizations in Kenya

H_{o4}: Leadership style does not play a role in the integration HMIS in healthcare organizations in Kenya

H_{4}: Leadership style significantly play a role in integrating HMIS in healthcare organizations in Kenya

H_{o5}: Technology adoption and information timeliness does not significantly influence on the relationship between operation factors and integration of HMIS in healthcare organizations in Kenya

H_5: Technology adoption and information timeliness does not significantly influence on the relationship between operation factors and integration of HMIS in healthcare organizations in Kenya

1.6 Justification of the Study

Despite the MoH having put policies in place to ensure integration of data collection, analysis and information utilization as a critical resource for decision making and management at the different tiers of the health system, integration of the different sub-systems had not been achieved. Prescribing an IHMIS would help in reducing the time and money that healthcare providers spend completing paperwork to meet reporting requirements thus freeing up valuable resources for direct decision making and offering regular feedback to team managers and staff about the effectiveness of their efforts, both in absolute terms and relative to other partners, hence promoting continuous improvement.

Benefits of integration have been demonstrated by different agencies and researchers but no effort had been made to prescribe an IHMIS that meets the needs of the stakeholders from the community-based healthcare services to the national healthcare services. Public-private partnership of healthcare service providers through information-sharing was also missing in Kenya yet both have the same interest of improving health outcomes in the country. Kenya was still faced with challenges of fragmented HMIS hence hindering timely analyses and dissemination of information

to support evidence-based decision making. This study prescribes a model of an integrated HMIS that will be used for management of the health system within the country, which is in line with its developed policy.

1.7 Scope of the Study

In order to maintain a desired level of homogeneity, this study considered public healthcare organizations from Tier 1 to Tier 3 in Kitui, Kiambu and Mombasa Counties. The tier 1 to tier 3 healthcare organizations included community units and facilities in 3 counties and formed the population of this study.

1.8 Limitation of the Study

No unified or commonly agreed upon conceptual model for integrated health management information systems was found in the literature reviewed. Despite the diversity of approaches and strategies for health management information systems integration found, authors across articles associated a number of principles with successful integration processes and models. There were unknown conditions or factors at the facility where the participants work that biased their responses. The study had targeted both public and private owned healthcare facilities. However due to institutional policies in the private hospitals the study ended up limiting itself to public (government-owned) facilities only. The study had targeted to get two respondents from each health organization i.e. the in-charge and the health records and information officer. However in most of the HO, this was not the scenario, they had one to three health workers who were burdened with a lot of work with some respondents not being very familiar with some concepts in HMIS. Hence the researcher had to take a lot of time explain the HMIS concepts while giving the service providers time to serve the

clients. Due to their busy work schedules, the challenge was on finding all of them together. Most of the facilities also lacked Health Records Information Officers. In some cases, the nurses in charge were multitasking as both the in-charges and health information officer. The participants might have given socially desirable answers based on their knowledge, albeit limited, of HMIS implementation.

1.9 Delimitation of the Study

The study selected key principles emerging from literature that informed integration of HMIS. The study did select three counties based on their level of development so as to give a picture of the entire country that is rural, peri-urban and urban. Hence the results of this study can be generalizable to the entire country. The facilities were government-owned. The study was anchored on the PRISM theoretical framework. To assure manageability of the collected data, the data collection instrument included Likert scale and open-ended questions to allow the respondent express themselves.

1.10 Significance of the Study

The study was aligned to the declaration made in the Fifty-Eighth World Health Assembly (Winter *et al*., 2011) by member states to consider establishing and implementing national public-health information systems that will improve, by means of information, the capacity for the surveillance of and rapid response to disease and public health emergencies among others. It was important to establish why integration of HMIS had not been achieved hence advise healthcare organizations, policymakers and funders on what was ailing and provide possible solutions to those challenges. Such timely and complete information will contribute towards making better decisions and targeted investments at the healthcare management as well as empower teams on sites

and healthcare providers with (near) real-time information on health outcomes. These include county health needs, behavior and healthcare performance that allows providers to tailor their care provision more closely to the needs of the county they serve. In addition Kenya has a referral strategy which is hindered by bottlenecks caused by inadequate information-sharing strategy. The study has made two major contributions i) proposed a computerized data collection strategy that will ensure data is centralized in one data warehouse making information retrieval easy ii) an improved model of the PRISM framework that facilitates the government with information and recommendations to improve efficiency of health management information systems for improved service delivery. The results will be published to contribute to the body of knowledge that future scholars could refer to.

1.11 Assumptions of the Study

In conducting this study, it was assumed that the participants would respond to the questions in an honest and candid manner. The inclusion criteria of the sample was appropriate and therefore, assures that the participants had all experienced the same or similar phenomenon of the study. Participants had sincere interest in participating in the research and did not have any other motives, such as impressing their job supervisor because they agreed to be in the study. The population represented the entire country since it was chosen in terms of the economic development status i.e. rural, peri-urban and urban. Participants responded to items based on their current HMIS practices and beliefs. The research design was appropriate for this study. The data collection instrument was valid and reliable.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents a summary of various theories and literature reviewed on HMIS for improved management of the health system. The focus is on the review and discussions of scholarly work in relation to specific factors that were likely to influence integration of HMIS, including organization, technical, and behavioral factors. The chapter also contains the theoretical and conceptual frameworks.

2.2 Influence of Organization factor on the integration of HMIS

Health information is the foundation of the overall building blocks of health system strengthening and timely availability of information enables health managers to utilize the same for better policy-making, planning, implementation, and monitoring and evaluation of health programmes (WHO, 2007). The organization factors examined in this study included policy documents in place guiding the collection and use of information generated at the different tiers, the different sources of data, coordination of data collection and management support given to facilitate smooth operation of HMIS.

2.2.1 HIS Policy Governing HMIS Design, Implementation and Operations

A study done in Kenya reported that the District Health Management Information System (DHMIS) was implemented without institutional documentation like the HMIS policy or a guideline (Odhiambo-Otieno, 2005a). Moreover the DHMIS was designed without any user in mind. Neither were the users involved in the designing of the system. On other hand, WHO (2007) outlines the framework which gives prominence for countries to setup governance on HMIS. Therefore, this necessitated countries to

develop HMIS policies and strategic plans to ensure the generation, analysis and use of information is emphasized on in order to strengthen efficiency and effectiveness in health. As a result an evaluation criteria was developed in Kenya together with its first HIS policy and strategic plan (2009) to address the weak institutional regulatory framework. The policy was envisaged to give guidance to the Health sector in developing and implementing information system across the health system (Odhiambo-Otieno, 2005a).

In the year 2010 Kenya started to operationalize the developed HIS policy. The policy aimed to address partnership in data collection and information-sharing, data warehousing, instituting standardized mandatory reporting by all care providers and standardization and harmonization of information systems. In 2017 this study sort to find out the extent to which the HIS policy was guiding the Health sector in Kenya in developing and implementing an integrated information system. Some of the key concerns in the policy included ensuring availability of reliable and relevant health information for use by all in order to make evidence-based decisions as well as inform allocation of resources effectively and improve the quality of health services in the country. In addition was the need to establish and maintain a simple, easily understandable and compatible information system, the need for readily available and accessible data, the need to share information amongst all stakeholders and the need to establish linkages with all data sources by using appropriate technology.

The HIS policy came up with an implementation framework that recognizes the various existing management levels of the health sector who are expected to give the guidance on information processes at their respective levels. Operationalization of the policy was

to be supported through a long term strategic plan complemented by action plans in each healthcare organization.

A study done in Iran argued that compliance to policies in place to guide health information management was not effectively achieved because people had no knowledge neither were they aware of the existence of such policies leave alone implementing them as stipulated (Raeisi *et al.*, 2013). Another study done in India revealed that disconnect between policy priorities and the actual implementation on the ground. Some of the factors contributing to the gap as reported by the policy implementers included policies not being clear and lack of documentation (Madon, Sahay, & Sudan, 2007). Emphasis has been made that for HMIS to be effective, the policy must be aligned with the national government activities. This would clearly provide a structure of how information should be organized as well as flow from one level of care to another hence easing monitoring and work load (WHO & ROWP, 2004). Effectiveness can be enhanced by allowing decision making at every station. Based on the literature reviewed the study sought to find out whether health workers in Kenya were aware of the available HIS policies and whether they were operationalizing the policy on the ground.

Health Information Systems is one of the pillars in the health system management. It serves as a lubricant that allows other pillars to work together with the goal of creating integrated and coordinated decision making for better management (WHO, 2007). There are guidelines developed by WHO and ROWP (2004) emphasizing that health planning should be based on information generated from a reliable HMIS and strategies should be designed to disregard decisions made out of past experience or beliefs.

In order to optimize the value of data collected, inter organizational information-sharing and coordination is invaluable. Good leadership styles, improved infrastructure, culture and having compatible systems are key drivers to achieving IHMIS. Lack of information systems integration causes insufficient data-sharing across all process and activities in the health system. The consolidation of information and voluminous data can improve transparency and quick access to information for purposes of decision making. However, the adoption of this kind of a system has been slow in the health sector in Kenya as opposed to other sectors despite her establishing a HIS policy in 2010. The policy implementers have not been able to connect policy priorities reflecting broad national interests with realities on the ground. There is a breakdown between the policy formulation process, which typically takes place at the national level and the implementation of health management information systems which takes place at the facility and county level. This has resulted to lack of transparency and poor accessibility and availability of data when needed to inform decisions leading to poor performance.

2.2.2 Data Collection Strategy for HMIS

To strengthen a health system, information provided must be timely, accurate and relevant for decision making. The goal of an IHMIS is to provide quality information in a timely manner for purposes of proper planning. Koskinen (2012), who did a study in Finland underscored this argument by noting that integration of information systems enables smoother coordination and control of organizational processes and healthcare delivery. However the gap that Koskinen leaves is on how to facilitate the integration process. To effectively achieve smooth coordination and control, a coordinated data collection strategy that eliminates duplication of data collection would be fundamental,

for it save time and also minimizes errors. A study done in Ghana, Mozambique, Rwanda, Zambia and Tanzania shows that HMIS integration is constrained by setbacks including duplicate, parallel reporting, channels and insufficient capacity to analyze and use data for decision making (Mutale *et al.*, 2013).The WHO, 2012 report states that health data can be generated from public health practice with data sources being population-based and institution-based. Population-based data are collected through censuses, civil registrations and population surveys. Institution-based data are obtained from individual health records and administrative records of health institutions.

The repositories for public health data are the public health information systems, whether paper-based or electronic. The computerized HIS are developed with broad objectives, such as to provide alerts and early warning, support public health management, stimulate research, and to assist health status and trend analyses. Significant advantages of HIS are their capability of electronic data collection, as well as the transmission and interchange of data, to promote public health agencies' timely access to information. The automated mechanisms of numeric checks and alerts can improve validity and reliability of the data collected. These functions contribute to data management, thereby leading to the improvement in data quality.

There are different sources of information subsystems as identified by the Ministry of Health (MoH) Kenya as reported by (Sherburne, 2010). They were grouped as follows: (i) Patient Management Software; (ii) Hospital HMIS Software /ERP Systems; (iii) Data Collection and Reporting; (iv) Data Analysis Software (v) Administration/Management Software (vi) External Systems (MoH, 2011). Therefore to successfully have an IHMIS, that consolidates information from the different sources

of information i.e. data from the public healthcare providers' inter-organizational factors become important and critical (Xiang-Hua, Huang, & Heng, 2006).

Successful implementation of IHMIS requires the cooperation and commitment of the different partners; thus, developing cordial relationships and partnerships. Studies done emphasize on the benefits of healthcare partnerships based on information-sharing (Ball, 2009; Evans & Thomas, 2007; Rottman, Smith, Long, & Crofts, 2007). Some of these studies attempted to provide an integrated perspective of HMIS and analyzed management issues, such as, commonality of objectives, desirability of establishing a long-term relationship from a business perspective, partners' willingness to participate, technical compatibility and Technical expertise of the partners. A Study done in China reveals seven Critical Success Factors for the HMIS, namely, intensive stimulation, shared vision, cross-organizational implementation team, high integration with internal information system, advanced legacy information system and infrastructure and shared industry standard (Xiang-Hua *et al.*, 2006). The gap identified in this study was the low cooperation and commitment of the different partners.

The vast majority of lower income countries still rely heavily upon paper tools for recording and monitoring its citizens' health information (Mbondji *et al.*, 2014; Odhiambo-Otieno, 2005a). Paper systems are often the most cost-efficient, and are frequently the only feasible current solution in areas with limited resources and infrastructure. Before enabling infrastructure for digital systems (computers, electricity, mobile phone coverage), paper systems can fulfill all of the necessary functions of a well-performing health information system. The suite of paper tools typically includes, but is not limited to, clinical registers or register books; child- or family-based health

records, consultation notes or medical charts; home-based child health records (health "cards" or booklets or immunization cards); tally sheets; tickler boxes or systems; reporting forms or registers; and logistics management tools (e.g., stock control cards) (Bill & Melinda, 2015)

The pressure for tighter integration in the healthcare sector results from existence of abundance of different IS which mirrors the image of the enormous variation in healthcare work along several dimensions: levels (hierarchically organized spanning from primary healthcare to large hospitals), geography (municipalities, counties, counties, nations and regions), professional groups (nurses, secretaries, physicians and physiotherapists to mention a few), agencies (patients, health providers, public health authorities and insurance companies) and specialization (for instance, cardiology, neurology, radiology and immunology together with service functions such as laboratories) as reported by Nyella, (2009) in a study done in Zanzibar.

Despite the facilitative efforts of different healthcare providers groups and governmental agencies, the development and integration of HMIS has not occurred due to challenges associated with uncoordinated data collection strategy (WHO, 2008). It is often difficult to achieve coordination of data collection among government units, even among adjacent healthcare service providers that perform similar functions. Most of the developing countries are funded by international donor agencies such as the World Bank, Global fund, and the Clinton Foundation, in order to support provision of health services (such as Family Planning, Immunization and VCT) to the population. However, donor policies tend to support implementation of vertical programs which maintain their own management structures and information systems (Barker, Mulaki,

Mwai, & Dutta, 2014; Kiberu *et al*., 2014,). These structures are often in conflict with the primary healthcare goals of integrated county-based health information systems. Therefore partners must agree that coordination with other healthcare providers is important, but partners who actually engage in such coordinated planning are very few (Nyella, 2009; WHO, 2006).

System developers are often confronted by organizational "turf" battles, incompatibility of technology and data standards, and conflicting organizational goals and priorities (Rottman *et al.*, 2007). IHMIS is a solution that can be used to eliminate the legacy of silo computer systems and replace them with networked servers. This presents new opportunities for sharing of information between parties but it is often difficult to arrange sharing to take place between governmental units with different responsibilities (Koskinen, 2012).

It is important to reengineer the work flow when replacing the silo systems and considering carefully the extent to which the new systems should conform to the needs of the organization and vice versa (Aqil, Lippeveld, & Hozumi, 2009; Rottman *et al.*, 2007; Seth *et al*., 2015). Ways of achieving this according to WHO (2006), include using two common methods 1) use of minimum data set and 2) integration through data management. Use of minimum data set method is based on the identification of essential information needed by health managers and health workers to carry out their functions. The concept of essential datasets contains the concept of integration.

In a typical case, an essential set of indicators or dataset is agreed upon at national level for reporting by all facilities which is then implemented with the provision that

additional indicators useful for management at each level (tier 1-tier 4) may be used. WHO (2006) identified the benefits resulting from integrating HIS using the minimum data set approach as being the following: first, the use of the minimum dataset/indicator reduces the burden in data collection and reporting, which has an impact on the quality of the data; second, the use of standardized reports and indicators allows the comparison of information across provinces, counties and health facilities and third, the process of getting many health programs to discuss the essential dataset creates a platform for discussions on integrating HIS. Integration through data management, datasets from all or most programmes are combined and streamlined by sorting out overlaps, gaps and inconsistencies.

The advantage for the users is that the information is then made available from a central source (Nyella, 2009). The quality and continuity of care can greatly be enhanced at the periphery level by integrating data collection and reporting systems which can be achieved say by integrated exchange of information among various programs and among types of services (Haux, Knaup, & Leiner, 2007; Ndabarora, Chipps, & Uys, 2014; Nyamtema, 2010).

2.2.3 Management Support in the Integration of HMIS

A study done in Kenya showed that information systems studied were found to be lacking key resources necessary for information processing, reflecting low managerial priority (Kimama, 2011; Odhiambo-Otieno, 2005b). The workers were handicapped in all their work by the lack of basic typing, duplicating, and filing equipment. All Health Information Systems require resources and adequate long-term funding for such necessities as trained staff, computers, stationery, communication equipment, systems

and staff development, reports and communication costs. However most health care providers in developing countries equate information systems with providing endless registers capturing names and addresses of patients, compiling information on diseases, (e.g. sex and age of patients) every week or every month and sending out reports without adequate feedback. Managers believe that so long as the data collection tools are provided and a small budget allocated to facilitate HIS activities they have supported.

Management support should be involved with dealing with the challenges facing the health information system in developing countries which include fragmented HIS with multiple and very often overlapping demands of disease-focused and specific services programs, heterogeneity of donors requirements and international initiatives (Kihuba *et al*., 2014; Ndabarora *et al*., 2014; Nyella, 2009). These programs usually maintain their own 'vertical' reporting systems existing side-by-side with the National health information system where the result emerging over time is disintegrated and heterogeneous collection of systems. Consequently, the capacity of countries' health information systems is overwhelmed by multiple parallel demands for information where health workers are overburdened by excessive and often uncoordinated reporting demands (Aqil *et al.*, 2009; Wave, 2009; WHO, 2008). Healthcare managers need to cultivate strategies which are advocated for through a piecemeal incremental process in the change attempts, to give room for experimentation and revision of strategies drawn upon to curb the challenges (Nyella, 2009). Specifically, the cultivation strategies include use of participatory approaches and modularization. He as well suggests the need to build and strengthen communication and collaboration linkages between the stakeholders in the attempt to curb the inertia of the vertical

and parallel reporting systems, this can be achieved through building systems that support integration.

Overall, a well-functioning health information system requires a coordinated mechanism to collect, process, report, and use health information to influence decision-making and action to dramatically improve the efficiency and efficacy of health-care delivery (Meier, Fitzgerald, & Smith, 2013) . Informed decision-making at all levels of a health system requires reliable data. Decisions informed by evidence contribute to more efficient resource allocation and to better outcomes. Mangers need to give preference to information availed through available information systems.

Information systems need to be simple and sustainable and must not overburden staff or be too costly to operate. In an ideal system, health workers should be empowered to use the routine data they collect and understand the importance of good quality information for improving health, through trainings. Use of local information for health system management is essential for performance monitoring at the community units, health centers and dispensaries, and sub-county and county level (Bill & Melinda, 2015). The ultimate goal of any health information system is to provide quality information that is subsequently used for evidence-based decision making in a health organization for purposes of evaluating health system interventions to improve health system performance and eventually improvement in quality of life.

The Ministry of Health in Kenya adopted and customized the District Health Information System (DHIS) after several attempts to improve its information system. The DHIS was developed by the Health Information Systems Programme (HISP), a

global south-south-north collaborative network, and is an open source software that can be tailored to integrate health information management activities. While the DHIS is designed to provide a comprehensive health information solution for decision makers at all levels, decisions are still not information based. Yet health workers collect and report data routinely on all their activities. Studies show that very little of this vast amount of data is used by those who are collecting the data and by local health management at health facility or County levels. Significant resources have been invested on Health Management Information Systems both at national and county level in Kenya but health information is barely used for decision making.

2.3 Influence of Technical Factor on Integration of HMIS

Embracing modern technology is one among very many ways of improving efficiency and reducing costs within healthcare organizations. While the integration of information and health services potential benefits cannot be disputed, there are many challenges which affect its adoption, in fact, majority of organizations have abandoned their newly acquired system only to go back to their old manual system. The technical factor in this study is assessed as indicated in the conceptual framework by examining i) IT infrastructure which can be divided into two related but distinct components as technical and human infrastructure. Technical infrastructure is a set of shared, tangible IT resources forming a foundation for business applications (hardware, software and data), ii) Human infrastructure includes human and organizational skills, expertise, knowledge, commitments, values and norms. Availability and adequacy of both technical and human infrastructure must be ascertained up-front. It addresses the basic question of whether the information system will work in a technical sense (Odhiambo-Otieno, 2005b). iii) System interoperability.

2.3.1 Human Infrastructure

Human infrastructure defines human users to include network administrators (NA), developers, designers and generic end users with access to any IT appliance or service. This is specifically with the advent of user-centric IT service development. Their information needs should be determined upfront. In a study done in Malawi a good information system needs to establish a comprehensive system capable of feeding information to the users at community, health facility, district and national levels (Chaulagai *et al*., 2005a). All health workers should be oriented on information management and use through trainings. Data requirements should be chosen taking into account the technical skills of the health workers collecting the data, or the available diagnostic equipment in peripheral health facilities. During the designing and implementing of health information system, health workers should be involved in the process (Chaulagai *et al*., 2005a; Odhiambo-Otieno, 2005b). There is a general lack of right capacity in developing countries especially for statistical analysis. Lack of computer literacy and brain drain is also a problem because most of the people have never used a computer. (Wave, 2009).

Developing IHMISs continues to be a challenge, implementations of it has frequently caused unintended consequences including communication issues, creation of new or more work, and even adverse events such as medical errors (Aladdin *et al*., 2014). Unintended consequences occur for several reasons including poor fit with clinical workflow, differences in needs between different user groups (that is clinicians and administrators) or the co-existence of manual and automated processes. The gap between HISs can be taken care of by integration. Constructing effective integrated

systems necessitates an understanding of operative work flow and technical considerations as well as achieving interoperability with existing information system (Wanderer & Ehrenfeld, 2013)

The issue is to ensure that the health sector partners involved in the collaboration will be able to work altogether in order to constitute a coherent and homogeneous set of HMIS. The growing chain of healthcare providers need to share and exchange such data. This collection and sharing, however, is affected by privacy concerns, and organizational and technical issues have to be solved and taken into account (Otjacques, Hitzelberger & Feltz, 2007).

2.3.2 Information Technology Infrastructure

IT infrastructure refers to the composite hardware, software, network resources and services required for the existence, operation and management of an organization's IT environment. It allows an organization to deliver IT solutions and services to its employees, partners and/or customers and is usually internal to an organization and deployed within owned facilities. IT infrastructure consists of the following components: i) Hardware: Servers, computers, data centers, switches, hubs and routers, etc. ii) Software: Enterprise resource planning (ERP), customer relationship management (CRM), productivity applications and more iii) Network: Network enablement, internet connectivity, firewall and security.

Most LMIC use paper-based data collection processes at primary healthcare level and computer-based health information systems at county level (Haux *et al*., 2007). However, paper-based information systems are often found to generate data with poor

quality and are underutilized within the health information management (Lium, Tjora, & Faxvaag, 2008). This affects the integration of data, hence the design of a system matters a lot.

The technical factors are critical to organizations in their adoption decision of Internet-based inter-organizational information systems (IBIS). Establishing costs, network reliability, data security, scalability and complexity are main factors that significantly affect the adoption decision of IBIS (Bouchbout & Alimazighi, 2008; Soliman & Janz, 2004).

The data flowing through the system is extremely valuable, hence data quality, security among other factors are important technical factors for successful implementation (Fenz, Heurix, Neubauer, & Pechstein, 2014). Hardware and software reliability is another factor to be considered for the success of the system (Chaulagai *et al*., 2005b; Lippeveld, Sauerborn, Bodart, & World Health Organization, 2000). Reliability consists of the accuracy of the data, adequate maintenance of the system and the capability of the hardware. Reliability of the Electronic Data Interchange (EDI) system is important. Since frequency of downtime leads to lack of faith in the system, for success, the system should be free from unplanned down-time (Craighead, Patterson, Roth, & Segars, 2006).

2.3.3 Information Systems Interoperability

Complexity of the software has been studied extensively by various researchers and they have concluded that there exists a negative relationship between complexity of the software and successful implementation of these systems. Information systems for

Health System should be accessible, compatible, user-friendly, stable and reliable, requiring minimal training and offering strong after-sales service (Petter, DeLone and McLean, 2008). The system quality features included in other studies were ease of use, ease of learning, system accuracy, flexibility, sophistication, integration capability and customization. They further included information quality features, such as, usability, understandability, relevance and conciseness.

Eze, Awa, Okoye, Emecheta and Anazodo (2013), stressed that data processing, technical, and electronic standards are essential if an equipment is to be able to interconnect, and that data definitions (standards) and terminologies will be essential if health professionals across different organizations are to communicate. It involves systems configuration, interface development, data standardization and conversion, testing and performance management.

Systems interoperability is also a crucial organizational capability that enables firms to manage information systems (IS) from heterogeneous trading partners in a value net-work (Zhao & Xia, 2014). Inter-organizational systems (IOS) standards are a key information technology infrastructure facilitating interoperability. In an organization's ability to work with external trading partners, interoperability's development depends not only on capability building within firm boundaries but also on community readiness across firm boundaries. (Zhao and Xia, 2014) emphasizes in their finding that interoperability acts as a mediator by enabling firms to achieve performance gains from IOS standards adoption. Consequently, it is crucial for firms to become interoperable in order to coordinate and co-create value with their partners. Interoperability is possible only when a common language is used by various IS, despite heterogeneity in

software, hardware, and system architecture. IOS standards contribute to interoperability by providing "shared business terms, functions, processes, and protocols. Zhao and Xia, (2014) argue that IOS standards adoption enables firms to develop interoperability. Specifically, interoperability is developed via two different paths. The first path is internal capability building. The organizational capability literature suggests viewing capabilities as a hierarchy, noting that simpler capabilities are needed to build more complex ones. Thus, identify standardized data infrastructure (SDI) as a simpler ability built from IOS standards adoption, which can be used as a basis for developing interoperability.

The second path considers community readiness across firm boundaries. If the same standards have been accepted by more trading partners, achieving interoperability in dynamic value networks becomes easier. The proposed IHMIS would be in charge of managing (i) information, (ii) functions and (iii) processes among the information systems (IS) of partner organizations involved in the network (Benaben, Boissel-Dallier, Pingaud, & Lorre, 2013). Healthcare Organizations are strongly dependent on their ability to successfully manage collaborations and to assume the involved interoperability functions: exchange of information, coordination of business functions and driving of processes. Therefore (Benaben *et al*., 2013; Lu, Panetto, Ni and Gu, 2012) recommend considering that crucial position of IHMIS and computed systems, the interoperability functions must be supported by these Systems.

2.4 Influence of Behavioral Factors of Health Workers on Integration of HMIS

This study believed that the demographic traits of the health workers such as age, education, years of service, professional training, culture and risks associated with

HMIS integration had an influence in the behavior of health workers towards integration of HMIS, this is supported by (Khan, Masrek, & Nadzar, 2015; Population, 2012; Tarak, 2012).

2.4.1 Demographic Traits of Health Workers

According to (Population, 2012) an aging society has an impact on its productivity, adaptation and innovation. Improved productivity plays a key role in the growth of long-run living standards and an important aspect of a society is its ability to innovate and adapt to changing conditions. Increases in productivity can be due to higher inputs which would include improved education, training and acquisition of more skilled labor. The users' levels of literacy have an impact on use of technology (Taherdoost, 2017). Therefore increased levels of education of the workforce improve the quality of labor inputs. Population (2012), also notes that as the workforce ages, it becomes more experienced and greater experience is generally associated with higher earnings and productivity. But an aging workforce might also experience deterioration in the relevant skills if job requirements change over time or if people's skills decline. It is also reported that increased penetration of information technologies into the workplace might place older workers at a disadvantage. Technology advance also includes advances in knowledge and organization. (Tarak, 2012) findings proved that the different demographics trait of a worker such as age, education, position, years in service and hours worked per week have significant impact on new innovations in an organization. Employees in the age group 18-25 years are more motivated to do new things, followed by those between 26-35 and 36-45, while those over 45 years are not so motivated. Findings also proved that the higher your education level the lower the desire to take extra load that you believe is not your responsibility (Tarak, 2012). Hence

secondary school education and diploma holders are happy to take more responsibilities as compared to workers who hold undergraduate and postgraduate degrees. (Khan *et al.,* 2015) argues that employees should be competent, knowledgeable of new innovations and keep their skills up to date for any organization to achieve its goals.

2.4.2 Risks Associated with HMIS

Data collection in health facilities is conducted using a set of forms, registers, and tally sheets which are filled in by health workers. Data collected should be aggregated to generate information on services provided to the population and for diseases surveillance. The ultimate goal of evidence-based decision making is to improve the quality of healthcare by increasing the health system's ability to respond to the needs of the individuals they serve. However, generated health information is often not used by key stakeholders to effectively inform policy and programmatic decision making (Garrib *et al.,* 2008). Rarely is sufficient consideration given to the amount of data that is collected as rightly observed by (Kihuba *et al.,* 2014).

The failure to consider all the empirical evidence before making decisions hinders the health system's ability to respond to priority needs throughout its structured levels of care (WHO, 2007). This explains disconnect in addressing information-based decision making exists because the people who collect and analyze the data are not involved in decision making in the healthcare system. This weighs down the efforts and resources used to generate health information. Health information collection and generation hence lacks value when it is not used to inform decisions and efforts to improve data quality get wasted. There are several reasons why health information is not used to support decision-making. Some of the reasons reported in the literature

include poor quality of data, weak analysis of data, lack of an information culture, lack of trained personnel and HIS activities being seen as a burden due to high workloads especially at the health facility level (Aladdin *et al.*, 2014; Cheburet & Odhiambo-Otieno, 2016; Kimama, 2011). This contributes to the behavioral aspects of performance, which are often the most difficult to identify and confront in a meaningful way. They involve intangible concepts such as motivation, attitudes, and the values that people hold related to health information, job performance, responsibilities, and hierarchy (Galimoto, 2007). Some of the risks associated with HIS include the incomplete and untimely reporting, the inaccuracy and lack of specificity of the coding of the data, the unavailability of risk factor information to guide preventive interventions, and the cost of data collection (Birkhead, Klompas, & Shah, 2015). Many healthcare providers lack adequate knowledge of reporting requirements and are encumbered by the additional workload required to file a report. Collecting detailed clinical information from healthcare providers is currently still paper- or telephone-based and is labor intensive. This practice results in delays in obtaining critical information for diseases of immediate public health importance and a lack of data on the most common causes of morbidity and mortality in the population other than self-reported survey information and limited death certificate coding (Birkhead *et al.*, 2015).

Another essential part of any system is the information flow related to all the functions of that entire system. Without accurate and timely information the health systems is disadvantaged because it cannot respond efficiently and in a coordinated way. Decision making can be improved when information is readily available to partners in the health sector (Seth *et al.*, 2015). Traditionally information systems in most companies as

stated by (Koskinen, 2012) have developed in a relatively unplanned, evolutionary way with little thought given to the inter-relationships between the various subsystems. Manual systems have gradually been automated as the computer becomes more widespread, but the computerized operating units have normally been treated as independent subsystems.

In any event if an organization plans to introduce a new innovation to its people, they must prepare them. In preparing the people consider change management as important. One key task is to build user acceptance by involving them in the project and foster a positive employee attitude (Ellis and Howard, 2011; Gillingham and Graham, 2016; Helms and Stern, 2001; Mohammed and Yusof, 2013). The benefits of the system should be properly communicated. As part of the change management efforts, users should be involved in design and implementation of the system. All personnel should be informed of the importance and benefits of integration and should be allowed to participate in the development of the system. Benefits of an IHMIS are quite a number such as providing timely, accurate and reliable information, providing a platform for sharing information among all partners of healthcare providers and cost optimization which will greatly improve decision making, coordination and management of the health system (Voulle, 2011).

