Utilization Of Health Management Information Systems at Vihiga County Referral Hospital

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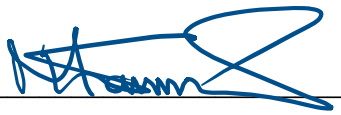
DECLARATION

Declaration by the Student

I, the undersigned, hereby declare that this research project is my original work and has not been presented for examination in any other institution.

Signature  02/05/2024

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Declaration by Supervisor

This research is submitted for examination with my approval as a University Supervisor

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ABSTRACT

Health Management Information Systems (HMIS) play a pivotal role in healthcare institutions. Previous evidence reveals that health information management systems are essential in facilitating the achievement of organizational objectives linked to patient care. However, despite HMIS utilization in some hospitals in Kenya, the country is yet to enjoy the full benefits of HMIS utilization. This study aimed to study the utilization of HMIS at Vihiga County Referral Hospital (VCRH), by considering the level of use and factors associated with its utilization. A mixed method cross-sectional study was in which all the 214 staff at VCRH were targeted for quantitative data collection using a questionnaire while qualitative data were collected from 10 purposively selected key informants. While quantitative data were analyzed using Stata 15, qualitative data were transcribed and analyzed thematically using Microsoft Word and NVIVO. 156 participants successfully completed questionnaires, of which only 135 were included in the analysis after removing incomplete questionnaires, while 10 key informants were interviewed. Individuals were aged between 30 to 39 (45.93%), with males comprising 47.41% and females 52.59%. The bivariate regression models demonstrated a significant effect of technological factors, managerial factors, operational factors, and organizational factors on HMIS utilization ($p < 0.0001$) while the multivariate regression model only showed significant relationship for technological factors ($p<0.05$). The qualitative results showed that persistent barriers included unstable infrastructure, personnel reluctance, and system functionality limitations. Strategic efforts focused on infrastructure, digitization of workflows, and end-user feedback mechanisms were advised by participants. The study concluded that technological factors, managerial factors, operational factors, and organizational factors were vital factors affecting the utilization of HMIS at VCRH while persistent barriers included unstable infrastructure, personnel reluctance, and system functionality limitations. There is a need to leverage on the identified factors to facilitate better transition to paperless record-keeping at VCRH.

DEDICATION

I dedicate this work to the staff and patients at Vihiga County Referral Hospital.

ACKNOWLEDGMENTS

I wish to begin by expressing my gratitude to the Almighty God for the privilege of being alive and for enabling me to participate in this investigation. It is in being alive that all other accomplishments of life are possible. To God be the Glory

I express my sincerest appreciation to my tutor, who has been so instrumental in critiquing this work and ensuring it gets better. Without his contribution, this would have just been another mediocre work.

Finally, I pass appreciation to my daughter Reign and my wife Dr. Janet, friends, and fellow students; without whose support, motivation, and sound advice this project would not have been possible.

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ACRONYMS AND ABBREVIATIONS

CIDP	County Integrated Development Plan
EMR	Electronic Medical Records
HCWs	Health Care Workers
HIE	Health Information Exchange System
HIM	Health Information Management
HMIS	Healthcare Management Information System
HMS	electronic Health Management System
HoD	Head of Department
HSIP	Health Strategic and Investment Plan
HT	HMIS Utilization
IREC	Institutional Review Ethics Committee
KEMRI -	Kenya Medical Research Institute
MF	Managerial Factors
MOH	Ministry Of Health
MTEF	Medium Term Expenditure Framework
MTEF	Medium-Term Expenditure Framework
MTRH	Moi Teaching and Referral Hospital
NHSP	National Health Strategic Plan
NHSP	National Health Strategy Plan
OF	Operational Factors
ORF	Organizational Factors
TF	Technological Factors
USA	United States of America
VCRH	Vihiga County Referral Hospital

CHAPTER ONE

INTRODUCTION

1.0 Chapter Overview

Health Management Information Systems (HMIS) are increasingly taking over the manual management of patient data and files. HMIS refers to using database management systems to manage healthcare information. HMIS is responsible for managing patient data, enhancing communication and coordination among physicians, and generating reports that assist healthcare workers in managing patients better. This chapter presents in-depth background information to this study detailing the problem statement, the objectives, and the significance of the study. The hypotheses for the study are also presented.

1.1 Background Information

The World Health Organization identifies six key pillars that comprise a health system: service delivery, health workforce, health information systems, access to essential medicines, financing, and leadership/governance (WHO 2007). A well-functioning health information system is critical as it ensures the production, analysis, dissemination, and use of reliable data on health determinants, system performance, and health status (Manya et al. 2016). Effective HMIS like DHIS2 provides real-time data to guide decision-making and service delivery at facility and management levels, enabling data-driven quality improvement, planning, and policy formulation (Kiberu et al. 2014). As a pillar supporting evidence-based decisions across all health system components, HMIS is pivotal to monitoring and enhancing programs, resource allocation, accountability, and ultimately advancing population health outcomes.

However, mere data collection is insufficient - realizing the benefits of HMIS requires a culture of information use and integrating evidence into practice across system levels (Mutale et al. 2018). Common HMIS challenges include poor data quality, limited analytical skills, underutilization of information, and inadequate infrastructure and human resources (Mbondji et al. 2014). Strategies to strengthen HMIS include leadership for a data use culture, capacity building for data management and use, data quality assessments, functional feedback loops from analysis to action, and integrated systems from community

to national levels (Manya et al. 2016). Where HMIS pillars are weak, decision-making is impaired, performance monitoring is inconsistent, and service delivery and quality of care suffer (Nutley & Reynolds 2013). Strong health information systems are thus critical for evidence-based management and driving healthcare improvements.

In summary, the WHO health system pillars are interdependent, and strengthening health information systems has a ripple effect on broader system functioning and health gains (Manya et al. 2016). HMIS enables regular assessment of healthcare needs and gaps, tracking service coverage and patient outcomes, and measuring progress towards objectives (Mutale et al. 2018). With quality data and capacity for information use, managers can identify priorities, allocate resources responsively, manage operations, and remedy service delivery deficiencies (Nutley & Reynolds 2013). Policymakers are empowered to develop strategic plans aligned with population health needs and direct health financing accordingly. Overall robust HMIS serves as the foundation for learning health systems, allowing continuous feedback and improvement (Kiberu et al. 2014). This underscores why data generation and utilization through strong HMIS is integral across health system components for meaningful and sustained gains.

The ability of Health Care Workers (HCWs) to monitor the improvement of individual patients is made possible by HMIS systems, which can enhance the overall quality of patient care (Mahla et al., 2021). With this information's help, physicians can provide patients with improved care and make more informed treatment decisions (Dhillon, 2021). HMIS also assists in the reduction and elimination of medical errors. By monitoring patient data, healthcare providers can determine if there is an issue with a patient's medical record and take appropriate action. After that, this information can be used to help avoid future medical mistakes (Dhillon, 2021).

Health management information systems (HMIS) make managing and storing patient data more accessible for healthcare organizations. HMIS can potentially improve patient care's eminence by lowering administrative costs and facilitating better communication between the many components of the healthcare system (Litchfield & Khan, 2019). One way HMIS may help improve the quality of treatment provided to patients is by tracking patient outcomes. This information can be utilized to make informed decisions on how to treat

patients and analyze the efficacy of various health measures (Mahmoudvand et al., 2019). Monitoring the effectiveness and safety of therapies is another potential application for HMIS. By keeping track of these outcomes, medical professionals can ensure that their patients receive the highest possible level of treatment (Mahmoudvand et al., 2019). Additionally, HMIS has the potential to assist in the reduction of administrative overhead in healthcare companies. The number of unsuccessful tries to enter data can be cut down with the help of HMIS's ability to consolidate data from numerous sources. This can result in significant time and financial savings for healthcare companies (Mahmoudvand et al., 2019). In general, HMIS is an indispensable tool for enhancing the level of care provided to patients. It is possible to utilize them to assess the efficacy of therapies, reduce the amount of administrative work required, and follow the results of patients' conditions.

Accurate and up-to-date health information is essential for appropriate health decision-making, resource utilization, evidence-based decision-making, policy development, evaluation and monitoring of the public medical situation, outcomes, and medical care delivery (WHO, 2020). Not only does the utility of health information keep individuals and members of the public knowledgeable and empower them to make the right decisions regarding their well-being, but it also impacts public health policy and decision-making. It advances the skills necessary to develop tools and products to promote, sustain, safeguard, and restore health (WHO, 2020). As a result, the utilization of information in the decision-making procedure is vital for the ongoing improvement of the health system.

A Health Information System (HIS) enables healthcare managers to use it in their day-to-day managerial responsibilities, which is a core pillar in strengthening health systems (WHO, 2021). Therefore, accurate information on the delivery of services and various other vital indicators is hugely beneficial for all healthcare managers. According to WHO (2021), healthcare practitioners across multiple healthcare organizations worldwide cannot identify problems and prioritize needs. Furthermore, these providers cannot evaluate and monitor the impact of interventions they put into place. Consequently, there is an increase in the overall operating costs of medical facilities due to the recurrence of diseases and the inconsistency in patient management. The correct information is put into the hands of the right people at the right time when there is an appropriately working HMIS. This permits

policymakers, executives, and personal service providers to think more critically about decisions spanning from the care of patients to the budgeting of national resources (Bahreini et al., 2021).

The utilization of health information enables easy movement of healthcare professionals, which can be used, for example, to initiate community dialogue and community engagement, ultimately resulting in improved access to health care for patients (Otieno et al., 2020). This is the case because the utilization of health information helps facilitate excellent and prompt communication between stakeholders in a healthcare system, ultimately leading to improved service provision. According to Tulu (2021), public health surveillance is one of the most critical aspects of the HIS. The primary objective of this aspect of public health is to quickly identify problems and implement solutions, for instance, during epidemics.

In the hospital setting, an HMIS system is tailored to work like the popular electronic health records system used in developed countries. Whereas its utilization is still significantly low, such systems give the advantage of fastened service, more secure records retrieval, and better patent management. However, few hospitals utilize such systems to manage patients for better service delivery. VCRH has implemented the system, but the level of use is still significantly low; this leaves many questions to be asked, especially since the systems are very expensive to install.

1.2 Problem Definition

Evidence gathered in the past reveals that health information management systems are essential in facilitating the achievement of organizational objectives linked to patient care (Dhillon, 2021). There is an issue with utilizing the HMIS at public hospitals in Kenya. This is because the systems are not implemented effectively, and there is insufficient data that can be used. Because they cannot do so or do not have the requisite staff to manage and deploy the procedures, public hospitals in Kenya are not utilizing the systems to their full potential. Mboera et al. (2021) included a study in the Garissa sub-county. They concluded that a lack of capability due to the low financial strength and staff shortage was one of the primary obstacles that impacted the competent utilization of HMIS. According to Mboera et al. (2021), the authorities responsible for implementing healthcare policies

and procedures are not purposeful when ensuring that HMIS is applied effectively. The distribution of insufficient funds demonstrates this. These issues with implementing HMIS produce significant waste and delays in diagnosing and treating patients (Mboera et al., 2021). Because of a lack of appropriate data that may be used, it might be challenging to monitor patients' development and arrive at well-informed judgments on their medical treatment. Because of this, the hospital cannot establish which therapies are the most beneficial, making it difficult to manage its resources properly.

A series of studies in Africa, including Kenya, have highlighted the low utilization of Health Management Information Systems (HMIS) and identified key factors influencing this. Kondoro et al. (2022) found that in Southern Ethiopia, the utilization of HMIS was low, with factors such as training, standard indicator definition, data analysis skills, regular feedback, performance evaluation, and timely reporting significantly associated with its use. Similarly, Seid (2021) reported low utilization in the Oromia Special Zone, Amhara Region, Ethiopia, with training, standard indicator definition, data analysis skills, regular feedback, performance evaluation, and timely reporting being significant factors. In Kenya, Nyaegah (2020) found a negative correlation between employee capacity and HMIS utilization in Homabay Sub-County, with inadequate employee capacity due to lack of training and skills. Kara (2020) also reported low utilization in the Hadiya Zone, Ethiopia, with factors such as monthly supportive supervision, written feedback, and compiled and sent additional parallel reports being significant. These studies collectively underscore the need for improved training, standardization, and support mechanisms to enhance the utilization of HMIS in Africa, including Kenya. Unfortunately, to the best of our knowledge, there are minimal studies investigating this subject in the Kenyan population.

There is a need for further research on the utilization of health management information systems (HMIS) in Kenyan public hospitals. Existing studies on HMIS adoption in Kenya's public health sector are limited, and those available have not deeply examined the factors affecting the successful rollout and utilization of these systems. This knowledge gap is concerning for public hospital administrators and Ministry of Health officials as they make decisions and investments related to HMIS selection, utilization, and optimization in facilities across the country. Without sufficient evidentiary bases regarding barriers and

enablers of HMIS success in Kenyan public hospitals, key aspects may be overlooked when planning and executing these projects (Nyaegah, 2020). Examining the on-the-ground realities of HMIS utilization in a specific county like Vihiga would provide valuable insights and lessons for improving adoption. By surveying end-users, gathering quantitative performance data, and assessing what issues arise post-utilization, researchers can equip public hospital managers with evidence-based best practices for their HMIS initiatives. Filling this research gap with a study grounded in the Kenyan public hospital context would strengthen future HMIS rollout and maximize their potential to enhance data-driven decision-making for quality of care.

This study investigates why hospital HMIS is not being utilized to its full potential to ensure the achievement of healthcare goals and objectives. Researchers from various institutions have investigated how HMIS is implemented across various medical facilities. According to the findings, the achievement of healthcare goals is hampered by several obstacles, including those of a managerial and budgetary nature and those about personnel (Mboera et al., 2021). According to the available research, many healthcare facilities in Kenya have not yet taken full advantage of the benefits offered by HMIS (Cheruiyot, 2019). Furthermore, the evidence suggests that the issue is more prominent in public health facilities than in private health facilities. However, their findings cannot be extrapolated to healthcare facilities across the nation since various facilities may be influenced by a variety of specific factors, such as the approach the county government takes to healthcare management. The Vihiga County Referral Hospital (VCRH) in Kenya is the focus of this investigation into implementing the HMIS. As a component of this study, examining the aspects that impact the utilization of HMIS at VCRH was also done. When it comes to providing a nation's population with high-quality medical care, public hospitals are vital organizations. They also act as important information sources for a variety of interventions for public health.

On the other hand, there is a dearth of information concerning introducing HMIS into Kenya's public hospitals. This study contributes to a greater understanding of the factors that impact VCRH's decision to use HMIS, including how and why they make that choice. The research believes this study is essential in bridging this gap by investigating the

utilization of HMIS at VCRH and the elements that determine staff adoption. By suggesting ways to further improve service delivery to patients through the use of HMIS, the study aims to also contribute to resolving the problem of limited benefits accrued from the expensive HMIS projects (Nyaegah, 2020). Practical recommendations from this study significantly improve service delivery in VCRH and other hospitals of similar levels.

1.3 Research Objectives

1.3.1 Broad Objective

To investigate the utilization and factors affecting the utilization of health management information systems at the Vihiga County Referral Hospital.

1.3.2 Specific Objectives

1. To determine the level of HMIS utilization in service improvement at VCRH
2. To determine the influence of technological, managerial, operational, and organizational factors on the utilization of HMIS at VCRH
3. To explore healthcare stakeholders' perspectives on the benefits, limitations and recommendations for optimization of the current HMIS at VCRH.

1.4 Research Questions

1. What is the current level of HMIS utilization and its impact on improving healthcare services at Vihiga County Referral Hospital (VCRH)?
2. How have technological, managerial, operational, and organizational factors influenced the utilization of the Health Management Information System (HMIS) at Vihiga County Referral Hospital (VCRH)?
3. What are the perspectives of healthcare stakeholders on the benefits, limitations and recommendations for optimization of the current HMIS at VCRH.?

1.5 Justification of the Study

Research documents that many factors may influence the utilization of HMIS in hospital management and decision-making at county levels. Similar to what is already documented, these factors may include technological, operational, organizational, and managerial factors in the counties where these hospitals are. VCRH, the referral facility for Vihiga County, receives much county attention but is also subject to all the complexities of the

bureaucratic county management process. Considering these factors may give a clear sight of the issues behind HMIS utilization and possibly give a basis for decision-making on how such systems may be bettered. This study aims to define an approach for improving healthcare delivery through HMIS at VCRH.

1.6 Scope and Limitations of the Study

The Vihiga County Referral Hospital is the location for the research project. To guarantee the achievement of healthcare goals and objectives, the HMIS system in Vihiga County Referral Hospital is not being utilized to its full potential as the subject of this study. Both the kinds of HMIS that are now on the market and the kinds of data that are typically entered have been investigated severally in other studies as cited herein. The accessibility of HMIS, as well as the difficulty that health practitioners have in making use of the Health Information Management System (HMIS) are addressed in this study. According to the available research, many healthcare facilities in Kenya have not yet taken full advantage of the benefits offered by HMIS. Scope-wise, this study focuses primarily on the factors that influence the utilization of HMIS at the hospital level by centering on technological, operational, managerial, and organizational factors. In addition to these, the study also attempts to suggest improvement strategies from the key members of the hospital service team. The primary limitation of the study is the limited scope since it focuses only on VCRH. A limited focus on one hospital not only confines the study to the prevailing factors and managerial environment of the selected center but also fails to recognize that there are several differences in the way different counties manage their health services. Nonetheless, it is worth noting that VCRH is a county hospital operating at level 5 similar to many county hospitals in the country. Therefore, despite all the differences notable, the findings of this study would still be applicable in most, if not all counties.

1.7 Significance of the Study

In the context of a referral hospital, this study aims to generate information on the aspects that impact health information management systems utilization. To solve the issues that have been encountered during the installation of the HMIS, the findings are potentially helpful to the county government of Vihiga as well as other organizations that are working in the healthcare context. The suggestions provided benefit other key areas with a context

comparable to the one described. Additionally, it is valuable as a contribution to the current research on the application of HMIS in establishing universal health care.

CHAPTER TWO

LITERATURE REVIEW

2.0 Chapter Overview

An in-depth literature review found a study in the context of already existing research in the field of interest. Therefore, conducting an effective literature review helps a researcher develop a clear perspective of the field of interest and develop a proper and workable concept built in proper theoretical frameworks. It also informs the methodology of the study. This chapter presents the concepts of HMIS as detailed in existing literature while also discussing the possible factors that might be associated with HMIS utilization at a hospital level. The chapter also identifies the present literature gap and presents theoretical and conceptual frameworks.

2.1 Theoretical Review

The present study, which is more of an action-oriented study aimed at bettering patient care, is built theoretically in the continuous improvement model. The continuous improvement paradigm recommends incremental enhancements to an organization's goods, services, and business processes. (Singh & Singh, 2009). Continuous improvement is essential to many improvement techniques, including the Plan Check Act model, Six Sigma, and the Toyota production system approach (Singh & Singh, 2009). Continuous improvement is also included in the lean principles and kaizen lean manufacturing best practices. Continuous improvement provides several short and long-term advantages to companies. Improved bottom-line profitability and customer service skills are two of the most prominent benefits of continuous improvement. When used correctly, continuous improvement may provide practically limitless optimization potential.

Since HMIS is already in use at VCRH, a continuous improvement model helps to increase the amount of benefit derived from the system by applying the three key principles of continuous improvement. First is the idea of small changes. Continuous improvement best practices support never-ending adjustments on a much smaller scale. Small long-term adjustments are far less daunting than huge strategic alterations. The unpleasantness of large strategy transitions is reduced by incremental improvements (Paraschivescu &

Cotîrleț, 2015). As a result, staff engagement and morale inside the firm benefit. The second issue is the use of staff ideas. In contrast to other types of improvement models that rely on top management perspectives, continuous improvement significantly relies on employee suggestions. It makes sense to solicit ideas from employees because they are the ones who do the work daily. Asking what modest adjustments employees might benefit from is one of the best methods for generating process improvement employee suggestions.'

Inexpensive utilization of improvement ideas stands out in the continuous improvement model. The low cost of most modest modifications is one of the most powerful characteristics of continuous improvement. In reality, case studies show that even tiny improvements can result in considerable bottom-line benefits through continual improvement (Carnerud et al., 2018). A continuous improvement paradigm is also less dangerous. Instead of riskier huge strategy moves, gradual improvements may be implemented with smaller expenditures spread out over a longer period.

Continuous improvement thrives in employee engagement, practical tools of improvement, and measurable results. Employee involvement is frequently increased since so much of the continuous improvement strategy is based on employee ideas. When employees are the brains behind an idea, they are more inclined to appreciate improvement procedures (Graban & Swartz, 2018). Receiving quality improvement modifications developed by senior management in a high-level meeting without members of the team's feedback might leave employees skeptical of business process changes. Due to these improvement procedures, senior management has more time to focus on enhancing the employee experience. A process management improvement must be quantified to be significant (Graban & Swartz, 2018). Understanding the efficacy of an improvement method opens up the prospect of applying the improvement to future business process adjustments. The capacity to demonstrate a favorable return on investment strengthens the organization's overall improvement culture. Short-term advantages and long-term company success are more sustainable than ever with the right improvement tools and software programs.

2.2 Theoretical Framework

The Health Information System (HIS) Strengthening Model provides a robust framework that aligns well with the study objectives for assessing HMIS utilization at Vihiga County Referral Hospital (VCRH). The first objective of the study is to determine the level of HMIS utilization in service improvement at VCRH. The 'information products and use' component of the HIS Strengthening Model focuses on how well health data is converted into usable information that guides service delivery improvements (MEASURE Evaluation, 2023). Examining this element at VCRH helped determine the extent to which HMIS data is transformed into feedback loops, performance tracking, and evidence-based practices that enhance health services (MEASURE Evaluation, 2023). The second objective is to determine the influence of technological, managerial, operational, and organizational factors on HMIS utilization at VCRH. The 'enabling environment' and 'data generation' aspects of the HIS Strengthening Model encompass these factors. Assessing the governance, resources, policies, processes, and capabilities surrounding HMIS at VCRH revealed how technological, managerial, operational, and organizational elements shape overall system performance.

The HIS Strengthening Model provides a clear roadmap that links barriers identified across the enabling environment, data systems, and use of information to targeted strategies for strengthening a health information system (MEASURE Evaluation, 2023). Applying this model at VCRH generated integrated recommendations to optimize HMIS performance in service of improved decision-making and service delivery. In summary, the HIS Strengthening Model provides a comprehensive framework for diagnosing the multi-faceted issues affecting HMIS utilization at VCRH. Its focus on governance, data generation, and information use spans the study objectives to generate evidence-based and actionable recommendations for enhancing HMIS performance and service delivery impact.

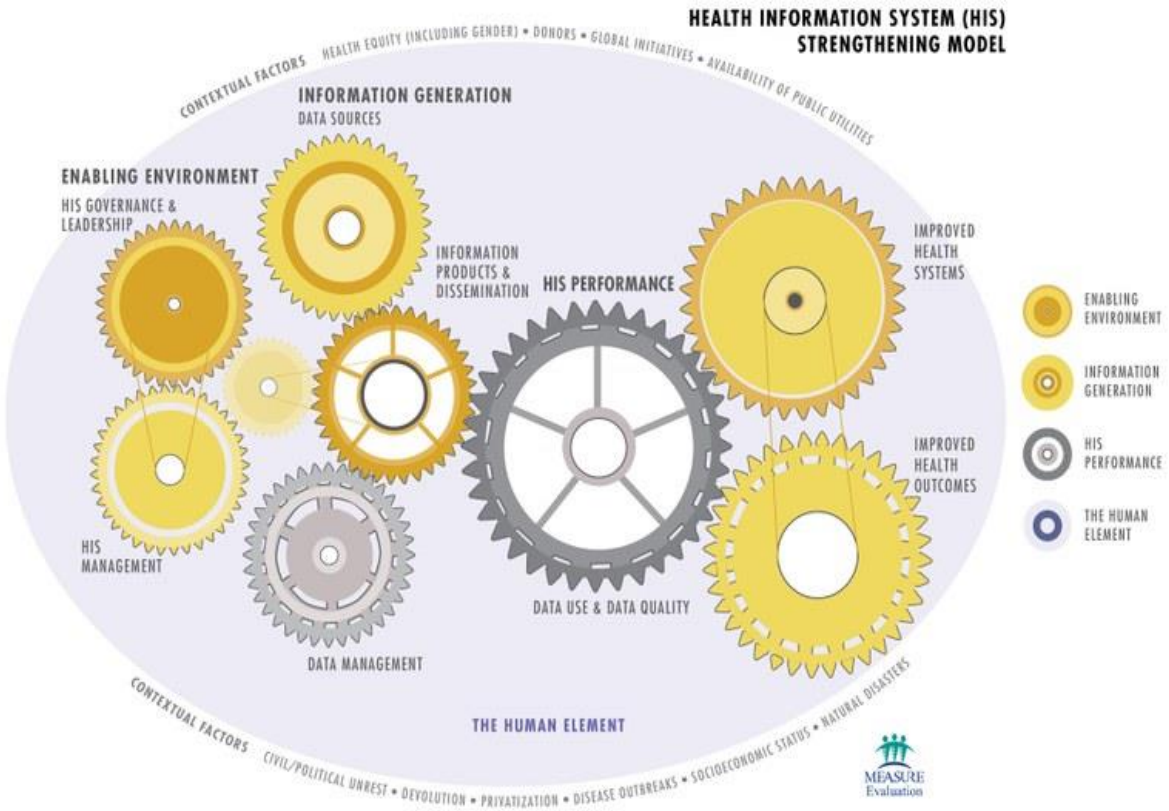

Figure 1 The Health Information System Strengthening Model

2.3 Empirical Literature

2.3.1 Health Management Information Systems Overview

Making judgments without knowledge is analogous to painting in the dark. Change is difficult because individuals overestimate the worth of what they have while underestimating the value of what they can acquire by giving it up (Gebre-Mariam & Bygstad,2019). The benefits of greater health data utilization to a health program have been highlighted and include: enhanced health strategies that lead to improved health programs, improved program management through an increased focus on quantifiable results, Programs have been improved by utilizing data and information to make service delivery, programmatic, and management decisions at the health institution, program site, and program management levels (Tan, 2019). Key decision-makers and opinion leaders are becoming more aware of developing or current health issues.

A healthcare management information system (HMIS) is an integration of ideas of effective business information management applied in healthcare to help speed up operations and improve efficiency through use of computer systems for data collection, storage, transmittal, and analysis (Tan, 2019). An HMIS software purchased by a hospital integrates all the essential departments of the hospital with the primary aim of storing all data that might be necessary for better decision making. In common practice, cutting-edge HMIS systems have been developed that can also for automated communication between departments like laboratory and clinician offices, manage finances and supplies, and collect data on the efficiency of care on issues like turn-around time (Endriyas et al., 2019). The managers can therefore easily analyze this data with the aim of operations improvement.

A patient entering the hospital is fed into the system as a new entry and assigned a unique patient identification number that helps to track all data related to the patient. Such data may include demographics, median history, signs and symptoms, diagnostic tests, and medications being administered (Endriyas et al., 2019). The system also documents details like the date of reporting and date of discharge and facilitates automated billing of the patient after the end of the hospital stay. HMIS is believed to significantly improve the quality of care offered to patients.

2.3.2 HMIS in Patient Quality Improvement

The World Health Organization identifies health information systems as one of the six key pillars of a health system (WHO, 2007). Effective HMIS that routinely collects, analyzes, and utilizes data is critical to monitoring health system performance, planning interventions, and guiding evidence-based decisions (Lippeveld, Sauerborn, & Bodart, 2000). High-quality data ensures policies tackle priority areas and allows tracking of progress towards health goals (AbouZahr & Boerma, 2005). At the facility level, HMIS like DHIS2 provides real-time data to understand patient volumes, disease patterns, and service coverage (Manya et al., 2016). This enables data-driven decisions on staffing, commodities, quality improvement, and resource allocation to improve service delivery and health outcomes. Aggregated HMIS data gives insight into population health trends and inequities to guide national strategic plans, healthcare financing, and program utilization (Nutley & Reynolds, 2013). Overall, HMIS strengthens health systems by

enabling regular monitoring, performance management, and data-informed decisions at all levels.

However, realizing the benefits of HMIS requires sustained investments in people, technology, and governance. Common challenges include limited infrastructure, skills gaps in collecting and using data, poor data quality, underutilization in planning, and lack of resources for HMIS (Mbondji et al., 2014). To strengthen national HMIS, there is need for standardized indicators, tools and databases, capacity building of personnel, data quality assessments, functional feedback loops, and leadership support (Aqil et al., 2009). At the facility level, HMIS use is facilitated through simplified user interfaces, training on data interpretation, supervision, and integrating analysis into management meetings (Gimbel et al., 2011). Strong health information systems empower health workers to track service delivery, managers to monitor system performance, and policymakers to make evidence-based decisions toward improved quality of care.

It is necessary to possess the patient's medical information and to be able to access this information in a centralized database. This is because the office staff and the physicians will have an easier and more efficient time evaluating the patient's medical history as a result of this change. The healthcare clinic will need to make some adjustments before it can carry out this program in a manner that ensures patients receive adequate and appropriate care (Endriyas et al., 2019). During the process of enhancing patient care, one of the most important steps to take is to make certain that the introduction of any innovative healthcare information system or change in the workflow will result in improved performance. This performance improvement will include an adjustment in coordinated care, a reduction in medical errors, and a more efficient utilization of procedures and tests (Wager et al., 2021). Because the company is having trouble converting the messaging system for electronic health records, none of the employees can access a patient's medical information within a single application. According to the patient's medical records, the patient portal will also give patients access to communicate with the staff members via encrypted messaging. This access will be provided to the patients. It is necessary to combine these programs into a single software application so that everyone will be able to view the notes from previous phone calls and conversations. This will make it possible to

provide better medical care to patients and to respond more precisely to their concerns (Wager et al., 2021).

2.3.3 HMIS Utilization Across Regions

2.3.3.1 HMIS in the USA

Health information management systems are rapidly becoming the order of the day in managing patient information in healthcare settings globally. The utilization of HMIS in the USA has a long and detailed background. The first use of electronic medical records (EMRs) began in the 1960s when hospitals started to store patient data on mainframe computers. This allowed for better patient care and more efficient hospital operations (Nisingizwe et al., 2014). However, it was not until the 1990s that EMRs became widely used in the USA. This was due to several factors, including the development of new technologies (such as personal computers and the internet) and the passage of federal legislation (such as the Health Insurance Portability and Accountability Act) (Adane et al., 2017). Today, all hospitals in the USA utilize some form of EMR system, and many physicians use EMRs in their private practices.

2.3.3.2 HMIS in Europe

Health Information Management Systems (HIMS) in Europe has a long and detailed history. HIMS has been used in Europe for many centuries, dating back to the early days of the continent's medical practices (Adane et al., 2017). The first HIMS was developed to manage the health information of European royalty and other high-ranking officials. These early systems were made up of paper records stored across Europe. As time passed, HIMS became more sophisticated and included electronic data storage and retrieval capabilities (Seid et al., 2021). The use of HIMS expanded rapidly throughout Europe during the 20th century as technological advances made it possible for more people to access and use these systems. HIMS is an integral part of the healthcare system in many European countries. They are used by hospitals, clinics, pharmacies, and other healthcare providers to store and share patient health information. HIMS plays a vital role in providing quality care to patients by helping healthcare professionals make informed decisions about treatment options and medication regimens.

2.3.3.3 HMIS in Other Parts of the World

HIMS is also used in other parts of the world, including Asia and the Middle East. However, their adoption varies significantly from region to region. In the Caribbean region, for example, HIMS is more commonly used in hospitals than in clinics (Seid et al., 2021). Hospitals are responsible for more complex patient records and have greater access to sophisticated IT systems. In Asia, HIMS is more commonly used in clinics than in hospitals. This is because clinics are often small businesses that do not have access to hospital-grade IT systems. Additionally, clinic patients often have less complex health records than patients in hospitals (Kondoro et al., 2022). In the Middle East, HIMS is less commonly used than in other parts of the world. This is because traditional healthcare systems in this region are based on manual systems of medicine rather than electronic records.