In a study done when devolution took place in Pakistan, findings showed that managers faced different hurdles in utilizing the preexisting Health Management Information System (Qazi, Ali & Kuroiwa, 2008). They were generally dissatisfied and confused over their roles and responsibility: respondents reported that the overall atmosphere was characterized by the reluctance of provincial managers to release data under their

authority, the absence of prerequisite human resources, and conflicts of interests between political and administrative leadership.

Another study reported that Health Information System Criteria in Isfahan do not completely comply with WHO framework (Raeisi *et al.*, 2013). Hence it recommends that health system managers engaged with underlying policy and decision making processes at district health level should try to restructure and decentralize the district health information system and develop training management programs for their managers. This is an indication that the managers have inadequate training hence compliance becomes an issue.

Some of the unique challenges in managing enterprise-wide projects which were highlighted through the findings of (Sumner, 2000,) included the challenge of re-engineering business processes to the process which the ERP software supports, investment in recruiting and re-skilling technology professionals, the challenge of using external consultants and integrating their application-specific knowledge and technical expertise with existing teams, the risk of technological bottlenecks through client-server implementation and the challenge of recruiting and retaining business analysts who combine technology and business skills.

Other studies dealing with risk factors in IS projects have described issues of organizational skill mix (lack of expertise, including lack of development expertise, lack of application-specific knowledge and lack of user experience), management structure and strategy (risks associated with customer mandate, which deals with a lack of senior management commitment (Faisal, Banwetm and Shankar, 2006; Palvalin *et*

al.,2013; Sumner, 2000). (Kimama, 2011,) also pointed to a lack of agreement on a set of project goals/objectives and lack of senior management involvement), software systems design flaws (-misunderstanding requirements and failing to manage change properly which can lead to cost and time overruns-), lack of user involvement and training (-lack of user commitment, ineffective communications with users and conflicts among user departments are all sources of risk-) and poor technology planning (-the risk factors include technological newness i.e. need for new hardware and soft-ware, application size i.e. project scope, number of users and team diversity, application complexity i.e. technical complexity and links to existing legacy systems, and failure of technology to meet specifications). Other failures included lack of project management (-control failures caused by inadequate planning and tracking can contribute to unrealistic schedules and budgets and project failure-) and social commitment (-risk of not being aware of expected outcomes needing to take into account distinctive human and organizational practices and patterns of belief and action).

Studies by Helms and Stern, (2001); Kimama, (2011); Kimaro and Nhampossa, (2007); WHO, (2007) show organizational resistance as a common cause of implementation failure. Another factor considered by the researchers for successful implementation under this head is training and education (Mantzana, Themistocleous, & Morabito, 2010; Verbeke, Ousmane, Karara, & Nyssen, 2013). This factor assumes importance because if proper training and education is not provided to the employees, there will be high resistance for change.

2.4.3 Information Culture

Information culture was another important factor that needs to be considered for the success of the IHMIS. Implementation success increases if the system is aligned with the information culture. A culture with shared values and common aims is conducive to success. Knowledge is seen as the key to effective management. Knowledge leads to enhanced organizational performance and innovation (Gresty, 2013). Cultivate Information Culture in organizations as supported by (Palvalin *et al*., 2013,) there are many different sources that generate data about healthcare issues—there are ministries of health and other national ministries, of course, but there are also for-profit providers, faith-based organizations, nonprofits, nongovernmental organizations, military healthcare providers, and even prison-based healthcare providers.

There are also professional associations, boards, and councils that maintain data on specific cadres—nurses, doctors, pharmacists, midwives, and so on. But none of them has a complete picture of the health sector. Everybody's got their own piece of the puzzle. An integrated system aggregates data from all of these different information sources, identifies conflicts in the data, and helps to build a high-quality, comprehensive information resource on the healthcare system. Only with that big picture can the country really see a true denominator of the healthcare delivery and how that measures against their target of improved healthcare. Therefore, understanding those elements that affect the consistency of employees' perceptions of organizational culture is of central importance to IHMIS.

As has been clearly elaborated so far, the key challenge is that the big picture is difficult to create. Some of the possible reasons why information is not integrated are challenge

in stakeholder leadership-getting everyone to agree to combine the datasets that will build the registry,- costs of being part of the network, possible downtime of the entire system (system crash) meaning all data is lost. Major management information system (MIS) projects in both the public and private sectors are notorious for cost overruns, late completion, and delivering systems that fall short of expectations as pointed out by (Rottman *et al.,* 2007). Security is also an issue of integration. Partners need assurance of data security and privacy. The literature has also researched trust between trading partners and has confirmed the trusting relationship as a critical factor for the success (Soliman & Janz, 2004). With the shared knowledge you can create whole new initiatives and challenge your own goals to create something new and innovative (Amerongen, 2014). Data, is the fuel that powers any robust national healthcare system. They can propel a country toward improved healthcare delivery or they can hold one back.

2.5 The Role of Leadership Style in the Integration of HMIS

Studies by scholars have reported a positive impact of the right leadership style if adopted on information systems success in organizations. Attention has been given to exploring the factors that enhance IS success. However little attention has been given to leadership styles adopted in a health organizations despite their potential of being effective. Leadership styles deserve more attention if integration of HMIS is to be successful. According to Alfian, (2016), a health management information system is a collection of sub-systems which are interconnected with each other and work together in harmony to achieve one goal of processing data into information needed by management in decision making processes when carrying out its functions. Most researches in the Information System field have often focused on very specific

managerial roles, such as allocating resources, monitoring outcomes, and controlling and coordinating people and work environments. While these managerial behaviors are undoubtedly important, they encompass only a small portion of a leader's role and thus primarily focus on attaining efficient operations. However, the role of a leader also includes motivating employees and adapting to changing conditions (Alfian, 2016). The study recognizes though that there is no one leadership style that is effective in all information systems situations. Therefore three types of management style were examined to determine how they impact on the integration of HMIS in Kenya; Laissez-Faire, transactional and transformational leadership styles. The study believes that strong leadership is required if integration of HMIS was to be achieved (Humaidi & Balakrishnan, 2015)

2.5.1 Laissez-Faire Leadership Style and Integration HMIS

Laissez-Faire is concerned primarily with organizational performance. Laissez-faire leadership gives authority to employees to work as they choose with minimal or no interference. Such a method involves leaders delegating decision-making and tasks. They keep abreast of what is occurring in the company and are available when advice and input are needed but take a hands-off approach and let the employees work on their own as long as they achieve the set organizational goals (Humaidi & Balakrishnan, 2015). An information system takes the form of the organization, meaning health workers will not be required to operate on some organizational guidelines. This leadership style is likely not to favor the IHMIS because everyone works based on their own whim. It does not encourage team work (Alfian, 2016).

2.5.2 Transactional Leadership Style and Integration of HMIS

Transactional leadership style involves other people in the leadership process but the leader retains the right to give or deny any subordinate a say in the leadership process (Abu-Nahleh, 2013). It is an open approach to leading, where decision making is shared and the views of a team or group are valued because they contribute to the vision, goals and decisions that are made. Transactional leadership is also known as participative leadership, capturing the ideas of involvement and engagement.

This kind of leadership encourages discussions and information-sharing and therefore builds commitment as individuals agree together what needs to be done. This builds a sense of belonging and demonstrates that skills and expertise are valued in an organization. This is an important aspect when it comes to integration of HMIS. Transactional leadership occurs when one person connects with others for the intention of an exchange of valued things such as information that can be economic or political or psychological in nature (Yahaya & Ebrahim, 2016). Burns noted that both parties have related purposes, but the relationship does not go beyond the exchange of valued information that benefits the two parties. The relationship is not likely to trigger extra-role behavior of followers (Erhart & Nauman, 2004). It also does not bind leader and follower together in a mutual and continuing pursuit of a higher purpose (Burns, 1978). Bass proposed that transactional leadership is characterized by the transaction or exchange of information that takes place among leaders, colleagues, and followers.

The exchange is based on the discussion between leaders and followers on the requirements and rewards that the followers will receive if they satisfy those conditions. (Bass & Avolio, 1994). Transactional leaders exchange things of value with followers

to advance both parties' requirements (Ivey & Kline, 2010). Followers fulfill the leader's requirement in exchange for praise and rewards or the avoidance of punishment for nonperformance or lack of goal achievement (Bass *et al*., 2003). Thus, transactional leadership is realistic as it focuses on meeting the specific aims or goals (Aarons, 2006). Thus, transactional leadership can be applied in many settings and is appropriate in encouraging employees to adhere to practice standards (Aarons, 2006).

2.5.3 Transformational Leadership style and Integration of HMIS

Transformational leadership involves the process of dynamic interaction among people with varying roles who align themselves to solve specific goals. Transformational leadership occurs when one or more persons engage with others in such a way that leaders and followers raise one another to higher level of motivation and morality. Transformational leadership approach appeals to higher ideals and moral values and empowers followers to produce profound and fundamental change. Transformational leadership style provides deeper levels of connection and higher levels of commitment, performance, and morality of both leader and follower.

Transformational leadership style helps managers identify and develop shared values and empower others. It influences workers to produce not only quality work but more quantity, and use creativity in problem solving. Transformational leadership focuses on leaders' transforming abilities. It is a process of changing and transforming an organization by increasing employees' motivation, building commitment, and empowering them to achieve organizational goals. In other words, transformational leadership style is able to enhance the commitment of employees through shared values and shared vision. Transformational leadership focuses on the organization and direct

commitment towards the organizational goals. It influences workers to focus on collective interest instead of self-interest (Yahaya & Ebrahim, 2016).

2.6 Integrated Management Information Sytems

Integrated Information Systems or Enterprise Resource Planning Systems (ERP) in healthcare systems that integrate data collection, processing, reporting, and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services (Teklegiorgis, Tadesse, Mirutse, & Lerebo, 2016). ERPs are information systems that manage the business and consist of integrated software applications such as customer relations and supply chain management, manufacturing, finance and human resources (Hoch & Dulebohn, 2013). An integrated HMIS is expected to ensure that appropriate data is collected from the various sources, processed and sent further to all the needy destinations (Sakthivel, 2014). The system is expected to fulfill the information needs of an individual, a group of individuals, the management functionaries, the managers and top management. It is to be noted, however, that the success in implementing IHMIS is not very encouraging (Aladdin *et al.,* 2014). Effective strategies to help physicians mitigate risk when working in collaboration with other healthcare professionals include using good communication skills, understanding the scopes of practice, roles and responsibilities of different healthcare professionals, and complying with applicable policies and procedures. The importance of effective written communication cannot be underestimated; including appropriate documentation and review of what is increasingly an interdisciplinary clinical health record.

Successful HMIS integration requires "big picture" thinking, such as analyzing the impact of service changes and new technologies. Healthcare managers should communicate and exchange ideas about providing coordinated service delivery to achieve desirable outcomes. Information-sharing and appropriate technological support are enablers of HMIS integration. Manager's involvement in monitoring and evaluating quality of service delivery is also required in integrated systems. Valid, useful indicators and standardized reporting allow for performance comparisons among individual, organizations and groups of healthcare providers. Since integration of HMIS favors an interdisciplinary approach to management, team members must have clear roles, responsibilities, and accountabilities, and these should be supported by a policy and procedural framework. Healthcare teams should also know and agree on the care provider with overall responsibility for directing and coordinating service delivery. Managers should be aware of any organizational policies outlining the expectations at each level of care. Another potential area of concern for doctors in an integrated HMIS relates to appropriate reporting. Hospitals should establish appropriate thresholds and pathways for reporting within the organization.

Brazil recognized the need to improve access to health care and hence embarked on a major initiative to reform the health system. As part of the reforms, the present Brazilian National Health system, called SUS (Sistema Unico de Saude) or unified health system was created in 1998. Under SUS, health services are structured in three tiers. Access of services in tier 2 and 3 has to be on referral basis. The HIS system that was developed would handle all requests for healthcare services and allocate resources optimally. The system helps to ensure longevity and continuity of care (Freire *et al.*, 2015).

In 2004 Zambia decided to streamline the patient record-keeping by introducing a SmartCare program with the vision of ensuring that each person in Zambia has a complete electronic health record that is used to assure them continuity of high-quality and confidential care by providing timely information to care givers at the point of service. Each Zambian now carries a SmartCard to help improve patient care and improve health management information for improving health service (Wave, 2009).

Bangladesh is using some innovative technological approaches to resolve a fragmented health information system. They have developed an electronic birth registration system that provides local citizens with a personal electronic identification card. Citizens are given incentives to register births because the card is required to access local services, such as immunization schedules and school enrolment. This system enables health authorities to reliably track each child's immunization history, replacing a disorganized manual system and effectively provides data to accurately monitor progress and enhance national decision making. On top of that system, they have developed an electronic data central repository for national health data called the National Data Warehouse. It aims to bridge the gap between fragmented systems by bringing together information from various databases.

In a study done in Belize, Belize government contracted the Canadian software developer Access-tee, to develop a health information system that tracked all patient encounters with the health system while managing patient flow, monitoring infectious disease, rapid identification of patients in the event of the release of unsafe medicines, country wide prevention of mother-child transmission of HIV and better care for diabetics (Ogunbekun, n.d.). The module-based system captures the vast majority of

individual encounters with the health care system by linking the ministry of health with the country's health facilities. The goal is an integrated resource management tool that integrates all aspects of the health system, where the various components are able to communicate concerning the needs and possible actions, replacing soiled or disease-specific systems. Patient flow, laboratory, pharmacy, HIV/AIDS and human resource management modules comprise the system and are designed to interact with each other.

In an attempt to strengthen the health services to meet national and international commitments, the government of Tanzania developed the Primary Health Service Development Program (PHSDP) whose main goal was to accelerate provision of quality primary healthcare services to all by 2017 (Nyamtema, 2010). The Health Management Information System in Tanzania is called Mfumo wa Taarifa za Huduma za Afya (MTUHA) with an overall goal to optimize the performance of health services at all levels of administration through the timely provision of necessary and sufficient information needed by the health managers to monitor, evaluate and plan their activities. The latest version involves manual data entry into 12 HMIS booklets. The system covers all health programs and health care services, and requires all health facilities, regardless of ownership, to use this system and report to the district health authority on quarterly basis.

An improved and harmonized health reporting system is critical for health system strengthening since it can generate timely information for proper planning, monitoring and evaluation of service delivery at all levels of the health system. However, in most developing countries, particularly in sub-Saharan Africa, health reporting has been dominated by paper-based data collection and storage systems that tend to generate

incomplete and inaccurate reports (Akiko, 2011; Asangansi, 2012; Nyamtema, 2010). Evidence shows that the continued use of paper-based systems contributes to poor data quality in terms of reliability, availability, timeliness and completeness of reporting, and compromises health service delivery (Kiberu *et al*., 2014). This has led to the development of web-based health information systems, which have opened a new chapter for improving health reporting in the developed world and this is slowly taking root in developing countries. Web-based systems have facilitated the ability to collect more accurate and enabled efficient data capture needed to inform planning and decision-making.

2.6.1 Information Accessibility

Health Information from various sources continues to attract significant concern to internal and external stakeholders such as healthcare providers, senior managers, government, researchers, donors and implementing partners at strategic, tactical and operational level. This is because accessing the information in a timely manner to support decision making has previously not been possible. Quality information underpins policy development, strategic planning and other health interventions. Great efforts have been made to improve Health Management Information Systems and to track progress towards global development agenda (Friberg *et al.*, 2010; Hotchkiss, Aqil, Lippeveld, & Mukooyo, 2010; Kihuba *et al.*, 2014). But one of the issues with the current system's existence is conflicting reports and disconnect between the need for information and ability to respond to the need and to inspire decentralization of the health system. Hence there is need to integrate routine Health Management Information System to facilitate information accessibility when needed (HMN, 2008).

2.6.2 Data and Information Quality

Data quality is described in four dimensions: consistency, completeness, timeliness, and accuracy. Completeness is measured not only as filling in all data elements in the facility report form, but also as the proportion of facilities reporting in an administrative area (province or district). Accuracy is measured by comparing data between facility records and reports, and between facility reports and administrative area databases, respectively. Consistency is the degree of similarity of patient data on register and patient cards. Timeliness is assessed as submission of the reports by an accepted deadline (Teklegiorgis *et al.*, 2016). Timeliness measures whether the health facility reports on the given time schedule to the next level. Poor data quality, however, has often been reported. For example, Australian researchers reported coding errors due to poor quality documentations in the clinical information systems. These errors had consequently led to inaccurate hospital performance measurement, inappropriate allocation of health funding, and failure in public health surveillance.

The establishment of information systems driven by the needs of single programs may cause excessive data demand and fragmented HIS systems, which undermine data quality. Studies in China, the United Kingdom and Pakistan reported data users' lack of trust in the quality of health management information systems due to unreliable or uncertain data. Sound and reliable data quality assessment is thus vital to obtain the high data quality which enhances users' confidence in public health authorities and their performance. As countries monitor and evaluate the performance and progress of established public health indicators, the need for data quality assessment in HIS that store the performance-and-progress-related data has never been greater. Nowadays,

data quality assessment is recommended for ensuring the quality of data in HIS has enjoyed widespread acceptance in routine public health practice.

2.6.3 Information System Security

Information is one of the most important assets. For any organization, information should be appropriately protected. Security is to combine systems, operations and internal controls to ensure the integrity and confidentiality of data and operational procedures in an organization (Hong, Chi, Chao, & Tang, 2003). Information system security is to mainly detect and prevent the access of unauthorized computer users. Information system security issues cover information security policy, risk analysis, contingency planning and disaster recovery. According to (Belsis, Kokolakis, & Kiountouzis, 2005) who did a study in Greece, information systems security has become a major concern for modern organizations as most organizations are heavily depending on information and communication technology. Different tools have been developed but serious questions have arisen as the volume of security related incidents and consequent financial losses continues to increase in magnitude, as well as in severity. The study further reports that security is both a people issue as well as an organization issue. Some of the measurers put in place include logging in mechanisms and the involvement of users and other stakeholders in security analysis, design, and implementation, as well as in actively defending the IS. IS security is a challenging task, as it demands not only the effective handling of technology related factors, but also dealing with the so-called “human factor”, which adds complexity and makes the goal of securing a system rather difficult to achieve. As a consequence, IS security depends primarily on the users’ knowledge of the IS, its organizational context and the technology trends.

IS security refers, mainly, to the preservation of the following key attributes: confidentiality, integrity and availability of the systems. Most organizations have come up with security policies and guidelines. Others conduct continuous audits on data. A study done in the USA by (Dhillon & Torkzadeh, 2006) looked at information system security from a value-focused thinking approach of people and concluded that maintaining information systems security should go beyond technical considerations and adopt organizational grounded principles and values. It further emphasized that IS security should take cognizance of ethical and human considerations. Some of the proposed considerations included developing and sustaining an ethical environment, maximizing access control, maximizing data integrity, maximizing privacy, improving authority structures, establishing ownership of information among others.

2.6.4 Information Use

Data demand and information utilization are central to achieving evidence-based decision making. Healthcare professionals spend a significant proportion of their working time collecting large amounts of client and patient data that is rarely analyzed and used at the point of collection (Gillingham & Graham, 2016; Helms & Stern, 2001; Mantzana *et al.*, 2010). Information generated is merely passed over to the next level. Very little information from collected data ever reaches health systems managers; this is despite the fact that an HMIS is mainly designed to facilitate the operations of health systems managers at various levels. Information may not be used because users were not involved in the design of the system or data is not of quality or staff lack reporting skills, analysis and interpretation skill which hinders the use of the data collected.

Therefore that is why a good HMIS, data collection should be closely-related to the data requirements of users (only relevant data) and to the available processing capabilities; also the information generated should be simple to obtain and only the minimum required information must be collected, so that analysis can be done quickly (Teklegiorgis *et al*., 2016). Use of information for planning and decision-making was found to be weak in Brazil as reported by (Teklegiorgis *et al*., 2016). Adopting IHMIS loses meaning when it is not used or accepted by users, therefore benefits of data collected are not likely to be obtained and subsequent increase in performance will not occur (Jan-Bert *et al*., 2014).

A study in Uganda showed that there was low information use which was consistent with the limited observed skills level to interpret data (Kintu, Nanyunja, Nzabanita, & Magoola, 2005). Information quality is contextual where the information must confirm and satisfy a fixed set of requirements, be fit for use at the point of intended usage and finally increase the information user's satisfaction. In Africa, the level of health information utilization has been poor, ranging from 10 to 56% (Shiferaw *et al.*, 2017). In Ethiopia, for instance, information quality and use remain weak within the health sector, particularly at the peripheral levels of districts and health facilities which have primary responsibilities for operational management. As a result, most managerial decisions are being made without evidence, resulting in the failure of many health programs. One critical weakness across Sub Saharan Africa is the current lack of capacity to effectively use data to monitor patterns of service use through time so that the impacts of changes in policy and service delivery can be evaluated (Nyamtema, 2010).

2.6.5 Teamwork

A good HMIS streamlines reporting by avoid parallel reporting systems where possible, and promote single reporting to development partners (WHO & ROWP, 2004). Within the health sector there are a myriad stakeholders (Baarah *et al*., 2014) who perform different functions with the aim of improving health outcomes. Regardless of structure, there has to be a centralized data center for better decision making. The theory of organization by (Gulick, 1937), informs the study on the structure of coordination imposed upon the work division units of an organization. It also emphasizes that the only way to determine how activities are organized in an organization is by the reporting and division of work. Therefore the division of work is the foundation of an organization. Work according to (Gulick, 1937), was divided based on two main reasons i) nature, capacity, skills and specialization required for a certain job; ii) range of knowledge and skill from different people.

The health system in Kenya is organized around six levels of care based on the scope and complexity of services offered (Ministry of Health, 2014). At Level 1, the community unit level focus mainly on promotive health through health education, treatment of minor ailments, and identification of cases for referral to health facilities; Levels 2 (dispensaries) and 3 (health centres) offer primary health care services which are basically outpatient care, minor surgical services, basic laboratory services, maternity care, and limited inpatient facilities. They also coordinate the community units under their jurisdiction. Levels 4 and 5, the secondary referral facilities, form the county referral facilities. They offer a broad spectrum of curative services, and some are also health training centres (-teaching and referral units). Level 6 constitutes the

tertiary referral facilities that offer specialized care and specialized training to health workers.

While the national government should effectively manage these facilities, the challenge is that they are semi-autonomous organizations, following devolution of the health function to the counties. These levels are defined by the care they provide, each one of them complements the other. This division of work indicates it is possible to ensure better utilization of the varying skills and aptitudes of the different health workers and encourages the development of specialization as well as eliminate the time lost in repeating what has been done or can be done by someone depending on the skills they have. For example promotional care at the community level does not need to be done by a specialized care giver, hence costs of hiring skilled workers can be cut at the community level and they can be used to handle complicated care at the higher levels.

This then assists in the coordination of activities which are informed by what the healthcare managers at the different levels should do. Gulick, (1937) organizes this as POSCORB which involves:

- Planning by working out a broad line outline of the things that need to be done and the methods of doing them in the effort of accomplishing the purpose of the health sector,
- Organizing which involves establishing the formal structure of the authority through which work subdivisions are arranged, defined and coordinated for the defined objectives,
- Staffing i.e. the whole personnel function of bringing in and training the staff and maintain favorable conditions of work,

- Directing - the continuous task of making decisions and embodying them in specific and general orders and instructions and serving as the leader of the county health activities,
- Coordinating i.e. is the all-important duty of interrelating the various parts of the work,
- Reporting i.e. keeping those to whom the managers are responsible to informed as to what is going on, which thus includes keeping the relevant people informed through records, research and inspection and
- Budgeting - with all that goes with budgeting in form of fiscal planning, accounting and control.

The integrated HMIS is expected to ensure that appropriate data is collected from the various sources, processed and sent further to all the needy destinations (Sakthivel, 2014). The system is expected to fulfill the information needs of an individual, a group of individuals, the management functionaries: the managers and top management.

2.6.6 Resource Allocation

A well-developed information system will include all information relevant for health decision making, including financial, programmatic, and geographic information about health services and Resource allocation. Generally there is little investment in ICT for health in most developing countries. It is very important to make a realistic financial plan for all costs in the system before the introduction of the HMIS (Odhiambo-Otieno, 2005a). Sustainability is very important when considering the introduction of an HMIS in an organization. Being able to continue supporting the system financially in the long run is an important issue to consider. Plans for

sustainability should be clearly expressed ensuring that the capital investment and costs are identified up front as well as ICT, capacity and infrastructure requirements.

Monitoring and evaluation is also part of the sustainability. In encouraging partnership between stakeholders on local, national, regional and international level, sustainability can grow (Gladwin, Dixon, & Wilson, 2003). At county level, financial Planning and Management, involves:

- Budget development - capital or investment, recurrent or operational,
- Budget allocation to services and activities within the county,
- publication of county annual health plans and budgets for public information,
- monitoring county health expenditure against budget,
- Adjustment between budget lines during the year,
- Setting fees for health services and drugs in the county (if applicable),
- Organizing community health insurance in the county,
- Collection of fees and/or insurance premiums in the county,
- Setting criteria for subsidies or exemption from fees in the county,
- Decisions on use of health income to the county and Audit of county health finances and functions.

Reliable policy, routine management decisions and resource allocation in the health sector need appropriate information from Health Information Systems (HIS) for them to track whether healthcare and services related to support systems that include equipment, infrastructure and supplies, finance, and human resources being delivered are of good quality (WHO, 2008).

Human Resources Planning and Management is also a resource for HMIS activities. This includes deciding the number and mix of staff required for health facilities and services in the county, long-term health workforce planning for the county, hiring and firing staff in the county and setting staff salaries and allowances for the county. It also includes deployment of staff to clinical, outreach and public health services and activities within the county, development of health staff job descriptions for the county, performance assessment of health staff in the county, training needs assessment for health staff in the county, in-service education and career planning for health staff in the county, setting and awarding county health staff incentives (both financial and- non-financial).

2.6.7 Technology Adoption and Information timeliness influence on integration of HMIS

A healthcare organization was characterized dependent on its adoption of technology meaning they use of ICT and information timeliness meaning information is shared simultaneously to every user in real time. ICT facilitates communication, the processing and transmission of information and the sharing of knowledge by electronic means. This encompasses the full range of electronic, digital and analogue ICT, from radio and television to telephone, computers, electronic based media such as digital texts and audio-video recording and the internet but excludes the non-electronic technologies. However this does not lessen the importance of non-electronic technologies such as paper-based text for sharing information and knowledge or communication about health (WHO, 2004).

Studies done in Uganda and Tanzania show that technology adoption is affected by lack of standardization, electrical power, back up and user friendliness systems (Gladwin, Dixon, & Wilson, 2000) . The adoption of information technology (IT) and information systems (IS) has been analyzed most often in relation to diffusion and assimilation of innovation. A report by (Shiels, McIvor, & O'Reilly, 2003) emphasizes that adaptation of technology is dependent on resources and range of technological competencies in an organization. (Boone, Cloutier, Lins, & Makuleck, 2013) argue that the complexity of the computer systems makes it hard for healthcare workers to adopt the IT systems and they end up using manual paper file recording which makes information distorted and poorly managed. In developing countries adaptation to technology is hindered by lack of connectivity, lack of electrical power and insufficient infrastructure. Garner and Smith (2010), discovered that some of the software for running the system of data entry and computation are also scarce, expensive and complex. Shiferaw, Zegeye, Assefa, & Yenit, (2017), reiterate that Information Technology (IT) use and applications are a new concept in modern institutions in developing countries particularly those in Africa. As a result they still find IT use as complex thus hindering their routine HIS activities. According to (Carbone, 2009), using Information Technology, health practitioners can reduce rates of medication errors in hospitals but evidence of reliable health information must be acquired from the clinicians as well as other personnel responsible for information gathering in health facilities.

To provide optimal care, healthcare institutions need timely health information from various sources at the point of care which is also comprehensive, complete and fully reliable to fulfill all these needs. One way to achieve this is to have a system that can disseminate information simultaneously to the users. As healthcare leaders strive to

reform and improve the healthcare system, a growing area of focus is how to achieve an integrated health management information system that meets the needs of patients and communities. Healthcare managers need to understand the goals of healthcare integration and their role in achieving these goals, in order to adapt their practice and become involved in the decision-making. Integration aims to improve the healthcare experience by creating a seamless system of care. A well-developed information system will include all information relevant for health decision making, including financial, programmatic, and geographic information about health services. The need for sound information is especially urgent in the case of emergent diseases and other acute health threats, where rapid awareness, investigation, and response can save lives and prevent broader national outbreaks and even global pandemics (Friberg *et al*., 2010).

The main objectives of the integrated health management information system are to improve the patient experience, enhance access and service coordination, strengthen the links between different levels of care and support services, reduce duplication, improve efficiency, and enhance clinical outcomes (Government of Canada, 2002). An integrated HMIS has a patient-centered approach, is structured around community health needs, with care coordinated across the continuum — meaning delivered over time, in different settings, and across various levels and types of care (Leatt *et al.*, 2000). Integrated healthcare also leverages key support functions such as information management, and uses the skills and experience of a variety of healthcare professionals.

2.7 Theoretical and Conceptual Framework

The theoretical framework was the “blueprint” for the entire research which served as the guide on which the study built and supported its research idea. It provided the

structure that defined the research philosophy, epistemology, methodology, and analytical approach that the study as a whole took (Grant & Osanloo, 2014). (Eisenhart, 1991) defines a theoretical framework as a "structure that guide's research by relying on a formal theory; that is, the framework is constructed by using an established, coherent explanation of certain phenomena and relationships". This study was guided by the theoretical framework discussed below:

2.7.1 Theoretical Framework

This study was guided by the Systems theory and the PRISM framework. As it was pointed out by (Mockler, 1968) the system theory provides a conceptual basis, as well as principles and guidelines, for establishing a more efficient system for planning, control, and operational decision making. Three important aspects of systems are implied by these definitions: i) the arrangement of components must be orderly and hierarchical, no matter how complex it is; ii) Since the components of the system are interdependent, there must be communication among them; iii) Since a system is oriented toward an objective, any interaction among the components must be designed to achieve that objective. (Ludwig, 1968) recognized the dangers that resulted from the increasing fragmentation of science into more and more subgroups and the growing difficulty of communicating among the scientific disciplines. He therefore developed the systems theory. Systems theory focuses on the dynamic interrelationship and interaction of entities. Systems theory as applied by (Mockler, 1968) has had an even greater impact on the internal and external organization of, and the decision-making processes within, an enterprise.

The systems approach forces the manager to look upon his business organization as an information network, with the flow of information providing the decision makers at varying management levels with the information needed to make decisions of all types. These information-communication systems necessarily link together the components needed to operate a business successfully i.e., the people, plants, and machines assembled for the purpose of achieving both the general corporate objective of making money and the individual corporate objective of making money by engaging in a specific type of profit-making business enterprise. In organizing the components of a business to achieve its objectives, traditional business organization theory has emphasized the relationships between people by focusing on the tasks to be performed, the job positions related to performing these tasks, and the appropriate authority and responsibility for each job position. It is however not clear why groups and organizations are not working together despite the fact that they depend on each other for better performance. Organizations still spend the scarce resources making wrong and uninformed decisions yet they want better results.