2.3.3.4 HMIS in Africa

Health information utilization in Africa ranges from 10 to 56 percent (Seid et al., 2021). There is a lack of capacity across Africa to use data to allow healthcare managers to evaluate the effects of changes they have implemented, which is a problem (Seid et al., 2021). Important health decisions in this context rely on disease projections and burden, donor demands and political opportunism, and sometimes on infrequently repetitive national studies like the DHS (Demographic Health Survey), which are unresponsive to changes that occur over a shorter period. According to Seid et al. (2021), making decisions about one's health depends on accurate data and the human and monetary funds engaged in advancing HMIS

HIMS has been utilized in Africa for a long time. In Africa, HIMS is used in both the public and private sectors. The first HIMS was implemented in the late 1990s in South Africa and Ghana (Nisingizwe et al., 2014). These systems were designed to address the specific needs of these countries, which included managing large volumes of patient data, improving patient safety, and reducing healthcare costs. Since then, HIMS has been adopted by other African countries, including Kenya, Nigeria, Tanzania, Uganda, and Zimbabwe (Nisingizwe et al., 2014). Whereas African Counters are making significant progress, the systems continue to be imperfect, as Moukénet et al. (2021) report issues with data quality and limited utilization. Further, Mremi et al. (2020) comment that HMIS

utilization in most of Sub-Saharan Africa is associated with incompleteness, inconsistency, and inaccuracy. Such data is considered biased and reflects only the population seeking care from healthcare facilities while ignoring the essential arm of community-based clinics and care settings.

African countries are increasingly appreciating that accurate data delivered promptly is a significant factor in determining public health policies. There were shards of evidence suggesting that the amount of data used for evidence-based judgments was only exhibited in 53% of the health hospitals in South Africa and 52% of the hospitals in Mexico, correspondingly (Hadgu, 2015). Similarly, a single project conducted in Tanzania and India suggested that section heads encountered wasted chances for making decisions based on data. The experimental evidence collected in Ethiopia revealed that the quantity of data utilized in the decision-making process varied greatly from one region to another throughout the country. The percentage was found to be the lowest in Jimma (32.9%), while it was found to be the highest in Hadya (69.3%) and North Gondar (78.5%) (Hadgu, 2015).

Several factors have contributed to the widespread adoption of HIMS in Africa. One recognizes the importance of health information for decision-making at all health system levels. Another is the need to improve healthcare facilities' quality assurance and accreditation processes (Wude et al., 2020). Additionally, many African countries have invested heavily in e-health initiatives to improve access to care and reduce costs associated with travel and missed appointments. One challenge that implementing HIMS in Africa faces is the lack of trained staff. In many cases, HIMS utilization has required recruiting additional personnel, including data managers, information technology specialists, and medical record administrators (Adane et al., 2022; Rumisha et al., 2021). Additionally, HIMS requires a robust infrastructure to support its operations. This includes an adequate number of computers and servers, as well as dedicated bandwidth and storage space.

2.3.3.5 HMIS in Kenya

Kenya has a long history of utilizing health information management systems (HIMS) to improve its citizens' quality of care and outcomes. One of the earliest examples of such a

system was implemented in the early 1990s by the government-run Kenya Medical Research Institute (KEMRI) (Bernardi et al., 2019). This system, known as KEMRI-HIMS, was designed to collect and track data on patients enrolled in clinical trials conducted by KEMRI. The Institute used this data to monitor patient outcomes and decide which treatments were most effective. In 2001, the Ministry of Health launched a nationwide program called Electronic Medical Record System (EMRS), which aimed to create an electronic medical record for every citizen in Kenya (Bernardi et al., 2019). The EMRS system was expanded to include a hospital management component called HMS. The eHMS allowed hospitals to electronically track patient admissions, discharge summaries, laboratory results, and radiology reports.

More recently, Kenya has been working towards implementing a nationwide health information exchange (HIE) system. The HIE allows different healthcare providers across Kenya to share patient data in real-time. This potentially improves care coordination and communication between providers, leading to better service delivery. The Kenya health information system is a multi-tiered structure that starts at the national level and extends to the facility level (Macharia & Maroa, 2019). The first tier is the NHIS which aggregates data from all health facilities in Kenya. This data is then transmitted to the second tier of the Ministry of Health (MOH). The MOH uses this data to inform policy decisions regarding healthcare in Kenya (Karimi, 2017). The third tier consists of individual health facilities using health information management systems (HIMS) to collect and store patient data. HIMS is also used to generate reports on various aspects of patient care, such as clinical outcomes and infection rates.

The utilization of HMIS in Kenya is still in its early phases, and additional study is required to improve the likelihood of successfully achieving the goals that have been set. This research investigates the utilization of HMIS in a public hospital in Kenya. The aspects that affect the utilization of HMIS at that public hospital were also investigated as part of this study. Public hospitals are indispensable when furnishing a nation's populace with high-caliber medical attention (Karimi, 2017). They also serve as vital information sources for various public health interventions. However, there is a lack of information regarding implementing HMIS in Kenya's public hospitals (Macharia & Maroa, 2019). This study

contributes to a better understanding of how and why a particular public hospital uses HMIS and the elements that influence their decision.

HMIS have been implemented in both public and private hospitals in Kenya to improve data collection, reporting, and utilization for decision-making. However, there are some key differences in how HMIS is implemented and utilized between the two sectors. In public hospitals, the utilization of HMIS has been driven by the Ministry of Health through a phased rollout to all public facilities (Karimi, 2017). The Ministry has provided training, hardware, and technical support to facilitate adoption. However, utilization has been gradual and faced challenges such as limited computer literacy among staff, poor internet connectivity, lack of electricity in some areas, and resistance to using the system. The quantity of data collected is high but quality remains a challenge.

In private hospitals, HMIS utilization has been more variable. Larger private hospitals and chains have implemented electronic HMIS and data warehouses. They have dedicated HMIS teams and use the data extensively for monitoring performance, resource allocation, and quality improvement. However, many mid-size and small private facilities still rely on paper-based data collection (Macharia & Maroa, 2019). There is no centralized coordination or standards for private sector HMIS like there is for public facilities. Overall, the public sector has wider coverage of HMIS across facilities. However utilization of data for decision-making is stronger in the private sector. Private hospitals are using HMIS for business intelligence, optimizing operations, and demonstrating quality for accreditation. Public facilities still mainly use HMIS as a reporting tool to the Ministry rather than for local decision-making.

2.3.4 Movement Toward an Efficient HIS Administration in Developing Countries

Literature on health management highlights a variety of early initiatives made by industrialized countries and developing countries to design and implement HMIS (Luz et al., 2021). The reasons behind these promises are not hard to find in the relevant literature. More than three decades ago, trends influencing health care in developing countries brought with them the necessity for those countries to reassess how their health sectors could be adequately managed. Although many other patterns have been discussed in published works (Haux, 2018), three significant themes are generally agreed upon. These

are: (1) The rise in the demand placed on health care systems sparked the requirement for health information systems that could guarantee the availability of new health-related information sources (Hertati & Syafarudin, 2018), (2) the surge and growth of the private health care sector over the past three decades have meant that the availability of new and improved health information is crucial for private practitioners and institutions, as they need to be able to compete successfully with public health providers (Tran & Nguyen, 2020), and finally (3) the surge in modernization and growth changed people's lifestyles that has rendered people more susceptible to a new profile of illness issues, where acute and contagious conditions remain a threat.

The mentioned changes have significantly informed the need to facilitate automated data collection, analysis, and sharing through EHR systems. This is necessary to facilitate the exchange of information regarding pandemic risks between developed and developing nations and to support disease surveillance programs that monitor disease outbreaks (Endriyas et al., 2019). In addition to other critical considerations, the abovementioned trends have molded health management in developing nations and prompted commitments to solve these difficulties. Among the various steps taken to meet these challenges was the establishment of health systems that assured reliable data on the functioning of different sections of the health system. This was significant since a consolidated data pool is required to develop, implement, monitor, and maintain health interventions (Atasoy et al., 2019). The requirement for pertinent, up-to-date, and accurate regarding the efficiency of the health sector in developing countries was the impetus for developing health information systems that supplied this type of information (Luz et al., 2021). As a result, the planning and utilization of HMIS have been going on for quite some time, and there are records of its achievements and failures.

Older health information systems did have some accomplishments in coordinating the sharing of health information; however, the flaws and inefficiencies of these earlier systems have been thoroughly researched in the literature (Puspita, 2020). The older HMIS was extremely renowned for funding research, follow-ups, and anti-retroviral medicine campaigns, which all contributed to the success of those HIS. There were also records of notable savings in the amount of time spent on emergency evacuations and the costs

incurred in numerous health institutions, thanks, among other things, to the assistance of HMIS (O'Leary, 2020). Concerning HMIS operations that did not go as planned, most were often implemented only at public medical institutions. This implied that such medical institutions only collected and shared data about relations within public medical institutions. They had no chance of learning from the innovations and research of private medical institutions, which appeared to be more advanced in terms of the delivery of health care (Puspita, 2020). One further significant problem of older HMIS was the logic of segmentation and redundancy in information collecting that defined the operationalization of these structures. This was a significant issue for earlier HMIS. This condition becomes even more ingrained in circumstances in which health institutions, donors, governments, and numerous other investors have little motivation to cooperate in sharing data, data collection, or leveraging common infrastructure (Kyalo et al., 2018). A recent investigation into health information systems recommends that developing countries transition from the traditional forms of HMIS focusing on paper-based medical information management to more information technology-based HMIS. This shift is taking place due to the increased availability of information technology in these countries.

In actuality, the last few years have witnessed an increase in the utilization of health management information systems all over the world, with developing countries increasing their commitments to design and operationalize efficient health management information systems that ensure the effective delivery of health care. This transformation is not surprising to some academics (Luz et al., 2021), particularly in light of the shifting landscape of healthcare management in Africa and other developing nations. Over the last few decades, there have been substantial shifts in the medical care systems of developing nations. A more decentralized approach with good coordination and information exchange has replaced the formerly prevalent model of centralized healthcare administration in the healthcare systems of developing countries. This new model is being implemented in place of the previous one (Alaro et al., 2019). Much restructuring has taken place in the traditional, hierarchical practice of healthcare management, in which the flow of decisions and information follows a top-down approach. Healthcare governance in developing nations has become significantly more decentralized in recent years, accompanied by considerable shifts in decision-making and management (Haux, 2018). Many developing

countries are now using a health care model that consists of a Ministry of Health (MOH) that supervises and monitors county and national health units through the use of HMIS. This model is currently in use in many countries. As a result of this restructuring, national, district, and community health units are each given some degree of operational autonomy (Miriovsky et al., 2012). Consequently, health units now have a significantly expanded mandate and increased responsibility for addressing concerns about health care.

2.3.5 The Utilization of HMIS

According to Bahreini et al. (2021), there are significant problems with leadership and governance, including ineffective management and leadership in the public health sector. Limited community participation in the management, planning, and monitoring of medical services, Inadequate health-related legislation enforcement, and horizontal and vertical inequities in health systems are all factors that affect the use of HMIS (Mboera et al., 2021). In addition, Mboera et al. (2021) mentioned that one factor that restricts the use of HMIS is inefficiency in resource allocation and utilization. Their study also found that using HMIS is impacted when national health information and research systems are inadequate (Mboera et al., 2021).

Successes and failures have been associated with implementing information systems in the healthcare industry. Problems associated with the organization itself are frequently to blame for the failure of an attempt to implement such a system. The success rate of a project is dependent on the developer's ability to develop their social and political interaction skills to the extent of 80%, while the utilization of the hardware and software technology contributes to the success of the project to the extent of 20% or less (Martinez eta l., 2021). This indicates that in developing countries, factors such as national and organizational cultures play a significant role. Another concern is reducing or eliminating personal benefits, such as supplemental income. The development of technology would also mean those dishonest ways of making money and fraudulent activities would become more obvious. These are some of the factors that come into play in developing countries, all of which significantly influence the degree to which hospitals in these countries can successfully implement information management systems.

There is a growing recognition within the literature on the medical information environment that many developing countries are transitioning from the conventional paper-based administration of both county and national health information to an increasingly digital information-based administration, where patient information is utilized to enhance clinical care at the point of service in addition to informing policy reviews. This transition is largely attributed to the advent of electronic health records (EHRs), which were introduced in the 1990s and have since become the de facto standard for electronic health (Haux, 2018). As was covered in the reviews before, many developing countries are beginning to recognize the need to transition toward health information systems with greater scope, scale, and sophistication in health admiration. Doing so ensures a delivery of healthcare that is both more interactive and of a higher quality. Five dimensions can be used to classify health information systems. These include gathering data and the flow of data, integrating data and its use, capacity and resources, scope, and scale (Luna et al., 2014). As far as he was concerned, these classifications had not been established yet, which contributed to a feeling of disjointedness and inadequate coordination of health information.

In recent years, this categorization has brought to light the increasingly coordinated and integrated manner in which health information has been managed. For instance, in recent years, healthcare information systems like computer-based health records and electronic physician order entry have now been utilized in various health facilities. These systems have significantly contributed to an improvement in the overall quality of care provided to patients, as well as an increase in the effectiveness and reliability of health services (Tummers et al., 2021). Despite this acknowledgment, the experiences regarding using HMIS in primary care and hospital settings as it applies to many developing countries have been varied. This is the case in both the hospital and primary care settings. Several study studies have been written that highlight the extent to which insufficient political commitments, a lack of financing, and inadequate management regimes have been obstacles to the adoption of HMIS (Bahadori et al., 2018). The vast majority of these research endeavors have suggested that developing countries use HMIS in the administration of health care delivery in various ways. It has been observed that certain developing countries use more HMIS systems based on paper, while others use both

traditional and ICT-based HMIS, and yet others utilize HMIS systems based on ICT (Luna et al., 2014).

2.3.6 Devolution and HMIS Utilization

With the devolution of health service delivery in Kenya to the counties, such as Vihiga County, there has been a shift towards localized decision-making in healthcare. HMIS at the county level plays a pivotal role in this context by providing timely and relevant health data specific to the county's needs. It empowers local healthcare authorities to make informed decisions regarding resource allocation, health program planning, and service improvement, thus tailoring healthcare interventions to the unique requirements of their communities. The devolution of healthcare in Kenya in 2013 aimed to bring decision-making closer to communities and facilitate citizen participation and rapid response to local priorities (Tsofa et al., 2017). This has led to greater autonomy for county governments to make decisions about health service delivery, including investments in health information systems (Barasa et al., 2017). Studies have found improved uptake of electronic medical records, data reporting systems, and disease surveillance tools in county hospitals following devolution (Manya et al., 2016; Wakaba et al., 2014). For example, Manya et al. (2016) found that Level 5 hospitals in devolved units had 2.3 times higher odds of adopting electronic medical records compared to the pre-devolution period. This enables more accurate patient data capture, information sharing between departments, and informed decision-making. In Vihiga County, the Level 5 Vihiga County Referral Hospital has benefited from devolution through training of health workers on data management, allocation of funds for computers and internet connectivity, and development of an integrated health information management system (Ndwiga et al., 2014). This has improved the hospital's ability to capture and report timely data on service utilization which informs planning and quality improvement.

While devolution has broadly facilitated improved health information system adoption in Kenya, challenges remain in some countries regarding technical capacity, funding, and political will (Tsofa et al., 2018). Sustainable gains require addressing IT infrastructure limitations, continuous training of personnel, and supportive supervision from the national government (Rommel et al., 2017). The full benefits of health information systems are only

realized with comprehensive capture, analysis, and utilization of data generated at service delivery points (Manya et al., 2019). In Vihiga County, further strengthening the use of data to guide decision-making has been identified as a priority (Vihiga County Government, 2018). Strategies include recruiting dedicated health records and information officers, building capacities for data analysis, data feedback meetings for hospital departments, and integrating community-level data from primary healthcare facilities (Vihiga County Government, 2018). Political commitment from county leadership must continue advocating for evidence-based planning. Additionally, national DHIS2 training and benchmarking with high-performing counties can enhance skills in Vihiga (Rommel et al., 2017). Ultimately, devolution has created opportunities to transform health information management in Vihiga County Referral Hospital, but sustained utilization efforts remain critical.

2.3.7 Challenges in Utilization and Utilization of HMIS

Many developing countries have made significant commitments to creating and implementing HMIS to enhance the quality of health care they provide to their populations. As a result, there has been significant progress made in both the development and usage of HMIS across the globe. On the other hand, health management information systems (HMIS) in many developing nations continue to struggle with several issues (Muhanga & Haule, 2021). One of the most significant obstacles is underdeveloped countries' inadequate organizational assets like inefficient business processes, lack of proper business models, and lack of management assets. When a country's political and social institutions are weak, there is frequently a propensity for the HMIS organizations that can function properly to have a poor basis. This can lead to ineffectiveness. As a result of this fact, many developing countries have difficulty implementing HMIS (Khubone et al., 2020). Another significant issue is that many emerging nations have inadequate information support systems. This is a problem for several reasons. Indeed, the information and communication technology (ICT) infrastructure in many developing nations is either insufficient or nonexistent. When conditions are like these, it is going to be challenging to establish the HMIS system.

Even though developing countries have made attempts to improve or upgrade their information and communications technology (ICT) facilities and national information systems, these efforts have barely yielded improvements, which makes the utilization of HMIS difficult, if not impossible, in these countries (Tulu et al., 2021). In certain nations that have successfully developed and put HMIS into operation despite operating under a framework of parallel HMISs, the result is frequently a redundancy of data (Muhanga & Haule, 2021). In circumstances like this, it is not unusual to find health workers struggling to keep up with their workload because they are required to generate reports utilizing health data that frequently overlap with one another and sometimes even contradict one another. In circumstances where these concurrent systems are not linked, a significant amount of time is wasted on collecting redundant information since the data are not cross-referenced between the various systems. This results in a significant loss of productivity. In light of these constraints, developing countries should make legally binding policies and political decisions to demonstrate their commitment to developing functional health information systems. These agreements can be quite helpful in developing an effective HMIS at every stage of the health supply chain (Muhanga & Haule, 2021).

Throughout its history, Kenya has also utilized a centralized method for making decisions regarding its healthcare services (Barasa et al., 2017). At the headquarters level of the MOH (Ministry of Health), centralized functions include the formulation of policy, the coordination of activities between the government and non-governmental organizations, the management of the execution of policy alterations concerning changes to governmental amenities like user fees, as well as the evaluation and monitoring of the effect that policy alterations have had (Barasa et al. 2017). Centralized decision-making has been held responsible for a variety of issues, including regional discrepancies in the dispersal of medical amenities, unequal access to quality health services, and disparities in budget allocations, all of which have resulted in regional distinctions in the pointers of health. In developing numerous national health sector strategic plans, the misfortune of excluding the involvement of other partners in centralized decision-making has been recognized (Barasa et al., 2017).

HMIS aims to enhance the capacity to gather, store, and analyze correct health data; raise accountability; improve the efficiency of service delivery; improve data accuracy; increase intervention effectiveness, and learn about trends (Endriyas et al., 2019). The system's purpose is to collect data on various health-related occurrences and evaluate the care level provided at each successive level of medical attention. Only a handful of countries in the world now have efficient and comprehensive data collection systems in place. However, there is no clear explanation of what an HMIS is included in any of these healthcare information systems that are now in use. There appears to be some misunderstanding regarding the distinction between a hospital facility and a health management system.

2.3.8 Determinants of HMIS Utilization

2.3.8.1 Technological Factors

The utilization of any new intervention in the healthcare field is dependent upon several factors. Setbacks associated with these factors, as already described above, equate to utilization challenges. Such issues may be categorized as technological, managerial, operational, and organizational factors (Farah & Mohamed, 2022). Technological factors are the most basic of these and are related to hardware and software issues that might affect the utilization of a computerized system at a hospital. The usability of the interface among the staff at the hospital and information fragmentation are key issues to consider. For proper HMIS utilization in a hospital setting, the interface should easily be usable among the staff that are intended to use it. The technology should also be well adapted to assigning specific rights and privileges only to the people who need them., It is also key to have a system that facilitates the speed and efficiency desired for quality improvement interventions like HMIS.

The technological components of HMIS including hardware, software, network infrastructure, and data standards have a major influence on system utilization and effectiveness (Luna et al., 2014; Odhiambo-Otieno, 2005). Adequate computers, servers, internet bandwidth, and reliable power supply facilitate data collection, transmission, and analysis (Tomasi et al., 2004). User-friendly, flexible software tailored to local needs improves adoption and data quality (Hapsara, 2016). Interoperable systems that can integrate data across departments provide comprehensive information critical for care

delivery and coordination (Smith et al., 2008). The adoption of data standards like ICD-10 codes enables the comparison and exchange of data across levels and partners (Chan et al., 2010). However, limited or outdated technology infrastructure hampers HMIS usage and data quality. Similarly, complex software with poor interface design reduces compliance and workforce computer literacy is imperative for proper system application (Gladwin et al., 2003). Assessing and upgrading technological capacities and designing appropriate solutions aligned with the setting promotes the routine use of HMIS to strengthen service delivery and management.

Based on the HIS Strengthening Model and the indicators presented by MEASURE Evaluation (2023), technological factors affecting HMIS utilization can be measured through several indicators. The key indicators are user-friendliness of the HMIS interface and ease of retrieving file formats, adequacy of hardware, software evaluation, and ICT infrastructure, and regular system testing and training of staff on the technology. These indicators assess the usability, sophistication, and accessibility of the technology underlying HMIS. They also examine whether capabilities and support systems exist to optimize the adoption and effective use of HMIS among end-users. Assessing these technological factors provides insights into how the design, infrastructure, and rollout of HMIS tools influence overall system performance and utilization.

2.3.8.2 Managerial Factors

A proper system cannot be implemented without the necessary managerial support needed to facilitate effectiveness and accuracy. Many times, senior managers in a bureaucratic leadership structure like the case of Kenyan government systems may not understand the implemented systems and therefore become setbacks in the proper utilization of HMIS (Farah & Mohamed, 2022). Key managerial challenges that may arise in the utilization of HMIS systems in a hospital setting, therefore, may include issues like lack of top management support, weak sharing of roles among managers thus leaving much of the authority under one person, and failure to create and implement proper avenues for the procurement and utilization of necessary technology (Ahmed et al., 2018). If proper workplace imprudent technologies are to be procured and implemented, there remains an urgent need for managers to consider a consultative process that collects opinions from

intended users and based on the data collected to implement the necessary technologies (Ally, 2019). Cooperation and communication therefore remain central.

Managerial factors including leadership, resources, training, and organizational culture have been found to significantly influence HMIS utilization in healthcare facilities (Kamadjeu et al., 2005; Odhiambo-Otieno, 2005; Kimaro & Nhampossa, 2005). Effective leadership entails setting a vision, advocating for resources, and providing supportive supervision for HMIS activities (Moszynski, 2008). It ensures HMIS utilization is prioritized and integrated into organizational strategy. Adequate allocation of financial resources facilitates procurement of equipment, software, and salaries for information technology staff (O'Carroll et al., 2003). Sufficient human resource capacity is built through training programs on data collection, reporting, analysis, and information use (Luna et al., 2014). An organizational culture that values data-driven planning and problem-solving motivates staff adoption of new HMIS processes (Degaut, 2015). Managerial commitment to building technical capacities coupled with a shared vision promotes acceptance and effective utilization of health information systems. However, deficiencies in leadership support, financing, skills, and organizational culture constrain HMIS utilization reducing data quality, use, and impact on service delivery (Kimaro & Sahay, 2007). Assessing and addressing managerial gaps is thus imperative for successful HMIS adoption. This requires consultative planning, change management, capacity building, and leadership that fosters a culture of data use, ultimately enabling evidence-based decision-making and quality of care improvements. Governance and managerial factors influencing HMIS utilization can be assessed through indicators like managerial support for HMIS use, strategic frameworks guiding adoption, communication around HMIS, and accountability mechanisms (MEASURE Evaluation, 2023). Examining leadership commitment, policy frameworks, resource allocation, and coordination around HMIS sheds light on how governance and management enable or hinder system performance.

2.3.8.3 Operational Factors

Operational factors are concerned with the logistical issues associated with launching an HMIS system in the hospital. Averagely, it is documented that effective launching may

take as long as 2 years before all issues in operation are resolved and the system becomes fully operational (Ahmed et al., 2018). With these logistical issues, a manager is very concerned about the costs, schedules, and timekeeping concerns that might arise. There is also always a need to train staff on how they can use such systems to better service delivery in the local setting (Yarinbab & Assefa, 2018). This also takes time. Such operational factors may therefore pose a serious challenge in the utilization of HMIS even if the management procures the best system available. HMIS investments alone cannot make organizations and managers more effective unless they are accompanied by supportive values, structures, and behavior patterns in the organization. Business firms like hospitals need to change how they do business before they reap the advantages of new information technologies. A system is only as beneficial as the ability of system users to fully make use of it.

Key operational factors that influence HMIS utilization include infrastructure, workflows, standard operating procedures, and data quality assurance mechanisms (Hapsara, 2016; O'Carroll et al., 2003). Adequate IT infrastructure including hardware, software, internet connectivity, and electricity is essential for effective data collection, analysis, and information sharing (Kimaro & Nhampossa, 2005). Integrating HMIS into provider workflows facilitates routine data capture during consultations and supports continuity of care (Waters, 1999). Standardized operating procedures and data collection tools promote consistent processes and quality data across system users (Gladwin et al., 2003). Effective data quality checks like audits, supervision, and data cleaning routines improve accuracy and reliability for decision-making (Makombe et al., 2008). Without proper infrastructure, workflows, standardization, and quality assurance, health facilities struggle with incomplete, inaccurate, and inconsistent data which compromises information use (Reeve et al., 2016). Additionally, a lack of interoperability with other electronic systems like laboratories and pharmacies leads to fragmentation and inhibits a comprehensive view of facility operations (Lessa et al., 2015). Addressing these operational barriers requires purposeful process redesign, change management, infrastructure upgrades, and capacity building to develop robust, holistic, and well-integrated HMIS aligned with end-user environments (Mutale et al., 2013). This further enables the institutionalization of a culture of information use and a shift towards data-driven management. Key operational factors

affecting HMIS utilization include system interoperability, data workflows, standard operating procedures, and data quality assurance processes (WHO, 2008). Assessing workflows, guidelines, infrastructure, and data verification routines provides insights into how day-to-day HMIS processes and operations shape overall system functioning and output quality (MEASURE Evaluation, 2023). This reveals facilitators and barriers related to the on-the-ground execution of HMIS activities.

2.3.8.4 Organizational Factors

Finally, there are the organizational factors. The truth is that organizations that have incorporated technology in third operations are already enjoying a competitive advantage over the ones that are yet to invest in technology. It is therefore important that public institutions also hurry to implement technologies that improve service delivery (Ahmed et al., 2018). This is significantly dependent upon organizational culture. A culture of continuous improvement can only be inculcated by top managers. It is these managers who facilitate the uptake of such technologies in the organization as well (Yarinbab & Assefa, 2018). Organizational values and goals geared towards continuous improvement are also vital in facilitating technology uptake. Organizational factors including structure, culture, staffing, and communication patterns have a significant influence on HMIS utilization (Kimaro & Nhampossa, 2005; Luna et al., 2014). Centralized vs decentralized authority and clear roles and responsibilities facilitate the coordination of HMIS activities across departments (Smith et al., 2008). A culture of information used for planning and decision-making provides institutional incentives for data collection and reporting (Chilundo & Aanestad, 2004).

Sufficient numbers of trained personnel in records, IT, and data management enable effective HMIS operations (Kihuba et al., 2014). Open communication and feedback loops promote data quality and system improvement (Gladwin et al., 2003). However, deficiencies in organizational structures and cultures can impede HMIS success, including lack of delegation of responsibilities, poor attitudes toward information use, inadequate staffing, and limited data sharing (Odhiambo-Otieno, 2005). Assessing and addressing these organizational gaps through management strategies like role clarity, motivational leadership, capacity building, and improved communication channels helps strengthen

HMIS utilization (Kimaro & Nhampossa, 2005). This facilitates teamwork, transparency, learning, and a shared vision across the institution to leverage data for enhancing service delivery and decision-making. Organizational factors like policies, accountabilities, training, culture, and structure play an important role in HMIS adoption (MEASURE Evaluation, 2023). Evaluating organizational readiness through indicators like HMIS policies, accountability mechanisms, and employee training sheds light on how well-existing systems, norms, and values support the institutionalization of HMIS. Aspects like leadership priorities, resources, and work processes enable or constrain effective uptake and sustainability.

2.4 Research Gap

This study addresses the underutilization of HMIS in hospitals to guarantee the realization of healthcare strategic vision, goals, and objectives. Several researchers have examined the utilization of HMIS in different healthcare facilities in Kenya. The findings show that several challenges, such as managerial, staffing, and budgetary allocation, adversely impact the realization of healthcare goals. The evidence suggests that many healthcare facilities in Kenya have yet to leverage the benefits of HMIS adequately. The evidence also indicates that the problem is more pronounced in public health facilities than in private facilities. However, their results cannot be generalized to healthcare facilities in the whole country as different facilities may be affected by unique factors such as the county government's approach to healthcare management. There was only a limited number of studies that focused on healthcare facilities in the western region or specifically centered on Vihiga County Referral Hospital (VCRH). Most of these did not narrow down to the statistical interplay of the various factors that might affect the adoption of HMIS as the present study proposes to investigate. Therefore, the application of HMIS, their efficiency, factors affecting their application, and alternatives for improvements specific to healthcare facilities in Kenya West, and more so VCRH remain unknown. As much as stakeholders may borrow the findings of studies in other parts of the country, their efficiency in realizing desired outcomes at VCRH remains in doubt. The researcher believes this study was critical in filling this gap by analyzing the utilization and factors determining staff adoption of HMIS at VCRH.

2.5 Study Hypothesis

There is no statistically significant association between technological, managerial, operational, and organizational factors and HMIS utilization at VCRH.

2.6 Conceptual Framework

Figure 1 below is a summary of the envisioned relationships between the variables of interest in this study. The indolent variables so far interest which are used in the formulation of the hypotheses for the study include technological factors, managerial factors, operational factors, and organizational factors. The dependent variable is HMIS utilization while the outcome of interest is improvement of patient services at VCRH. It is envisioned that other moderating variables like standard operating procedures at the hospital, political factors at the county level, and employee behavioral factors may also influence the utilization of HMIS at VCRH as shown. Inferential statistics done including correlations and regressions were based on the relationships in this framework. The dependent and independent variables were measured using the quantitative data collection questionnaire, and supplemented by the interviews.

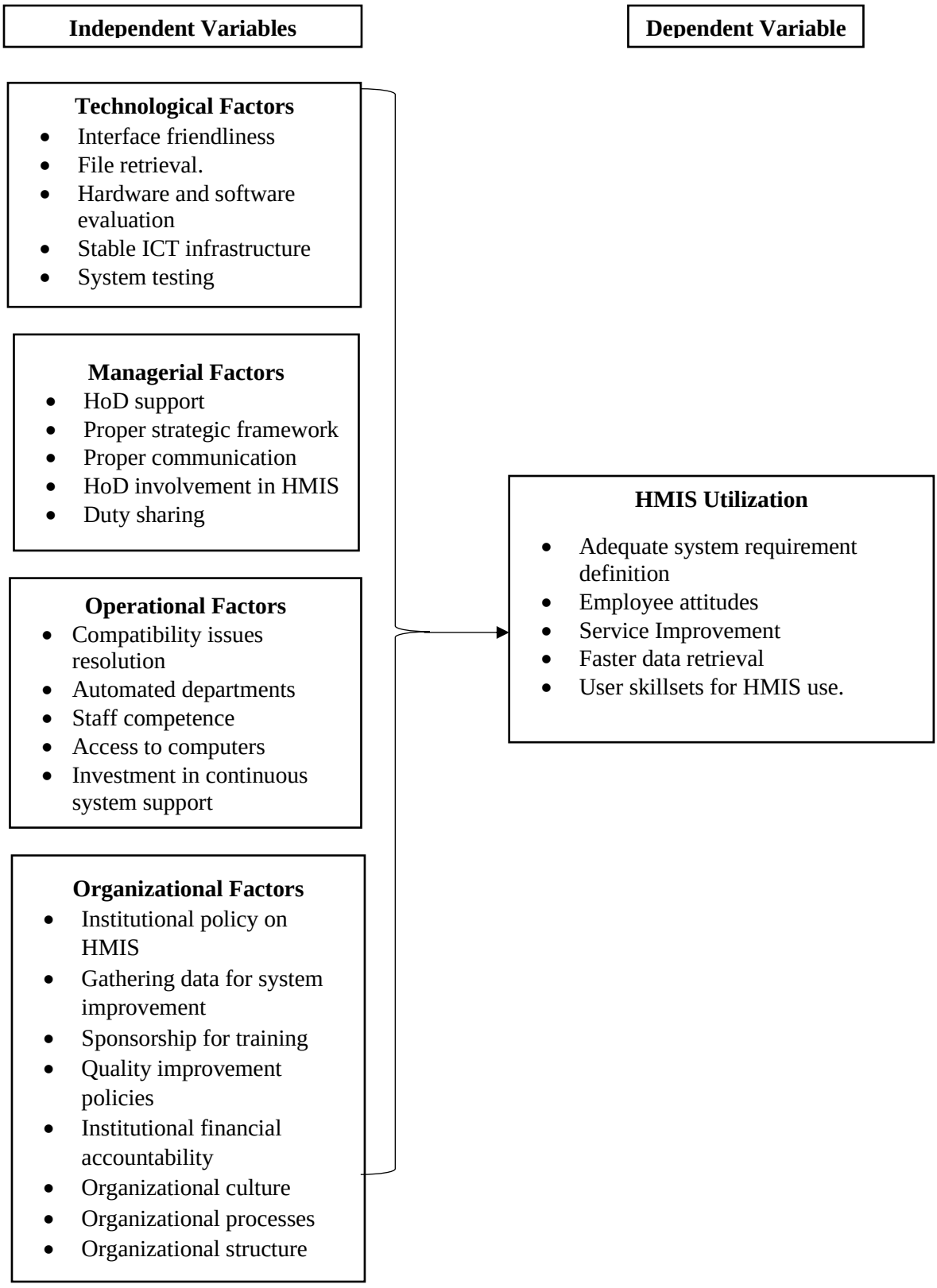

Figure 2 Conceptual framework

2.7 Operationalization of Study Variables

The study variables discussed in the literature review were operationalized for measurement as detailed in the table below. The table indicates the objectives, the name of the variable as per the conceptual framework above, and the indicators and scales used for measurement of each of these variables. This same operationalization was used for analysis.