The effective implementation of an HMIS in health organizations is a key source of improved and quality healthcare services and has been shown to have positive relationship with the performance of a healthcare system. Information is a great organizational resource and hence its quality, timeliness to the right person for purposes of making informed decision is essential. The platform for sharing this information should hence be enhanced from time to time. Consequently, to achieve quality services, good management of healthcare information should be supported by a good information system. In the effort to ensure good governance, transparency, minimal wastage on the

constrained resources and accountability, healthcare organizations have been adopting or developing HIS which are expected to strengthen evidence-based decision-making.

Global alliances are also increasingly requiring quality information. This trend has necessitated the health sector to demand for timely information. Studies have been carried out investigating the different HIS or HMIS that healthcare organizations are adopting to assist them in managing their facilities with different health facilities. This is considering different data sources that they prefer for developing and tracking health system targets, documenting best practices or effectiveness of interventions, and identifying gaps in performance of the HIS. Most of the findings indicated that the greatest gap in HIS is the systems that were operating on standalone. This caused a dichotomy between information system professionals (data people) and health systems managers (action people) who could not understand each other's role and responsibilities, and the need to work together.

This therefore results in most of the system not being able to contribute much to decision making processes. The missing point is that each system is working towards achieving the same goal but unfortunately it is not communicating to any other. Further, there is no evidence that integrated HMIS assures better accountability and improvement in the health system management. Management remains an organizational issue and needs to be dealt with as such. Aqil *et al.,* in (2009) come up with the PRISM framework as an innovative strategy to take care of the issues of previous HMIS. However they do not consider IHMIS as a strategy.

With the guidance of the system theory this study adopted the PRISM framework from (Aqil, Lippeveld, & Hozumi, 2009) a framework for understanding HIS performance. Aqil *et al*., (2009) recognize the efforts made in the 1990s in promoting the development of routine health information systems in developing countries with the aim of improving the management of the health systems. The core components of the HMIS are information needs, data collection, processing and analysis, resources provided by the management and set organizational rules. This had been called the Performance of Routine Information System Management (PRISM) framework and the assessment borrowed heavily from the Organization, Behaviour, Application and Technical (OBAT) tool. This approach also created information demand and information use best illustrated by the strategic triangle linking process, organization, individual behavior, and technical knowledge and system challenges. Sustainable demand for high quality health information was most likely to result from a strategy that simultaneously focused on four fronts - improving technical quality of data and data tools, building individual capacity for understanding and using information, strengthening the organizational context in support of data collection and information use. This strategy could be pursued with a clear appreciation of the importance of understanding the political, cultural, and social context of decision making.

Based on the documented HIS weaknesses, Hotchkiss, Aqil, Lippeveld and Mukooyo, (2010) developed the Performance of Routine Information System Management (PRISM) framework, an innovative approach to design, strengthen and evaluate HIS. The PRISM framework offers a paradigm shift by putting emphasis on HIS performance and incorporating the organizational, technical and behavioral

determinants of performance as aspects that have an influence in any HIS. RHIS performance was defined as 'improved data quality and continuous use of information. As depicted in the Figure 2.1 below , the Prism framework hypothesizes that technical, behavioral and organizational determinants (inputs) influence data collection, transmission, processing, and presentation (processes), which in turn influence data quality and use (outputs), health system performance (outcomes), and ultimately, health outcomes (impact).

The RHIS performance occurs within an environment/organizational setting. Organizational members need motivation, knowledge and skills (behavioral factors) to perform RHIS tasks, and specialized technical know-how/technology (technical) is required for timely analysis and reporting (Aqil *et al.*, 2009) . This study derived its independent variable from the framework. These variables were used to explore the current knowledge gap, understand the arguments that had been made by (Aqil *et al.*, 2009) and subsequently inform the problem statement. Although this theory argued that technical, behavioral and organizational factors affect performance of RHIS, it had not explained why some healthcare organizations have implemented them and are doing better than others.

Aqil *et al.*, (2009) emphasized that a RHIS pays more attention to the internal determinants. Therefore, the environmental/organizational category is renamed as organizational factors, while environmental factors are considered to be constraints under which every RHIS works and has little control over.

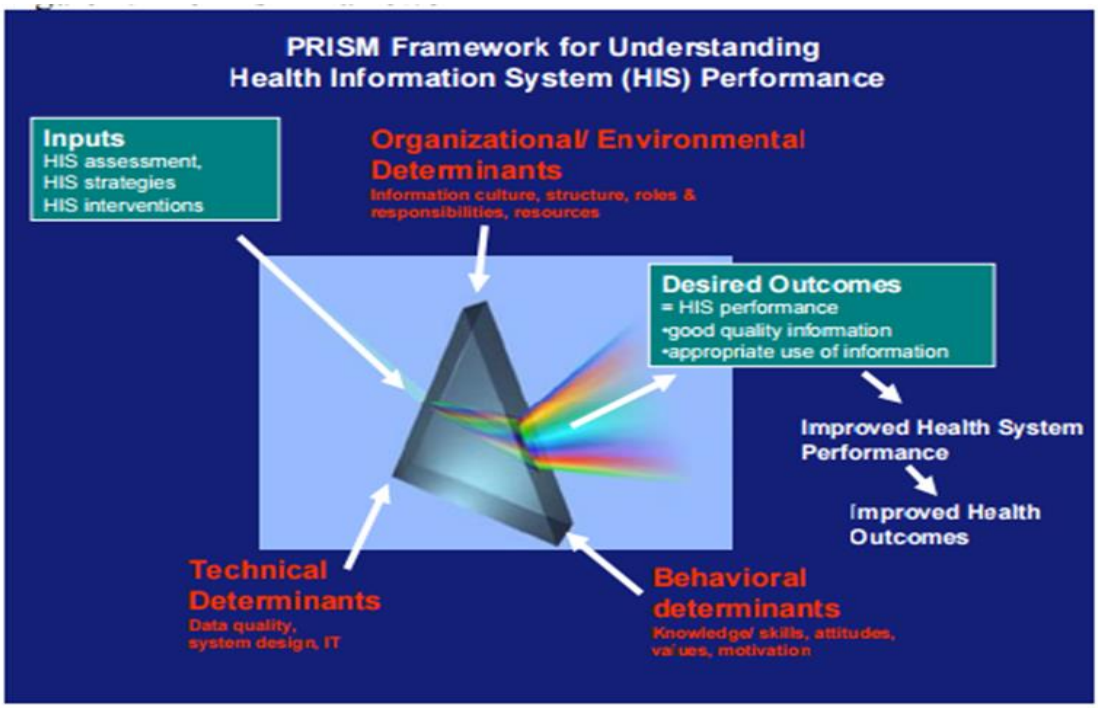

Figure 2. 1: Prism Framework
Source: Adopted from (Aqil, Lippeveld, & Hozumi, 2009) a framework for understanding HIS performance.

2.7.2 Conceptual Framework

The conceptual framework brings out the dependent variable and the independent variables and how they were operationalized. The conceptual framework borrowed greatly from the PRISM framework developed by (Aqil *et al.,* 2009). The PRISM framework promotes the information culture and encourages accountability in health systems strengthening. Most countries are faced with constrained resources. A lot of attention has therefore been given to strengthen good governance by emphasizing on evidence-based decision making which can only be achieved if the countries have reliable health information systems. The purpose of this study was to test whether employing the prism framework would lead to an IHMIS meant to improve performance of players in the health sector to share information, in good time hence leading to better decision making and better management of the health sector.

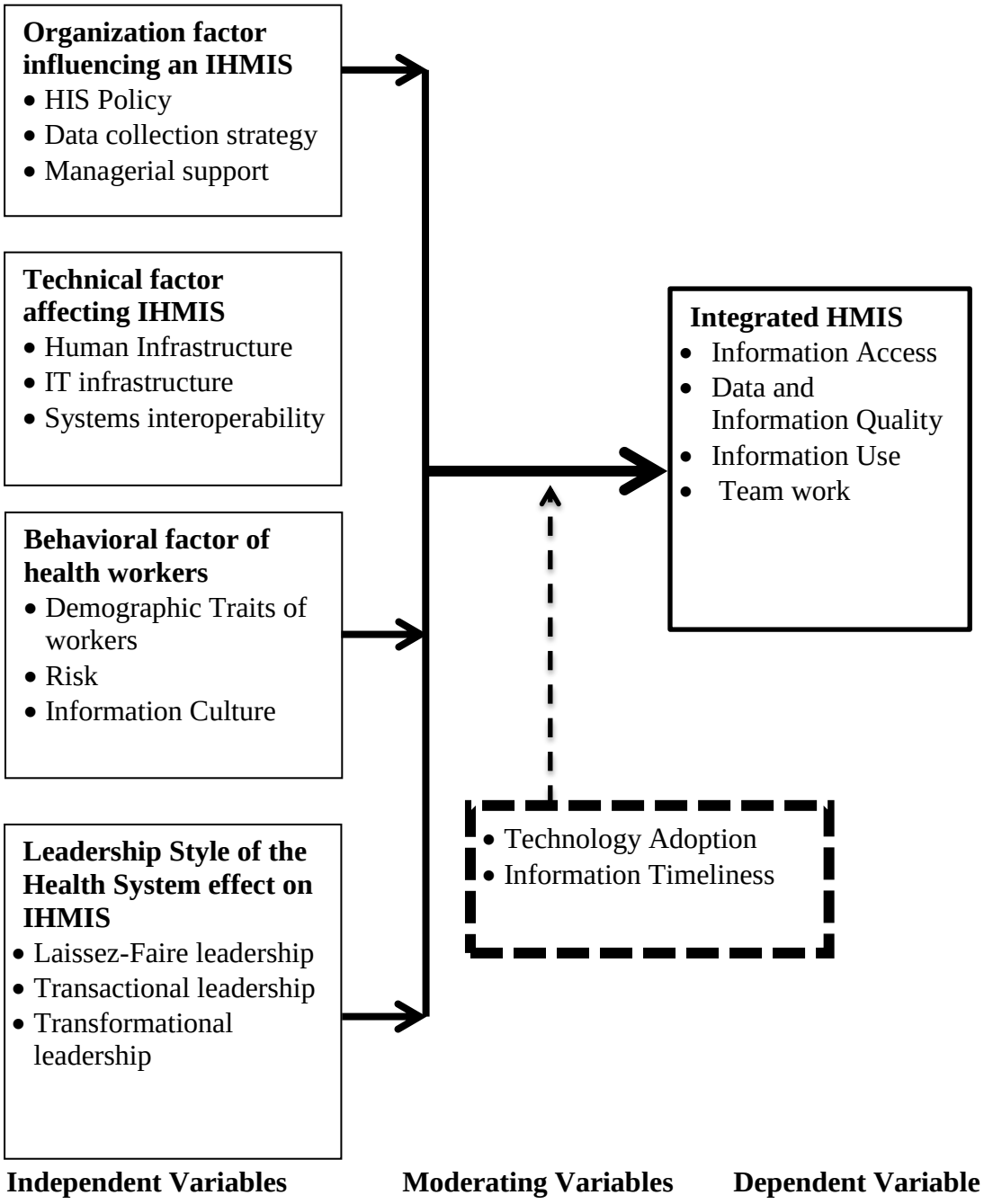

Figure 2. 2: Conceptual Framework

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methods and procedures that were used to gather, analyze and present data on the subject IHMIS. It presents the research design adopted, the study population, sampling framework, sample size determination and sampling technique used, data collection instruments and procedures, pilot test and data processing and analysis. It also presents the research models that this study utilized to analyze and test various hypotheses developed in the study.

3.2 Research Design

To achieve the purpose of this study, a mixed method research design was adopted to determine the factors that influence the integration of HMIS in Mombasa, Kiambu and Kitui Counties. Positivism and Interpretivism are the two basic approaches to research methods in this study. Positivist prefer scientific quantitative methods, while Interpretivists prefer humanistic qualitative methods. Therefore, exploratory research design was used to explore hypothesis developed, descriptive research design was employed because fact finding enquiries were carried out with a major purpose of describing the state of affairs on the ground, quantitative research design was used because numerical data was used to quantify and predict outcomes while correlations were done to show the relationship between the independent and the depended variable. The mixed method design was adopted because quantitative methods ensure high levels of reliability in gathering data while qualitative methods give more in-depth information about the respondents' perceptions (Harwell, 2011). According to Isaac and Michael (1995), descriptive studies are conducted "to describe systematically a situation or area of interest factually and accurately".

3.3 Target population

The population of interest in this study included all the healthcare organizations in in tier 1, tier 2 and tier 3 engaged in providing healthcare services in Kitui County, Kiambu County and Mombasa County. A list of all registered healthcare organizations within Kitui, Kiambu and Mombasa Counties was obtained from the Ministry of Health website as at 15 August 2016. The list contained 479 public healthcare provider organizations engaged in offering healthcare services in the 3 counties. The target population in this study included all healthcare organs all the in-charges, health records information officers and management teams engaged in providing healthcare services from tier 1 to tier 3 in the selected counties. The service providers were chosen from community units, health centers and dispensaries, sub-county hospitals, county hospitals and management teams. The breakdown of the organizations is shown in Appendix I.

To take care of all the counties in the county, counties were selected depending on their development status i.e. Rural, Peri-urban and Urban. The study was carried out in Kitui (rural), Kiambu (peri-urban) and Mombasa (urban) counties of Kenya. Kitui County is made up of eight sub counties (Kitui :Central, East, Rural, South, West, Mwingi : Central, North and West), Kiambu County twelve sub counties (Gatundu North and South, Githunguri, Juja, Kabete, Kiambaa, Kiambu, Kikuyu, Lari, Limuru, Ruiru and Thika) and Mombasa six sub counties (Changamwe, Jomvu, Kisauni, Likoni, Mvita and Nyali).

Table 3: 1: Target Population Public Health Organizations

Facility Type	Kitui	Kiambu	Mombasa	Total	Percentage
	N	N	N	N	%
Tier 1: Community Units	34	64	28	**126**	26.3
Tier 2: Health centers or dispensaries	176	54	35	**265**	55.3
Tier 3: Sub county and county hospitals	45	33	10	**88**	18.4
Total				**479**	**100**

Source: Ministry of Health, Kenya health facility list website as at 15th August 2016

3.4 Sampling Frame

According to Kathori (2004), the ultimate test of a sample is how well it represents the characteristics of the entire population. Three counties were selected in regards to their development status i.e. rural, peri-urban and urban to represent the whole population (country). 30% of the target population will be used as the sample size (Kothari C.R., 2004).

Therefore, using 30% of the target population

30% of 479 = 144

=144 healthcare organizations

The sampling frame included 479 registered public healthcare organizations operating within Kitui, Kiambu and Mombasa Counties as at August 2016. These healthcare organizations were grouped into three main clusters depending on the Tier of operation. This led to classifications like the community units, health centers & dispensaries and county & sub-county hospitals. The aim of this was to ensure that the sample selected in this study maintained homogeneous characteristics (Gatheya, Bwisa & Kihoro,

2012). Based on this criterion, the limit of 144 healthcare organizations constituted the sampling frame for this study. The aim of this limitation was to ensure that the sample selected in the study maintained some standardized characteristics (Wilmot, 2005). The study also targeted sub-county and county management teams from the three counties. In each county the target was one team member from each county. The categories and size of the respondents that took part in the study are herein presented in Tables 3.3 and 3.4.

Table 3: 2: Sample Frame

Facility Type	**Kitui**	**Kiambu**	**Mombasa**	**Population**	**Percentage**
	n	**n**	**n**	**n**	**%**
Tier 1: Community Units	10	19	8	37	26
Tier 2: Health centers or dispensaries	53	17	11	81	56
Tier 3: Sub county and county hospitals	14	9	3	26	18
Total facilities				**144**	**100%**

Source: Ministry of Health facilities list as at 15th August 2016

Table 3: 3 County Management Teams

Management Teams	**Kitui**	**Kiambu**	**Mombasa**	**Population**	**Percentage**
	n	**n**	**n**	**n**	**%**
Sub-County	8	12	6	26	89.7
County	1	1	1	3	10.3
Total				**29**	**100%**

3.5 Sampling technique

A multi-stage sampling method was used in this study. This was done to ensure that different health workers, from the different regions of Kenya in the different level of care in the population were represented in the sample. The total population was 479 healthcare organizations. The population was divided into layers or strata. The population was characterized as heterogeneous i.e. the different tiers (tier 1, tier 2 and tier 3) but consisted of a number of homogeneous sub-populations or strata that is the in-charges. Multi-stage sampling was applied to sample the health facilities (County Referral Hospital, Sub-County Hospitals, Health Centers, Dispensaries and community units). Thereafter a simple random sampling to select the health centers, dispensaries and community units was done. Then purposive sampling was used to sample the two healthcare workers from each health care organization who were believed to be best-placed to provide the required information.

3.5.1 Inclusion Criteria

All consenting in-charges and health records and information officers and any other person identified by the in-charge as a key resource in information management in the facility at the time of the study in all the tiers.

3.5.2 Exclusion Criteria

Respondents who wanted to be compensated in order to take part in the study and those who were not available during the study.

Table 3: 4: Sample Size

Organization Type	Population	Formulae	Sample Size	No. of Respondent per HO	Total No. of Respondents
	N	N(%)	n	n	n
Community Units	126	126(30)	37	2	74
Dispensaries and Health Centers	265	265(30)	81	2	162
Sub-County and County Hospitals	88	88(30)	26	2	52
Total	**479**		**144**		**288**

3.6 Data Collection Instruments

After completion of a comprehensive literature review, there were no instruments found that measured the four factors affecting integration of HMIS among health organisations. The four factors were: Organisation factor, Technical Factor, Behavioural factor of health workers and Leadership styles adopted. To accomplish the purpose of this study, a questionnaire was developed to measure factors affecting integration of HMIS. A key informant interview was later used to get an in-depth understanding of the study. These two instruments addressed the main constructs of the variables used in this study. In stage 1, a self-administered questionnaire was used to measure the level of agreement of these factors. In stage 2, key informant interviews were conducted with members from the management teams. This research design gave an opportunity to examine the co-relationship between the four tiers of the health system in Kenya. This choice of design ensured no gap was left in the data collected because questions were answered from a number of perspectives.

Expert Panel Review- McDermott and Sarvela (1999) recommended that researchers' colleagues should serve as an expert panel to conduct an initial review of an instrument

to check for ease of use, understandability, relevance, wording, grammar, spelling, readability, and flow. The expert panel for review of the instrument consisted of, Prof. Odhiambo and Dr. Otieno and colleagues. They were selected because of their knowledge about HMIS, Health system and business management. Each panel member reviewed the instrument for face and content validity. Based on their recommendations, changes were made with wording and items added or deleted to ensure that the instrument was valid and clear.

3.7 Pretest Results

The next step was to pre- test the instrument to establish internal consistency reliability. This was done immediately the researcher received the university's ethical clearance from the SERC board. 31 questionnaires were pretested in 10 hospitals in Nairobi County; Kenyatta National Hospital, National Spinal Injury Referral Hospital, Mutuini Hospital, Mbagathi County Hospital, Mama Lucy Hospital, Administration Police Training College Health Centre Embakasi, Mihango Dispensary, Embakasi Health Centre, Rhodes Chest Clinic and Ngaira Dispensary. 31 respondents took part in the pretest. Data was compiled for analysis in Statistical Package for the Social Sciences (SPSS). Internal consistency reliability was established by calculating Cronbach Alphas for integration of HMIS. A minimum of Cronbach Alpha level of .70 was used to establish internal consistency reliability (Nunnally, 1978). During the review of the items it was determined that certain items should be deleted to increase the reliability of the instrument. The Cronbach alphas are indicated in the table below.

Table 3: 5: Cronbach Alphas of developed Instrument

Construct	No. of Items	Mean	Standard deviation	Cronbach's Alpha
Integration of HMIS	20	63.76	8.73	0.742
Organization factor	14	47.99	7.43	0.777
Technical factor	21	61.63	10.68	0.829
Behavioral Factor	10	32.21	5.32	0.709
Leadership Style adopted	23	78.47	10.35	0.789

The Cronbach Alpha levels of the variables were all above .70. This meant that the internal consistency was reliable (Nunnally, 1978).

3.8 Ethical Considerations

In the research process, ethics focused on the application of ethical standards in planning the study data collection and analysis, dissemination and use of results (Mugenda, 2008). It included enjoined virtues of honesty, compassion and empathy especially when dealing with subjects in research. Since this research involved human participants, ethical principles and values governing the research were observed to protect both the respondents and researcher as highlighted by (Habibis, 2006). Therefore the researcher ensured that there were no issues affecting the study and formal authorization was sought from Science and Ethics Review Committee (SERC), National Council of Science, Technology and Innovation (NACOSTI) and the County Health Department. Documents informing subjects of the main objectives of this study were issued and ethical considerations were discussed. The respondents were assured that data would be treated confidentiality and approval from relevant bodies had been granted. The issues of anonymity and confidentiality were significant in this study. This

is because interviews were on one-on-one. The researcher ensured that confidentiality was observed during data collection.

The respondents were also informed of the benefits associated with the research. Therefore, significant efforts on ethical consideration were made in order to ensure the study adhered to the ethical principles. Determined efforts were undertaken to ensure that the data and information gathered from respondents was not shared and stored unethically.

3.9 Data Processing and Analysis

Prior to the processing of the responses obtained from this study, the questionnaires were edited for completeness and consistency. The incomplete ones were exclude for analysis. Data was analyzed using the SPSS program version 21.0 (SPSS, Inc., 2010). The following coding procedures were applied for data analysis. For descriptive statistical analysis, responses for Likert-type scale questions were coded as follows: strongly agree = 5, agree = 4, neutral 3, disagree = 2, strongly disagree = 1. All items were using measures of central tendency and dispersion at middle mean of 3.40 as identified by (Bajunaid, 2008).

Descriptive statistics were computed for each item including frequencies, percentages, means, standard deviations and content analysis. Items within each of the variable constructs and factors were summed to create total scores so that frequencies, percentages, measures of central tendency, and measures of dispersion could be calculated. Independent Turkey's HSD Tests were used to determine the extent of differences that existed among participants' total construct scores based on

demographic variables such as, age, education level, years of work experience, professional training, and the level (tier) of institution.

Pearson correlations were calculated to determine the relationships between the operational factor, technical factor, behavioral factor and leadership styles adopted with integration of HMIS. Multiple linear regression analysis was calculated to determine how much variance in the identified factor with integration of HMIS can be attributed to the organization factor, technical factor, and behavioral factor and leadership styles. Lastly, Cronbach alphas were calculated to determine the internal consistency reliability for all questions. An alpha level of 0.70 and above was taken as an acceptable test for reliability and consistency in the items included in the questionnaire (Cronbach, 1951). An alpha level of .05 was to be used to determine statistical significance.

To test the hypotheses, the following two conditions had been set such that given H_0 and H_1, set a = 0.05, the rule is that reject H_0 if P- value, is less than (0.05) else fail to reject H_0: where

1. H_0: Null Hypothesis: H_{0i} $\beta i = 0$. Where, (i=1, 2, 3, 4,5)
2. H_1: Alternative hypothesis: H_{1i}, $\beta i \neq 0$. Where, (i=1, 2, 3, 4,5)

The bivariate linear Correlation output had a corresponding P-value for a given variable. If $P < 0.05$ then reject the null hypothesis H_0 and accept alternative hypothesis H_1. If $P > 0.05$ fail to reject the null hypothesis. The regression output also provided the t- values and the corresponding p-values. In the test results of the hypotheses where the p-value is less than 0.05 ($P < 0.05$) then null hypotheses H_{0i} was to be rejected in favor

of alternative hypotheses H_{1i} implying that the independent variable (X_i) has a significant relationship with dependent variable (Y).

3.10 Measurement of Variables

The psychometric instruments developed to measure variables in this study were based on the philosophy of logical positivism (Scotland, 2012) where logical analysis is used as a major instrument in resolving philosophical issues or disputes. Several statements which attempt to establish the correlation between real objects or processes and the abstract concepts of the theory were developed as psychometric measures of the independent variables (organization factor, technical factor, behavioral factor and leadership styles) and dependent variable (integration of HMIS) in this study.

a. Integration of HMIS

The integration of HMIS in healthcare organizations in Kenya was measured by the degree of satisfaction on the levels of information access, information system security, data and information quality, information use and team work. Due to the sensitivity of obtaining information related to operations of a healthcare organization where health workers did not want to look like they were jeopardizing the organizations image hence were not willing to say much, a 5 point Likert scale psychometric instrument (Boone & Boone, 2012) was developed to capture information using signifying integration measures where the degree of satisfaction with HCO's integration was used based on health workers perceptions. The scale ranged from (1= Strongly Disagree, 2= Disagree 3= Not Sure, 4=Agree, 5= Strongly Agree). The mean score was then calculated as an average of the 5 items examined on the HCO's integration. A mean score of 3.4 and above on each item indicates that the respondents agreed with the statement given while

those with a mean score below 3.4 indicates disagreement. Then the average mean score per HCO was obtained from aggregating the means on integration and dividing by 5 items. The higher the score, the better the statement is in terms of the HCO's perceived integration of HMIS. This was also reinforced by the use of Key Informant Interview approach where the respondents were asked to state their opinion on satisfaction with integration of HMIS. Qualitative data of the interview content was analyzed in steps. Step 1 included reading through the transcripts, the researcher browsed through the transcripts making notes about the first impression. The transcripts were then read again very carefully. Step 2 included labelling relevant phrases using codes. The labels were done on concepts that were emerging frequently. Step 3 included creating categories or themes. The themes were then labeled under the objectives of the study.

b. Organization Factor

Organization factor was used to measure the extent to which a HCO pays close attention to the requirements of the key factors that drives successful integration of HMIS in a HCO. In order to measure the variables under organization factor (HIS policy, data collection strategy and management support) using a 5-items Likert scale was developed (Boone & Boone, 2012) which ranged from (1= Strongly Disagree, 2= Disagree 3= Not Sure, 4=Agree, 5= Strongly Agree). The mean score was then computed as the average of the 5 items. The higher the score, the more the variable is important to the integration of HMIS in HCOs in Kenya.

c. Technical Factor

Technical factor of the HCO was used to measure the extent to which a HCO has put emphasis to have adequate and competent employees, IT infrastructure and systems

interoperability as a key facilitator in the integration of HMIS efforts. In order to measure this variable under technical factor, a 5-items Likert scale was used (Boone & Boone, 2012) which ranged from (1= Strongly Disagree, 2= Disagree 3= Not Sure, 4=Agree, 5= Strongly Agree). The mean score was then computed as the average of the 5 items. The higher the score, the more the variable is important to the integration of HMIS in HCOs in Kenya.

d. Behavioral Factor

The age, risks and information culture of a HCO was used to measure the extent to which it influences integration of HMIS. In order to measure this variable, a 5-items Likert scale was used (Boone & Boone, 2012) which ranged from (1= Strongly Disagree, 2= Disagree 3= Not Sure, 4=Agree, 5= Strongly Agree). The mean score was then computed as the average of the 5 items. The higher the score, the more the variable is important to the integration of HMIS in HCOs in Kenya.

e. Technology Adoption and Information Timeliness

Technology adoption and information timeliness were used to measure the moderating effect of the relationship between organization factor and integration of HMIS in HCOs in Kenya. Technology Adoption of the HCO was considered as embracing use of ICT in HCO. On the other hand, information timeliness at the point of service was measured by the number of times employees working get instant data when they need it to make decisions. A HCO that has synchronized their data and could retrieve it at any time was considered to have timely information for decision making.

3.11 Operationalization of variables

Table 3: 6: Operationalization of Variables

Type of Variable	Name	Operationalized indicator of the variable
Dependent Variable	Integration of HMIS	• Information accessibility, Data and Information quality, Information system security, Information use and Team work
Independent Variable	Organization factor	• HIS policy, Data collection strategy and Management support
	Technical factor	• Human Infrastructure, IT infrastructure and Systems interoperability
	Behavioral factor	• Demographic characteristics of health works age, education level, professional training and years of work experience, Risks associated factors and Information culture
	Leadership style	• Laissez-Faire, Transactional and Transformational leadership
Moderating variables	Technology adoption Information Timeliness	• HCO embracing ICT • Information always available when needed

This chapter explained how the study was to be conducted. There were five hypothesis to be tested pertaining to the purpose of the study. The research design, sample, data collection and data analysis procedures were described. By following the strict guidelines presented in this section, the researcher was confident that the study conducted was valid and reliable.

3.12 The Research Model

This study adopted a multiple regression model that attempted to predict the extent to which each of the four independent variables (X_1, X_2, X_3 and X_4) and the two moderating variables (Z_1,Z_2) influences the dependent variable (Y) through Integration

of HMIS initiatives of the HCOs in Kenya. The influence of X_i, i= (1, 2, 3, 4) and Y is expressed in the following functional relationship:

$Y = f(X1, X2, X3, X4, Z1, Z2) + \varepsilon$

Where;

Y = Integration of HMIS

X_1 is influence of organization factor on integration of HMIS

X_2 is influence of technical factor on integration of HMIS

X_3 is influence of behavioral factor on integration of HMIS

X_4 is influence of the Leadership styles on integration of HMIS

Z1 is the dummy variable for technology adoption of the HCO

Z2 is the dummy variable for the information timeliness in HCO

ε is the stochastic disturbance error term.

To achieve the objectives of this study, the following three multiple regression models were developed to show the steps or the order in which the variables in this study were tested in a hierarchical manner. These models were informed by the conceptual frame as dedicated by (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002)

a) Model 1

$Y = \beta_0 + \beta_i X_i + \varepsilon$, (i = 1, 2, 3, 4) ……... (1a)

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$…… (1b)

Where:

Y is the integration of HMIS

β_0 is the Y intercept / constant.

βi is the coefficient of independent variable Xi where i = 1, 2, 3, 4.

X_1 is the influence of organization factor on integration of HMIS

X_2 is the influence of technical factor on integration of HMIS

X_3 is the influence of behavioral factor of care givers on integration of HMIS

X_4 is the role of leadership style on the integration of HMIS

ε is the error term.

These models were used to establish the influence of the independent variables (organization factor, technical factor, behavioral factor and leadership style) on the dependent variable (integration). The model included the ordinary predictors of integration in HCO before any moderating effect of technology adoption and information timeliness

b) Model 2

$Y = \beta_0 + \beta_i X_i + \beta_j Z_j + \varepsilon$, (i = 1, 2, 3, 4, j = 1, 2) ……. …….. (2a)

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_j Z_j + \varepsilon$…….. (2b)

Where:

Bj is the coefficient of the moderator as a predictor

Zj is the moderating variable (dichotomized technology adoption/information timeliness)

The rest of the variables are as defined in the model 1. These regression models were used to test whether the moderating variable is a significant predictor of integration of HMIS in the presence of the variable to be moderated in the HCOs in Kenya.

c) Model 3

$Y = \beta_0 + \beta_i X_i + \beta_j Z_j + \beta_{ij} X_i Z_j + \varepsilon$ …….. (3a)

$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_j Z_j + \beta_{ij} Z_{ji} + \varepsilon$…….. (3b)

Where:

Bji is the organization factor, technical factor, behavioral factor and leadership style

$\beta_{ij} Z_{ji}$ is the interaction term between variable Xi (i = 1, 2, 3, 4) and moderating variable Zj (j = 1(technology adoption), 2(information timeliness)

The rest of the variables are as defined previously. These regression models were used to bring in the interaction terms between Xj and Zj. The models were used to test whether the technology adoption/information timeliness of the HCO had any moderating effect on the relationship between operational factor and integration of HMIS in HCO in Kenya. This study utilized different tests for hypotheses as presented in Table 3.7.

Table 3: 7: Study Hypotheses

Variable	Null Hypothesis	Type of Analysis	Interpretation
Organization Factor	**H_{01}**	Pearson Correlation	$P < 0.05$ reject null
	No significant influence	Linear Regression	$P > 0.05$ fail to reject null
Technical Factor	**H_{02}**	Pearson Correlation	$P < 0.05$ reject null
	No significant influence	Linear Regression	$P > 0.05$ fail to reject null
Behavioral Factor	**H_{03}**	Pearson Correlation	$P < 0.05$ reject null
	No significant influence	Linear Regression	$P > 0.05$ fail to reject null
Leadership Style	**H_{04}**	Pearson Correlation	$P < 0.05$ reject null
	No significant influence	Linear Regression	$P > 0.05$ fail to reject null
Moderation:	**H_{05}**	Pearson Correlation	$P < 0.05$ reject null
Technology Adoption & Information Timelines	No significant influence	MMR	$P > 0.05$ fail to reject null

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1 Introduction

The aim of this study was to establish the influence of operational factors on the integration of HMIS in HCO in Kenya as moderated by technology adoption and information timeliness. Specific objectives were to determine how the organization factor, technical factor, behavioral factor and leadership style relates to the integration of HMIS of HCO. This chapter presents the results and findings of the study.

4.2 Response Rate

A total of 143 healthcare organizations participated in the study. A total of 288 questionnaires were distributed. Questionnaires were administered to at least 2 representatives of each healthcare organization; the in-charges of the HO and a health records and information officer. In the HCO where the in-charges were multitasking and being the sole service providers, they were the only respondents. In HOs that had an in-charge but did not have health records information officer, a health worker who was supporting the data collection and information generation was allowed to participate in the study.

A total of 243 out of the 288 expected respondents filled the questionnaires. All the questionnaires returned were valid for data analysis and therefore the response rate was 84%. Key informant interviews (KII) were also carried out based on the findings in the questionnaires. The KII either confirmed, rejected or added to findings from the questionnaires. The interviews were held with members from the sub-county and county health management team members. The available ones included 2 sub-county

and 2 county health records officers, one sub-county management team chair and one county assistant director. Six instead of 11 key informant interviews were conducted. The analyses were done based on the variables studied. Means, standard deviations, frequencies and percentages, Pearson correlation, and multiple linear regression analysis were conducted with the appropriate data variables. An alpha level of 0.05 was used to determine the statistical significance. Means, median, mode and standard deviation were used to indicate the central tendency of the responses.

Table 4.1 tabulates the total respondents per tier per county. The respondents were made up of community unit chairs, in-charges of the health facilities, health records and information officers or suitable proxies.

Table 4. 1 Total Respondents per Tier in the County of Operation Cross Tabulation

		County of operation			Total
		Kiambu n	Mombasa n	Kitui n	n
Tier of operation	Tier 1	20	12	23	55
	Tier 2	43	29	37	109
	Tier 3	13	27	39	79
Total		**76(31%)**	**68(28%)**	**99(41%)**	**243**

Study findings on the demographic characteristics of the respondents are presented in Table 4.2. Majority of the respondents 39.9% were aged between 25-35 years old, meaning most of the health workers were in their youth. Most of the health workers 59.3% were diploma holders. 66.7% had worked for a period of 1-10 years.

Table 4. 2: Demographics Characteristics of the Respondents

(*N=243)*

Characteristics		Frequency	Percent
Age	18-24	6	2.5
	25-35	97	39.9
	36-45	85	35
	46-55	33	13.6
	Above 55 years	22	9.1
	Total	243	100
Highest certificate of education attained			
	Primary School Certificate	30	12.3
	Secondary School Certificate	32	13.2
	Diploma Certificate	144	59.3
	University Degree Certificate	37	15.2
Working Experience			
	1-10 years	162	66.7
	11-20years	49	20.2
	21-30 years	21	8.6
	31-40 years	9	3.7
	Over 40 years	2	0.8

The study also sought to find out the current positions held by the respondents providing the data for this study. The results in Figure 4.1 indicate that majority of the respondents 37% occupied the position of a nurse in-charge, 22% Community Health Volunteers, 12% Clinical Officers, 11% Health Records and Information Officers, 8% Hospital Administrators, 4 % Lab technologists, 2 % Pharmaceutical technologists, 2% Medical Doctors and 2% Nutritionists.

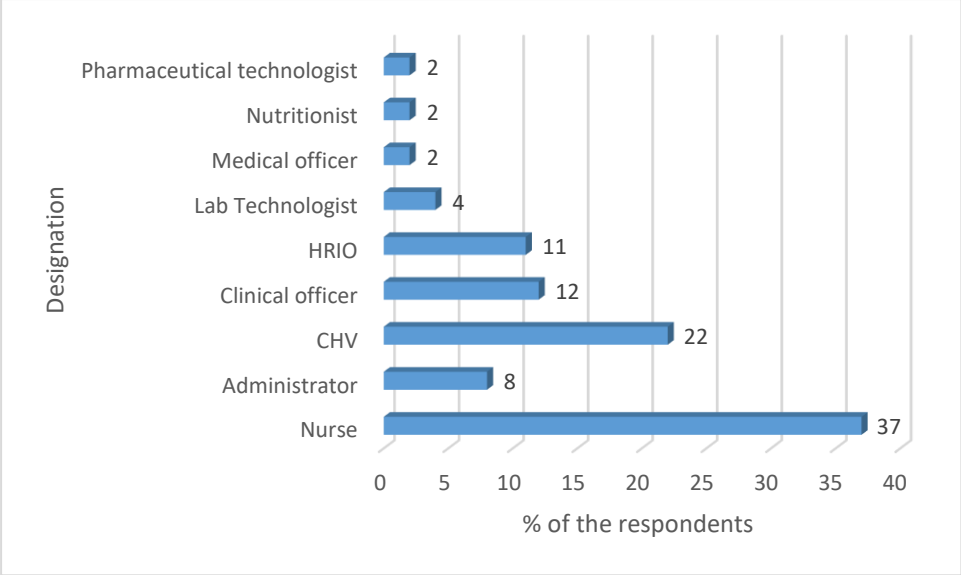

Figure 4. 1: Positions Held by the Respondents

The study findings in Figure 4.2 show the education level. The results show that majority of the respondents were Diploma Holders 59 %, University degree holder 15%, secondary certificate holders 13%, and primary certificate holders 12%. The general observation from these results is that majority of the health workers are joining the job market with a diploma certificate and most are nurses.

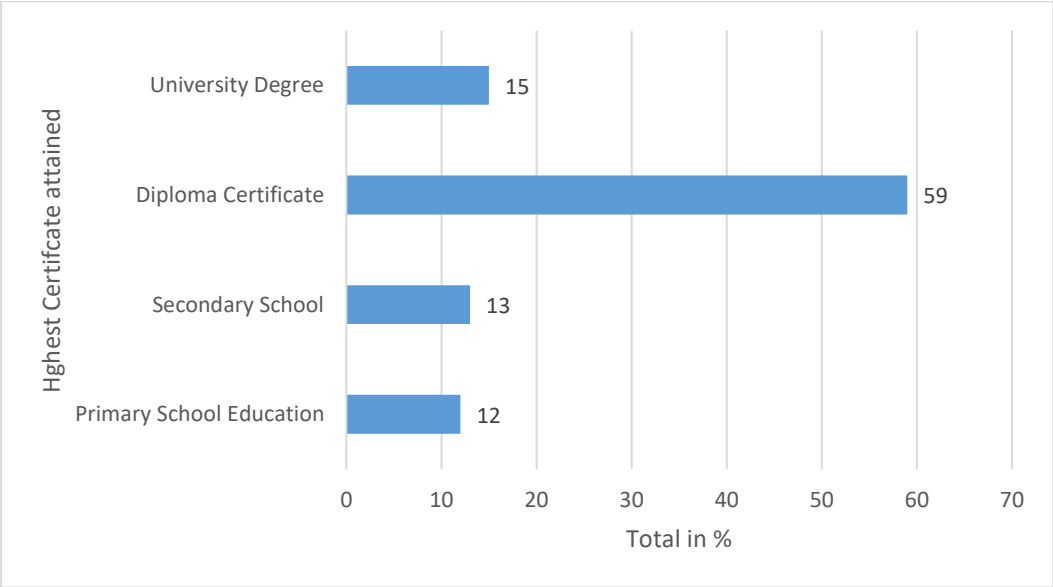

Figure 4. 2: Education Level

4.3 Inferential statistical Analysis

The first model under investigation in this study intended to establish the influence of operational factors on the integration of HMIS in healthcare organizations in Kenya. This model expressed as;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Where: Y= Integration of HMIS, β_0 = Intercept, β_1, β_2, β_3, β_4 = slope coefficients representing the relationship of the associated independent variable with the dependent variable, X_1 = Organization Factor, X_2 = Technical Factor, X_3 = Behavioral factor, X_4 = Leadership style and ε = error term, was the basis under which the first 4 objectives outlined in chapter one were set. Each of these objectives and the hypotheses were tested and analyzed to find out whether they conformed to what the study had proposed to achieve.

4.2.1 Test of Normality: All variables

Many data analysis methods depend on the assumption that data were sampled from a Gaussian distribution (Athanasiou, Debas & Darzi, 2010). The best way to evaluate how far data are from Gaussian is to look at a graph and see if the distribution deviates grossly from a bell-shaped normal distribution. The testing of normality all variables in this study was done by using the Shapiro-Wilk test since it is considered more reliable than Kolmogorov-Smirnov test. Such that given H_0 and H_1, set $\alpha = 0.05$, the rule is that reject H_0 if P- value is less than α else fail to reject H0:

Where,

H_0: The data is normally distributed

H_1: The data is not normally distributed

Table 4. 3: Test for Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Y	.052	243	.200*	.995	243	.674
X1	.052	243	.200*	.992	243	.218
X2	.083	243	.000	.991	243	.122
X3	.088	243	.000	.987	243	.027
X4	.051	243	.200*	.992	243	.240

a. Lilliefors Significance Correction

Table 4.4 gives the tests results for all variables using Shapiro-Wilk tests of normality which this study considers more reliable. Three out of four variables had P-values greater than 0.05. That is, integration of HMIS (Y), organization factor (X_1) and leadership style (X_4). This study, therefore, failed to reject their corresponding null hypotheses ($H0_1$ and $H0_4$) respectively and concludes that the data sets for these three variables were normally distributed. On the other hand the Shapiro-Wilk tests indicated that the P-vales for technical factor (X_2) and behavioral factor (X_3) were less than 0.05. This study further interrogated these two variables (X_2 and X_3) further by looking at their normal Q-Q plots.

a. Q-Q plots for Technical factor (X_2)

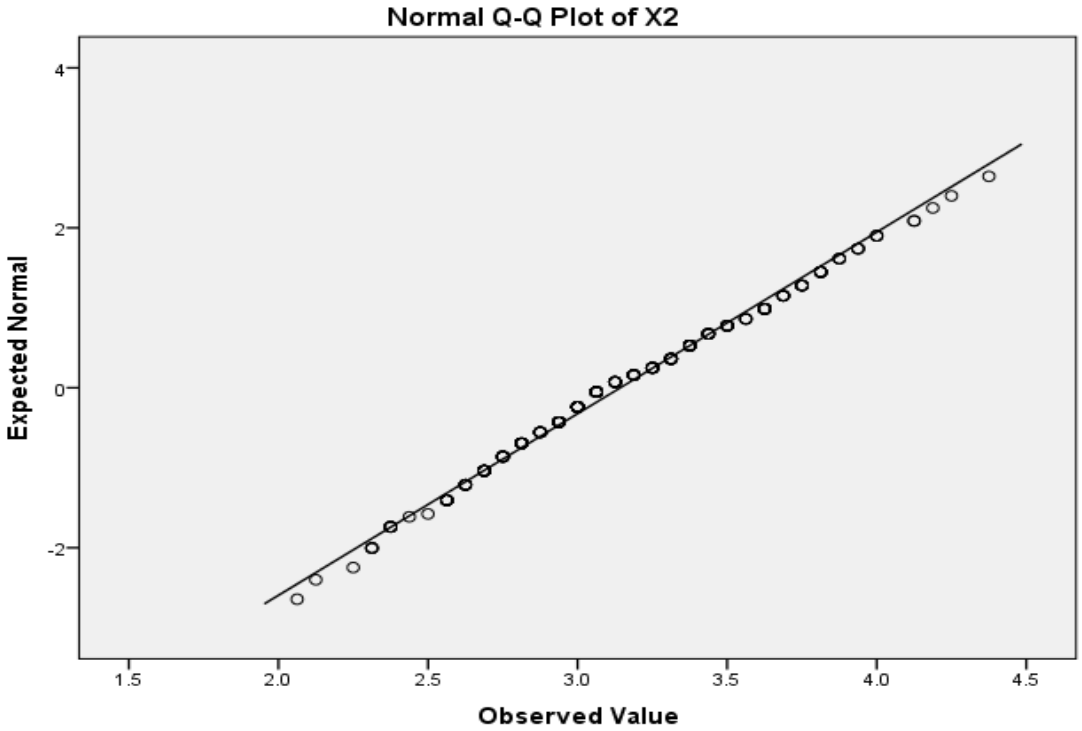

Figure 4. 3: Q-Q Plot for technical factor

b. Q-Q plots for Behavioral Factor

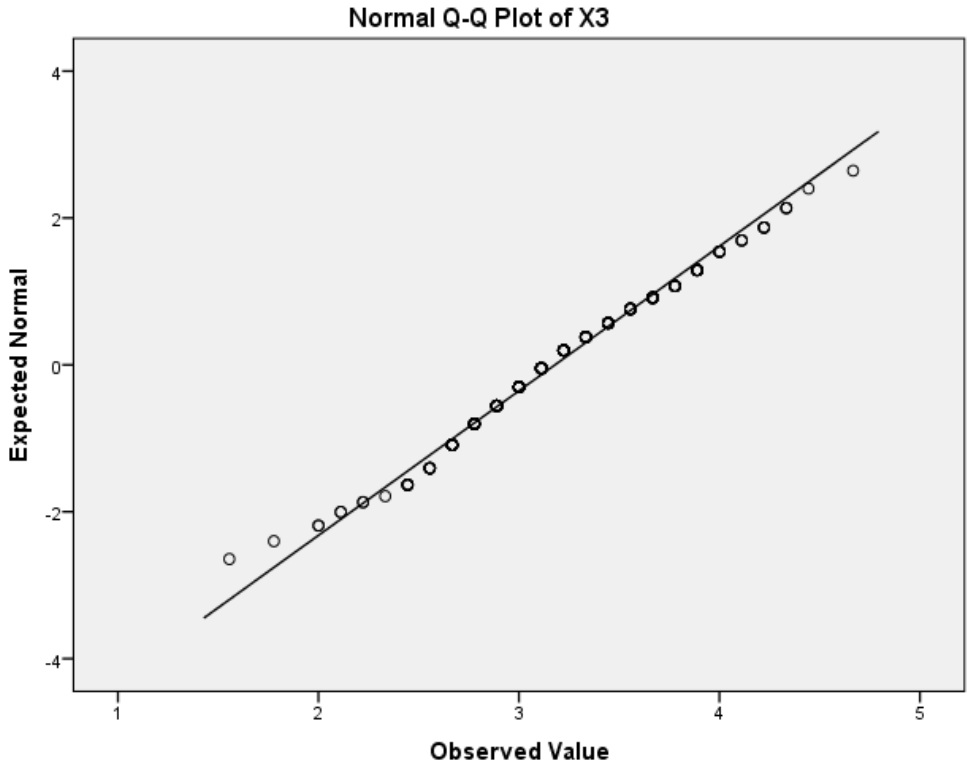

Figure 4. 4: Q-Q plot for Behavioral Factor

Although the technical factor and behavioral factor returned a P-value less than 0.05 in the Shapiro-Wilk test for normality, the Q-Q plots shows that apart from some few cases the data collected fits along the line of best fit. From the observations made in the Q-Q plots for X_2 and X_3, it true to say that, even when this study results indicate that the null hypothesis (H_{02}, H_{03}) need to be rejected, the data on the perceived technical and behavioral factors does not so much deviate from the normal distribution. This study proceeded for further analysis with the treatment that the data on X_2 and X_3 as can be seen from Figure 4.6 and Figure 4.7 closely approximates a normal distribution.

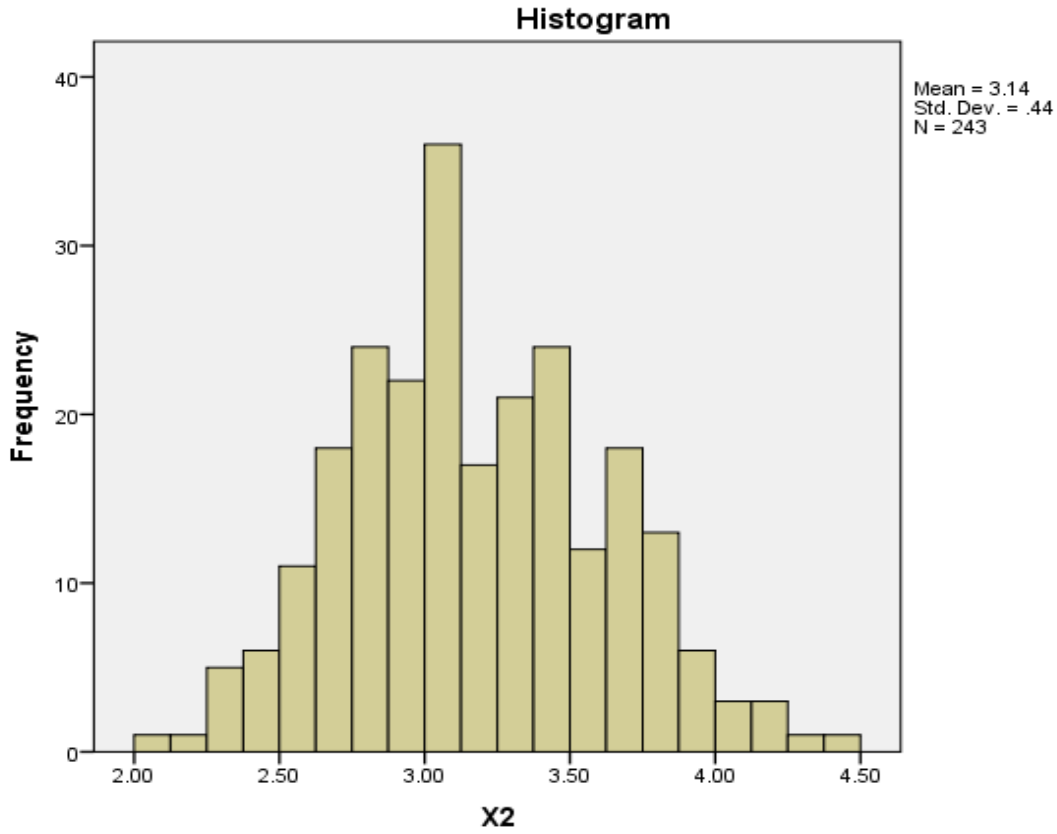

Figure 4. 5: Histogram on Technical Factor Data Distribution

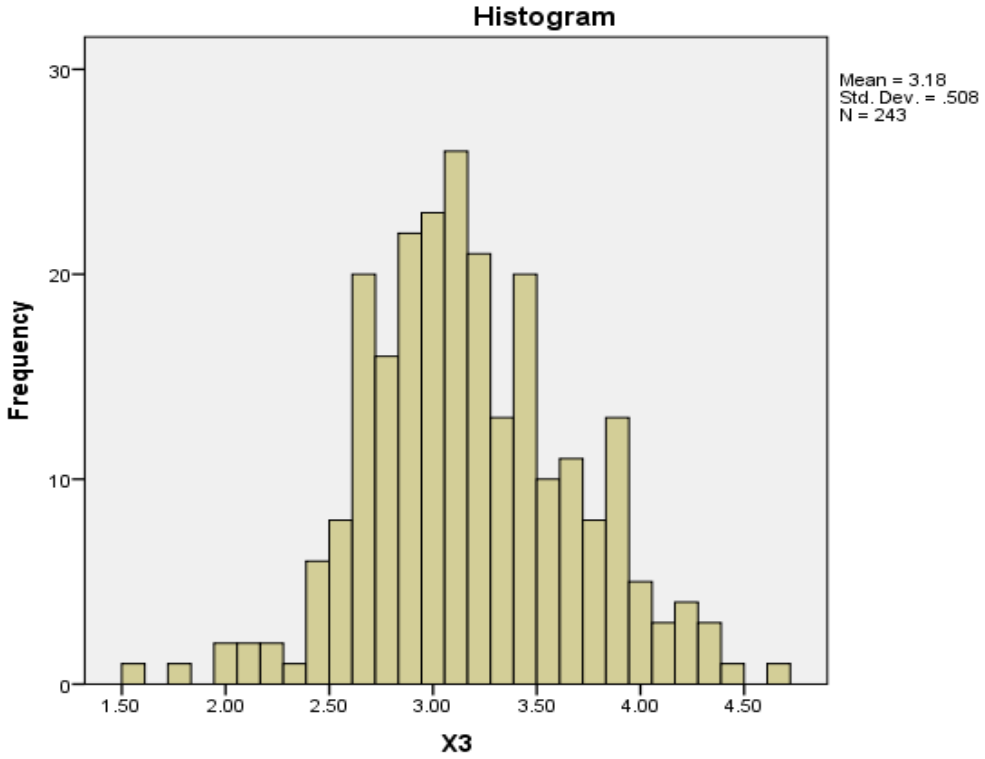

Figure 4. 6: Histogram on Behavioral Factor Data Distribution

4.3 Influence of Organization Factor on Integration of HMIS

4.3.1 Descriptive statistics on the organization factor

Organizations are made up of people, processes and equipment's. All this work together to enable achievement of set organization objectives. Organizations cannot be without resources. The study results indicate that the respondents agreed with the following statements describing the organization factor: all persons attending to patients undertake to record data they collect either manually or electronically (mean, 4.26), the data we collect is in line with the prescribed templates (mean, 4.14), we use the provided templates for essential data collection at every service point (mean, 4.08), every patient goes through a series of well-organized process to ensure services are well delivered (mean, 3.82), we have multiple data sources in the facility (mean, 3.82), the management gives information generated from the HMIS preferences (mean, 3.69), the

HIS policy has strongly strengthened the regulatory of HMIS in our facility (mean, 3.52), we have a guideline for data management (mean, 3.50), I am fully aware of the HIS policy provided by MoH in the year 2010 (mean, 3.47).

On the other hand respondents disagreed with the following statements on the organization factor: we have one of the best sustainability strategy in place for the HMIS in place (mean, 2.72), our HMIS is well aligned to our organization structure (mean, 2.70), I implement the HIS policy fully (mean, 2.64), the storage capacity that we have for records is enough (mean, 2.35), with help of the available HMIS we are able to share information within the facility at all times (mean, 2.28), the management provides technical assistance to ensure reports are comprehensive (mean, 2.28), we have an automatic power backup when needed (mean, 2.26), we have timely support in case system fails (mean, 2.19).

The Key Informant Interviews done with the sub-county and county HRIO confirmed that the government gives healthcare facilities support in HIS activities by providing data collection and reporting tools. One of the county HRIO said, “The ministry of health has been facilitating trainings on how to process data. However the support has not been adequate due to constraints of resources”. The greatest challenge presented in the KII was about frequency in the introduction of new data collection tools. This means lack of consistency in reporting because most of the times new data sets were introduced. The HRIOs also confirmed that as much as the government was providing data tools, they were paper based and too bulky due to data duplication. Health workers preferred that the government introduces electronic tools. This finding implies that the government was acting contradictory to the policy they had provided that was

emphasizing on need to embrace technology considering they were the key resource providers.

The need for continuous resource provision for HMIS maintenance and updates was still on the higher side according to one of the county HRIO. The interview findings also indicated that integration of HMIS had not been achieved because managers were not keen to ensure that the HIS policy was fully implemented. Respondents also believed that data collection strategy would be well-coordinated if the HMIS tools were electronic. The county HRIOs also said parallel reporting systems should be completely avoided. This study suggests well-structured feedback mechanisms in the effort to curb some of the challenges reported. This would enhance information-sharing and team work. From this finding it is clear that in order to be effective, an organization has to expand its operation to reflect systems thinking, synthesis and alignment. Unfortunately this is currently lacking in the health sector in Kenya. This is evident from the findings that prove there is use of the different sub-systems operating autonomously. To achieve integration of HMIS efficiently, this research advocates for adoption of an aligned data collection strategy that supports the use of evidence-based practices and enhancing team work through sharing information for informed decision making. This view is also supported by (Koiskinen, 2012) who emphasized on the need to adopt integrated information systems to enable smoother coordination in healthcare service delivery. Therefore, adopting and implementing an integrated health management information system that provides comprehensive information for decision making is a step towards the right direction (Xiang-Hua *et al.*, 2006).

The factors of organization factor were grouped to measure the identified organization factors the HIS policy, Data collection strategy and management support. The scores were summed up for each specific factor. The total score was divided by the total number of indicators to give a composite mean of each specific indictor. The descriptive statistics on each organization factor were presented by mean scores and standard deviations as indicated in Table 4.4

Table 4. 4: Composite Mean Scores for the Specific Organization Indicators

	HIS Policy	Data Collection Strategy	Management Support	Organization Factor
N	243	243	243	243
Mean	13.1358	27.4486	13.1276	53.7119
Std. Deviation	1.95668	3.47726	3.01034	5.63850

a. Multiple modes exist. The smallest value is shown.

Study findings showed that respondent's average agreement score to adherence to HIS policy was 13.1, average agreement score that their healthcare organizations had a data collection strategy was 27.4 and average agreement score that management supported HIS activities was 13.1. This implies that data collection strategy had a higher agreement mean score as compared to adherence to HIS policy and management support. This study finding implies that respondents were aware that there were policies in place guiding HMIS activities however they were not adhering to those policies fully. This finding is in agreement with findings of a study done in Iran that reported compliance to policies in place to guide HIM was not effective (Raeisi *et al.*, 2013). Non-compliance to policy plays a big role in the performance of an organization. This finding explains disconnect observed between policy priorities and the actual

implementation. This was a concern not only in this study but also in a study done in India (Madon, Sahay, & Sudan, 2007). When policies are not in compliance with the happenings on the ground there is also a likelihood that transparency in informed decision making is hindered.

The average agreement score that there was a data collection strategy in place was 27.4, despite the fact that the strategy employed was not embracing timeliness in reporting, accuracy and no set minimum standards. New data collection tools were frequently introduced to health workers hence inconsistency in the data set standards. The data collection strategy had a lot of repetitive data leading to data redundancy and overburdening the staff. These findings are similar to findings of studies done in Ghana, Mozambique and Rwanda showing constrains arising due to duplicate, parallel data collection strategies (Mutale *et al*., 2013). This therefore beats the purpose of data collection, meaning the resources used to facilitate data collection were actually going to waste. This study therefore is in agreement with the study findings of a study done in Finland suggesting integration of HMIS for smoother coordination of data collection (Koskinen, 2012). Use of minimum data sets based on the identification of essential information needed by health workers is also an essential concept in the integration of HMIS (WHO, 2006).

Average agreement score that management supports HIS activities in the health sector was 13.1. This implies that there is an attempt to support HIS activities however the support is not adequate. This finding is in agreement with Kimama's, 2011 study findings done in Nairobi, Kenya which found that facilities lacked the most important resources for data processing. In Kimama's study he also reported low managerial

priority in things to do with HIS activities. Regression analysis however predicted that management support had the highest significance level in facilitating the achievement of integration of HMIS. This finding was in agreement with the findings of Aquil *et al*., 2009 and WHO 2008, who proposed that healthcare managers need to cultivate strategies which enhance support in the activities of Health Information Systems.

The overall analysis on whether the organization factor had an influence on Integration of HMIS had an average agreement mean score of 53.7. This means that, the organization factor is quite an important factor in influencing the integration of HMIS. Considering the dynamic healthcare environment today, greater potential in healthcare organizations can be achieved if a clear policy is established with a clear vision of where the organization wants to be. A policy provides direction that the organization should take hence it is important for the management to communicate that it while casting the organizational vision to staff. Management should involve all stakeholders in the process and empower staff to actualize the vision. This can be well achieved if the data collection strategy was well aligned with the health system structure (Nyella, 2009).

4.2.2 Bivariate Correlation of Specific Organization Factor

Table 4.5 show the specific organization factors identified had a significant relationship with the integration of HMIS. The study found out that: Management support ($r= .545^{**,}$ $P<.001$), data collection strategy ($r= .330^{**,}$ $P<.01$), HIS policy ($r= .222^{**,}$ $P<.001$) had a significant and positive relationship with the integration of HMIS. Their P values were < 0.001. Under the specific organization factor variables, the strongest association was found to be between management support and integration of HMIS ($r= .545^{**,}$ $P<.001$) with a moderate relationship with data collection strategy ($r= .330^{**,}$ $P<.001$) and a

minimal relationship with the HIS policy (r= .222**, P<.001). This study finding confirmed the findings in previous studies that emphasized that awareness of policy was not enough but the implementation of it becomes the game changer (Koisen 2012). The study findings also confirmed that there are different data sources as reported by (Sherbune, 2010). However benefits of the data can only be realized if it was well-utilized by avoiding parallel information systems. This study agrees with other researchers that information is power and only useful if shared and disseminated to others (WHO and ROWP, 2004).

Table 4. 5: Bivariate correlation of specific organization factor

		Policy	Data collection Strategy	Management Support	Organization Factor	Integration
Policy	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	243				
Data Collection Strategy	Pearson Correlation	.024	1			
	Sig. (2-tailed)	.712				
	N	243	243			
Management Support	Pearson Correlation	.285**	.149*	1		
	Sig. (2-tailed)	.000	.020			
	N	243	243	243		
Integration	Pearson Correlation	.514**	.705**	.725**	1	
	Sig. (2-tailed)	.000	.000	.000		
	N	243	243	243	243	
	Pearson Correlation	.222**	.330**	.545**	.572**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	243	243	243	243	243

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

H_{o1}: Organization factor has no significant influence on the integration of HMIS in Kenya. This hypothesis intended to test whether there was any significant influence of organization factor on Integration of Health Management Information System. The hypothesis H_{01}: $\beta_1 = 0$ Versus $H_1=\beta_1 \neq 0$ was tested. The researcher found out that there was a significant and positive relationship between organization factor and integration of health management information system ($r = .572^{**,}$ $P<.001$). This leads to rejection of the null hypothesis (H_{o1}) and the acceptance of alternative hypothesis (H_1). This study, therefore, concludes that organization factor has a significant positive relationship with the integration of HMIS.

A regression analysis test was further done to test the model fitness and to also help in predicting whether the outcome (dependent variable) would improve i.e. (Integration of HMIS) if there was an increase in investment in the independent variables. This was done using linear regression (one predictor) and several predictor variables under each independent variable (multiple regression).

Table 4.7 shows the univariate linear regression model $Y = \beta_0 + \beta_1 X_1 + \varepsilon$ used to determine the influence of organization factor which on integration of HMIS. Results show that, F $(_{1, 117.106})$, $P < .01$. This result shows that there is less than a 0.1% chance that an F-ratio this large would happen if the null hypothesis was true. Therefore, the study concluded that the regression model was significantly a good in explaining total variations in integration of HMIS.