Table 1 Operationalization of study variables

Objective	**Variable**	**Indicators**	**Scale**	**Data Analysis**
To determine the influence of technological factors on the utilization of HMIS at VCRH	Technological factors	User-friendliness of HMIS Easy to retrieve file formats Adequate software and hardware evaluation Efficient ICT infrastructure Regular system training of staff	Ordinal	Percentages and mean
To determine the influence of managerial factors in HMIS utilization at VCRH.	Managerial factors	Managerial support of HMIS use Strategic framework for HMIS use Effective communication on HMIS HoD awareness and involvement in HMIS Effective sharing of duties	Ordinal	Percentages and mean
To determine the effect of operational factors on the utilization of HMIS at VCRH.	Operational factors	System compatibility and interoperability Automated and computerized departments Technological competence of staff Access to working computers.	Ordinal	Percentages and mean

		Financial investment in HMIS's success		
To determine the influence of organizational factors on HMIS utilization at VCRH.	Organizational factors	Institutional policy on HMIS Accountability in HMIS use Sponsoring employee training on HMIS Internal policy for continuous quality improvement Financial accountability Organizational culture Organizational processes Organizational structure	Ordinal	Percentages and mean
To determine the level of HMIS utilization in service improvement at VCRH.	HMIS Utilization level	Adequate system requirement definition Attitudes towards HMIS use HMIS improvement of service delivery HMIS in fastening service delivery Skills and knowledge for HMIS use	Ordinal	Percentages and mean
To determine the factors associated with HMIS use at VCRH	N/A	Technological factors Managerial factors Operational Factors Organizational factors	Continuous	Inferential statistics (correlation and regression)

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Chapter Overview

This chapter gives a detailed description of the study methodology that was applied in conducting the study. It presents, in order, the study design, study population, sample size, and sampling technique, eligibility criteria, data collection, and data management approaches that were applied. The ethical issues are also detailed herein in addition to the dissemination of the study findings.

3.1 Research Design

The research design for this study is a mixed-method approach, combining both quantitative and qualitative methods to comprehensively investigate the utilization of HMIS at Vihiga County Referral Hospital (VCRH). A mixed-method cross-sectional study was conducted to answer the proposed objectives. The first two objectives were accomplished through the collection of quantitative data whereas the objective of suggestions for further improvement was answered through a collection of qualitative data from staff at VCRH. The general purpose of mixed methods research, which combines qualitative and quantitative aspects, is to broaden and reinforce the results of a study and so add to the weight of conclusions made. The use of mixed approaches should contribute to addressing research issues in all investigations by increasing knowledge and validity (Mugenda & Mugenda, 2003). The methodology should be of adequate quality as a product to accomplish multiple validity legitimation, which relates to the mixed research study fulfilling the required combination or set of statistical, subjective, and mixed methods criterion validity in the same study.

The chosen research design is the explanatory sequential approach, where quantitative data is collected and analyzed first, followed by the collection of qualitative data from key informants. This research design is selected for several reasons including its provision for explanation of Quantitative Findings. By starting with quantitative data collection and analysis, it is possible to first establish patterns, trends, and statistical relationships. This provides a solid foundation for understanding the quantitative findings. Additionally, the subsequent collection of qualitative data from key informants helps explain the quantitative

observations. It allows the researcher to delve deeper into the reasons behind certain trends and gain a more holistic understanding of the research objectives. The qualitative component also serves to generate suggestions from key informants on how the system can be improved. This practical input is invaluable for enhancing the healthcare system at VCRH. This approach is well-suited to this study because it allows for the integration of both quantitative and qualitative data, ultimately answering the research objectives more comprehensively. Combining the benefits of both qualitative and quantitative research methodologies enhances the overall effectiveness of the study, ensuring a more thorough exploration of the research questions and objectives as defined by (Mugenda & Mugenda, 2003).

3.2 Study Site

The study was conducted at the Vihiga County Referral Hospital. Vihiga County Referral Hospital (VCRH) is a level 5 government healthcare institution in Vihiga County, located along the Kisumu-Kakamega route, at Mbale Town, adjacent to the County Offices. VCRH has offered services to the residents of Vihiga and its surrounding areas for many years since its establishment in 2001. The 174-bed capacity hospital reports a consistent 108% bed occupancy in its 6 wards. It was once known as the Vihiga District Hospital until it was renamed after Kenya decentralizes health services. The institution was gazetted as a level 5 referral hospital in August 2017.

Vihiga County was selected as the study area because it is representative of many other counties in Kenya and similar regions, making the findings applicable to a broader context. Additionally, at VCRH there is access to relevant stakeholders, key informants, and HMIS data within Vihiga County, facilitating data collection. It is noteworthy to highlight that research in Vihiga County can directly contribute to the improvement of healthcare services in that specific area, addressing local needs and challenges.

The hospital's strategy plan is in accordance with the Health Strategic and Investment Plan, the County Integrated Development Plan (CIDP), the National Health Strategic Plan (NHSP), the Medium-Term Expenditure Framework (MTEF) Budgetary System, and Vision 2030. It was created based on a scenario analysis and outlines important goals to be accomplished between 2018 and 2023, with frequent monitoring and review. The strategic

plan's primary goal is to enable the hospital to function efficiently as a level 5 referral health institution in Vihiga County and its surrounding areas. As a result, hospital administration is eager to collaborate with employees and stakeholders to make the plan a reality and achieve the aim of making the facility a health provider of choice in the region.

The VCRH's key strategic objectives are as follows: to have an effective and efficient hospital management, leadership, and governance system, to broaden the scope and improve the quality of clinical services, to optimize health workforce size, skills, motivation, and distribution, to have an efficient health management and information system, to modernize and revolutionize health infrastructure, to increase resource mobilization, streamline budgeting and expenditure processes, and to have an efficient health management and information system.

3.3 Study Population

HMIS utilization relies on several categories of key people in the current structure of health services management at county level. The first category are the senior managers at the county referral hospital. This then trickles down to hospital managers and finally to the users of the system. The current study considers all these levels of potential users of the HMIS system so as to get a more comprehensive picture of the utilization of the system and the challenges encountered in its utilization. The study population, therefore, includes all healthcare workers, health information officers, and health service managers at the hospital level. The selection of this study population presented a prime opportunity to collect prime data from direct HMIS users.

3.4 Sampling Size

The total population of healthcare workers, health information officers and healthcare managers at the VCRH only amounts to about 214 people. Since the population is relatively small, a census sampling approach is used. In a census sampling approach, a researcher includes all qualifying members of the population in a study especially when the population is relatively small and easily accessible which is the case in this study (Mugenda & Mugenda, 2003). Table 1 below is a summary of the distribution of the staff at VCRH that qualify for inclusion in the study.

Table 2 Summary of Study Sample

Cadre	**Number of Staff**
Specialist consultants	11
Dentists	1
Medical officers	14
Pharmacists	3
Pharmaceutical technologists	12
Clinical officers	37
Nurses	96
Laboratory technologists	26
Health records and information officers	10
Dental technologists	4
TOTAL	214

3.5 Eligibility Criteria

3.5.1 Inclusion Criteria

For inclusion in the study, it was necessary that one must fulfill several conditions to ensure the quality of the data collected. First, one must either be a healthcare worker (Medical doctor, pharmacist, pharmaceutical technologist, dentist, dental technologist, nurse, medical laboratory technologist, or clinical officer) at VCRH, a health service manager (medical superintendents and other administrative officers) or ah health records and information officer. These are the parties directly involved in using HMIS and so were believed to have important data on the utilization and challenges encountered in its application.

3.5.2 Exclusion Criteria

All qualifying persons who had not served at the hospital for at least 3 months were excluded from the study. This is done to avoid taking data from unqualified persons as this may dilute quality. New staff have little knowledge of the HMIS system and may not accurately judge it. Also, all staff on leave during the time of the study were excluded because of the logistical complications of reaching them.

3.6 Data Collection Method and Instruments

Two approaches were used for data collection. Quantitative data were collected using a structured questionnaire consisting of Likert scale questions. The respondents were required to only state their level of agreement with the given statements on a 5-point scale. A questionnaire is selected for this quantitative arm of the study because it gives the advantage of structured and unfirm questions as well as ease of administration especially to an elite audience as is the case in the present study. The structured nature also allows for easy collection of quantitative data within a short time. Ease of response is promoted by designing the question to be as short as possible so that respondents can fill it in a short time without feeling burdened. The questionnaire was designed from existing literature and borrowed standard utilization/performance indicators from the MEASURE Evaluation (2023) framework for HIS strengthening.

Qualitative data were collected through interviews with key informants in Vihiga County. Key informants, including healthcare professionals, administrators, and other relevant stakeholders, were selected purposively based on their expertise and involvement in HMIS at VCRH. Before conducting interviews, informed consent was obtained from participants, ensuring they understood the study's purpose and their role in it. One-on-one semi-structured interviews were conducted with the selected key informants. These interviews provided a platform for participants to share their insights, experiences, and perspectives related to HMIS utilization at VCRH. Interviews were recorded (with participant consent) and transcribed accurately, ensuring that the spoken words were transformed into written text for analysis. Thematic analysis, using software like NVIVO, was employed to systematically identify and categorize recurring themes and patterns in the qualitative data.

3.7 Data Analysis

Quantitative data were checked manually for completeness and then imported into STATA version 15 for analysis. This analysis first involved summary statistics and frequency tables then followed by inferential statistics aimed at determining the relationships between the independent variables and the dependent variable of interest. Inferential statistics included correlation for study variables based on the Pearson Rank Correlation method, and linear regression for all checking association between the independent variables and the

dependent variable. The analysis of qualitative data was conducted through thematic analysis using NVIVO and Microsoft Word. First, the qualitative data, which includes participant interviews, was transcribed to convert spoken words into written text, ensuring the data was ready for analysis. The thematic analysis involved the generation of thematic codes. Initially, a deductive approach was employed, aligning with pre-defined main themes derived from the research objectives. These main themes provide a structured framework for the analysis. The qualitative data were closely examined to identify recurring and important themes within the interviews. These themes could pertain to various aspects, such as challenges, reasons for observed statistics, or suggestions for HMIS improvement at VCRH. The identified themes were then organized systematically, grouping them into categories that reflect the reasons behind the quantitative observations or suggestions for improving HMIS utilization. This organization helps in making sense of the qualitative data and drawing meaningful insights.

3.8 Ethical Considerations

The researcher recognizes the need for ethical research and the essence of ethical considerations in research. To ensure the research is undertaken ethically; hence, the researcher first sought ethical approval from the Institutional Research Ethics Committee (IREC) of Strathmore University, before undertaking the research. Discussions were also done with the Training and Research Committee of VCRH on the conduct of the study. All the recommendations made by these bodies were observed. Besides, participants were not dragged into the research without their consent—no coercion of whatever form was permitted – as the researcher administered written consent forms with all the details for participants to read and understand before choosing voluntarily to participate in the study. Confidentiality was guaranteed by concealing the identity of the participants and coding the questionnaires using randomly allocated participant numbers. All collected demographics were deidentified.

3.9 Dissemination of Study Findings

Following the completion of the study, the researcher shared the study findings with the members of the VCRH strategic planning committee as well as all other essential managers who may use such data for continuous improvement. Besides, findings shall be shared in

local and international research conferences as opportunities arise, in addition to presentations done at the school level.

CHAPTER FOUR

FINDINGS

4.0 Introduction

Chapter 4 presents the findings of the study on factors affecting Health Management Information System (HMIS) utilization at Vihiga County Referral Hospital (VCRH). It encompasses an analysis of demographic data, HMIS utilization, and the influence of various factors such as technological, managerial, operational, and organizational factors on HMIS utilization. The chapter provides insights into the factors shaping HMIS adoption, utilization, and its impact on healthcare delivery within the hospital setting.

4.1 Response Rate

Despite targeting a sample size above 214 participants, logistical challenges hindered achieving a higher response rate, resulting in data collection from 156 participants. Participants tended to not return questionnaires even after follow-up attempts, contributing to the moderate response rate of approximately 78%. This limitation underscores the difficulty in engaging participants effectively and highlights the challenges associate with survey-based research in certain settings. Nonetheless, the insights garnered from the available data still provide valuable information regarding the Health Management Information System (HMIS) utilization at Vihiga County Referral Hospital (VCRH). Of the 156 questionnaires collected, a further 21 were omitted from the analysis following the data-cleaning step. Many of these were majorly blank leaving deletion as the only viable option. Analysis therefore used on 135 respondents. Whereas the deletions had an impact on the quality of the data, the 135 respondents represent 63% of the targeted respondents, which is still sufficient for analysis and extrapolation of findings, considering that this was a census study. On the other hand, interviews were successfully conducted with 10 purposively selected key informants sampled from departments that are heavy users of the HMIS.

4.2 Quantitative Data Analysis

4.2.1 Reliability Analysis of the Data Collection Tool

The overall alpha value for all six items was 0.9044, indicating strong internal consistency among the items in the scale. This suggests that the data collection tool, encompassing HMIS Utilization (HT), Technological Factors (TF), Managerial Factors (MF), Operational Factors (OF), Organizational Factors (ORF), and Key Performance Indicators (KPI), demonstrates high reliability. The average interitem covariance of 0.343782 suggests a moderate level of covariance among the items, indicating a degree of shared variance in the responses. These statistics imply that the tool consistently measures the intended constructs and exhibits strong internal reliability, enhancing the validity of the data collected.

Table 3 Cronbach Alpha Determinations

Scale	**Alpha Value**	**Average Interitem Covariance**	**Number of Indicators**	**Number of Items/Constructs**
HMIS Utilization (HT), Technological Factors (TF), Managerial Factors (MF), Operational Factors (OF), Organizational Factors (ORF), and Key Performance Indicators (KPI)	0.9044	0.343782	30	6

4.2.2 Demographic Data

The key demographic variables analyzed in the study include age, level of education, gender distribution, and years worked at VCRH. Age is categorized into four groups: below 30, 30-39, 40-49, and above 50. The level of education is segmented into five categories: Bachelor, Certificate, Diploma, and Postgraduate. These demographic variables serve as crucial factors for understanding the characteristics of the study population and their potential influence on Health Management Information System (HMIS) utilization at VCRH.

Table 4 Demographic variables analysis

Variable	Particulars	Frequency	Percentage
Age	Below 30	29	21.48
	30-39	62	45.93
	40-49	34	25.19
	Above 50	10	7.41
Gender			
	Male	64	47.41
	Female	71	52.59
Education Level			
	Certificate	2	1.48
	Diploma	75	55.56
	Bachelors	42	31.11
	Postgraduate	16	11.85
Years of work at VCRH			
	Less than 1	22	16.30
	1-5	63	46.67
	6-10	32	23.70
	Over 10	18	13.33
Totals		135	100

The study revealed notable trends in participant characteristics. Predominantly, individuals aged between 30 to 39 constituted the largest proportion at 45.93%, followed by those aged 40 to 49, representing 25.19% of the sample. In contrast, participants aged above 50 constituted the smallest segment, accounting for only 7.41% of the total. Gender distribution showcased a relatively equal representation, with males comprising 47.41% and females slightly higher at 52.59%. Education-wise, the majority of participants held diplomas, constituting 55.56% of the sample, whereas individuals with certificates formed the least at 1.48%. Moreover, regarding tenure at Vihiga County Referral Hospital (VCRH), participants with 1-5 years of experience dominated, representing 46.67% of the

sample, whereas those with over 10 years of experience constituted the smallest segment at 13.33%. These demographic insights provide an overview of the study's participant characteristics, shedding light on the distribution and composition of the sample group.