Table 4. 6: Organization Factor: Model Validity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	40610.075	1	40610.075	117.106	.000[b]
	Residual	83573.810	241	346.779		
	Total	124183.885	242			

a. Dependent Variable: Integration of HMIS
b. Predictors: (Constant), Organization Factor

The study revealed that organization factor accounts for 33.6% of the total variations in the integration of HMIS (R^2 =.336), as indicated in Table 4.7. Looking at the result, the β_0 is 51.159, meaning that when the organization factor is at a constant (when X = 0), the model predicts that 51.159 integration will still take place. However when organization factor changes then integration will also change by 2.297, as shown in Table 4.7. Therefore, if our predictor variable is increased by one unit (if the organization factor is increased by 1), then our model predicts a 2.297 increase in integration. The results in Table 4.8 indicate that organization factor has a positive and significant influence on the Integration of HMIS. This means that how an institution chooses to organize itself affects how well integration of HMIS will be achieved. This study finding concurs with observations and conclusions made by earlier scholars in HIS that organization factor influence the integration of HMIS in an institution (Koskinen, 2012), (Sherburne, 2010), (Xiang-Hua *et al.*, 2006) (Nyella, 2009).

Table 4. 7: Organization Factor and Integration of HMIS: Regression Weights

Model		Unstandardized Coefficients		Standardized Coefficients	R^2	t	Sig.
		B	Std. Error	Beta			
1	(Constant)	51.159	11.466			4.462	.000
	Organization Factor	2.297	.212	.572	.336	10.822	.000

a. Dependent Variable: Integration of HMIS

The result in Table 4.8 shows that the model containing the three organization factors were found to be valid.

Table 4. 8: Specific organization factor: Model Validity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	45466.815	3	15155.605	46.015	.000[b]
	Residual	78717.070	239	329.360		
	Total	124183.885	242			

a. Dependent Variable: Integration

b. Predictors: (Constant), Management support, Data collection strategy, HIS policy

Table 4.9 implies that in a combined relationship of the indicators under the organization factor variable, data collection strategy and management support makes a significant contribution to predicting integration of HMIS however HIS policy does not. This implies once the management fully supports the HIS activities, data collection strategy will automatically be streamlined. Then once everything is up and running well the HIS policy automatically becomes governing.

Table 4. 9: Specific organization factor: Regression Weights

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	69.054	12.119		5.698	0.000
	HIS Policy	0.9	0.622	0.078	1.447	0.149
	Data Collection Strategy	1.668	0.339	0.256	4.916	0.000
	Management Support	3.648	0.409	0.485	8.921	0.000

a. Dependent Variable: Integration of HMIS

A comparative analysis of past studies indicated that some of the findings of the current study are consistent with the works of several scholars who attempted to relate the specific organization factors and the integration of HMIS, while others were not. In regards to HIS policy, literature reviewed had argued that most HIS policies in place meant to guide integration of health management information system were not effective because people had no knowledge neither were they aware of the existence of such policies. This current research findings agreed with that statement partially because some improvements were observed. The respondents reported that they were aware of the existence of the policy but confirmed that they were not implementing it fully. Data collection strategies in place included every person attending to a patient collecting data either manually or electronically.

The government had provided standardized data collection tools which were in the form of manual registers, data reporting tools were also provided to sub county and county HRO's who extracted data from the different types of register for example (MOH 405-Antenatal care, MOH 406-Postnatal care, MOH 510-immunisation register, MOH 333-maternity Register, MOH 301-Inpatient Register, MOH 710-Integrated Immunization

and Logistics summary, MOH 731- Comprehensive HIV/AIDS facility reporting form, MOH 728-CT Tally sheet, MOH 711 – Integrated RH, MCH, Social Work & Rehab Summary, MOH 204- Outpatient Register: Under 5years, MOH 204B- Outpatient Register: over 5years, MOH 240-Laboratory Register, MOH 366- HIV-care and treatment, MOH 361A- Pre-Art Register, MOH 733B- Facility monthly summary for nutrition service, Drug Movement Register- Injectable, Antibacterial & Insulin Register, Artemether-Lumefantrine Dispensers Book, MOH 204-Diagnosis/Treatment Register, MOH 514-Community health workers service delivery log book just to mention but a few).

KII done with sub-county HRIOs confirmed that the health system in Kenya is organized in four tiers of care based on the scope and complexity of services offered. This implies that there are different data sources. Tier one is made of the community units. Their function is to mainly promote health through health education, treatment of minor ailments, and identification of cases for referral to health facilities. Tier two comprises of Levels two (dispensaries) and three (health centers), they offer primary healthcare services which are basic outpatient care, minor surgical services, basic laboratory services, maternity care, and limited inpatient facilities. Tier three is made up of Levels four and five, the secondary referral facilities and form the county referral facilities. They offer a broad spectrum of curative services, and some are also health training centers. Tier four facilities are made up of level 6 (MoH 2010). This tier was not investigated during this study because the three counties studied did not have this kind of health organizations. This implies that the health system is made of 4 different broad subsystems and within the four subsystems we also have different functions which make other subsystems. The study findings also revealed that the referral strategy

was not fully functional hence patients would seek care for minor illness even in the tier 3 facilities hence congesting the facilities that should instead be administering specialized care to patients. This could be streamlined if integration of HMIS was achieved.

The biggest impediment with the registers was the duplication of data in the provided registers which made it very difficult for the Health workers to collect quality data. This became a challenge for health workers because it required them to use the information collected while overburdened with too many tools as supported by (Meier, Fitzgerald & Smith, 2013). One of the medical officers in Kitui County said, "Having manual registers makes it very difficult to share timely data within the organization and with other partners." This finding is similar to studies done previously that state that it is often difficult to achieve coordination of data collection among governmental units, even among adjacent healthcare service providers that perform similar functions. This becomes an obstacle to the use of evidence-based decision making therefore rendering efforts made towards interventions to improve the health system performance mostly not fruitful. This is because donor policies tend to support implementation of vertical programs which maintain their own management structures and information systems which is still happening in the Kenya Health system as pointed out before by (Barker *et al*., 2014; Kiberu *et al*., 2014, 2014; Kyalo & Odhiambo-Otieno, 2017; Odhiambo-Otieno, 2005b). Nyella, 2009; WHO, 2006) however had proposed that partners must agree that coordination with other healthcare providers was important. Integration through data management, datasets from all programmes should be combined and streamlined by sorting out overlaps, gaps and inconsistencies. Findings also indicated that data collected was not shared in a timely manner and therefore this finding concurs

with the WHO, 2007 report that delayed information reporting affects decision making. The study proposes the following computerized data collection strategy (Figure 4.7).

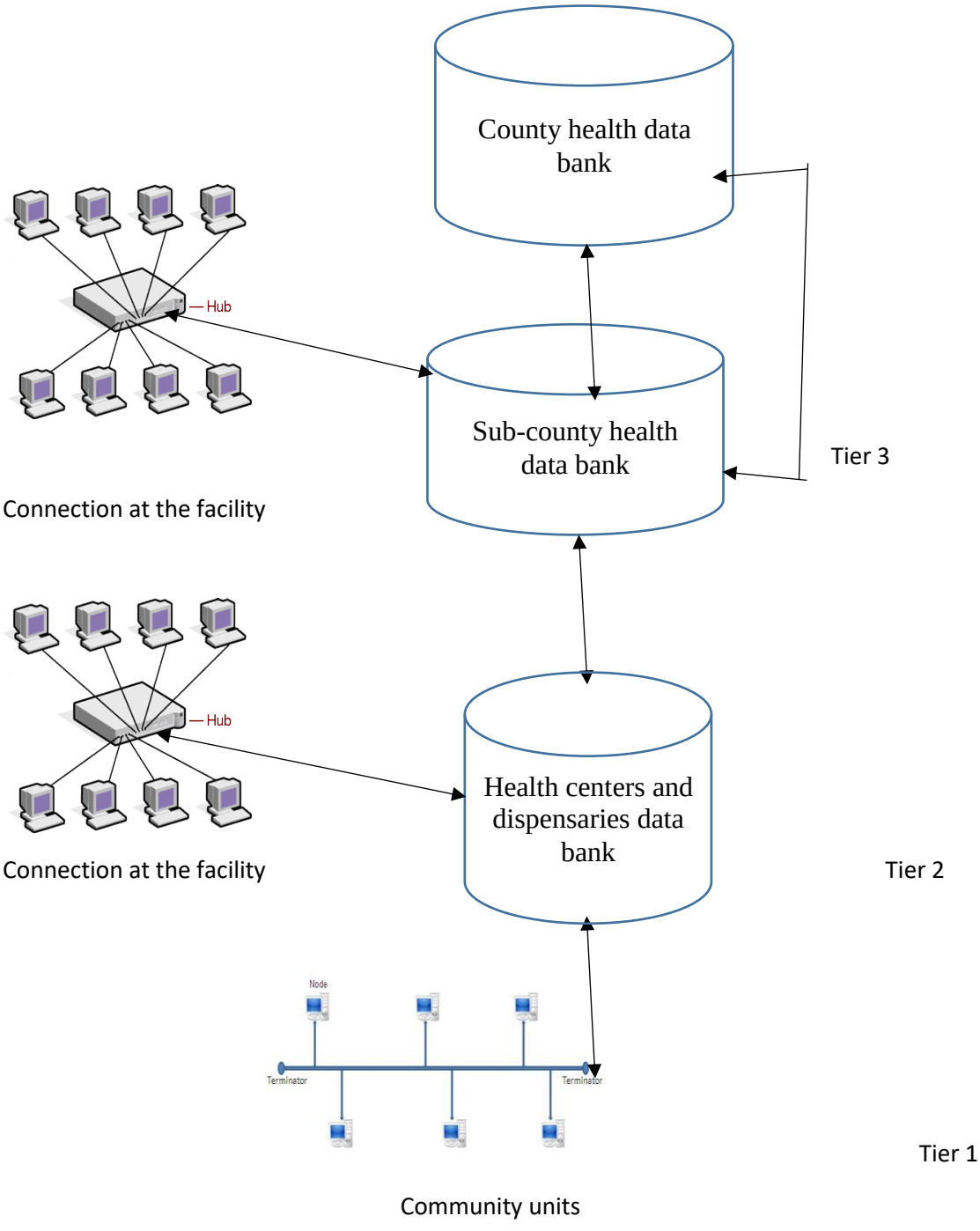

Figure 4. 7: The Proposed Data Collection Strategy

Findings in Table 4.9 show that management support had a positive and significant influence in achieving an integrated HMIS. A study done by (Xiang-Hua *et al.*, 2006)

on Management Information Systems found that in order to be successful in managing information, the different sources of information from public healthcare providers' become important and critical. Successful implementation of IHMIS requires the cooperation and commitment of the different partners, developing cordial relationships and partnerships. This can only be achieved when the management is supportive. The study findings support the findings of Bill & Melinda 2015, who identified management issues, such as, commonality of objectives, desirability of establishing a long-term relationship from a business perspective, partners' willingness to participate, technical compatibility and Technical expertise of the partners to be important for a system that desires to have IHMIS.

This study therefore concludes that most policies in place guiding the HMIS were not effective because people were either not aware of the policies or they were aware they existed but did not have knowledge on what exactly the policies were all about. These study findings prove that health workers were aware of the HIS policy provided by the MoH but they did not implement it fully. The study also established that there was a data collection strategy in place in the Kenya health system and according to the respondents it was effective. However in the real sense, information-sharing was not done in real time and because respondents were comfortable with what they were used to, they did not see any issues with current status. This clearly reflects that the unknown has no effect on anyone or anything. However if the health workers knew or had a taste of the full benefits of having an integrated HMIS their behavior would not be the same.

The study showed that the management supported HIS activities by providing data collection tools. However these were bulky, repetitive and not easy to analyze. KII

reported that minimal support was provided in information generation and use. This therefore implies the need to reinforce the policy in place for integration to be successful, data collection strategy should be made easier by moving from paper based tools to electronic data collection tools. This would assist in ensuring duplication of data was avoided hence standardization of data needed would be easy to achieve. If the management emphasized on real time information-sharing for effective decision making this would speed up the integration of HMIS. The norm that monthly reporting is acceptable has led to laxity in providing quality data collection and information-sharing hence the need to for an IHMIS is not viewed as urgent. This has hindered the achievement of IHMIS.

The KII findings also showed that healthcare workers worked hand in hand with each other, and that data collection strategy employed in the Kenya Health system involves each person attending to a patient, recording data they collect either manually or electronically. KII also confirmed that, government provides the health workers with standardized data collection and reporting tools that they use to capture and disseminate data. The challenge arises because these tools are in the form of registers which in addition have duplicated data fields which are quite tedious for the health worker. This then hinders integration of health information leading to challenges in coordination and control of organization processes. This findings therefore agree with (Koskiden, 2012) that paper based tools makes information-sharing a challenge. The study also confirmed that there are different sources of data made up of the different health service providers as well as different health information systems adopted by the different facilities. This confirms that data is still in silo systems as reported by WHO (2007). This therefore

overburdens the health workers hence there is minimal use of information in monitoring performance at the different care levels.

4.3 Influence of Technical Factor on Integration of HMIS

4.3.1 Descriptive statistics on the technical factor

The respondents agreed with the following statements: there has been the need to establish linkages with all data sources in the facility (mean, 4.20), most of our staff members understand the benefits of using evidence based information for decision making (mean, 3.95), information collected by our health workers is often used by the hospital management team (mean, 3.72), there are on job trainings for health workforce to analyze and utilize information (mean, 3.66), our health workers always embrace HMIS technology (mean, 3.53), the existing data collection tools are always user friendly (mean, 3.51),

However respondents disagreed with the following statement: our facility recruits high experienced professionals in every department (mean, 3.40), all facilities performing well in our county, have a well-functioning integrated HMIS (mean, 3.16), professional development is often provided for Health Records Officers (mean, 3.05), our facility ensures that the subsystems run by the different health programmes are integrated (mean, 2.96), data from the various data sources are well organized in one database (mean, 2.96), I reconcile information from the different data sources on time (mean, 2.70), transmission of information to the national referral hospitals about our patients is well facilitated by HMIS (mean, 2.62), the staff numbers in our facility are adequate to enable the facility perform its daily functions (mean, 2.55), we have adequate

computers to use in managing data collection, analysis and dissemination of information (mean, 2.18), the internet connection in our facility is always available mean, 2.15).

To interrogate the technical factor further the composite means were developed by summing up the scores of the specific factors under the technical factor. Three indicators were addressed; Human Infrastructure, Information Technology Infrastructure and Systems Interoperability. Table 4.10 indicates the composite means scores and standard deviations. All the 243 respondents participated in giving their opinions on this variable by indicating their agreement level. Respondents' average agreement score that they had adequate and qualified human resources was 23.9. On whether their organizations had a reliable Information Technology Infrastructure the average agreement score was 6.9 and the average agreement score that the health information systems were interoperable was 19.5. This finding implies that information technology infrastructure was the weakest hence systems interoperability automatically became a challenge. The human infrastructure however had a moderate score. The overall analysis on technical factor shows an average agreement score of 50.3 meaning there is an attempt in supporting the human infrastructure, IT infrastructure and systems interoperability in public facilities. However more efforts needed to be made.

Findings in this study as indicated in Table 4.10 show that human resources for health were fairly distributed. However it was evident from KII that most did not have the right capacity for data analysis. This finding is in agreement with other study findings. For instance lack of computer literacy and brain drain are some of the human resource challenges reported by (Wave, 2009). Health information systems were not meeting the

needs of the users hence the users were not so keen in using the data collected. This finding was in agreement with the finding of (Chaulagai *et al*., 2005a) who reported that a good information system should be capable to meeting all the users' needs. The users' needs can be identified through involving them in designing the system. This will facilitate developing constructive systems with an understanding of operative work flow and technical considerations (Wanderer & Ehrenfeld, 2013).

Information Technology Infrastructure was found to be the weakest pillar under the technical factor, yet the most important in the integration of HMIS as observed in other studies ((Eze *et al*., 2013; Kiberu *et al.*, 2014; Chaulagai *et al.,* 2005b). The reliability of the IT infrastructure is quite critical because frequent down-time leads to lack of trust in the system (Craighead *et al*., 2006) and service delays.

Table 4. 10: Mean and Standard Deviation of the Technical factors

	Human Infrastructure	Information Technology Infrastructure	Systems interoperability	Technical factor
N	243	243	243	243
Mean	23.8519	6.9465	19.4856	50.2840
Std. Deviation	3.79466	2.47492	2.71109	7.04748

Technical factors include both technology and human infrastructure. These are resources management uses to achieve its goals. IT resources include; hardware, software and data while human infrastructure includes human and organizational skills, expertise, knowledge, commitments, values and norms (Aladdin *et al.,* 2014). Integration of HMIS is largely affected by how well a health institution has matched its

health workers knowledge and understanding about the job and also the ability to use the tools availed to them to make their work easier so that the production levels increases. HOs can perform better with quality and resourceful people. Developing IHMIS continues to be a challenge as found in this study. These findings agree with the finding of (Wanderer & Ehrenfeld, 2013; Zhao&Xia, 2014). The major challenge with Integration of HMIS in the health system in Kenya is inadequate use of ICT in healthcare and unskilled health workforce as indicated in Table 4.10. Use of ICT supports organizations to yield maximum work output for minimum energy input by the worker. Therefore this study advocates for more investment in capacity development and training in technological, communication and content development of skills to ensure more successful integration of HMIS.

IT infrastructure consists of software, hardware and networking. This study found out that IT infrastructure in the public health facilities was quite weak. This finding agrees with a study finding on LMIC that presented that most facilities use paper-based health information, therefore scanty investment on IT infrastructure (Haux *et al*., 2007; Lium *et al*., 2008).

4.3.1 Test of Hypothesis Two

H_{o1}: Technical factor was likely not to have an effect on integration of HMIS. This hypothesis intended to test whether there was any significant influence of technical factor on integration of Health Management Information System. The hypothesis H_{01}: $\beta_1 = 0$ Versus $H_1=\beta_1\neq 0$ was tested.

Table 4.11 shows study findings on the specific factors identified under the technical variable. The results indicated that: Human Infrastructure (r= .557**, P<.01), IT infrastructure (r= .635**, P<.01), System Interoperability (r= .644**, P<.01) were all positively and significantly influencing integration of HMIS. The findings indicated that the strongest correlation under the technical factor was between Systems interoperability and integration of HMIS. Health information systems are interoperable when there is free and flawless information exchange in an organization. This is however not the case in the health system in Kenya because of the use of paper-based information systems and in addition the facilities are required to submit their reports on the 5th of every month.

Table 4. 11: Specific Technical Factor: Correlation Coefficient

		Human infrastructure	IT Infrastruc-ture	System Interope-rability	Integration
Human infrastructure	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	243			
IT Infrastructure	Pearson Correlation	.327**	1		
	Sig. (2-tailed)	.000			
	N	243	243		
System Interoperability	Pearson Correlation	.414**	.531**	1	
	Sig. (2-tailed)	.000	.000		
	N	243	243	243	
Integration	Pearson Correlation	.557**	.635**	.644**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	243	243	243	243

**. Correlation is significant at the 0.01 level (2-tailed).

The researcher further conducted F- statistical analysis to access the significance level of technical factor. The study found out that the F-ratio was 351.973 which is significant P<.001 as shown in Table 4.12. This result implies that the null hypothesis will be

rejected and the alternative hypothesis accepted. Therefore, the study concludes that the technical factor is a good predictor of integration.

Table 4. 12: Technical Factor: Model Validity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	73712.287	1	73712.287	351.973	.000[b]
	Residual	50471.598	241	209.426		
	Total	124183.885	242			

a. Dependent Variable: Integration of HMIS
b. Predictors: (Constant), Technical Factor

The study further revealed that Technical Factor explains 60.9% of the total variations in the integration of HMIS (R^2 =.609), as indicated in Table 4.14. The coefficients in the regression model in Table 4.14 indicate that technical factor will always exist at a certain minimum (β_0=50.034, P<.01). However a change in the technical factor would also bring positive and significant change, β_1 as indicated in Table 4.13 shows an increase in integration of HMIS by 2.476. This implies that when the technical factor improves, then integration of HMIS will also improve by 2.476.

Table 4. 13: Technical Factor: Regression Weights

Model		Unstandardized Coefficients		Standardized Coefficients	R^2	t	Sig.
		B	Std. Error	Beta			
1	(Constant)	50.034	6.702			7.465	.000
	Technical Factor	2.476	.132	.770	.609	18.761	.000

a. Dependent Variable: Integration of HMIS

The study further broke down the specific technical factor parameters and subjected them to multiple linear regression analysis and all the parameters were predictive of integration of HMIS as shown in Table 4.14. Results indicate that Human Infrastructure, IT infrastructure and System Interoperability in a combined relationship still remained as good predictors to improved integration of HMIS. Therefore the increase in one unit of the specific variables would also lead to an increase in the integration of HMIS.

As shown in Table 4.14 Human Infrastructure is a good predictor of integrated HMIS. This study therefore agrees that Healthcare professionals across different organizations need to understand data processing, equipment in use and be knowledgeable and skilled for integration of HMIS to be achieved. Otherwise, unintended consequences arise when adapting to IHMIS if employees are not well informed about the systems as reported by (Aladdin *et al*., 2014).

Table 4.14 results confirm that Systems interoperability is a crucial organizational capability that enables firms to manage information systems (IS) from unrelated working partners to a value net-work (Zhao & Xia, 2014). KII findings also revealed that most of the data collection and reporting tools were paper-based hence explaining why interoperability has been a big challenge. The researcher also observed the co-existence of both the manual and automated processes. This was quite strenuous for the health workers because they had to extract data from a number of paper tools and transfer it to the DHIS2 software. That is why unintended consequences including communication breakdown, creation of more work and even adverse events such as medical errors keep occurring (Aladdin *et al*., 2014). The multiple information system

designs (paper-based and electronic) makes it difficult to achieve interoperability. Systems interoperability is a crucial organizational capability that enables firms to manage information systems. Two critical paths reported to be important in enabling interoperability include standardizing data tools through automating them and the community readiness to adopt change (Zhao and Xia, 2014).

Integration of HMIS continues to be a challenge as confirmed in this study findings because internet connection, power issues and availability of computers was a big challenge in the HOs. Low and Middle Income Countries use paper-based data collection processes at primary healthcare level and computer-based health information systems at county level. This is a great hindrance to integration of HMIS (Haux *et al*., 2007).

Results in Table 4.14 prove that IT infrastructure is also an important factor and IT impacts an organization positively if it is reliable. In this study, indicators of a reliable IT infrastructure included accurate data, well-maintained systems, internet connectivity, and availability of power and the capability of the hardware. However, most of the HOs studied were using paper-based information systems hence the aspect of IT infrastructure was not given any weight. About 60% of the healthcare organizations studied did not have computers neither internet connectivity. This finding concurs with the findings of Kimama, 2011, that showed most of the healthcare facilities in Kenya were operating with paper-based information systems. However study findings predict that an increase in the integration of HMIS would occur if IT infrastructure improved. This is an indication that IT infrastructure is quite fundamental in the efforts towards the integration of HMIS. This implies that the HO need to

examine and re-adjust their technical factor to be in line with the changing healthcare environment and realign with the new technical factor requirements for integration of HMIS to be achieved.

Table 4. 14: Specific Technical factors predictors with integration of HMIS

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	55.262	7.603		7.269	.000
	Human Infrastructure	1.808	.268	.303	6.750	.000
	IT infrastructure	3.317	.441	.362	7.516	.000
	System interoperability	2.726	.418	.326	6.519	.000

a. Dependent Variable: Integration

The KII with the Sub County and county management team member's results confirmed what most of the respondents had pointed out. There was shortage of human resources in most of the facilities and therefore health workers were mostly overloaded with work. There was general lack of capacity in analysis and interpretation of data. The counties were making attempts to conduct on-job trainings. However, they were not intensive due to lack of resources. A skilled work force is an essential ingredient for effective integration of HMIS in healthcare. Systems professionals, service providers and team leaders in HMIS activities with high skills levels and experience in an organization are important components. However, as reported by one of county HRIOs, most of the healthcare facilities lacked team leaders for HMIS activities. The in-charges were left to handle HMIS activities yet they had other responsibilities which were more important to them.

The KII respondents confirmed that plans were underway to improve on Information Technology Infrastructure in the counties. The county managers were aware there was need to boost the IT infrastructure. There was also an agreement that there was need to automate and standardize the paper-based HMIS, there was need to involve the healthcare personnel in the identification of HMIS activities, ensure internet connectivity was enabled in the healthcare facilities. The challenge was however resources. The need to increase the number of computers and ICT systems was identified. More so the respondents felt there was need for the health system to build more capacity in Health Information Managers who can keep track of the current and future technology needs. Other key challenges pointed out by KII that affect the operation of HMIS included unreliable power supply and internet connectivity. This was a problem that cut across all the three counties.

The study concludes that the counties need to deal with enabling fiber network, building access to reliable power supply, backups, and sufficient infrastructure. The better these things are functioning, the greater the chance for successful HMIS integration. Information systems for Health System should be accessible, compatible, user-friendly, stable and reliable, requiring minimal training and offering strong after-sales service (Petter, DeLone and McLean, 2008). This study observes the need for the health system to have systems that are easy to use, easy to learn, accurate, flexible, sophisticated, and have integration capability and customization. Therefore this study concludes that healthcare organizations in Kenya need to build collaborations in exchanging information, coordination of their business functions and processes. If this is acceptable among the healthcare providers then achieving interoperability and value networks becomes easy.

Finally, technical factor is a dynamic capability therefore healthcare organizations that are able to adjust their technical factor to the new changes will be able to achieve better results in their facilities. These findings concur with various observations and conclusions made by several scholars in Health Information System who have studied the technical factor. This study confirms the work done by Eze, Awa, Okoye, Emecheta and Anazodo (2013) who emphasises that technological factor is a key factor in IHMIS and it is unavoidable for HOs that want to develop and maintain effective management information systems in line with the current market. This study therefore concludes that technology adoption is crucial for improved integration of HMIS.

4.4 Influences of Behavioral Factor on Integration of HMIS

4.4.1 Descriptive statistics on behavioral factor

The results show that the respondents agreed with the following statement: our organization policy often permits us to share information with all the health care stakeholders (mean, 3.92), there are always changes in the regulatory environment on how to handle health information (mean, 3.63), healthcare restructuring which emphasizes on the need to share information is done in our facility once in a while (mean, 3.60). On the other hand respondents disagreed with the following statements: our facility is one of the best since proper planning is based on information shared with the management (mean, 3.32), the HMIS available makes us do double work (mean, 3.05), the HMIS available never limits information sharing ever (mean, 2.98), reconciliation in HMIS has always been easy (mean, 2.95), the donor driven programmes do not at all allow information sharing (mean, 2.61), the hospitals regularly publishes the reports we generate at the Ministry of Health website (mean, 2.55)

Composite means of two elements of behavioral factor were developed by summing up the scores of the specified factor giving the total score of each factor. The total score is divided by the total number of indicators to give a composite mean score of each specific indicator. Demographic Characteristics of the health workers, risks they associate with integration of HMIS and information culture. In addition to the presentations done in previous results, comparison of total means was used to test the significance of the health workers demographic characteristics in integration of HMIS.

Table 4.15 indicates that all the 243 respondents participated in giving their views on this variable by indicating their agreement level, which was presented to them in a Likert scale of one to five where 1 represents strongly disagree and five represents strongly agree. The respondents' average agreement score that they had fears/risks they associated with integration of HMIS was 15.2, average agreement score that they either used or shared information with other healthcare providers was 13.4 and the overall mean score on whether health workers behavior was affecting HMIS integration was 28.6. This finding presents that the information culture is quite weak in the health system in Kenya, despite the fact that 90% of health workers time is used in collecting data this finding is supported by (Garrib *et al*.,) (2008) who said health information is not often used by stakeholders. (Kihuba *et al.,* (2014), confirmed the same observation when their study rightly observed that rarely is sufficient consideration given to the amount of data collected in the health sector. This finding explains the malfunctioning witnessed in the health system. The failure to consider real time data while making decisions hinders the health system's ability to respond to priority needs throughout its structured levels of care (WHO, 2007). Inadequate information culture weighs down the efforts and resources used to generate health information.

The findings also presented that there are risks health workers associate with HMIS integration. Information culture was the weakest factor. Some of the risks were selfish for example fears of losing their jobs if the system functions well and fears of having to learn new ways of doing things. Other reported risks included costs of operating the systems, fears of conflict of interest between political and administrative leadership. These risks had been reported previously in other studies (Qazi *et al*., 2008).

Table 4. 15: Means and standard deviations for specific indicators on behavioral factor

	Risks	Information Culture	Behavioral factor
N	243	243	243
Mean	15.2346	13.3786	28.6132
Std. Deviation	3.14763	2.33299	4.57158

4.4.1 Test of Hypothesis Three

H_{o1}: There was no significant relationship between behavioral factor and integration of HMIS. This hypothesis intended to test whether there was any significant influence of behavioral factor on Integration of Health Management Information System. The hypothesis H_{01}: $\beta_1 = 0$ Versus $H_1=\beta 1 \neq 0$ was tested. Two tests were run to determine the influence through the comparisons of means on the demographic characteristic of the respondents and correlation analysis on risks associated with integration of HMIS and information culture in the organization.

Table 4.16 confirms that the age of the health workers was statistically significant in the integration of HMIS. At $P < .05$. As shown in Table 4.16, it was also noted that,

majority (n=103) of the respondents were aged below 35 years, hence relatively young. Given that healthcare organizations operate within a dynamic and technology-driven environment, there is a high chance that, the younger the health workers are, the more flexible they are in mastering, reacting and adjusting to this environment swiftly. This means that if integration of HMIS had good stewardship achieving it would not be difficult. These study findings agree with those of (Tarak, 2012) whose study findings proved that workers between the ages of 18-45 were motivated to learn new things unlike workers of over 45 years old. It has been shown that the skills, risk tolerance and career dynamics of young workers can contribute positively to changing environment, in terms of achieving the integration of HMIS given that younger employees have had recent education and possess more current technical skills (Tarak, 2012).

Table 4. 16: Comparison of Total Means by Age

Age categories	N	Mean	Std. Deviation	Std. Error	f	df	Sig
<35	103	3.1219	.30859	.03429	102.328	3	0.000
36-45	85	3.3318	.33636	.03193			
46-55	33	3.8504	.07715	.01409			
> 55 years	22	4.2205	.19819	.04325			

Table 4.17 indicates that the overall model of age category was fit and significant in predicting the integration of HMIS. Age predicts integration significantly well (F= 273.955, P< .05).

Table 4. 17: Comparison of Integration of HMIS Means by Age Category

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	25.548	1	25.548	273.951	.000*
Residual	22.475	241	.093		
Total	48.022	242			

As shown in Table 4.18 education level had no significant relationship with the integration of HMIS. Therefore it was not a good predictor of integration. F=1.253, P>.05. Majority of the respondents had a diploma or degree certificate as indicated in Table 4.18. This clearly indicates that, it is not the level of education that will influence integration of HMIS. It is the benefits that come with it. Tarak, 2012, points out that the higher the education level, the more a worker wants to focus on what they are supposed to handle, if it is a nurse; nursing responsibilities only, a doctor the same. This explains why most of the workers who were trained to work as nurses were not keen on data quality despite high level of education. Majority of the secondary or primary certificate holders were volunteers at the community units with an additional basic training in community health. Since majority of the health workers in all the tiers have some basic education, it is possible to equip them to effectively support the implementation of an integrated health management information system through educating them on the benefits of having one so that whether the education level is high or not integration of HMIS will be supported.

Table 4. 18: Comparison of Total Means by Education

	N	Mean	Std. Deviation	Std. Error	F	df	Sig
Primary Education	30	3.4609	.52060	.09505	1.258	4	0.289
Secondary School	32	3.5216	.52159	.09220			
Diploma Certificate	144	3.3664	.41356	.03446			
University Education	37	3.3937	.42572	.06999			

Table 4:19 shows Years of service for this group had no significant influence on the integration of HMIS as shown in Table 4.19 (F=1.211, P>.05)

Table 4. 19: Comparison of Total Means by Years of Service

	N	Mean	Std. Deviation	Std. Error	f	df	Sig
1-10 years	162	3.4268	.48199	.03787	1.211	4	0.307
11-20years	49	3.4183	.36287	.05184			
21-30 years	21	3.2043	.36859	.08043			
31-40 years	9	3.3617	.27388	.09129			
Over 40 years	2	3.3319	.15321	.10833			

Table 4.20 shows that Professional training was found not to have any statistical influence on the integration of HMIS as shown in Table 4.20 (F=0.540, P>.05). Majority of the respondents were trained nurses with little or no training on how to handle health information hence its value as a strategic asset of an organization was not fully tapped into. Majority of the nurses who were interviewed in the study were of the view that health data capturing, processing and storage was not their responsibility. This finding is supported by the finding of (Tarak, 2012) whose study findings showed that the more educated a worker is in certain discipline the more they are not willing to do

anything out of their scope of work. The study therefore proposes that since health information generation and management is a subject that concerns every healthcare provider and it requires some technical skills, it is a subject that needs to be taken as part of the curriculum in the training of the health workers. As reported by (Ellis and Howard, 2011; Gillingham and Graham 2016; Mohammed and Yusof, 2013), it is important to involve people in an organization when preparing to introduce a new innovation to its people. This is done to build user acceptance. By involving them in the process they develop a positive attitude. (Qazi, Ali and Kuroiwa, 2008,) reported on hurdles faced in utilizing preexisting HMIS. The hurdles included dissatisfaction and confusion of employees over their roles and responsibility, reluctance of managers to release data, the absence of prerequisite human resources and the conflicts of interest between political and administrative leadership in the health system. Some of these hurdles are still experienced in 2017 as this study findings agree with those views.

Table 4. 20: Comparison of Total Means by Professional Training

	N	Mean	Std. Deviation	Std. Error	f	df	Sig
Community Health Volunteer	64	3.4117	.46989	.05874	0.540	4	0.706
Nurse	101	3.3847	.45574	.04535			
Clinical Medicine	34	3.3679	.37946	.06508			
Health Records Officers	41	3.4388	.44363	.06928			
Medical doctors	3	3.7185	.37846	.21851			

As shown in Table 4.21, the Behavioral factor correlates significantly with integration of HMIS ($r=.531^{**,}$ $P<.01$). The specific factors identified in this study also indicated that: Risks associated with integration ($r= .357^{**,}$ $P<.01$) and Information Culture ($r= .559^{**,}$ $P<.01$) were all positively and significantly influencing integration of HMIS.

These study findings indicated that the strongest correlation under the behavioral factor was between information culture and integration of HMIS. This implies that information is an important aspect in the healthcare organization but its value is not enjoyed as it ought to be. These study findings concur with the findings of (Gillingham and Graham, 2016; Helms and Stern, 2001; Mantzana *et al.*, 2010) who found out that-healthcare professionals spend a significant proportion of their working time collecting large amounts of client and patient data that is rarely analyzed and used at the point of collection. But because information is always demanded for as a routine, the health workers provide it as they obliged to, despite the use of the information provided being minimal. This implies that there is need to instill a culture of use of information generated. These findings agree with those of (Palvalin *et al*., 2013)

Study findings also indicate lack of commitment, ineffective communication and conflicts among user departments as sources of risks. When respondents were further interrogated to state some of the fears they had with shifting to integrated HMIS they reported concerns of cost, unreliable power supply, lack of computers, lack of internet connectivity and creation of more work. These findings were in agreement with those identified by (Sumner, 2000). Other key concerns that were mentioned by Sumner that organizations get worried about included the fear of re-engineering business processes to the process which the new IHMIS software would support, investment in recruiting and reskilling technology professionals, the risk of technological bottlenecks through client-server implementation and the challenge of recruiting and retaining business analysts who combine technology and business skills.

Table 4. 21: The specific Behavioral factor Bivariate Correlation Coefficient

		Integration	Risks	Information culture
Integration	Pearson Correlation	1		
	Sig. (2-tailed)			
	N	243		
Risks	Pearson Correlation	.357**	1	
	Sig. (2-tailed)	.000		
	N	243	243	
Information culture	Pearson Correlation	.559**	.378**	1
	Sig. (2-tailed)	.000	.000	
	N	243	243	243

**. Correlation is significant at the 0.01 level (2-tailed).

In table 4.22 *F* is 94.755 of the behavioral factor, meaning it is significant. This result implies that there is less than a 0.1% chance that an *F*-ratio this large would happen if the null hypothesis were true. Therefore, this study concludes that the regression model result is a significantly good predictor of integration of HMIS.

Table 4. 22: Behavioral Factor: Model Validity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35046.437	1	35046.437	94.755	.000[b]
	Residual	89137.448	241	369.865		
	Total	124183.885	242			

a. Dependent Variable: Integration of HMIS
b. Predictors: (Constant), Behavioral Factor

The results in Table 4.23, show that β_0 is 99.239, meaning that when the behavioral factor is at a standstill (when X = 0), the model predicts that 99.239 integration will still take place. However when behavioral factor changes then integration will also changes, as shown in Table 4.23: β_1 is now at 2.632. Therefore, if the predictor variable is increased by one unit (if the behavioral factor is increased by 1), then the model predicts a 2.632 increase in integration. The results also show that behavioral factor accounts for 33.8% of the total variation in integration of HMIS. Results from regression analysis in Table 4.23 and 4.24 multiple regression reveal that behavioral factor of health workers in Kenya was significant and positively influences the Integration of HMIS. This therefore implies the need to examine and understand what influences the attitude of the health workers towards Integration of HMIS. Previous scholars have considered change management to be an important task that helps to build user acceptance. Involving health workers in the project creates a positive employee attitude. The benefits of the system should be properly communicated and users should be involved in the design and implementation of the system (Ellis and Howard, 2011; Gillingham and Graham, 2016; Helms and Stern, 2001; Mohammed and Yusof, 2013).

Table 4. 23: Behavioral factor and Integration of HMIS: Regression weights

Model		Unstandardized Coefficients		Standardized Coefficients	R^2	t	Sig.
		B	Std. Error	Beta			
1	(Constant)	99.239	7.835			12.665	.000
	Behavioral factor	2.632	.270	.531	0.338	9.734	.000

a. Dependent Variable: Integration of HMIS

As reported in Table 4.25, in a combined relationship of all the behavioral factors, risks associated with integration and information culture still remain significant. Information culture however has a higher influence on IHMIS than the others. This implies that if information use (culture) was well institutionalized integration of HMIS would be easy to achieve. It would be a great step towards achieving better health outcomes as a country considering that Kenya devolved its healthcare services in the year 2010 after a new constitution was passed and this had some influence on how health management information systems work in the country. Devolution as reported after a study was carried out in Pakistan, contributes to the increase of hurdles in utilizing the preexisting Health Management Information System, hence complicating integration of HMIS (Qazi, Ali and Kuroiwa, 2008) . Findings in this study, show that health workers were generally dissatisfied and confused over their roles and responsibilities after devolution because the overall atmosphere was characterized by the overload of duties, the absence of prerequisite human resources, stagnation in due promotions/transfers, frequent changes in the data collection tools, and conflicts of interest between political and administrative leadership. This has influenced information use.

Table 4. 24: Multiple Regression Analysis of Specific Behavioral Factor and Integration

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	91.606	7.732		11.847	.000
	Risks	1.222	.408	.170	2.993	.003
	Information culture	4.809	.551	.495	8.728	.000

a. Dependent Variable: Integration of HMIS

This study concludes that information culture is quite significant in the efforts towards the integration of HMIS. Information is power therefore every health worker should always have the right information at the right time and most importantly use that information. KII results however indicate that health workers collect data and push it to the next level without keen interest on what the data is communicating. (Gresty, 2013,) emphasises on the need to have knowledge of the information generated from data collected because this is key to effective management of that knowledge. An organization sensitive to information use (culture) directs itself to enhanced performance and innovation. Every health worker should cultivate information culture as supported by (Palvalin *et al*., 2013). This will therefore enhance the quality of data collected.

Findings from the key informant interviews affirmed that health workers were not motivated to share information because most of the time it was never used. The culture to use information for evidence-based decision making should be cultivated in the health sector. Proposed strategies to improve information culture include notifying every worker that they are accountable for the information collected and shared. Timely reporting should also be emphasized on, and capacity building on health information collection, dissemination and utilization should be keenly undertaken. Provision of required tools such as computers, good connectivity and standardized data collection tools would also improve information use. From the findings it was evident that the software in use in some of the facilities were still a concern because they had missing data fields. Sustainability of the information systems was also an issue because of lack of budgets. The county HRIOs believed the country had to some great extent a culture of sharing health information because it was mandatory for facilities to send their

reports by every 5th of each month, of which this was done. It was however also confirmed that it was a challenge to determine whether the data was of good quality because the workload was heavy due to the fact that all the reports would come in at the same time. So auditing of data was rarely done, hence creating some doubts in the use of information generated.

The interviews also revealed that it was important to involve the producers of the information in management decision making at the top level so as to empower communities and health workers through feedback and participatory mechanisms designed to improve the quality of health services. Interviews showed that more training for data interpretation was required at the facility level. This study findings are in agreement with those of (Mohammed & Yusof, 2013) that staff should be motivated by involving them in HMIS activities. (Voulle, 2011) reported that lack of expertise in information management brings issues when it is time to utilize the information.

4.5 Leadership Style Role in the Integration of HMIS

4.5.1 Descriptive statistics

This objective was set out to determine if the leadership styles adopted played any role in the effort to integrate HMIS. The respondents agreed with the following statements: we always gives basic outpatient care (mean, 4.02), employees in different levels work together harmoniously and assist each other to achieve organization goals (mean, 3.94), our hospital is guided by the established plans and objectives in offering her services (mean, 3.90), our established structures in the hospital enable patients to access health care with ease (mean, 3.73), we offer curative services adequately (mean, 3.68), our hospital management team communicates regularly with its staff members (mean,

3.67), the information sharing by our HMIS has significantly improved our relationship with all stakeholders (mean, 3.56), the leadership styles practiced by our hospital management team enable our facility to perform better at all times (mean, 3.56), we share health information with other hospitals within the county on a regular basis (mean, 3.53), in compliance with HIS policy on information sharing, our facility regularly shares information with various stakeholders (mean, 3.47), our hospital has well trained/experienced personnel at every service point (mean, 3.43).

On the other hand respondents disagreed with the following statements; the leadership styles used by our leaders are admirable to all employees and clients (mean, 3.36), our employees are always motivated to serve our clients better (mean, 3.29), we only offer promotive/preventive care (mean, 3.00), our hospital always achieves her targets in good time (mean, 2.97), we offer patient services satisfactory (mean, 2.58), information sharing with the national referral hospitals is well facilitated by the available HMIS (mean, 2.52), our hospital has adequate staff at every service point (mean, 2.49), we provide best surgical services (mean, 2.40).

Composite means of three types of leadership style were developed by summing up the scores of the specified factor giving the total score of each factor. The total score is divided by the total number of indicators to give a composite mean score of each specific indicator. Table 4.25 indicates that the respondent's average agreement score that laissez-faire leadership style would improve integration of HMIS was 9.7, average agreement score that transactional leadership style would enhance integration was 22.6 and average agreement score that transformation leadership style would improve integration of HMIS was 34.3. Overall analysis on whether the role played by

leadership style was important had an average score of 66.5. This findings show that transformational leadership style had a greater mean score. To a great extent Laissez-faire leadership style was found to dominate in the health sector in Kenya, with a few managers practicing Transactional Leadership Style. Laissez-faire leadership style was however found to have a negative and none significant effect in the integration of HMIS. This type of leadership style tends to fragment the information systems instead of integrating them. Transactional leadership style had a moderate agreement score. Its role was in between fragmenting HMIS and integrating them at the same time. Transformational leadership style portrays a good score in the integration of HMIS. The study therefore recommends that healthcare managers should embrace the leadership style that fully encourages team work, because this kind of a leadership style automatically leads to integration of HMIS.

Table 4. 25: Means and Standard Deviations for leadership styles responses

	Transactional	Laissez-faire	Transformational	Leadership style
N	243	243	243	243
Mean	22.5514	9.7160	34.2716	66.5391
Median	23.0000	10.0000	34.0000	67.0000
Mode	25.00	10.00	40.00	66.00
Std. Deviation	4.48879	1.56855	5.89371	9.16298

4.5.1 Test of Hypothesis

H_{oi}: Leadership style do not play any role in the integration of HMIS was tested. Thus hypothesis H_{01}: $\beta_1 = 0$ Versus $H_1=\beta_1 \neq 0$ was tested. Results in Table 4.26 show that leadership styles play a significant and positive role in the integration of HMIS (r

=.747**, P<.01). This leads to rejection of the null hypothesis (H_{o1}) and the acceptance of alternative hypothesis (H_1). This study, therefore, concludes that leadership styles play a role in the integration of HMIS. From this result it is noted that leadership style had the greatest influence on the integration of HMIS followed by the technical factor. A leader in HMIS integration is someone who is responsible for owning, steering and driving forward the implementation efforts towards achievements of the set organizational goals.

Table 4.26 shows the specific leadership styles were also correlated with integration of HMIS and study findings show that Transactional Leadership (r =.478**, P<.01), Transformational Leadership Style (r =.765**, P<.01) all were significantly correlated with integration of HMIS apart from Laissez-Faire leadership (r =.121, P>.01) which was insignificant. This study found that among the three leadership styles, the transformational leadership style had the highest influence and was positively correlated to the integration of HMIS. These findings are in consistent with a study by (Yahaya and Ebrahim, 2016) who found a positive correlation between transformational leadership styles with information System integration/use. It is expected that transformational leaders would give directions and create an enabling environment for employees to drive the integration of HMIS. Leaders should foster and, nourish and support new ideas, new products application. That is why the leadership style adopted has a great influence when new ideas and products are introduced in an organization.

Table 4. 26: Specific leadership styles Bivariate Correlation Coefficient

		Integration	Transactional	Laisse-faire	Transformational
Integration	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	243			
Transactional	Pearson Correlation	.478**	1		
	Sig. (2-tailed)	.000			
	N	243	243		
Laisse-faire	Pearson Correlation	.121	.110	1	
	Sig. (2-tailed)	.060	.086		
	N	243	243	243	
Transformational	Pearson Correlation	.765**	.385**	.252**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	243	243	243	243

**. Correlation is significant at the 0.01 level (2-tailed).

The Leadership Style Adopted as indicated in Table 4.27, was significant and influenced integration of HMIS, *F* is 303.991. This result tells us that there is less than a 0.1% chance that an *F*-ratio this large would happen if the null hypothesis were true. Therefore, this study concludes that the regression model result was significantly a good predictor of integration of HMIS. Therefore, the regression model overall predicts integration significantly well.

Table 4. 27: Leadership Style adopted and Integration of HMIS: Model Validity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	69268.641	1	69268.641	303.991	.000[b]
	Residual	54915.243	241	227.864		
	Total	124183.885	242			

a. Dependent Variable: Integration of HMIS

b. Predictors: (Constant), Leadership Style

Study findings in Table 4.28 prove that leadership style adopted accounts for 63.1% of the variation in IHMIS $R^2 = .631$. Table 4.29, shows that β_0 is 51.702, meaning that when the leadership style is at a standstill (when X = 0), the model predicts that 51.702 integration will still take place. However when the leadership styles adopted changes then integration will also change, as shown in Table 4.28 with 1.846. Therefore, if our predictor variable is increased by one unit (if the leadership style adopted is increased by 1), then our model predicts a 1.846 increase in integration.

Table 4. 28: Leadership Style Adopted and Integration of HMIS: Regression Weight

Model		Unstandardized Coefficients		Standardized Coefficients	R^2	t	Sig.
		B	Std. Error	Beta			
1	(Constant)	51.702	7.113			7.269	.000
	Leadership style	1.846	.106	.747	0.631	17.435	.000

a. Dependent Variable: Integration of HMIS

As shown in Table 4.29 in a combined relationship, Transactional and Transformational leadership style adopted remain predictive. Laissez-faire leadership style however shows a negative effect on integration of HMIS. It can be concluded that Laissez fair has a negative effect when it comes to integration of HMIS, because employees are allowed to work as they choose to with minimal or no supervision so long as they do their jobs. This indicates that team work is not a virtue in this kind of set up, yet for integration to work well team work is key. This is bearing in mind that an information system takes the form of operation of an institution. A leader should be the architect who drives the organization in implementing new innovation by closely engaging the employees closely. Collaborative leadership is an important dynamic capability required to drive performance in organizations operating in a dynamic environment like the health sector.

Table 4. 29: Combined effect of the specific leadership styles on Integration

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	68.735	7.308		9.406	.000
	Transactional	1.089	.215	.216	5.066	.000
	Laissez-faire	-1.156	.587	-.080	-1.970	.050
	Transformational	2.699	.168	.702	16.044	.000

a. Dependent Variable: Integration of HMIS

This study fairly concludes that it possible that the main reason as to why integration of HMIS has not been achieved in the health sector is because majority of the organizations are practicing Laissez faire leadership style. As long as the objectives of

the organizations are met, the leaders are okay. However as indicated above in Table 4.29 this results to a negative effect when it comes to integration of HMIS.

Transaction leadership was found to have a positive and significant relationship with integration of HMIS because it encourages participative leadership which encourages discussions and information-sharing. This builds a sense of belonging and demonstrates skills and expertise are valued, hence an important aspect in integration of HMIS. However it is not as effective as the transformational leadership style. This finding agrees with that of (Erhart and Nauman, 2004).

4.6 Integrated Health Management Information System Model

An integrated health management information system would support management to provide networks in three distinct areas: providing high quality patient care, managing operations, transfer of sensitive confidential data and demonstrating responsiveness (Major and Turner, 2001). This can only be achieved if data is easily accessible, if it is available at all time, there is secure IS and it is of good quality. Literature reviewed informs this study that technology is best-placed to drive integration of information systems. Findings in this study showed that Kenya health system has long collected data on health statistics from public healthcare facilities. However the country lacks a coherent strategy for integrating, synthesizing and analyzing data to allow faster responses from the government. The reporting process focuses on a top-down imposition of data requirements and pays little attention to the need for information that can help healthcare workers to improve on service delivery.

The study results indicate that the respondent agreed with the following statements describing the integration of HMIS in healthcare organizations in Kenya: works hand in hand with the sub-county/health centers hospitals (mean, 4.35), we are always happy to share information to assist prevention and control of diseases (mean, 4.31), our HMIS to a large extent is manual (mean, 4.19), we are always glad to share any information that assist resource allocation (mean, 4.16), health workers who have privileged access to patients records maintain the highest level of confidentiality (mean, 4.09), our HMIS always ensures that confidentiality is maintained when sharing information (mean, 4.02), health information users always demand quality data (mean, 4.00), demand for information for decision making purposes is high in our facility (mean, 3.96), the management frequently requires evidence to ensure that reports used to facilitate their decision are correct (mean, 3.95), all departments/divisions/sections work together harmoniously to achieve the organization goals (mean, 3.89), in our facility reports are up to the standard provided by the Ministry of Health (mean, 3.88), we often hold regular meetings with the county health department to inform them the health status and needs on the ground (mean, 3.70), the departmental health often demand for resources to facilitate information generation (mean, 3.63), our reports are always well organized and are in favorable format (mean, 3.59), data is collected, analyzed and used in every department in the facility (mean, 3.54), since internal monitoring and control is done in our facility, various departments/sections share information freely (mean, 3.53), our management team has instituted control mechanisms to enable the organization perform well (mean, 3.51), we are able to receive adequate information from the sub-county hospitals via the HMIS tools available (mean, 3.51), changes are effected in our facility based on reports generated

through the HMIS (mean, 3.49), the existing reporting tools are always user friendly (mean, 3.44).

Respondents on the other hand disagreed with the following statements; our HMIS ensures that standardization of information is maintained at the various points of service (mean, 3.33), data collected is is always complete (mean, 3.27), the management team in our facility often performs benchmarking activities (mean, 3.18), cost saving has significantly improved in our facility because information sharing has been effective (mean, 3.11), information for returning patients is easily accessible to all service providers simultaneously (mean, 3.08), our HMIS allows data management to be done in the most effective way (mean, 3.04), the management ensures there are adequate facilities, equipment's and drugs to enable efficient service delivery (mean, 3.01), we can retrieve information shared from the sub county hospitals with ease (mean, 3.00), reports are often sent to the sub-county MoH on a weekly basis (mean, 2.97), information on the cost of health care is readily available in our HMIS (mean, 2.91), deviations arising from our activities and planned activities are noticed and corrected in good time (mean, 2.67), feedback for corrective action is always shared with the relevant people in good time (mean, 2.65), our HMIS is both manual and electronic (mean, 2.62), we audit data to ensure its quality regularly (mean, 2.62), the budget allocated to our facility is adequate to operate it (mean, 2.28), the hospital management has ensured that all departments are fully automated (mean, 2.27) and the vote for HMIS in our facility has adequate funds (mean, 2.09)

Composite means of all elements of integration were developed by summing up the scores of the specified factor giving the total score of each factor. The total score is

divided by the total number of indicators to give a composite mean score of each specific indicator. Results in Table 4.30 show that the average agreement score that information was easily accessible was 21.5, average agreement score that information was accessed in a timely manner was 28.9, average agreement score that the information system was secure was 8.1 and average agreement score that data and information was of good quality was 16.7. In addition, the average agreement score that information was used was 41.8, average agreement score that there was team work in the health system was 21.9, average agreement score that resources were allocated for HMIS activities was 18.8 and average agreement score that their facilities had adapted technology was 16.7.

Results from Table 4.30 reveal that 243 respondents participated in giving their opinion on whether integration of HMIS had been fully achieved. The average agreement score that integration of HMIS had been achieved was 174.559. This implies that the health system is yet to fully achieve integration of HMIS. Hence, this study proposes examination and realignment of the design of the current HMIS. These findings concur with various observations and conclusions made by several researchers in systems design. Information system security is quite low as indicated in Table 4.30. With unsecure information systems, their use becomes very minimal, hence affecting continuity of care as well as integration of HMIS.

Table 4. 30: Means and Standard Deviations for accessing integration of HMIS responses

	Information access	Information system security	Data and information quality	Information use	Teamwork	Resource allocation	Integration
Mean	21.543	8.1029	16.749	41.831	21.925	18.8148	174.559
Median	22.000	8.0000	17.000	42.000	22.000	19.0000	172.000
Mode	20.00	8.00	17.00	42.00[a]	23.00	18.00	156.00[a]
Std. Dev.	4.4052	1.42937	2.4066	4.3740	3.3689	3.86373	22.6529

The study further sought to find out the agreement score on achievement of integration of HMIS per county. Table 4.31 shows Kiambu County had a higher average agreement score 183.1, followed by Mombasa County 181.5 and Kitui County had the lowest average agreement score 163.3. Kiambu County seemed to be ahead of Mombasa County and Kitui County in terms of automating their information systems. In Kiambu County, majority of the facilities were using Check Health Information System which was covering the outpatient section. They were also using IQ Care, a donor-driven system, Funsoft information system and DHIS2 system. Paper-based information systems provided from the ministry of health were also in use. This portrays how fragmented the information systems were. In Mombasa County only the Coast General Hospital (Level 5) had a trace of some computers in the finance section only, the software available was known as Funsoft taking care of money collection in the hospital. IQ Care a software donated to take care of HIV patients seemed to be available in all the counties i.e. Kitui, Mombasa and Kiambu. The sub-county and county health records information officer had access to DHIS2 where they reported on the some key indicators on a monthly basis in all the counties. The challenge was that all the available systems were operating independently.

Integration in this study aimed at having the different tiers of care and their functions linked to each other. The different tiers of care were basically a component of the sub-systems that could be linked to each other electronically. More so, the different healthcare organizations have different functions hence influencing the design of the system they adopt. The sub-systems are created to meet the user needs (Sherburne, 2010). A good system incorporates all the relevant stakeholders by taking care of the required specifications. This is critical because the HMIS should be a reflection of the organization structure. Any gap in the system affects the functioning of the bigger system (van der Aalst & Stahl, 2011).

Table 4. 31: County of operation and level of Integration of HMIS

County of operation	N	Mean	Std. Deviation
Kiambu	76	183.0526	23.55979
Mombasa	68	181.5147	22.41368
Kitui	99	163.2626	16.74819
Total	243	174.5597	22.65296

The study also sought to find out the average agreement score that integration of HMIS was taking place in the different levels of care in Kenya. Table 4.32 indicates that the highest average agreement score that integration was taking place was in sub-county and county hospitals at 182.2, followed by health centers/dispensaries at 174.6, then the community units scored the lowest at 167.4.

Table 4. 32: Tier of operation and level of Integration of HMIS

Type of organization	N	Mean	Std. Deviation
Community unit	55	167.4000	21.78344
Health center/Dispensary	109	174.5703	22.74047
Sub County and County Hospitals	79	182.1636	21.86809
Total	243	174.5597	22.78253

4.6.1 Bivariate Correlations

Table 4.33 shows the bivariate linear correlations among the operation variables in this study and integration of HMIS in healthcare organizations in Kenya. The study revealed that organization factor (X_1) has a positive and significant influence on integration of HMIS (r =.683**, P < .001). Organization factor has been identified as one of the drivers of integration of HMIS. This means that as the organization factor improves during the integration process, there is a significant positive change in integration of HMIS in healthcare organizations. This study finding is supported by study findings on Health Management Information System (HMIS) that indicated that without a functional organization with proper plans for HMIS activities, integration of HMIS cannot thrive (Odhiambo-Otieno, 2005a). Moreover the users of the system must be in mind.

The study findings also revealed that there is a positive and significant influence of technical factor on the integration of HMIS (r = .683**, P < .001). Technical factor is a key influence in the integration of HMIS in a dynamic environment. This means that, as the healthcare organizations engages dynamic employees, improves there IT infrastructure and systems become more interoperable, integration of HMIS significantly improves. This study finding is supported by (WHO, 2007), WHO has observed that Health Information Systems is one of the pillars in the health system management. It serves as a lubricant that allows other pillars to work together with the goal of creating integrated and coordinated decision making for better management. This can only be achieved with if the technical factor is strengthened. But IT infrastructure in the public health facilities was quite weak yet most important for

driving integration, this finding agrees with a study finding on LMIC (Haux *et al*., 2007; Lium *et al.,* 2008).

The bivariate correlations also revealed that there is a positive and significant influence of behavioral factor on integration of HMIS (r = .507**, P < .001). The literature identified workers behavior is influenced by perceptions and the value of something. Every worker needed to be accountable for the information collected and shared, timely reporting should be emphasized on, capacity building on health information collection and dissemination and utilization of data collected. This study findings were in agreement with those of (Mohammed & Yusof, 2013) that staff should be motivated by involving them in HMIS activities. (Voulle, 2011) reported that lack of expertise in information management brought issues when it was time to utilize the information. The findings of this study support this observation. To influence the behavior of workers it is import to involve them during the designing and implementing process of health information system as supported by (Chaulagai *et al*., 2005a; Odhiambo-Otieno, 2005b). Hardware and software reliability was another factor to be considered for the success of the system as reported (Chaulagai *et al*., 2005b; Lippeveld, Sauerborn, Bodart, & World Health Organization, 2000). Therefore reliability of the systems affect the attitude towards the process on integration.

The study findings indicate that leadership style and integration of HMIS relates positively and significantly with integration of HMIS (r =.731**, P < .001). This study intended to test whether leadership style plays any role in influencing integration of HMIS. Leadership Style is one of the dynamic capabilities that influence the organizations dynamic environment. This means that, as the healthcare organizations

adopt leadership styles it should fit and support the HCO HMIS integration efforts. This study finding was supported by (Alfian, 2016), that leadership styles deserve more attention if integration of HMIS was to be successful. The role of a leader also includes motivating employees and adapting to changing conditions. The study believes that strong leadership is required if integration of HMIS was to be achieved and this is supported by (Humaidi & Balakrishnan, 2015).

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Table 4. 33: Bivariate correlations

		Integration	Organization Factor	Technical Factor	Behavioral Factor	Leadership Style
Integration	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	243				
Organization Factor	Pearson Correlation	.472**	1			
	Sig. (2-tailed)	.000				
	N	243	243			
Technical Factor	Pearson Correlation	.683**	.534**	1		
	Sig. (2-tailed)	.000	.000			
	N	243	243	243		
Behavioral factor	Pearson Correlation	.507**	.170**	.506**	1	
	Sig. (2-tailed)	.000	.008	.000		
	N	243	243	243	243	
Leadership Style	Pearson Correlation	.731**	.473**	.588**	.423**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	243	243	243	243	243

**. Correlation is significant at the 0.01 level (2-tailed).

4.6.2 The Combined Effects of all Variables: (Multiple Regression)

A multiple regression analysis was performed on the four drivers of integration of HMIS to test their combined effects on the HCOs in Kenya.

The regression model in Table 4.34 containing all variables was found to be valid (F (4,238) = 109,730, P < .001) meaning the all the variables in this study are good predictors of the variations in integration of HMIS in HCOs in Kenya.

Table 4. 34: The Multiple Regression: Model Validity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.685	4	5.671	109.730	.000[b]
	Residual	12.301	238	.052		
	Total	34.985	242			

a. Dependent Variable: Integration of HMIS

b. Predictors: (Constant), Leadership Style, Behavioral factor, Organization factor, Technical factor

Due to the presence of multi-collinearity among some of the study variables, all the variables were centered and the results thereafter showed collinearity statistics (VIF) value of less than ten in all variables indicating absence of multi-collinearity after centering all the variables (see Table 4.35). The multiple regressions results in Table 4.35 indicates that only organization factor (β_1 = 0.079, P > .005) was significant insignificant to integration of HMIS in healthcare organizations in Kenya.

All the other variables, that is, Technical factor, behavioral factor and leadership style have a p-value less than 5% (P<0.05) meaning that, when all variables in this study are combined, technical factor, behavioral factor and leadership style remain significant in explaining variations in integration of HMIS in HCO in Kenya.

Table 4. 35: The Multiple Regression: Weights of Variables

Model		Unstandardized Coefficients		Standardized Coefficients	t	R^2	Sig.	Collinearity Statistics	
		B	Std. Error	Beta				Tolerance	VIF
1	(Constant)	.689	.157		4.380		.000		
	Organization factor	.079	.055	.069	1.448		.149	.652	1.533
	Technical Factor	.260	.048	.301	5.444		.000	.482	2.073
	Behavioral factor	.111	.035	.148	3.214		.001	.694	1.441
	Leadership Style	.381	.042	.458	9.154	.648	.000	.589	1.698

a. Dependent Variable: Integration of HMIS

The multiple regression model in Table 4.36 established that constant (β_0 = 4.380, P< .001), technical factor (β_2 = 0.301, P < .005), behavioral factor (β_3 = 0.148, P < .005), and leadership style (β_4 = 0.458, P < .005), are significant in influencing integration of HMIS in a combined relationships. This means that the most important factors in predicting integration of HMIS in HCOs are leadership style followed by technical factor and lastly behavioral factor. Based on the findings of the multiple regressions, the study rejected the null hypotheses technical factor, behavioral factor and leadership style in favor of alternative hypothesis. The study concludes that the technical factor, behavioral factor and leadership style have a significant positive influence on the integration of HMIS. On the other hand this study failed to reject null hypothesis of organization factor concluded that, in a combined effect, there are no significant influence of organization in the integration of HMIS in HCOs in Kenya. The study model was also found to explain up to 64.8% total variation in the integration of HMIS, 35.2% is explained by the statistical disturbance error term. The standard error of .227 shows how the model regression line is deviating from the line of best fit. The Durbin Watson statistics of 1.528 shows that the study suffered from auto correlation. This may

have affected the model. All the VIF are below 10 meaning that the data in all variables do not suffer multicollinearity.