4.2.3 Distribution Per Areas of Specialty/Training

The distribution of staff members' areas of training for the study revealed a diverse workforce with varying expertise at Vihiga County Referral Hospital. Nurses constituted the largest proportion at 29.63%, indicating their pivotal role in healthcare delivery. They were closely followed by Clinical Officers and Medical Doctors, comprising 15.56% and 13.33% respectively, showcasing the core medical expertise within the team. The presence of 8.89% of Laboratory Technologists underlined the significance of diagnostic services. Pharmacy staff, at 11.11%, highlighted the importance of medication management. Public health and Health Records staff contributed to administrative and preventive healthcare aspects. While each discipline played a crucial role, the low percentages of other areas such as Accounts, Physical Therapy, Psychology, and ICT suggested a possible need for enhancement in those fields. This distribution underscored a comprehensive approach to healthcare provision, ensuring a well-rounded team capable of addressing various medical needs at Vihiga County Referral Hospital.

Table 5 Distribution Per Areas of Specialty/Training

Area of Training/Discipline	**Frequency**	**Percentage**
Accounts	2	1.48
Clinical Officers	21	15.56
Physical therapy	2	1.48
Psychology	2	1.48
Public health	4	2.96
Health Records	8	5.93
ICT	2	1.48
Pharmacy	15	11.11
Radiology	3	2.22
Nurses	40	29.63

Medical Doctors	18	13.33
Laboratory Technologists	12	8.89
Others	6	4.44
Total	135	100.00

4.2.4 Descriptive Statistics of Key Study Variables

4.2.4.1 HMIS Utilization

Key highlights from the HMIS utilization survey indicate mixed perceptions at Vihiga County Referral Hospital (VCRH). While an adequate definition of system requirements was acknowledged (Mean = 2.881), concerns arose regarding staff attitudes toward HMIS usage (Mean = 2.748). However, respondents generally agreed on the system's positive impact, noting significant improvements in service delivery (Mean = 3.622) and efficiency (Mean = 3.562). Despite these improvements, there's room for enhancement in staff skills and knowledge concerning HMIS operation (Mean = 3.333). Overall, the data reflects both successes and areas for further development in HMIS utilization at VCRH.

Table 6 Descriptive statistics on HMIS Utilization

Variable	**Label**	**Observations**	**Mean**
HT1	An adequate definition of system requirements was done	135	2.881
HT2	VCRH staff have negative attitudes toward the use of HMIS	135	2.748
HT3	The HMIS system has greatly improved service delivery	135	3.622
HT4	The HMIS has fastened service delivery significantly	135	3.562
HT5	VCRH staff have the needed skills and knowledge to use the HMIS	135	3.333
Overall Mean			3.229

4.2.4.2 Technological Factors

Analysis of technological factors influencing HMIS use reveals notable insights. Respondents generally find the HMIS user interface friendly (Mean = 3.193) and file

conversion formats effective (Mean = 3.281). However, concerns arise regarding the stability of ICT infrastructure, particularly internet connectivity (Mean = 3.422), impacting HMIS usage. Adequate hardware and software evaluations appear less consistent (Mean = 2.993), suggesting a potential area for improvement. Despite this, regular system testing is organized by management to align tasks with HMIS functionalities (Mean = 3.177), indicating proactive efforts to ensure system efficacy. Addressing infrastructure stability and enhancing evaluation processes could further optimize HMIS utilization.

Table 7 Descriptive Statistics on Technological Factors

Variable	Label	Observations	Mean
TF1	The HMIS user interface is friendly to use	135	3.193
TF2	File conversion formats are effective and easy to retrieve in the HMIS	135	3.281
TF3	Adequate hardware and software evaluation is done regularly		2.993
TF4	There is unstable ICT infrastructure like the internet to allow the use of HMIS	135	3.422
TF5	The management organizes regular system testing to ensure current tasks match the HMIS functionalities	135	3.177
Overall Mean			3.213

4.2.4.3 Managerial Factors

Evaluation of managerial factors impacting HMIS utilization yields insightful findings. Overall, heads of departments (HoDs) exhibit strong support for HMIS utilization (Mean = 3.467), indicating organizational backing for the system. While a proper strategic framework exists for HMIS adoption and use (Mean = 3.200), there's room for enhancement in communication effectiveness between HoDs and users (Mean = 3.274). However, HoDs demonstrate awareness and active involvement in HMIS usage (Mean = 3.444), facilitating system integration. Additionally, effective sharing of duties among

department HoDs is apparent, contributing to HMIS monitoring (Mean = 3.422). Strengthening communication channels could further optimize managerial support for HMIS utilization and operation.

Table 8 Descriptive statistics on Managerial Factors

Variable	**Label**	**Observations**	**Mean**
MF1	All HoDs support HMIS utilization	135	3.467
MF2	There is a proper strategic framework for HMIS adoption and use	135	3.200
MF3	There is effective communication between HoDs and Users to ensure HMIS effectiveness	135	3.274
MF4	HoDs are aware and fully involved in using the HMIS	135	3.444
MF5	There is effective sharing of duties among department HoDs to monitor the HMIS	135	3.422
Overall Mean			3.361

4.2.4.4 Operational Factors

Assessment of operational factors impacting HMIS operation reveals notable findings. While there's prompt resolution of system compatibility and interoperability issues (Mean = 3.081), complete automation and computerization of departmental operations within the HMIS appear lacking (Mean = 2.837). Technological competence is deemed essential for HMIS manipulation (Mean = 3.444), highlighting the need for staff training. Although accessibility to working computers within departments is moderate (Mean = 3.007), financial investments are made to ensure sufficient gadgets meet HMIS technological demands (Mean = 3.303). Addressing automation gaps and bolstering technological competence through training could enhance HMIS efficiency and effectiveness in operational settings.

Table 9 Descriptive statistics on Operational Factors

Variable	Label	Observations	Mean

OF1	System compatibility and interoperability issues are pointed out and resolved promptly	135	3.081
OF2	All departmental operations are automated and computerized in the HMIS	135	2.837
OF3	One needs technological competence to manipulate and use the HMIS	135	3.444
OF4	Every staff member can access a working computer in my department	135	3.007
OF5	Financial investment is done to ensure enough gadgets are installed to meet the technological demands of HMIS use	135	3.303
Overall Mean			3.134

4.2.4.5 Organizational Factors

Analysis of organizational factors influencing HMIS utilization at VCRH unveils significant insights. The presence of a proper institutional policy guiding HMIS utilization is acknowledged (Mean = 3.118), fostering structured deployment. Furthermore, institutional encouragement of accountability in data collection and utilization for HMIS enhancement is evident (Mean = 3.533), emphasizing a culture of improvement. However, there's a perceived gap in sponsoring employee training for HMIS usage (Mean = 2.925), suggesting a potential area for investment in staff development. Notably, the HMIS is credited with promoting financial accountability (Mean = 3.703) and enjoys favorable organizational structures and cultures (Mean = 4.496), fostering seamless integration and utilization. Despite these strengths, complete automation of routines remains incomplete (Mean = 3.385), indicating ongoing efforts toward optimization. Addressing training gaps could further enhance HMIS effectiveness within VCRH's organizational framework.

Table 10 Descriptive statistics on Organizational Factors

Variable	Statement	Observations	Mean
ORF1	There is a proper institutional policy that guides HMIS utilization at VCRH	135	3.118

ORF2	The institution encourages accountability in collecting and using information for further HMIS improvement	135	3.533
ORF3	The institution sponsors employee training on how to use the HMIS	135	2.925
ORF4	There are proper internal policies for continuous quality improvement at VCRH	135	3.333
ORF5	The HMIS has promoted financial accountability at VCRH	135	3.703
ORF6	The organizational structure of VCRH favors HMIS	135	3.629
ORF7	VCRH's routines, processes, and culture are favorable for HMIS utilization	135	4.496
ORF8	HIMS has automated all routines and processes at VCRH that were formally performed manually	135	3.385
Overall Mean			3.515

4.2.4.6 Key Performance Indicators

Evaluation of key performance indicators (KPIs) regarding HMIS utilization and utilization provides valuable insights into VCRH's performance. The availability of qualified and competent HIS and service management personnel appears moderately sufficient (Mean = 2.822), suggesting a potential need for further staffing improvements. However, the existence of a hospital-level strategic plan developed through a participatory process is notably strong (Mean = 3.325), indicating strategic foresight and collaboration. Policies, laws, and regulations governing HMIS use and reporting are in place (Mean = 3.170), contributing to operational clarity and compliance. Additionally, the availability of standard core indicators and SOPs enhances data consistency and interpretation (Mean = 3.244 and 3.170 respectively). The utilization of data for planning, budgeting, and advocacy activities is evident (Mean = 3.592), showcasing the practical application of HMIS insights. Moreover, data utilization for health system performance evaluation demonstrates accountability and improvement efforts (Mean = 3.237). Overall, while strengths in strategic planning and data utilization are evident, addressing staffing

adequacy and further enhancing policy clarity could optimize HMIS effectiveness at VCRH.

Table 11 Descriptive statistics on Key Performance Indicators

Variable	Label	Observations	Mean
KPI1	Availability of a sufficient number of qualified and competent HIS and service management personnel	135	2.822
KPI2	The existence of a hospital-level strategic plan developed through a participatory process	135	3.325
KPI3	Existence of policies, laws, and regulations on HMIS use and reporting	135	3.170
KPI4	Availability of a standard minimum set of core indicators that the HMIS must report periodically.	135	3.244
KPI5	Availability of an SOP that contains HIS information, analysis, and interpretation details for staff to use	135	3.170
KPI6	Use of data for planning, budgeting, or advocacy activities in the past year	135	3.592
KPI7	Data or results of analyses are used to inform the health system's performance evaluation	135	3.237
Overall Mean			3.223

4.2.5 Correlation Analysis

The correlation analysis unveiled moderate positive relationships between HMIS utilization (HT) and various independent variables. Specifically, the correlation coefficients indicated that as Technological Factors (TF) increased, HMIS utilization tended to increase as well, with a coefficient of 0.5649. Similarly, Managerial Factors (MF), Operational Factors (OF), Organizational Factors (ORF), and Key Performance Indicators (KPI) demonstrated moderate positive correlations with HMIS utilization, with coefficients of 0.4422, 0.4268, 0.5167, and 0.4928, respectively. These findings suggest that improvements in Technological, Managerial, Operational, Organizational, and Performance Indicator aspects coincide with enhanced HMIS utilization within the healthcare setting. Notably, the relatively stronger correlation between Organizational

Factors and HMIS utilization compared to other factors underscores the significance of organizational structures and processes in facilitating effective HMIS adoption and utilization.

Furthermore, the observed positive correlations align with the conceptual framework of HMIS utilization, indicating that factors such as technological advancements, effective managerial practices, streamlined operational processes, supportive organizational structures, and robust performance indicators contribute synergistically to the successful integration and utilization of HMIS within healthcare facilities. These findings have implications for healthcare administrators and policymakers, highlighting the importance of addressing multiple facets, including technological infrastructure, managerial strategies, operational workflows, organizational culture, and performance monitoring, to optimize HMIS utilization and maximize its potential impact on healthcare delivery and patient outcomes.

Table 12 Correlation matrix between HT and the TF, MF, OF, ORF, and KPI

```
. correlate HT TF MF OF ORF KPI
(obs=135)
```

	HT	TF	MF	OF	ORF	KPI
HT	1.0000					
TF	0.5649	1.0000				
MF	0.4422	0.7375	1.0000			
OF	0.4268	0.6681	0.7140	1.0000		
ORF	0.5167	0.6626	0.6862	0.6899	1.0000	
KPI	0.4928	0.6295	0.6071	0.5921	0.7635	1.0000

4.2.6 Regression Analyses

4.2.6.1 Simple Linear Regressions

In the analysis assessing the influence of Technological Factors (TF) on Health Information Management System Utilization (HT), the results indicated a statistically significant relationship. The regression model demonstrated a significant effect of Technological Factors on HT ($F(1, 133) = 62.33$, $p < 0.0001$). The model explained a substantial proportion of the variance in HT, as evident from the R-squared value of 0.3191. The coefficient for Technological Factors (TF) was 0.531421 ($p < 0.0001$, 95% CI [0.3982859,

0.6645562]). This positive coefficient suggests that an increase in Technological Factors is associated with higher Health Information Management System Utilization. Adjusting for the number of observations and degrees of freedom, the overall model fit was considered good (Root MSE = 0.59054). The Adjusted R-squared value of 0.3140 indicates that approximately 31.40% of the variability in the dependent variable (HT) was explained by the independent variable (Technological Factors). Therefore, the findings suggest that Technological Factors significantly influence the utilization of the Health Information Management System, as reflected in Health Information Management System Utilization (HT).

Managerial Factors (MF)

Table 13 Simple linear regression analysis between HT and the TF

```
regress HT TF
```

Source	SS	df	MS		
				Number of obs	= 135
				F(1, 133)	= 62.33
Model	21.7386637	1	21.7386637	Prob > F	= 0.0000
Residual	46.3828178	133	.348742991	R-squared	= 0.3191
				Adj R-squared	= 0.3140
Total	68.1214815	134	.508369265	Root MSE	= .59054

HT	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
TF	.531421	.0673093	7.90	0.000	.3982859	.6645562
_cons	1.521997	.2221789	6.85	0.000	1.082535	1.961458

In the analysis assessing the influence of Managerial Factors (MF) on Health Information Management System Utilization (HT), the results indicated a statistically significant relationship. The regression model demonstrated a significant effect of Managerial Factors on HT ($F(1, 133) = 32.32$, $p < 0.0001$). The model explained a proportion of the variance in HT, as evident from the R-squared value of 0.1955. The coefficient for Managerial Factors (MF) was 0.3758399 ($p < 0.0001$, 95% CI [0.2450757, 0.5066041]). This positive coefficient suggests that an increase in Managerial Factors is associated with higher Health Information Management System Utilization. Adjusting for the number of observations and degrees of freedom, the overall model fit was considered acceptable (Root MSE =

0.64192). The Adjusted R-squared value of 0.1894 indicates that approximately 18.94% of the variability in the dependent variable (HT) was explained by the independent variable (Managerial Factors). In conclusion, the findings suggest that Managerial Factors significantly influence the utilization of the Health Information Management System, as reflected in Health Information Management System Utilization (HT).

Table 14 Simple linear regression analysis between HT and the MF

regress HT MF

Source	SS	df	MS	Number of obs	=	135
				F(1, 133)	=	32.32
Model	13.3175387	1	13.3175387	Prob > F	=	0.0000
Residual	54.8039428	133	.41205972	R-squared	=	0.1955
				Adj R-squared	=	0.1894
Total	68.1214815	134	.508369265	Root MSE	=	.64192

HT	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
MF	.3758399	.0661106	5.69	0.000	.2450757	.5066041
_cons	1.966251	.228994	8.59	0.000	1.51331	2.419192

In the analysis assessing the influence of Operational Factors (OF) on the Health Information Management System Utilization (HT), the results revealed a statistically significant relationship. The regression model demonstrated a significant effect of Operational Factors on HT (F (1, 133) = 29.63, p < 0.0001). The model explained a proportion of the variance in HT, as evident from the R-squared value of 0.1822. The coefficient for Operational Factors (OF) was 0.4058688 (p < 0.0001, 95% CI [0.2583911, 0.5533465]). This positive coefficient suggests that an increase in Operational Factors is associated with higher Health Information Management System Utilization. Adjusting for the number of observations and degrees of freedom, the overall model fit was considered acceptable (Root MSE = 0.6472). The Adjusted R-squared value of 0.1761 indicates that approximately 17.61% of the variability in the dependent variable (HT) was explained by the independent variable (Operational Factors). In general, the findings suggest that Operational Factors significantly influence the utilization of the Health Information

Management System, as reflected in Health Information Management System Utilization (HT).