From the models tested, the findings show that technical factor is a very crucial factor if integration was to be achieved. However, an average agreement score of 16.7 that technology had been adopted in healthcare institution was observed. This finding confirms why integration of HMIS has not been achieved. It was evident that most of the healthcare institutions were using paper -based information systems with a few having electronic information systems which were operating in silos. This finding proved that different systems were increasingly being adopted in Kenya to support medical record management, health program management, facility management and the quality of patient care (Sherburne, 2010). This has led to delay in the achievement of integrated HMIS. Literature reviewed however confirms that this is not only happening in Kenya. Other countries like the United States of America (USA) through the American Hospitals Association (AHA), have set a timeframe for hospitals, physicians and other eligible healthcare professionals in the USA to meet meaningful user requirements of HMIS (AHA, 2014). The Kenyan government might need to come up with such a requirement.

KIIs further revealed that some of the other factors hindering the integration of HMIS in Kenya especially at the community level involved the health system managers not having the ability to sensitize the community frequently on the emerging issues and structures in place. There were also delays in providing the CHVs .With the resources required to facilitate the data collection process. A need to emphasize on policies put in place at the community level, retention of community health volunteers was also

observed. CHVs were not upfront trained on how to use regularly developed data collection tools hence there was a lot of confusion. Community health volunteers also reported that they had a challenge when they took their reports to the facilities, because the reports were not recognized. This automatically dented team work and in the long run integration of HMIS.

In assessing the stability of Information Technology infrastructure, KII raised several challenges; i) when power was not available the workers were unable to work; ii) internet connectivity was a challenge leading to use of modems and at times due to poor network or inadequate bundles they were not working well; iii) most of the facilities had made plans to automate their information system however they had inadequate resources; iv) most of the registers were stored in the health records office full of dust and respondents reported that mostly the registers kept on being revised even before what they have had been fully utilized; v) surprisingly some facilities as old over 45 years were still operating as dispensaries, meaning even for them to advance was a challenge.

Literature reviewed has shown how different countries are working towards achieving integration of HMIS. For instance, India has deployed a web-based system that collects health indicators, involving thousands of health facilities and hundreds of thousands of health workers. Brazil has a HIS called SIGA Saude designed to manage resources in a public health system. Its features are of an enterprise resource planning system with electronic records to manage resource allocation and patient flow. Zambia has adopted three significant health information management systems i.e. European Union supported HMIS, SmartCare and ZEPRS. SmartCare provides frontline health care

providers, with relevant, timely patient information which is housed in electronic medical records. Bangladesh has developed an electronic birth registration system that provides local citizens with a personal electronic identification card. Belize has developed an open source health information system that tracks all patients' encounters with the health system while managing patient flow, monitoring infectious disease outbreaks and keeping track of supply inventories and human resources. Indonesia has a national health information system structured vertically, with central, provisional, district and village levels. At the village levels, health centers collect data from local facilities, including integrated health service posts and midwife homes or clinics. Routine health data e.g. (birth registration, immunization, mortality etc.) is accumulated at the district level where it is combined with other health data. At the district level, the routine health data is reported to the province-level health offices and then flows all the way up to the center of health data and information at the central level (Wave, 2009).

On the other hand, in Kenya, the study findings showed that data was collected from different levels of care then pushed to the DHIS2 software through a sub-county or county HRIO, who keyed in that data in DHIS2. Only specific data indicators are reported. At the community level registration of home births and deaths are done by a community health volunteer who takes a report to a community health extension worker based in a dispensary/health center near them. This process clearly is costly, not efficient and replicates the HMIS activities, causing errors. It was also noted that only a set of reports are shared at DHIS2 to help managers make decisions. Therefore the reports are not comprehensive and also not shared on time.

Table 4. 36: Summary of Results of Hypothesis Tested

No.	Variable	P-Value	Direction	Deduction
H_{o1}	Organization factor & Integration of HMIS	.000	Positive	Reject Null
H_{o1a}	HIS policy	.149	Positive	Fail to reject Null
H_{o1b}	Data collection Strategy	.000	Positive	Reject Null
H_{o1c}	Management Support	.000	Positive	Reject Null
H_{o2}	Technical Factor and Integration of HMIS	.000	Positive	Reject Null
H_{o2a}	Human infrastructure	.000	Positive	Reject Null
H_{o2b}	IT Infrastructure	.000	Positive	Reject Null
H_{o2c}	Systems Interoperability	.000	Positive	Reject Null
H_{o3}	Behavioral factor	.000	Positive	Reject Null
H_{o3a}	Age	.000	Positive	Reject Null
H_{o3b}	Risks associated with integration	.003	Positive	Reject Null
H_{o3c}	Information Culture	.000	Positive	Reject Null
H_{o4}	Leadership style Adopted	.000	Positive	Reject Null
H_{o4a}	Transactional Leadership	.000	Positive	Reject Null
H_{o4b}	Laissez-Faire Leadership	.050	Negative	Fail to reject Null
H_{o4c}	Transformational Leadership	.000	Positive	Reject Null

4.7 Moderating effects of technology adoption and information timeliness on integration of HMIS

Objective 5: To establish whether technology adoption and information timeliness has a moderating effect on the relationship between operational factors and the integration of HMIS in healthcare organizations in Kenya.

This study intended to establish whether technology adoption and information timeliness moderate the relationship between operational factors and the integration of HMIS in HCOs in Kenya. To achieve this objective, this study was guided by the moderated multiple regression model (MMR) showing the interactions between technology adoption and information timeliness of the organization with the dependent and independent variables in this study;

$Y = \beta_0 + \beta iXi + \varepsilon$, where (i= 1, 2, 3, 4)…… (i)

$Y = \beta 0 + \beta iXi + \beta zZj + \varepsilon$, where (j = 1, 2)…… (ii)

$Y = \beta 0 + \beta iXi + \beta zZj + \beta izXiZj + \varepsilon$ …… (iii)

The first model shows the relationship between the dependent variable and the independent variables of the study. The second model shows introduction of the moderating variable (Zj: technology adoption/information timeliness) into the multiple regression model while the third model shows the introduction of the interaction terms (Xi*Zj) in the relationship between operational factor variables and the dependent variable. The relationship between operational factors and integration of HMIS in this study was moderated by technology adoption and information timeliness.

a) Moderating effect of technology adoption on operational factors and integration of HMIS

To test whether technology adoption in HCOs moderates the relationship between operational factors and integration of HMIS in HCOs, a moderated multiple regression model was used: $Y = \beta_0 + \beta_1 X_1 + \beta z Z_1 + \beta iz X_1 Z_1 + \varepsilon$, where Y is the integration of HMIS, β0 is the constant, β_1, β_2, β_3, β_4 are slope coefficients representing the relationship between independent variable and the dependent variable, X_1, X_2, X_3, X_4 is organization factor, technical factor, behavioral factor and leadership style. Z_1 represents technology adoption as a moderating variable while X_1Z_1 is the interaction term which is the product of technology adoption and operational factors (Technology Adoption* X_1, X_2, X_3, X_4). The results are presented in Tables 4.37, 4.38 and 4.39

Table 4. 37: Moderating effect of technology adoption on operational factors and integration: Model Validity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.685	4	5.671	109.730	.000[b]
	Residual	12.301	238	.052		
	Total	34.985	242			
2	Regression	22.687	5	4.537	87.446	.000[c]
	Residual	12.298	237	.052		
	Total	34.985	242			
3	Regression	23.038	9	2.560	49.922	.000[d]
	Residual	11.947	233	.051		
	Total	34.985	242			

a. Dependent Variable: Y

b. Predictors: (Constant), X_4, X_3, X_1, X_2

c. Predictors: (Constant), X_4, X_3, X_1, X_2, Tech

d. Predictors: (Constant), X_4, X_3, X_1, X_2, Tech, TechX_3, TechX_4, TechX_2, TechX_1

The results in Table 4.37 shows that the F statistics in model one, F (4,238) = 109.730, P <.005 was valid and there is a significant influence between operational factors and the integration of HMIS in HCOs in Kenya. When technology adoption was introduced as a moderating variable, the F statistics, F (5, 237) = 87.446, P < .005 in model two remained valid and indicated that there is a significant influence among operational factors, technology adoption in a HCO on integration of HMIS. When the interaction term (technology adoption*operational factors) was added in model two, the new model three was valid (F (9,233) = 49.922, P <.005) indicating that there is a significant influence among operational factors, technology adoption in HCOs, the interaction term (technology adoption*operational factors) on the integration of HCOs in Kenya.

Table 4. 38: Moderating Effect of Technology Adoption on Operational Factors and Integration of HMIS: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig. F change
1	.805[a]	.648	.642	.22734	.000
2	.805[b]	.648	.641	.22779	.000
3	.811[c]	.659	.645	.22644	.000

a. Predictors: (Constant), X4, X3, X1, X2

b. Predictors: (Constant), X4, X3, X1, X2, Tech

c. Predictors: (Constant), X4, X3, X1, X2, Tech, TechX3, TechX4, TechX2, TechX1

The R^2 in model one in Table 4.38 show that 65% of the total variations in integration of HMIS in HCOs in Kenya can be explained by operational factors. The adjusted R^2 shows that when the constant is excluded from the study, operation factors explain 64.2% of the total variation in integration. The value of (r =.805, P <001) indicate a significant positive influence of operation factors on the integration of HMIS and the

standard error of estimate (0.227) shows mean deviation of the predictor variable from the line of best fit.

The second model introduced technology adoption in firms into the relationship between operation factors and integration of HMIS. There is no change in R^2 however the model remains significant. This implies that just adopting technology and not interacting it with the operation factors of the HCOs will not have any influence in the relationship between operation factors and integration of HMIS.

The third model shows the relationships among operation factors, technology adoption in HCOs, the interaction term (technology adoption*operation factors) and integration of HMIS in HCOs in Kenya. The results indicated that with the introduction of the interacting term, the R^2 significantly improved further by 1.1% ($P < .001$) from 65% to 66% implying that technology adoption in HCOs is a significant moderator of the relationship between operation factors and the integration of HMIS when an interaction takes place.

Model one in Table 4.39 indicate that all variable were significant predictors of HMIS apart from X_1, with the introduction of the moderating variable (technology adoption) in model two, X_1 still remains insignificant in predicting integration of HMIS while all the other variables were still good predictors. When the interaction term (technology adoption*operation factors) was introduced as shown in model three, behavioral factor and leadership style also became insignificant predictor of integration of HMIS and there role is significantly taken up by technical factor which remained predictive. This shows a partial moderation of the operation factors. This findings are supported by

study findings of studies done in Uganda and Tanzania show that technology adoption is affected by lack of standardization, electrical power, back up and user friendliness systems (Gladwin, Dixon, & Wilson, 2000). A report by (Shiels, McIvor, & O'Reilly, 2003) emphasizes that adaptation of technology is dependent on resources and range of technological competencies in an organization.

Table 4. 39: Moderating Effect of technology adoption on operation factors and integration of HMIS in HCOs in Kenya: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.689	.157		4.380	.000
	X1	.079	.055	.069	1.448	.149
	X2	.260	.048	.301	5.444	.000
	X3	.111	.035	.148	3.214	.001
	X4	.381	.042	.458	9.154	.000
2	(Constant)	.709	.179		3.963	.000
	X1	.074	.059	.064	1.241	.216
	X2	.255	.052	.296	4.905	.000
	X3	.111	.035	.148	3.200	.002
	X4	.381	.042	.458	9.121	.000
	Tech	.006	.025	.013	.232	.817
3	(Constant)	1.246	.470		2.649	.009
	X1	.051	.168	.045	.306	.760
	X2	-.016	.142	-.018	-.113	.910
	X3	.096	.110	.128	.874	.383
	X4	.512	.131	.617	3.926	.000
	Tech	-.197	.181	-.430	-1.088	.278
	TechX1	-.003	.071	-.026	-.043	.966
	TechX2	.117	.059	1.091	1.987	.048
	TechX3	.004	.042	.032	.087	.931
	TechX4	-.053	.050	-.491	-1.055	.292

a. Dependent Variable: Y

b) **Moderating Effect of information timeliness on operation factors and integration of HMIS**

To test whether need for information timeliness in HCOs moderates the relationship between operation factors and integration of HMIS in HCOs, a moderated multiple regression model was used: $Y = \beta_0 + \beta_1 X_1 + \beta z Z_2 + \beta iz X_1 Z_2 + \varepsilon$, where Y is the integration of HMIS, β0 is the constant, β_1, β_2, β_3, β_4 are slope coefficients representing the relationship between independent variable and the dependent variable, X_1, X_2, X_3, X_4 is organization factor, technical factor, behavioral factor and leadership style. Z_2 represents information timeliness as a moderating variable while X_1Z_2 is the interaction term which is the product of information timeliness and operation factors (Information timeliness* X_1, X_2, X_3, X_4). The results are presented in Tables 4.41, 4.42 and 4.43

The results in Table 4.40 shows that the F statistics in model one, F (4,238) = 109.730, P <.005 was valid and there is a significant influence between operation factors and the integration of HMIS in HCOs in Kenya. When information timeliness was introduced as a moderating variable, the F statistics, F (5, 237) = 106.919, P < .005 in model two remained valid and indicated that there is a significant influence among operation factors, information timeliness in a HCO on integration of HMIS. When the interaction term (information timeliness*operation factors) was added in model two, the new model three was valid (F (9,233) = 64.982, P <.005) indicating that there is a significant influence among operation factors, information timeliness in HCOs, the interaction term (information timeliness*operation factors) on the integration of HCOs in Kenya.

Table 4. 40: Moderating Effect of information timeliness on operation factors and integration: Model Validity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.685	4	5.671	109.730	.000[b]
	Residual	12.301	238	.052		
	Total	34.985	242			
2	Regression	24.239	5	4.848	106.919	.000[c]
	Residual	10.746	237	.045		
	Total	34.985	242			
3	Regression	25.018	9	2.780	64.982	.000[d]
	Residual	9.967	233	.043		
	Total	34.985	242			

a. Dependent Variable: Y

b. Predictors: (Constant), X4, X3, X1, X2

c. Predictors: (Constant), X4, X3, X1, X2, Info Timeliness

d. Predictors: (Constant), X4, X3, X1, X2, Info Timeliness, InfoX3, InfoX2, InfoX4, InfoX1

The R^2 in model one in Table 4.41 show that 64.8% of the total variations in integration of HMIS in HCOs in Kenya can be explained by operation factors. The adjusted R^2 shows that when the constant is excluded from the study, operation factors explain 64.2% of the total variation in integration. The value of (r =.805, P <001) indicate a significant positive influence of operation factors on the integration of HMIS and the standard error of estimate (0.227) shows mean deviation of the predictor variable from the line of best fit.

The second model introduced information timeliness in firms into the relationship between operation factors and integration of HMIS. The change in R^2 from 64.8% to 69.3% implies that information timeliness significantly improved the relationship between operation factors and integration of HMIS by 4.5% (P <.005).

The third model shows the relationships among operation factors, information timeliness need in HCOs, the interaction term (information timeliness*operation factors) and integration of HMIS in HCOs in Kenya. The results indicated that with the introduction of the interacting term, the R^2 significantly improved further by 1.8% (P <.001) from 68.6% to 70.4% implying that information timeliness in HCOs is a significant moderator of the relationship between operation factors and the integration of HMIS.

Table 4. 41: Moderating Effect of information timeliness on operation factors and integration of HMIS: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.805[a]	.648	.642	.22734
2	.832[b]	.693	.686	.21294
3	.846[c]	.715	.704	.20683

a. Predictors: (Constant), X4, X3, X1, X2
b. Predictors: (Constant), X4, X3, X1, X2, Info Timeliness
c. Predictors: (Constant), X4, X3, X1, X2, Info Timeliness, InfoX3, InfoX2, InfoX4, InfoX1

Model one in Table 4.42 indicate that all variable were significant predictors of HMIS apart from X_1, with the introduction of the moderating variable (information timeliness) in model two, in addition to X_1, X_3 became insignificant in predicting integration of HMIS while X_2 and X_4 variables were still good predictors. When the interaction term (information timeliness*operation factors) was introduced as shown in model three, X_1 (organization factor), X_2 (technical factor) and X_4 (leadership style) became significant predictors of integration of HMIS while on the other hand X_3 (behavioral factor) remained insignificant. This finding shows almost a full moderation, implying that information timeliness is a very good moderator between HMIS integration and

operation factor. This study findings are supported by those of (WHO, 2007) reporting that information timeliness means information is shared simultaneously to every user in real time. ICT facilitates communication, the processing and transmission of information and the sharing of knowledge by electronic means. This encompasses the full range of electronic, digital and analogue ICT, from radio and television to telephone, computers, electronic based media such as digital texts and audio-video recording and the internet but excludes the non-electronic technologies (Carbone, 2009).

Table 4. 42: Moderating Effect of information timeliness on operation factors and integration of HMIS in HCOs in Kenya: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.689	.157		4.380	.000
	X1	.079	.055	.069	1.448	.149
	X2	.260	.048	.301	5.444	.000
	X3	.111	.035	.148	3.214	.001
	X4	.381	.042	.458	9.154	.000
2	(Constant)	.710	.147		4.817	.000
	X1	.088	.051	.077	1.723	.086
	X2	.138	.049	.159	2.785	.006
	X3	.052	.034	.069	1.525	.129
	X4	.314	.041	.378	7.732	.000
	Info Timeliness	.241	.041	.325	5.855	.000
3	(Constant)	3.260	.998		3.266	.001
	X1	-.756	.329	-.659	-2.296	.023
	X2	-.396	.259	-.458	-1.528	.128
	X3	.001	.195	.001	.004	.997
	X4	.888	.245	1.069	3.627	.000
	Info Timeliness	-.528	.307	-.713	-1.718	.087
	InfoX1	.264	.106	1.571	2.503	.013
	InfoX2	.168	.084	1.233	1.986	.048
	InfoX3	.013	.062	.100	.213	.832
	InfoX4	-.188	.078	-1.407	-2.401	.017

a. Dependent Variable: Y

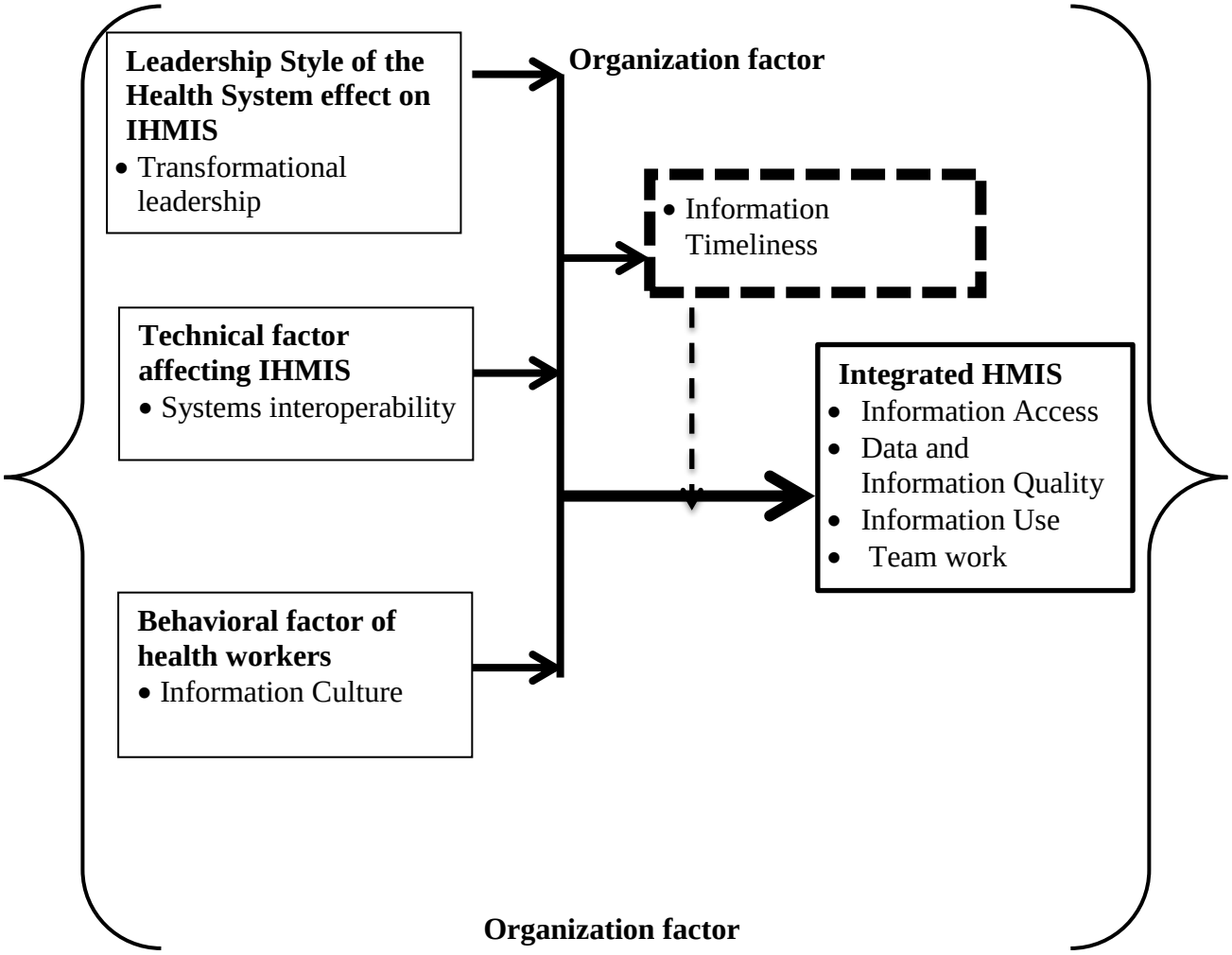

Figure 4. 8: The predicated model of integrating HMIS in healthcare organizations

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter the presents summary of the study findings guided by the specific objectives in chapter one. Conclusions and recommendations are also presented for future action and research direction.

5.2 Summary of the findings

This study adopted a mixed method research design that explored operation factor, technical factor, behavioral factors and leadership style adopted towards integration of HMIS. Qualitative and quantitative data was collected to get an in-depth understanding of the factors influencing the integration of HMIS in the Kenyan health system. The purpose of the study was to establish whether the operation factors influence the integration of HMIS in healthcare organizations in Kenya.

Operation factor had a significant and positive association with the integration of HMIS ($r = .472^{**}$, $P < .05$). Operation factor however accounted for 36.6% variation in the integration of HMIS. All the three indicators (policy, data collection strategy and management support) holding the organization factor were interdependent on each other, meaning they worked best together. There was however, a strong indication that data collection strategy was more important in driving the efforts towards integrating HMIS. The greatest impediment with the data collection strategy was when it was done using parallel or silo systems posing a challenge of uncoordinated information systems with some made of paper and others electronic. This led to data duplication. Inferential statistics however, predicted that with adequate management support data collection

strategy would be streamlined if standardized data collection tools, equipment and software were provided. Management support hence stood out to be a key to the integration of HMIS.

The study found statistical evidence that technical factor positively and significantly influences the integration of the HMIS. Technical factor turned out to have the second strongest relationship ($r = .683^{**}$, $P<.05$) with the integration of HMIS. It accounted for (60.9%) of the total variation in integration of HMIS. Under the technical factor, systems interoperability was found to have the strongest relationship with integration of HMIS. Therefore the study agrees that it is okay for a health care organization to adopt a health information system that meets its needs. However it is important for the system to be flexible and interoperable with other systems. The IHMIS should also be accessible, compatible, user friendly, stable and reliable. An unreliable system with frequency of downtime leads to lack of faith in the system.

Behavioral factor was found to have a positive and significant association with integration of HMIS ($r = 507^{**}$, $P<.05$). Behavioral factor accounted for 33.8% of the total variation in the integration of HMIS. Information culture had the strongest association with integration of HMIS. Meaning the more the right information culture was cultivated in the health workforce the more we would expect integration to take place. The study also agrees that if the health workers could enjoy some good experience with the integration of HMIS they would embrace integration easily. On the other hand bad experiences can affect their view or reception of a new innovation.

The study findings indicated that leadership styles have a positive and significant influence on the integration of HMIS (r=.731**, P<.05). Leadership style had the strongest relationship with the integration of HMIS). On the other hand, leadership style had also the highest account (63.1%) of the total variation in integration of HMIS. This means the choice of a leadership style greatly influence integration of HMIS. The health system in Kenya has to a large extent adopted the Lassiez-faire leadership style, where the facilities are allowed to work autonomously so long as they achieve their objectives. The challenge is this type of leadership style has a negative effect on the integration of HMIS. Therefore this study found out the biggest contributor to not achieving integration of HMIS in Kenya to be the leadership style adopted.

To a large extent the health system in Kenya has adopted the DHIS2, an open source system, with the goal of helping the Ministry of Health get to know what is happening in the country in relation to the health of its people. However, it is not effective because data should be keyed in the open source software by every 5th day of the month. The challenge is that on the ground, information-sharing is delayed because the design of the current system is not user-friendly neither is it sufficiently comprehensive... Adoption of an integrated system design will enable a complete, real time view of the health system anytime. This is because it will consolidate internal and external elements into a single, living structure that goes beyond an ordinary HIS. An integrated HMIS is expected to connect all the healthcare processes, provide live information and insights and seamlessly integrated the health system at large and also within an organization.

The findings showed that integration of HMIS had not been achieved despite the Ministry of Health launching an HIS Policy in 2010 emphasizing on the need to have

integrated HMIS. Findings showed that the model adopted accounted for 64.8% variation in integrated HMIS. Information use had the highest average agreement score of 41.8 and the lowest average agreement mean score that information system was secure was 8.1. This implies that the importance of using information that is evidence-based to make decision is extremely high. Therefore if the data and information quality was improved better decisions would be made in the health system.

5.3 Conclusion

On organizational factor, there is need to enhance, foster and vary the data collection strategies to suit the changing demands in the health system. There too many data collections tools in use in the health system resulting into duplication of efforts and causing fatigue to data and information personnel. The proposed data collection strategy in Figure 4.7 should be adopted. Health organizations should start computerizing their data collection tools and progressively change to electronic IHMIS.

Technical factor had the greatest association with the integration of HMIS however, there was minimal adoption of information technology. This means that those Health Care Organizations that are able to improve on their technical factor in line with the changes in the environment are able to achieve efficiency in their operations through integrated HMIS. Therefore the Health Care Organizations should always endeavor to properly develop its IT infrastructure and train their staff

The study revealed that a significant positive influence exists between behavioral factor of health workers and integration of HMIS. It can be concluded that if risks associated

with integration of HMIS can be minimized and the information culture enhanced, integration would be achieved faster.

Since the leadership styles had the highest account of the variation of IHMIS, health care organizations in Kenya should be keen to adopt the transformational leadership style for it to effectively achieve integration of HMIS in Kenya. The currently-adopted leadership style is more reactive in nature and it does not respond to situations and problems systematically. This has a negative effect on the desired outcomes.

The model adopted in this study accounts for 64.8% of the total variation in the integration of HMIS. All the factors had a positive and significant influence on the integration of HMIS apart from the organization factor whose role was taken up by the other variable X_2, X_3 and X_4 this is demonstrated in fig 4.8. This implies that the model was fit in informing pertinent issues concerning what was key in achieving integration of HMIS in healthcare organizations in Kenya. The study concluded that PRISM framework can be improved by adding the component of leadership style. As it has turned out that leadership style is a key player for having improved performance of health management information systems for better health outcome.

5.4 Recommendations

i. Health system managers should support the review of the current data collection tools and clean-up of all the duplications by employing the electronic data collection strategy as proposed in this study in figure 5.1.

ii. The healthcare organizations need to enhance their adoption of information technology through strengthening the IT infrastructure and adopting information systems that are interoperable

iii. Health system managers should enhance information culture by reinforcing evidence based decision making

iv. Health systems managers should ensure adoption of transformational leadership style

v. The need for timely information for use during decision making has been found to be a very good moderator between organization factor, behavioral factor and leadership style with integration of HMIS. If integration of HMIS would ride on this and ensure the system achieves provision of timely information then integration of HMIS would be whole heartedly supported. Technology adoption has also been found to be moderating technical factor hence it is quite an impact factor in driving integration.

5.5 Suggestions for Further Research

The findings of the study, as summarized in the previous section have several implications for theory, methodology and practice

5.5.1 Theoretical studies and Academic Implication

The PRISM framework theory viewed the operation, technical and behavioral determinants as the only capabilities that would influence HIS performance. However, this study found out that in addition to the three identified capabilities, leadership styles adopted also had a significant influence in the integration of HMIS.

The results from this study contribute to the existing body of knowledge in the literature by providing experience in HMIS. Many studies in HIS tend to have a different view from this study of HMIS integration in the development of HIS. Therefore findings from this study have contributed in filling this gap of knowledge.

The study has laid emphasis on four main factors influencing the integration of HMIS: operation, technical, behavioral factor and leadership style adopted. As an addition to the existing body of knowledge, this study has tested whether operation, technical behavioral factors and leadership style adopted are an important factor in the integration of HMIS. The results indicated all these factors are important.

Future studies should replicate this study in the private health sector to establish whether the study variables are applicable as well. More studies are needed to confirm whether integration of HMIS has any moderating role on the influence between HMIS implementation and management of the health system. Studies are needed to establish whether emphasis on operation factor has a direct influence on the integration of HMIS.

5.5.2 Studies on Methods and Methodology Implication

This study adopted a mixed research design utilizing descriptive and quantitative design. The study relied on the information given based on the perception of the health workers and the managers of the health system. With the challenge of not being able to investigate the private hospitals, there is a likelihood of some bias in this study and hence to increase reliability of the findings, future studies should strive to obtain data from the private hospitals.

This study has developed a design of an integrated HMIS model. Future studies should incorporate other drivers and further expand this model. Since HMIS integration is a process which takes a long time, future studies should also consider using longitudinal approach and incorporate the experimental design to capture the real effect.

5.5.3 Practice and Policy implication

The findings of this study indicate that integration of HMIS can improve health outcomes if strategies are properly and effectively implemented. In practice, community units, health centers /dispensaries and sub-county and county hospitals should pay close attention to adopting HMIS that aligns with the provided structure of operation to help them work together as a team as they maintain the continuity of care. There is also need to balance the health workers needs and the management team needs to ensure that all stakeholders are taken care of by the HMIS systems adopted.

On policy, the vision 2030 lays a lot of emphasis on the role of health sector as a backbone for a healthy human resource who then play a major role in building the economy of this country. Hence health service delivery needs to be improved to ensure

the society stays healthy, saves time and life in seeking healthcare services. To realize this dream, the findings in this study imply that the government of Kenya needs to give attention to the leadership style adopted as well as give a lot of support by investing in human and IT infrastructure in the health sector country wide.