Table 15 Simple linear regression analysis between HT and the OF

regress HT OF

Source	SS	df	MS	Number of obs	=	135
				F(1, 133)	=	29.63
Model	12.4117685	1	12.4117685	Prob > F	=	0.0000
Residual	55.709713	133	.418870023	R-squared	=	0.1822
				Adj R-squared	=	0.1761
Total	68.1214815	134	.508369265	Root MSE	=	.6472

HT	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
OF	.4058688	.0745604	5.44	0.000	.2583911	.5533465
_cons	1.957306	.2402789	8.15	0.000	1.482044	2.432568

In the analysis assessing the influence of Organizational Factors (ORF) on Health Information Management System Utilization (HT), the results indicate a statistically significant relationship. The regression model demonstrated a significant effect of Organizational Factors on HT ($F(1, 133) = 48.44$, $p < 0.0001$). The model explained a substantial proportion of the variance in HT, as evident from the R-squared value of 0.2670. The coefficient for Organizational Factors (ORF) was 0.5355126 ($p < 0.0001$, 95% CI [0.3833248, 0.6877004]). This positive coefficient suggests that an increase in Organizational Factors is associated with higher Health Information Management System Utilization. Adjusting for the number of observations and degrees of freedom, the overall model fit was considered good (Root MSE = 0.61274). The Adjusted R-squared value of 0.2615 indicates that approximately 26.15% of the variability in the dependent variable (HT) was explained by the independent variable (Organizational Factors). To conclude, the findings suggest that Organizational Factors significantly influence the utilization of the Health Information Management System, as reflected in Health Information Management System Utilization (HT).

Table 16 Simple linear regression analysis between HT and the ORF

```
regress HT ORF
```

Source	SS	df	MS	Number of obs	=	135
				F(1, 133)	=	48.44
Model	18.1870996	1	18.1870996	Prob > F	=	0.0000
Residual	49.9343819	133	.375446481	R-squared	=	0.2670
				Adj R-squared	=	0.2615
Total	68.1214815	134	.508369265	Root MSE	=	.61274

HT	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ORF	.5355126	.0769417	6.96	0.000	.3833248	.6877004
_cons	1.413845	.2661661	5.31	0.000	.8873788	1.940311

4.2.6.2 Multiple Linear Regressions

The regression output provides valuable information about the relationship between the dependent variable (HMIS utilization and service improvement represented by HT) and the independent variables (technological factors TF, managerial factors MF, operational factors OF, organizational factors ORF, and key performance indicators KPI). The F-statistic tests whether at least one of the independent variables is significantly related to the dependent variable. In this case, the F-statistic is 14.73, and the associated p-value is 0.0000, indicating that the overall model is statistically significant. The R-squared value is 0.3635, suggesting that approximately 36.35% of the variance in HMIS utilization and service improvement (HT) can be explained by the independent variables included in the model. The coefficients represent the estimated change in the dependent variable for a one-unit change in the corresponding independent variable, holding other variables constant.

For TF with a coefficient of 0.3826, holding other variables constant, a one-unit increase in technological factors (TF) is associated with a 0.3826 unit increase in HMIS utilization and service improvement (HT). MF coefficient of -0.0555 means that holding other variables constant, a one-unit increase in managerial factors (MF) is associated with a -0.0555 unit decrease in HT. Similarly, the coefficients for OF, ORF, and KPI showed diverse but small effects on each of the variables as per the modeled regression tabulated. The intercept represents the estimated value of HT when all independent variables are zero. In this case, it is 1.1149. In summary, technological factors (TF) appear to be a statistically

significant predictor of HMIS utilization and service improvement (HT). However, managerial factors (MF), operational factors (OF), organizational factors (ORF), and key performance indicators (KPI) do not appear to be statistically significant predictors in this model.

Table 17 Multiple regression analysis between HT and the TF, MF, OF, ORF, and KPI

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regress HT TF MF OF ORF KPI
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Source	SS	df	MS		
				Number of obs	= 135
				F(5, 129)	= 14.73
Model	24.7626755	5	4.95253509	Prob > F	= 0.0000
Residual	43.358806	129	.336114775	R-squared	= 0.3635
				Adj R-squared	= 0.3388
Total	68.1214815	134	.508369265	Root MSE	= .57975

HT	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
TF	.3826426	.1072049	3.57	0.001	.1705352	.5947501
MF	-.0554506	.1015949	-0.55	0.586	-.2564586	.1455575
OF	-.0149539	.1059042	-0.14	0.888	-.224488	.1945802
ORF	.2104508	.1312886	1.60	0.111	-.049307	.4702085
KPI	.1256155	.1084021	1.16	0.249	-.0888607	.3400918
_cons	1.114867	.2634967	4.23	0.000	.5935325	1.636202

4.3 Qualitative Analysis

4.3.1 Introduction

The qualitative component of this study aimed to examine the perspectives and experiences of healthcare stakeholders about the utilization of Health Management Information Systems (HMIS) implemented at the Vihiga County Referral Hospital in Kenya. The hospital, along with the broader Kenyan healthcare system, is undergoing a transition from paper-based medical records and reporting to integrated digital systems and electronic health records. However, as identified through background research, user adoption levels of newly implemented HMIS systems have been sub-optimal in many contexts. Additionally, myriad technological and infrastructural barriers pose utilization challenges, affecting the intended utilization outcomes. In alignment to investigate

stakeholder perspectives and experiences, the following three research sub-questions were defined to guide the direction for the qualitative analysis component of the current study.

1. What are the perspectives of healthcare stakeholders on the benefits, limitations, and desired capabilities of the HMIS in use?
2. What facilitating and hindering experiences do stakeholders encounter in the use of HMIS?
3. How can the utilization of HMIS be optimized from the stakeholder perspective?

For the systematic analysis of the qualitative interview data collected from stakeholders, a three-step coding approach was followed:

1. Open Coding: This first-level coding process focused on identifying and labeling concepts throughout the textual interview data. Line-by-line coding was carried out to assign conceptual codes and categories related to the research objectives, for example, perceived benefits and limitations, desired functionalities as well as factors enabling or hindering use. This enabled the segmentation of data into meaningful groups from which relationships could be derived.
2. Axial Coding: In the next step, analytical connections were made between the categories and concepts resulting from open coding. Codes were related based on shared characteristics, allowing the aggregation of codes into sub-themes, and linkage to overarching themes such as factors influencing HMIS adoption. This allowed for further conceptual abstraction in line with answering the defined research questions.
3. Selective Coding: Lastly, through selective coding, the core conceptual themes about stakeholder perspectives and utilization experiences could be determined. The related sub-categories were systematically drawn together under the core themes that reflected components aligned to the questions - perspectives on limitations and values, as well as factors hindering or facilitating use. Conclusions could now be derived connecting the conceptual themes to address the research questions.

4.3.2 Results from The Coding Process

4.3.2.1 Open Codes Identified

The Table below shows a table displaying the results of the open coding analysis including all identified codes and associated themes and subthemes from the qualitative data. The open coding analysis of interviews with healthcare stakeholders in Vihiga County Referral Hospital aimed to elucidate perspectives and experiences regarding the utilization of the health management information system (HMIS). Three key thematic areas emerged from the initial coding process – factors considered by stakeholders when selecting and implementing HMIS, barriers, and facilitators impacting utilization, and recommendations to optimize benefits.

Table 18 Results of open coding analysis

Codes	**Themes**	**Subthemes**
Cost-effectiveness, Affordability	Key Technology Considerations	System Qualities and Capabilities
User-friendliness, Ease of use	Key Technology Considerations	System Qualities and Capabilities
Interoperability, Integration with other systems	Key Technology Considerations	System Qualities and Capabilities
Customizability to needs	Key Technology Considerations	System Qualities and Capabilities
Security, Privacy, and Data protection	Key Technology Considerations	System Qualities and Capabilities
Internet instability	Utilization Barriers	Infrastructure Limitations
Insufficient devices/hardware	Utilization Barriers	Infrastructure Limitations
Access limitations for users/departments	Utilization Barriers	Infrastructure Limitations

Codes	Themes	Subthemes
Lack of training, Reluctance to adopt	Utilization Barriers	Personnel Challenges
Scope limitations, Reporting issues	Utilization Barriers	System Functionality Gaps
Suboptimal developer support, Upgrades	Utilization Barriers	External Stakeholder Support
Power supply challenges	Utilization Barriers	Operational Issues
Increased efficiency	Perceived Benefits	Process Improvements
Improved data storage/backup	Perceived Benefits	Health Information Enhancements
Better recordkeeping, coordination	Perceived Benefits	Health Information Enhancements
Enhanced transparency, monitoring	Perceived Benefits	Oversight and Accountability
Improved clinical decision-making	Perceived Benefits	Patient Care Benefits
Expanded system scope	Recommendations	System Enhancements
Improved equipment availability	Recommendations	Infrastructure Development
Comprehensive training	Recommendations	Personnel Skill Building
Collaborative review processes	Recommendations	Stakeholder Engagement
Backup protocols	Recommendations	Contingency Planning

Note. This table comprehensively maps all the codes identified from the open coding analysis to associated qualitative themes and subthemes in a structured format.

4.3.2.2 Axial Coding Outcomes

In summary, this table captures the key components of the explanatory matrix linking the axial code dimensions of causal conditions, contextual interactions, strategic responses,

and outcomes across the four categories of technological, infrastructural, personnel, and administrative factors interacting to shape the central phenomenon of constraints-driven suboptimal HMIS utilization.

Table 19 the explanatory matrix integrating the key elements from the axial coding analysis

	Causal Conditions	**Contextual Interactions**	**Strategic Responses**	**Outcomes**
Technological	Complex system interfaces and bugs	Leadership technology priorities	IT-management collaborations	Variable adoption behaviors
Infrastructural	Internet unreliability and power outages	Government digitization policies	Investments in devices and backups	Persisting information discontinuities
Personnel	Motivational deficits and digital skills gaps	Financial decision tradeoffs	Workflow integration initiatives	Impeded productivity metrics
Administrative	Bureaucratic controls and documentation burdens	Vendor system permissions	End-user feedback mechanisms	ROI optimization difficulties

4.3.2.3 Selective Coding Outcomes

The selective coding analysis revealed that suboptimal utilization of the health management information system (HMIS) at Vihiga County Referral Hospital is driven by a complex interplay of constraints. Technological factors like complex system interfaces and software bugs, infrastructural issues like unreliable connectivity and limited devices, personnel challenges like motivation deficits and modest digital skills, as well as process restrictions from bureaucracy and documentation burdens all contribute to impeding HMIS optimization. Contextual forces like leadership directives, policy ecosystems, financial

prioritization, and developer engagement dynamics further shape utilization trajectories. Stakeholders proposed facilitating strategies encompassing leadership commitments through steering groups, infrastructure investments in devices and integration, workflow enhancements towards digital integration, and stakeholder collaboration platforms. Ultimately, these constraints culminate in variable adoption patterns across user groups, productivity impediments, information discontinuities, and barriers to maximizing returns on investment from the HMIS technology. Comprehensive interventions targeting the multi-dimensional barriers are necessary to unlock the system's full potential.

Table 20 Selective Coding Outcomes

Component	Description
Central Category	Constraints-driven suboptimal HMIS utilization
Causal Conditions	1. Technological constraints (complex interfaces, software bugs) 2. Infrastructure limitations (connectivity, power, devices) 3. Personnel barriers (motivation, digital skills) 4. Process restrictions (bureaucracy, documentation burdens)
Contextual Interactions	1. Leadership directives (vision, planning, resource allocation) 2. Policy ecosystems (government mandates, regulations) 3. Financial prioritization tradeoffs (budgets, costs) 4. Developer engagement dimensions (permissions, customizability, support)
Facilitators-Strategies	1. Leadership commitments (steering committees, working groups) 2. Infrastructure investments (devices, backup systems, integration) 3. Workflow enhancements (integrated digital workflows) 4. Stakeholder collaborations (feedback, co-design, alignment)
Outcomes Continuum	1. Variable adoption patterns (across user groups) 2. Productivity impediments (reporting, continuity of care, redundancy) 3. Information discontinuities (care integration, data fidelity) 4. ROI acceleration barriers (maximizing returns)

4.3.3 Major Themes in Qualitative Data

4.3.3.1 Considerations in HMIS Selection and Utilization

The interviews highlighted key attributes that stakeholders felt needed prioritization when HMIS is implemented, focused predominantly on system qualities, capabilities, and overall “value for money”. As one interviewee indicated, “One Okay, the

cost, affordability and then value for money. And by that, I mean for whatever they want to use that information system to do, it should be optimized at a very affordable rate and it should give them exactly what they want ” Customizability was equally important to align with organizational needs as stated: “It should be a system that is flexible in terms of it can be customized to suit the interests of the facility that's going to implement it”. Beyond cost, stakeholders emphasized user experience factors like simplicity and accessibility to encourage adoption: “So, user friendly stuff like that software should be user friendly, easy to understand and again there should be some element of interoperability and it should be able to be implementable across the department."

Hospital leadership buy-in and involvement are critical to direct resources and strategic priorities toward HMIS enhancement as indicated by one interviewee: “What they can do is try to address the issue about access and I think it will be easier as operations will run smoothly." (Interview 4). Another elaborated: "For me, I give them the report, I\'m feeling this is not right, this is wrong." (Interview 6) suggesting the need for stakeholder collaborations at the executive level.

External policy directives like digitization mandates for health facilities shape systems adoption yet centralized bureaucratic controls constrain hospital efforts as this quote indicates: "So you find that we, most of the decisions we make are pegged to another scrutiny." (Interview 5). Another interviewee suggested the need for standardized guidance: "I know what exactly needs to be done. Maybe, but for example, we are using an example of ultrasound, we have ultrasounds of different parts of the body." (Interview 7).

Sustained funding allocation for infrastructure and hardware upgrades as well as system licensing costs is imperative yet often inadequate. One interviewee highlighted the revenue generation imperative "Because if we were losing, for example, 200,000 every week and then we gain around 150,000 every week, we can get at least, uh, the hardware about two computers or three." (Interview 5). Financial constraints thus constantly shape investment tradeoffs.

Vendor cooperation in providing customized solutions, maintenance support, and continuity arrangements is crucial for long-term viability. However restrictive vendor permissions regarding access to data and analytics as well as system modifications often

hindered optimization initiatives. One interviewee expressed: "And we were told we have to protect the developer, which I think for me wasn't working well." (Interview 2) indicating the need for balanced engagement models.

4.3.3.2 Utilization Facilitators and Barriers

In terms of barriers to optimal utilization of the HMIS, infrastructure limitations and gaps in personnel capabilities emerged most prominently from the coding process. Unreliable connectivity and accessibility posed frequent challenges as expressed: “One of the challenges, I think our, the use attitude and the use, I believe the system is there to monitor them rather than to help them.” Hardware availability, coverage across all departments, and general readiness for a paperless transition also imposed hindrances, while inadequate technical support compounded these effects: “Now, if we have funds we want to get an AIE to spend Mm-Hmm we have to, we have to have, okay we are controlling it from somebody somewhere else.”

Conversely, benefits perceived from using the system facilitated buy-in by some stakeholders. Streamlining of processes, continuity of care, and administration were commonly cited: “Because everything is, is, is in the system. That means from the entry point to exit point, the period or the time that has been used has been reduced greatly because of the time taken by a patient whereby data is collected by only one person.” Enhanced care coordination and decision-making also emerged: “And also, uh, as I said earlier, let’s hope that system will not become obsolete with time.” Additionally, monitoring capabilities enabled oversight of operations and revenue leakage reduction.

The core phenomenon examined through the qualitative interviews is the suboptimal utilization of the health management information system (HMIS) currently implemented in Vihiga County Referral Hospital. Despite the adoption of the system, it is not being used to its fullest potential across all departments leading to process and continuity of care inefficiencies. Several aspects related to inherent technological and design issues with the system negatively influence utilization rates as indicated by one interviewee: “The system has increased, uh, it has increased the patient waiting time. Mm-Hmm. sometimes when the system goes off, the patient has to wait.” (Interview 3). Another elaborated difficulty faced by clinicians using the system’s current patient workflow configuration and limitations integrating with diagnostic platforms: “So it is a challenge to

us. You need to go back to the patient card for you to check the medication that the patient is on rather than the, the, the, the patient can." (Interview 4).

Infrastructural gaps in terms of unstable connectivity, insufficient equipment availability, and coverage were emphasized by many stakeholders. One noted: “We've had a myriad of challenges when it comes to the HR system in VCRH, we have many times migrated from one system to another. And it's unfortunate that the last system was a by not, and the downtime was to us to be quite a lot, there could be a lot of patient delays.” (Interview 2). Another reiterated the infrastructure barriers: “The cases we see daily is you find this patient has come for a, maybe the patient is for N-H-I-F and it has been entered in the system as a cash patient.” (Interview 3). Infrastructural constraints regarding unreliable connectivity, power supply deficiencies, and inadequate equipment availability limited the adoption and use of the HMIS system. One interviewee noted: “Sometimes you get, you get, we have a, a lot of people waiting for us to see them because the power is not there. It\'s not” (Interview 1). Another elaborated on the infrastructural barriers: “The cases we see daily is you find this patient has come for a, maybe the patient is for N-H-I-F and it has been entered in the system as a cash patient.” (Interview 3). Limited investments in technology upgrades and server capabilities also impacted utilization as stated: “We have a small server that cannot serve the whole building.” (Interview 10).