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APPENDICES

Appendix I: Community Health Units and Facilities in Kenya as at 15th August 2016

	Facility Type	County			
		Kitui	Kiambu	Mombasa	
		Fully-Functional	Fully-Functional	Fully-Functional	Total (N)
Tier 1	CHU (Level 1)	34	64	28	126
Tier 2	Level 2	176	54	35	265
	Level 3	35	24	5	64
Tier 3	Level 4	10	8	5	23
	Level 5	0	1	0	1
	Total	255	151	73	**479**

Ownership – Public facilities

Appendix II: Introduction Letter

Kenya Methodist University
P. 0 Box 45240-00100
Nairobi, Kenya

SUBJECT: INFORMED CONSENT

Dear Respondent,

My name is Caroline Kawila Kyalo, I am a PhD student from Kenya Methodist University. I am conducting a study titled: Integrated Health Management Information System for the Management of the Health System in Kenya. The findings will be utilized to strengthen the health systems in Kenya and other low-in-come countries in Africa. As a result, countries, communities and individuals will benefit from improved quality of healthcare services. This research proposal is critical to strengthening health systems as it will generate new knowledge in this area that will inform decision makers to make decisions that are research based.

Procedure to be followed

Participation in this study will require that I ask you some questions and also access all the hospital's department to address the six pillars of the health system. I will record the information from you in a questionnaire check list. You have the right to refuse participation in this study. You will not be penalized nor victimized for not joining the study and your decision will not be used against you nor affect you at your place of employment. Please remember that participation in the study is voluntary. You may ask questions related to the study at any time. You may refuse to respond to any questions and you may stop an interview at any time. You may also stop being in the study at any time without any consequences to the services you are rendering.

Discomforts and risks.

Some of the questions you will be asked are on intimate subject and may be embarrassing or make you uncomfortable. If this happens; you may refuse to answer if you choose. You may also stop the interview at any time. The interview may take about 40 minutes to complete.

Benefits

If you participate in this study you will help us to strengthen the health systems in Kenya and other low-in- come countries in Africa. As a result, countries, communities and

individuals will benefit from improved quality of healthcare services. This research is critical to strengthening the health systems as it will generate new knowledge in this area that will inform decision makers to make decisions that are research based.

Rewards

There is no reward for anyone who chooses to participate in the study.

Confidentiality

The interviews will be conducted in a private setting within the hospital. Your name will not be recorded on the questionnaire and the questionnaires will be kept in a safe place at the University.

Contact Information

If you have any questions you may contact the following supervisors:

Prof. George Odhiambo-Otieno- 0720716770 or Dr. Wanja -0726678020 Head of Department of Health Systems Management of Kenya Methodist University, Nairobi campus.

Participant's Statement

The above statement regarding my participation in the study is clear to me. I have been given a chance to ask questions and my questions have been answered to my satisfaction. My participation in this study is entirely voluntary. I understand that my records will be kept private and that I can leave the study at any time. I understand that I will not be victimized at my place of work whether I decide to leave the study or not and my decision will not affect the way I am treated at my work place.

Name of Participant…….

Date……..

Signature…….

Investigator's Statement

I Caroline Kawila -0721612745 the undersigned, have explained to the volunteer in a language s/he understands the procedures to be followed in the study and the risks and the benefits involved.

Name of Interviewer……Date…….

Interviewer Signature……

Appendix III: Questionnaire

INTEGRATED HEALTH MANAGEMENT INFORMATION SYSTEM FOR THE MANAGEMENT OF HEALTH SYSTEM QUESTIONNAIRE FOR THE COUNTY HOSPITALS

Dear Respondent,

You have been chosen as a respondent in the above titled study which is being undertaken as part of an educational research in the partial fulfillment of the PhD of Health Systems Management in Kenya Methodist University. Your cooperation in filling this questionnaire will ensure success of the study. Please feel free to give your views on the items given by answering all the questions and indicate your choice by TICKING (√) the response that you view as the most appropriate answer. Most of the questions are in a likert scale of 5 i.e. either strongly agree (SA), agree(A), neutral(N), disagree(D) or strongly disagree(SD). The responses will be for academic purposes only and will be treated with utmost confidentiality. Whether your HMIS system is automated or manual you are quite fit to participate in the study.

Section A: Bio Data

Name of your facility _____

Age of your facility _____

County of Operation_____

Form Completed by (optional) _____

Contacts (optional) Mobile

No…….email……

Designation _____

your age: _____

Highest Education certificate attained _____

Number of years that you have been working _____

Closed and open structured questions

Organization factors

The effectiveness of an organization often relates to the ability of leaders to get all departments and employees to work together. This variable will be used to explain the extent to which healthcare managers at the county hospital have organized their facility, the competence and number of the staff. Then examine the means of information generation, dissemination and use during decision making.

1. Please indicate your response using a tick (√) to the following statements based on the objectives and functions of your facility

		SA	A	N	D	SD
	HIS POLICY					
1	I am fully aware of the HIS policy provided by MoH in the year 2010					
2	I implement the HIS policy fully					
3	The HIS policy has strongly strengthened the regulatory of HMIS in our facility					
4	We have a guideline for data management					
	DATA COLLECTION STRATEGY					
5	All persons attending to patients undertake to record data they collect either manually or electronically					
6	The storage capacity that we have for records is enough					
7	The data we collect is in line with the prescribed templates					
8	We use the provided templates for essential data collection at every service point					
9	Every patient goes through a series of well-organized process to ensure services are well delivered					
10	With help of the available HMIS we are able to share information within the facility at all times					
11	We have multiple data sources in the facility					
12	Our HMIS is well aligned to our organization structure					
	MANAGEMENT SUPPORT					
13	The management provides technical assistance to ensure reports are comprehensive					
14	we have one of the best sustainability strategy in place for the HMIS in place					
15	We have an automatic power backup when needed					
16	We have timely support in case system fails					
17	The management gives information generated from the HMIS preferences					

a) Other than the objectives mentioned above, name other services your facility offers

_____

b) Please state other information sub-systems available in your facility

_____

c) What do you think your facility needs to offer better healthcare services?

_____

d) Name all the departments not automated in your facility

Technical factors

Technological factors are variables which relate to the existence, availability, and development of technology and human infrastructure to facilitate information generation and dissemination. This study is looking at technology that's used in day-to-day life in our facilities, the IT infrastructure (internet connectivity, software applications, systems interoperability) and health worker's competence and reception to use technology

		SA	A	N	D	SD
	Human Infrastructure					
1	The staff numbers in our facility are adequate to enable the facility perform its daily functions					
2	Information collected by our health workers is often used by the hospital management team					
3	Our facility recruits high experienced professionals in every department					
4	There are on job trainings for health workforce to analyze and utilize information					
5	Professional development is often provided for Health Records Officers					
6	Our health workers always embrace HMIS technology					
7	Most of our staff members understand the benefits of using evidence based information for decision making					
	IT Infrastructure					
8	We have adequate computers to use in managing data collection, analysis and dissemination of information					
9	Transmission of information to the national referral hospitals about our patients is well facilitated by HMIS					
10	The internet connection in our facility is always available					
	Systems Interoperability					

11	The existing data collection tools are always user friendly					
12	There has been the need to establish linkages with all data sources in the facility					
13	I reconcile information from the different data sources on time					
14	Our facility ensures that the subsystems run by the different health programmes are integrated					
15	Data from the various data sources are well organized in one database					
16	All facilities performing well in our county, have a well-functioning integrated HMIS					

1. Other than the statements mentioned above, what other concerns health workers in relation to information generation and dissemination

_____

Behavioral factors

Behavioral factors in this study reflect the shared values within the organization that impact employee attitude where it concerns information-sharing and reporting. To what extent do you agree with the following statements? Please tick (√) where appropriate.

		SA	A	N	D	SD
	Risks					
1	The HMIS available makes us do double work					
2	The donor driven programmes do not at all allow information-sharing					
3	The HMIS available never limits information-sharing ever					
4	There are always changes in the regulatory environment on how to handle health information					
5	Reconciliation in HMIS has always been easy					
	Information Culture					
6	Our organization policy often permits us to share information with all the health care stakeholders					
7	Healthcare restructuring which emphasizes on the need to share information is done in our facility once in a while					
8	The hospitals regularly publishes the reports we generate at the Ministry of Health website					
9	Our facility is one of the best since proper planning is based on information shared with the management					

State other factors affecting information-sharing and reporting in your facility

_____

Leadership Styles adopted

Management involves the process of organizing, planning, leading and controlling resources within an entity with the overall aim of achieving its objectives. The question is, does the current HMIS assist the facility to achieve this. Kindly provide us with the feedback below.

		SA	A	N	D	SD
	Transactional leadership					
1	We always gives basic outpatient care					
2	We provide best surgical services					
3	We only offer promotive/preventive care					
4	We offer patient services satisfactory					
5	We offer curative services adequately					
6	Our hospital is guided by the established plans and objectives in offering her services					
7	Our hospital always achieves her targets in good time					
	Laissez-Faire leadership					
8	Information sharing with the national referral hospitals is well facilitated by the available HMIS					
9	We share health information with other hospitals within the county on a regular basis					
10	Our hospital management team communicates regularly with its staff members					
11	Our established structures in the hospital enable patients to access health care with ease					
12	Our hospital has adequate staff at every service point					
13	Our hospital has well trained/experienced personnel at every service point					
14	Our employees are always motivated to serve our clients better					
	Transformational leadership					
15	Employees in different levels work together harmoniously and assist each other to achieve organization goals					
16	The information-sharing by our HMIS has significantly improved our relationship with all stakeholders					
17	In compliance with HIS policy on information-sharing, our facility regularly shares information with various stakeholders					

18	The leadership styles practiced by our hospital management team enable our facility to perform better at all times					
19	The leadership styles used by our leaders are admirable to all employees and clients					

Integrated HMIS Model.

A system design is the process of defining the architecture, components, modules, interfaces and data need to satisfy specified requirements. The systems design is supported by a HMIS which should go through 3 phases of development. A HMIS should facilitate the functioning of a facility towards achieving an expected outcome. To what extent do you believe the HMIS is achieving it purpose? Please tick (√) your preferred choice

		SA	A	N	D	SD
	Information Access					
1	The existing reporting tools are always user friendly					
2	Information for returning patients is easily accessible to all service providers simultaneously					
3	Information on the cost of health care is readily available in our HMIS					
4	The hospital management has ensured that all departments are fully automated					
5	Our HMIS to a large extent is manual					
6	Our HMIS is both manual and electronic					
	Information System Security					
7	Our HMIS allows data management to be done in the most effective way					
8	Health workers who have privileged access to patients records maintain the highest level of confidentiality					
9	Our HMIS always ensures that confidentiality is maintained when sharing information					
10	We can retrieve information shared from the sub county hospitals with ease					
	Data and Information Quality					
11	Data collected is always complete					
12	We audit data to ensure its quality regularly					
13	Data is collected, analyzed and used in every department in the facility					
14	Health information users always demand quality data					
15	Our HMIS ensures that standardization of information is maintained at the various points of service					

	Information Use					
16	Demand for information for decision making purposes is high in our facility					
17	The management frequently requires evidence to ensure that reports used to facilitate their decision are correct					
18	Deviations arising from our activities and planned activities are noticed and corrected in good time					
19	Our management team has instituted control mechanisms to enable the organization perform well					
20	We are always happy to share information to assist prevention and control of diseases					
21	Since internal monitoring and control is done in our facility, various departments/sections share information freely					
22	Cost saving has significantly improved in our facility because information-sharing has been effective					
23	Feedback for corrective action is always shared with the relevant people in good time					
24	The management team in our facility often performs benchmarking activities					
25	Our reports are always well organized and are in favorable format					
26	In our facility reports are up to the standard provided by the Ministry of Health					
27	Changes are effected in our facility based on reports generated through the HMIS					
	Teamwork					
28	We are able to receive adequate information from the sub-county hospitals via the HMIS tools available					
29	We often hold regular meetings with the county health department to inform them the health status and needs on the ground					
30	Works hand in hand with the sub-county/health centers hospitals					
31	All departments/divisions/sections work together harmoniously to achieve the organization goals					
32	Reports are often sent to the sub-county MoH on a weekly basis					
	Resource Allocation					
33	The departmental health often demand for resources to facilitate information generation					
34	The management ensures there are adequate facilities, equipment's and drugs to enable efficient service delivery					

35	We are always glad to share any information that assist resource allocation					
36	The budget allocated to our facility is adequate to operate it					
37	The vote for HMIS in our facility has adequate funds					
	Technology Adoption					
38	Our HMIS to a large extent is electronic					
39	The heavy investment in ICT infrastructure has brought in better returns in the facility					
40	Our facility employs latest technology in the market to protect data					
41	The HMIS software used in our facility is among the best in the market					
42	The system regularly backs up data keyed in					
43	We have an electronic medical record management system which simplifies the record keeping					
44	Our HMIS supports all departments centrally very well					
	Information Timeliness					
45	We are able to access information or reports from the sub-county MoH in a timely version					
46	Reconciliation information from the multiple data sources has been easy for me					
47	Information is shared among all stakeholders in the facility simultaneously					
48	Information shared is always timely					
49	Reconciliation in HMIS is always done on time					
50	Our staff are able to get required information for decision making with ease					
51	Our clients are able to get required information with ease					
52	Our HMIS enables timely reporting to DMIS					
53	Our facility has had an effective mechanism to ensure data capturing and dissemination of information is done					
54	Our HMIS only supports clinical health workers to do their jobs in a timely manner					

a) What are the other functions that you're HMIS does not support you to do?

_____

a) Please name the reports shared with the county health department**?**
b) Who do you share the reports with at the county health department? ----------
c) Are any actions taken of proposal or concerns that you raise? ----------
d) If no, suggest improvements that can be made? ----------

e) What happens to the health facility if reports are not sent to the next level of management? _____
f) How often have you received support supervision from the county health department in the last one year? _____
g) List the main sources of finances for your facility
_____

h) How many people are working in your facility on full time on average over the last three years?
i) Overall how satisfied is the facility with the current Health Management Information System
j) List the most important benefits of the present HMIS

k) Which of the documents stated below exist in the facility to guide decisions concerning the facility operation? Tick all that is applicable
- Health Information System Policy 2010-2030
- Strategic Plan
- Operational plan
- HMIS guidelines
- Standard operating procedures
- All the above

l) Kindly state other management matters that could be have not been captured above and should be addressed by the HMIS

_____

End

Appendix i: Key Informant Interview Guide

HEALTH MANAGEMENT INFORMATION SYSTEM (HMIS) INTEGRATION IN HEALTH SYSTEM IN KENYA

Dear Respondent,

You have been chosen as a respondent in the above titled study which is being undertaken as part of an educational research in the partial fulfillment of the PhD of Health Systems Management in Kenya Methodist University. Your cooperation in filling this questionnaire will ensure success of the study. Please feel free to give your views on the items given by answering all the questions and in others indicating your choice by TICKING (√) the response that you view as the most appropriate answer. Most of the questions are open ended with a few in a likert scale of 5 i.e. either strongly agree, agree, neutral, disagree or strongly disagree. The responses will be for academic purposes only and will be treated with utmost confidentiality. Whether the HMIS system in the county is automated or manual you are quite fit to participate in the study. The purpose of this study is to develop an Ideal Health Management Information System for the management of Health System in Kenya

SOCIO-DEMOGRAPHIC FACTORS

COUNTY: ……

Location …….

Office of operation……

Form Completed by (optional) _____

Contacts (optional) Mobile

No…….email……

Designation _____

highest certificate of education attained _____

Number of years that you have been working _____

ORGANIZATION FACTOR

1. There is a HIS policy that was put in place by the Ministry in 2010 to encourage integration of HMIS.
   a. Do you know of its existence? No ( ) Partially ( ) Yes ( )
   b. If yes, do you implement it? No ( ) Partially ( ) Yes ( )
   c. If yes to **QB** above how do you implement it? ----------
   ---

   ---
   2. Do you have a customized guideline for HMIS activities in the county? No ( ) Maybe ( ) Yes ( )
   3. If yes to question 2 above how have you instituted
      a) Data collection process ----------

      ---

b) Data analysis ----------

---

c) Information reporting ----------

---

d) Feedback mechanism ----------

---

4. What are the strategies in place to integrate data collected from multiple sources?

---

5. State the different HMIS technologies known to you that are available in facilities in your county
   1. _____
   2. _____
   3. _____
6. Do you think there is political goodwill to automate Health information in the county?
   No ( ) Don't Know ( ) Yes ( )
7. How is information shared among all healthcare stakeholders within the county?

---

a) If you do not share information as stated in Q7 above why?

8. When was the last meeting with the stakeholders' to foster partnership in HIS activities?
   ---
   b) Are there any meeting minutes available? No ( ) Don't Know ( ) Yes ( )
9. What is the quarterly budgetary allocation to HIS activities in the county? Kshs.

Technical factor

In the scale below how would you rate the following statements?

		SA	A	N	D	SD
1.	ICT has helped us simplify administrative processes in our facilities					
2.	We have successfully established coordinated data collection in the county					
3.	The HMIS applications are standardized					
4.	Data collection tools are standardized					
5.	The information sources are linked to a central data warehouse					
6.	DHIS 2 is sufficient enough to give us information that is needed for decision making					
7.	Our work force is fully equipped to be able to handle data and information					
8.	The multipurpose data standards fully meet the needs of each group					
9.	The data processing cost has been reduced					
10.	HMIS available has assisted us to eliminate duplication of data gathering					
11.	Reporting has been harmonized in the county					
12.	The community units are always provided with data collection tools					
13.	Data collection tools for community units are effective					
14.	The mechanisms put in place to facilitate partnership with community units are successful					
15.	We give regular trainings to all health workers on HIS activities					
16.	We have back up for our data in our county					
17.	Our HMIS is always accessible					
18.	To a large extent our HMIS is manual					
19.	To a large extent of HMIS is electronic					
20.	Our HMIS is both manual and electronic					

Behavioral Factor

1. Outline the schedule of information dissemination to the relevant offices?
1. _____
2. _____
3. _____

2. Which are the measures in place to address:

a) Data storage: …….
b) Security of data collected:
c) Backup of data:
3. How do you sustain Health Information System activities in the county? ----------

---
---
4. How are the investment inflows into HMIS in the county performing? ---
---

---
5. How is the current HMIS helping in monitoring performance in the county? -
---

---
6. Which areas has the county invested in HMIS
a) Equipment ( )
b) Software ( )
c) IT infrastructure ( )
d) Training ( )
e) Others _____
7. Describe the reporting schedule of information providers from the different healthcare providers on the activities on the ground?
8. How do you ensure timeliness in reporting?
9. How do you address late reporting?
1. _____
2. _____
3. _____
10. What type of support do you provide to information providers?
11. How do you deal with ethical issues when it comes to reporting across different levels of care?
1. _____
2. _____
3. _____

12. What type of data is reported by all healthcare providers?
1. _____
2. _____
3. _____

13. In what format are the reports? Paper based ( ) Electronic ( ) Both paper and electronic ()
14. Is it mandatory for all healthcare providers to report? No ( ) Don't Know ( ) Yes ( )
15. Is it mandatory to give them feedback to them after they report? No ( ) Don't Know ( ) Yes
16. If yes to Q15 how often do you give them the feedback?
17. How do you align the multiple stakeholders towards a common reporting mechanism?
18. How is data accessed from all the facilities?
19. How should departmental managers filter out data that would be of help to them from the different facilities?

Integrated HMIS

20. Do you have an established standard for choosing the HMIS to adopt in the county?

No ( ) Don't Know ( ) Yes ( )

a. If yes, did the criteria evaluate the design of the current HMIS?

b. How was the evaluation done?

21. What are some of the

a) Policies when choosing an HMIS?

1. _____
2. _____
3. _____

b) What objectives should the system achieve?

1. _____
2. _____
3. _____

22. State some of the measures put in place to take care of technical issues of HMIS

1. _____
2. _____
3. _____

23. Explain how HMIS is financial supported?

1. _____
2. _____
3. _____

4. What are the functions of the current HMIS?

1. _____
2. _____
3. _____

4. To ensure the HMIS is well functioning –

i) Do you have a system analyst in the ground to ensure the systems is functioning as it should?

ii) How are you able to determine the success of systems implementation?

iii) How do you ensure that the system is achieving its stated objectives?

1. _____
2. _____
3. _____

iv) State some of the benefits of the current system?

1. _____
2. _____
3. _____

5. To determine the extent to which the benefits of the introduced system have been realized by HMIS:

i. When do you do your data quality audits?

ii. Is the support of HMIS activities always adequate?

iii. How do you use information generated for planning and forecasting?

6. To sustain the system, how do you ensure

i) How do you ensure that the staff working in the HMIS are technically qualified

1. _____
2. _____
3. _____

ii) Does the Health records departments have adequate numbers to handle the work load No ( ) Don't Know ( ) Yes ( )
   a. If yes justify?

   b. If no why?

iii) What is the training schedule in place for HMIS activities to avoid retraining those already trained?

iv) How do you mobilize resources (equipment, material, infrastructure, and financial) required for ensuring an effective functional HMIS
   1. _____
   2. _____
   3. _____

v) What support do you get for HMIS operations in the county
   1. _____
   2. _____
   3. _____

7. State in priority 5 suggestions to improve HMIS activities
1. _____
2. _____
3. _____
4. ----------
5. ----------

8. Kindly name any HMIS software's known to you and are available in the county
   1. _____
   2. _____
   3. _____
   4. _____
   5. _____

Appendix ii: The Map of Kenya showing counties

Appendix iii: List of Healthcare organizations visited

	Kitui County			
	Name	**Level**	**Sub-County**	**Ward**
1	Kabaa Dispensary	Level 2	Kitui Central	Kyangwithya East
2	Syongila Dispensary	Level 2	Kitui Central	Kyangwithya East
3	Itoleka Dispenasry	Level 2	Kitui Central	Kyangwithya West
4	Kavuta Dispensary	Level 2	Kitui Central	Kyangwithya West
5	Tungutu Dispensary	Level 2	Kitui Central	Kyangwithya West
6	Chuluni Dispensary	Level 2	Kitui Central	Mulango
7	Kangalu Dispensary	Level 2	Kitui Central	Mulango
8	Katumbu Dispensary	Level 2	Kitui East	Chuluni
9	Kinakoni Dispensary	Level 2	Kitui East	Chuluni
10	Yaathi Dispensary	Level 2	Kitui East	Nzambani
11	Kiseuni Dispensary (Kitui)	Level 2	Kitui Rural	Kanyangi
12	Kanyongonyo	Level 2	Kitui Rural	Kanyangi
13	Kalulini Dispensary	Level 2	Kitui Rural	Kanyangi
14	Mosa Dispensary	Level 2	Kitui Rural	Kisasi
15	Kisasi Dispensary (Kitui)	Level 2	Kitui Rural	Kisasi
16	Mbusyani Dispensary	Level 2	Kitui Rural	Kisasi
17	Ngiluni Dispensary (Kitui)	Level 2	Kitui Rural	Kisasi
18	Ikuyuni Dispensary	Level 2	Kitui Rural	Mbitini
19	Kitungati Dispensary	Level 2	Kitui Rural	Mbitini
20	Katwala Dispensary	Level 2	Kitui Rural	Mbitini
21	Katutu Dispensary	Level 2	Kitui West	Kauwi
22	Kivani Dispensary (Kitui West)	Level 2	Kitui West	Kauwi
23	Syokithumbi Dispensary	Level 2	Kitui West	Kauwi
24	Mutanda Dispensary	Level 2	Kitui West	Kauwi
25	Kwa Mulungu Dispensary	Level 2	Kitui West	Kwa Mutonga/Kithumula
26	Kwa Mutonga Dispenasry	Level 2	Kitui West	Kwa Mutonga/Kithumula
27	Kalimani Disensary	Level 2	Kitui West	Matinyani
28	Ngiluni Dispensary (Mwingi)	Level 2	Mwingi Central	Nguni
29	Mulinde Dispensary	Level 2	Mwingi Central	Nguni
30	Kakululo Dispensary	Level 2	Mwingi West	Nguutani
31	Katalwa Dispensary	Level 2	Mwingi West	Migwani
32	Lundi Dispensary	Level 2	Mwingi Central	Mui
33	Ngongoni Dispensary (Mwingi)	Level 2	Mwingi West	Nguutani
34	Mbondoni Dispensary (Mwingi)	Level 2	Mwingi West	Kyome/Thaana
35	Kitungati Dispensary	Level 2	Kitui Rural	Mbitini
36	Kanzau Dispensary	Level 2	Kitui Rural	Mbitini
37	Katwala Dispensary	Level 2	Kitui Rural	Mbitini
38	Waluku Dispensary	Level 2	Kitui Central	Kyangwithya East

39	Mikuyuni Dispensary	Level 2	Kitui Central	Miambani
40	Kiseveni Dispensary	Level 2	Kitui West	Kauwi
41	Nzangathi Health Centre	Level 3	Kitui East	Chuluni
42	Kyatune Health Centre	Level 3	Kitui East	Nzambani
43	Yanzuu Health Centre	Level 3	Kitui East	Nzambani
44	Mbitini Health Centre	Level 3	Kitui Rural	Mbitini
45	Nzawa Health Centre	Level 3	Mwingi West	Nguutani
46	Nzeluni Health Centre	Level 3	Mwingi West	Migwani
47	Thitani Health Centre	Level 3	Mwingi West	Kyome/Thaana
48	Miambani Health Centre	Level 3	Kitui Central	Miambani
49	Kisayani Health Centre	Level 3	Kitui East	Chuluni
50	Mutomo Health Centre	Level 3	Kitui East	Chuluni
51	Matinyani Dispensary	Level 3	Kitui West	Matinyani
52	Ikanga Sub-District Hospital	Level 4	Kitui Central	Mulango
53	Katulani Sub District Hospital (Kitui)	Level 4	Kitui Central	Mulango
54	Kitui District Hospital	Level 4	Kitui Central	Township
55	Kanyangi Sub-District Hospital	Level 4	Kitui Rural	Kanyangi
56	Kauwi Sub-District Hospital	Level 4	Kitui West	Kwa Mutonga/Kithumula
57	Mwingi District Hospital	Level 4	Mwingi Central	Central
58	Migwani Sub-District Hospital	Level 4	Mwingi West	Migwani
59	Ikanga Sub-District Hospital	Level 4	Kitui Central	Mulango
	Mombasa			
Code	**Name**	**Keph Level**	**Sub-County**	**Ward**
1	Bokole Cdf Dispensary	Level 2	Changamwe	Airport
2	Jomvu Model Health Centre	Level 2	Jomvu	Jomvu Kuu
3	Miritini Cdf Dispensary	Level 2	Jomvu	Jomvu Kuu
4	Bamburi Dispensary	Level 2	Kisauni	Mtopanga
5	Utange Dispensary	Level 2	Kisauni	Shanzu
6	Junda Dispensary	Level 2	Kisauni	Shanzu
7	Mtongwe (Mcm) Dispensary	Level 2	Likoni	Mtongwe
8	Shika Adabu (Mcm) Dispensary	Level 2	Likoni	Shika Adabu
9	State House Dispensary (Mombasa)	Level 2	Mvita	Mji Wa Kale/Makadara
10	King'orani Prison Dispensary	Level 2	Mvita	Majengo
11	Mbuta Model Health Centre	Level 2	Mvita	Majengo
12	Mvita Dispensary	Level 2	Mvita	Majengo
13	Maweni Cdf Dispensary (Kongowea)	Level 2	Nyali	Kongowea
14	Kisauni Dispensary	Level 2	Nyali	Ziwa La Ng'ombe
15	Mrima Cdf Health Cenre	Level 3	Likoni	Timbwani

16	Tudor District Hospital (Mombasa)	Level 3	Mvita	Tudor
17	Mlaleo Health Center	Level 3	Kisauni	Kisauni
18	Likoni District Hospital	Level 4	Changamwe	Chaani
19	Port Reitz District Hospital	Level 4	Changamwe	Airport
20	Coast Province General Hospital	Level 5	Nyali	Frere Town
Kiambu				
	Name	**Level**	**Sub-County**	**Ward**
1	Gitiha Dispensary	Level 2	Githunguri	Githiga
2	Miguta Dispensary	Level 2	Githunguri	Ngewa
3	Athi Dispensary	Level 2	Juja	Kalimoni
4	Gsu Dispensary (Ruiru)	Level 2	Juja	Murera
5	Mugutha (Cdf) Dispensary	Level 2	Juja	Murera
6	Gachororo Health Centre	Level 2	Juja	Juja
7	Magogoni Dispensary	Level 2	Thika Town	Ngoliba
8	Githiga Health Centre	Level 3	Githunguri	Githiga
9	Githunguri Health Centre	Level 3	Githunguri	Githunguri
10	Karia Health Centre	Level 3	Githunguri	Ikinu
11	Ngewa Health Centre	Level 3	Githunguri	Ngewa
12	Juja Farm Health Centre	Level 3	Juja	Murera
13	Munyu Health Centre	Level 3	Juja	Kalimoni
14	Hamundia Health Centre	Level 3	Juja	Murera
15	Wangige Health Centre	Level 3	Kabete	Kabete
16	Karuri Health Centre	Level 3	Kiambaa	Karuri
17	Limuru Health Centre	Level 3	Limuru	Limuru Central
18	Githunguri Health Centre (Ruiru)	Level 3	Ruiru	Mwihoko
19	Ngoliba Health Centre	Level 3	Thika Town	Ngoliba
20	Jkuat Hospital	Level 4	Juja	Kalimoni
21	Kihara Sub-District Hospital	Level 4	Kiambaa	Kihara
22	Kiambu District Hospital	Level 4	Kiambu	Township
23	Tigoni District Hospital	Level 4	Limuru	Ngecha Tigoni
24	Ruiru Sub-District Hospital	Level 4	Ruiru	Mwihoko
25	Thika Level 5 Hospital	Level 5	Thika Town	Kamenu

Appendix iv: Approval letters from relevant bodies

KENYA METHODIST UNIVERSITY
P. O. BOX 267 MERU - 60200, KENYA
TEL: 254-064-30301/31229/30367/31171
FAX: 254-64-30162
EMAIL: INFO@KEMU.AC.KE

20TH FEBRUARY, 2017

Caroline Kawila Kyalo
HSM-4-4343-3/2014

Dear Caroline,

SUBJECT: ETHICAL CLEARANCE OF A Ph.D. RESEARCH THESIS

Your request for ethical clearance for your Ph.D. Research Thesis titled "Integrated Health Management Information System for the Management of Health System in Kenya: Diagnosis and Prescription" has been granted to you in accordance with the content of your thesis proposal.

As Principal Investigator, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the thesis.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the SERC for re-review and approval prior to the activation of the changes. The Proposal number assigned to the project should be cited in any correspondence.
3. Adverse events should be reported to the SERC. New information that becomes available which could change the risk: benefit ratio must be submitted promptly for SERC review. The SERC and outside agencies must review the information to determine if the protocol should be modified, discontinued, or continued as originally approved.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by subjects and/or witnesses should be retained on file. The SERC may conduct audits of all study records, and consent documentation may be part of such audits.

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email:dg@nacosti.go.ke
Website: www.nacosti.go.ke
when replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. NACOSTI/P/17/86779/15758

Date: 9th March, 2017

Caroline Kawila Kyalo
Kenya Methodist University
P.O. Box 267- 60200
MERU.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Integrated Health Management Information System for the management of health system in Kenya: Diagnosis and prescription,"*** I am pleased to inform you that you have been authorized to undertake research in **selected Counties** for the period ending **9th March, 2018.**

You are advised to report to **the County Commissioners and the County Directors of Education of the selected Counties** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. STEPHEN K. KIBIRU, PhD.
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioners
Selected Counties.

The County Directors of Education
Selected Counties.