Table 21Key infrastructure-related barriers

Code	**Verbatim quote**
Power supply deficiencies	"Sometimes you get, you get, we have a, a lot of people waiting for us to see them because the power is not there. It's not"
Insufficient equipment	"the cases we see daily is you find this patient has come for a, maybe the patient is for N-H-I-F and it has been entered in the system as a cash patient."
Limited server capabilities	"We have a small server that cannot serve the whole building."

Limitations in personnel capabilities and readiness to transition to fully digitized workflows using the platform consistently were indicated as another barrier, as this statement reflects: “Number two, many users are reluctant to use the system and they have

to be forced." (Interview 10). One interviewee noted that comprehensive training is imperative in this regard to ameliorate adoption issues: "Staff should be impacted on the system so that they can understand." (Interview 3). Limited technology exposure led some staff to reluctance to embrace systems as one interviewee indicated: "Number two, many users are reluctant to use the system and they have to be forced." (Interview 10). Another elaborated need for motivational support and training to address adoption barriers: "So that they understand. Yes. And as I\'ve said, we have not maximum used it. And I think the same reasons are those we are not; we are not uploading the reports yet." (Interview 3).

Finally, entropy in processes as departments straddle both digital and paper workflows posed additional strains in uptake. One interviewee elaborated: "So you\'ll find that at one point we\'re using hard copy. At the other point we\'re using the system." (Interview 5). Another noted: "We\'ve had a system like Elephant, which went and it went with all that of the patient. And we just woke up the, in the morning. In the morning, you\'ve been denied, denied the rights. And you know those, we had over 10,000 patients who are in the system already." (Interview 3).

Gaps in integration across departments using hybrid digital and paper workflows hindered continuity of care and reporting. One interviewee elaborated: "So you\'ll find that at one point we\'re using hard copy. At the other point we\'re using the system." (Interview 5). Decentralized patient identifier assignment also contributed as expressed by another stakeholder: "Generally, Yeah. For if a patient comes with a certain number, say 0, 0 1, 2, 4. And the patient takes another different number. The patient is placed the first number, the patient changes the number, and the history on the first number disappears." (Interview 1).

Centralized bureaucratic controls over technology acquisition and data access decision rights hampered optimization initiatives. One interviewee expressed: "If we were using the system fully, we could benefit a hundred percent. But right now we, we, I cannot say a hundred percent. Uh, hundred percent because like we are not fully digital digitized." (Interview 8). External developer restrictions also hindered as noted: "And there\'s a very good system. But to have patient, that\'s not a good system a patient wants when he walks in a room" (Interview 7) indicating the need for greater customization latitude.

The effects of infrastructure limitations, workflow integration gaps, and personnel readiness barriers manifest in inconsistent adoption of HMIS across hospital departments. As one interviewee summarized: "So, uh, on the side of the, of being digital digitalized, you see it has reduced chances of uh, uh, of losing data. So, uh, you\'ll always get the information of the patient in real-time and it\'s always available. Yeah." (Interview 8). Yet utilization continues to be variable based on the specific departmental context.

Gaps in digitization pose barriers to streamlined processes for patients and providers, as this stakeholder indicates: "Yeah. It\'s, but it\'s on and off. It\'s not off" (Interview 1). Providers must thereby rely on hybrid paper and digital workflows, hindering productivity. Another interviewee noted: "No, we don't have enough staff, you see for the system. Where by now a system is new to you. A system is new to your colleagues." (Interview 6), indicating ripple effects on operations.

Data fidelity issues and impediments to the care continuum arise from dual media workflows as shown by this quote: “Initially like malaria, the results are not directly in the system. They\'re to be read and then fed. And fed. Yeah. Then if somebody confuses these papers and feeds the wrong information, therefore you\'ll find that you\'re being treated for a condition that you don't have." (Interview 5). Another stakeholder raised concerns regarding limitations in patient data availability affecting the quality of care: "The other challenge will be....access of information HMI system for our facility is not garbage in only. It will be useful to apply the Kiko principle that once this information is put in by the user the same users or the decision makers can use the same data can access the data and use it for decision making." (Interview 2).

Limitations in realizing the hospital's full value potential from their technology investment surfaced in many interviews like this one: "So it depends with the speed. Speed, yeah." (Interview 2). One elaborated on difficulties tracking return on investment: "Then the final thing is, uh, the challenge. We also have the sub we had systems that come, but the facility maybe we said if we can be able to sit on HMT, the hospital should be given the height." (Interview 3), thus constraining expansion initiatives.

4.3.3.3 Recommendations for Optimization

To amplify the benefits of the HMIS, stakeholders provided suggestions focused largely on infrastructure and workflow expansion, enhanced personnel training, and

collaborative review for system refinement. Comprehensively transitioning all hospital services to integrated digital workflows was viewed as essential by most: “I think for me, one is to lobby. So lobby that we get one or two to expand the scope of this health ecosystem in the entire hospital.” Another recommended: “More capacity building on the system. And then in discussion with the developer of the vendor, can they enhance the scope? So that covers inpatient.” Beyond infrastructure shoring and workflow digitization, comprehensive capability building received immense emphasis: “Staff should be impacted on the system so that they can understand.” Lastly, engagements with system developers were highlighted to collaboratively augment HMIS functionalities per hospital needs and address any recurring problems faced by end-users.

In summary, the open coding process elucidated important insights around attributes stakeholders seek in HMIS solutions to improve adoption and utilization outcomes, barriers stemming largely from limited infrastructure and personnel readiness hindering efforts currently, and actionable measures centered on infrastructure upgrading, workflow expansion in digital modalities, personnel capability advancement and collaborative system enhancements with external partners to achieve optimized HMIS utilization success. Additional coding stages will build further on unraveling relationships between these concepts towards developing an overarching theory on maximizing HMIS investments, acceptance, sustained usage, and value generation from the perspective of local stakeholders.

Enhanced collaborations between hospital administrators and system developers were recommended to optimize utilization and address end-user issues. As one interviewee suggested engaging the vendor more closely: “because I believe there is a rift that is growing up. You know, there is a rift that, you know, there\'s a different difference in opinion." (Interview 6). Another highlighted the need for developer partnerships by stating: "So they can enhance the scope. So that covers inpatient.” (Interview 3).

Prioritizing infrastructural upgrades to expand accessibility across all departments was considered imperative by most stakeholders: “Number one, purchase a server with bigger capabilities. Number two, purchase UPS that can run for at least 2 hours." (Interview 10). Another emphasized "Because if I, if you look at the continuum of care, this patient as enter, the patient enters the hospital to the point of exit. Yeah, you\'ve there already areas

where this patient will pass through that doesn’t have the systems." (Interview 1) indicating the need to achieve comprehensive coverage.

Full transition to integrated digital workflows was strongly advocated: "I think for me, one is to lobby. So lobby that we get one or two to expand the scope of this health ecosystem in the entire hospital." (Interview 1). Another suggested: "So we need to see how we can bring in that person-centered sort of care into the health system" (Interview 1) to augment patient engagement functionalities.

Incorporating structured end-user input into system refinements was advised by most like this stakeholder: "Above all, institutionalize the client exit, no, no, no customer feedback, where the customer could be the users of the system or even the patients and holds, I don\'t know if I can call them fishbowl sessions, they can have focus group discussions on how the system is doing." (Interview 2). This can enable ongoing enhancements based on experiences.

4.3.5 Summary of the Qualitative Findings

The open coding analysis identified key themes regarding technology considerations, utilization barriers, perceived benefits, and recommendations for optimizing HMIS utilization. Desired system attributes focused on cost-effectiveness, ease of use, customizability, and data protection. However, unstable infrastructure, personnel reluctance, system functionality limitations, and inadequate support imposed adoption barriers. Streamlining workflows, enhancing care coordination and administration, and monitoring abilities facilitated utilization benefits, though sub-optimally overall. Suggested enhancements spanned expanded system scope, improved equipment availability, comprehensive personnel training, and collaborative review for refinements.

Conceptual abstraction via axial coding pointed to constraints-driven suboptimal HMIS utilization as the core phenomenon arising from technological, infrastructural, personnel, and administrative barriers. Key contextual factors including leadership support, government mandates, financial constraints, and vendor permissions also shaped assimilation trajectories. Proposed strategic facilitators centered on elevated leadership involvement, infrastructure investments, digitization of workflows, and multi-stakeholder collaborations to regain momentum. Variable system adoption patterns, persisting hybrid

manual procedures, care fragmentation, and difficulties tracking ROI were prevalent outcomes.

The selective coding distilled the constraints-technology utilization connection as the explanatory matrix grounded in the multi-layered barriers, moderating contextual interactions, promising facilitators, and complex adoption consequences. A narrative storyline was outlined conveying the nonlinear assimilation journey across pre-utilization, post-deployment discontinuities, and strategic response efforts to recoup intended utilization levels necessary for HMIS success. In summary, a complex picture emerges from the coding analyses highlighting technology assimilation challenges within the organizational setting, yet strategic pathways hold promise if constraints can be alleviated through concerted mitigation efforts on technological, infrastructural, individual, and administrative dimensions.

Table 22 key results from the three qualitative analysis stages

Analysis Stage	**Key Concepts**	**Central Findings**
Open Coding	Technology considerations Utilization barriers Perceived benefits R**ecommendations**	Cost, utility, and ease of use are valued in system selection Infrastructure and skillset barriers constrain adoption Workflow efficiencies and care coordination benefits Infrastructure and personnel capability upgrades advised
Axial Coding	Causal conditions Contextual factors Strategic facilitators Outcomes	Technological, infrastructural, personnel, and policy barriers drive constrained utilization. Leadership, regulations, finances, vendors shape context. Leadership commitment, digitization, and collaboration suggested Variable adoption, productivity loss, and ROI suboptimality persist

Analysis Stage	Key Concepts	Central Findings
Selective Coding	Explanatory matrix Storyline	Constraints-utilization nexus core phenomenon Non-linear HIT assimilation journey Strategic mitigation of barriers essential

Note. This table covers the key results and findings from each of the three qualitative coding processes in a structured format.

4.4 Summary of Findings

The analysis showed that the data collection process had strong internal consistency with a Cronbach alpha value of 0.9044. A total of 135 respondents were included in the analysis. Predominantly, individuals aged between 30 to 39 constituted the largest proportion at 45.93%. Gender distribution showcased a relatively equal representation, with males comprising 47.41% and females slightly higher at 52.59%. Education-wise, the majority of participants held diplomas, constituting 55.56%. Nurses constituted the largest proportion at 29.63%, indicating their pivotal role in healthcare delivery. They were closely followed by Clinical Officers and Medical Doctors, comprising 15.56% and 13.33% respectively. The overall level of utilization was scored at 3.229 on a scale of 1 to 5, translating to moderate utilization. Nonetheless, all the factors studied were shown to be statistically significant predictors of utilization based on bivariate regressions. The bivariate regression model demonstrated a significant effect of Technological Factors on HT ($F(1, 133) = 62.33$, $p < 0.0001$), significant effect of Managerial Factors on HT ($F(1, 133) = 32.32$, $p < 0.0001$), significant effect of Operational Factors on HT ($F(1, 133) = 29.63$, $p < 0.0001$), significant effect of Organizational Factors on HT ($F(1, 133) = 48.44$, $p < 0.0001$). In the multiple regression model, only technological factors were significant at the $p=0.05$ level. The qualitative results showed that despite benefits in streamlining workflows and care coordination, persistent barriers related to unstable infrastructure, personnel reluctance, and system functionality limitations resulted in suboptimal, inconsistent HMIS adoption across departments. Strategic efforts focused on infrastructure

investments, digitized workflows, and end-user feedback mechanisms were advised by stakeholders to optimize assimilation.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.0 Introduction

This chapter situates the key results of the study within existing literature to derive deeper analytical inferences. The chapter is structured around the three research objectives - first, HMIS utilization level for service improvement is analyzed in light of recent evidence regarding its quality enhancement impacts. Next, factor linkages are explained through theoretical frameworks like HIS Strengthening model that highlight technological, operational and organizational dimensions enabling adoption. Finally, innovation diffusion theory is leveraged to interpret uneven assimilation patterns noted in user perspectives, revealing change management strategies for optimal deployment. Collectively, the discussion enables a more rounded diagnosis of gaps and pathways to regain momentum toward universal HMIS usage for strengthening healthcare delivery.

5.1 Summary of Key Findings

The first study objective on the level of HMIS utilization revealed moderate use of HMIS and moderate improvements enabled by the system at VCRH in areas of service delivery efficiency, transparency around operations, informed decision making and monitoring effectiveness (means of 3.622, 3.562 and 2.881 respectively on a scale of 1 to 5). This aligns with literature evidence on the role of HMIS analytics in improving governance, accountability, and data visibility for strategic action (Nutley & Reynolds, 2013; AbouZahr & Boerma, 2005). The study a linear regression analysis to understand associations between technological, organizational, operational and managerial factors and HMIS utilization. Results found technology factors most strongly predict adoption ($F(1,133) = 62.33$, $p<0.0001$), followed by organizational setting ($F(1,133) = 48.44$, $p<0.0001$), operations ($F(1,133) = 29.63$, $p<0.0001$) and managerial leadership ($F(1,133) = 32.32$, $p<0.0001$). This compliments framework-based literature highlighting the role of technological reliability, systemic governance, standard workflows and leadership stewardship in shaping assimilation (Smith et al, 2008; Degaut, 2015). The third study

objective qualitatively captured user perspectives on HMIS. This revealed the benefits, limitations and recommendations for optimal HMIS deployment. Reported advantages included workflow enhancements in patient handling, access to accurate data for monitoring and evaluation, and evidence-based decision-making support. However, infrastructure limitations like power outages, reluctant adoption within clinical teams, support gaps during initial transition phases and suboptimal data capture at source locations inhibited assimilation.

Respondents proposed renewed leadership emphasis on HMIS adoption through policies that incentivize and integrate digital interventions into provider schemes, refined software design suited for local settings, motivational engagements, integrated health records, and infrastructure building as facilitators to regain momentum. This uneven adoption trajectory marked by the discontinuity of several key aspects of technology integration, aligns with various innovation diffusion studies cautioning against techno-centric utilizations devoid of user change management and localized customization (Kaminski, 2011; Kihuba et al, 2014).

5.2 Discussion of Findings on Level of HMIS Utilization in Service Improvement

The first objective of this study was to determine the level of HMIS utilization in enabling service improvements at Vihiga County Referral Hospital (VCRH). Findings from surveyed participants indicated a reasonable definition of system requirements during initial roll-out phases (Mean = 2.881). This aligns with literature stating clear design processes enable adaptation to user needs (Hapsara, 2016). However, lingering gaps persist regarding building staff skills and willingness to leverage analytics (Means = 3.333 and 2.748 respectively), hindering optimal utilization. Nonetheless, most respondents acknowledged gains in delivery efficiency (Mean = 3.622), transparency (Mean = 3.562), informed decisions (Mean = 2.881) and monitoring effectiveness since HMIS activation.

Many of the participants agreed HMIS analytics better empower evidence-based planning and interventions. Prior global research similarly found routine aggregate health data analysis via information systems crucially assists priority-setting, targeted resource allocation and strategic initiatives planning (AbouZahr & Boerma, 2005). Secondly, operational enhancements noted at VCRH echo studies demonstrating patient record

digitization significantly improves care coordination, team communication, data visibility and workflow management (Tan, 2019). However, counterintuitively, nearly half the respondents remained neutral or disagreed with statements regarding perceptible quality changes from HMIS utilization at VCRH, contradictory to most literature evidence on health digitization impacts. This discrepancy suggests while coordination gains noted reflect documentation improvements, holistic care enhancements through clinical decision support activation remain lackluster. For instance, an Australian hospital IT assessment study found most digitized systems enabled more reporting than insight generation due to fragmented infrastructure and data duplication issues failing to feed intelligent analytics (Georgiou et al., 2021).

Participant skill sets and motivational barriers persist at VCRH as evident through poor technology self-efficacy, with just a third agreeing colleagues proactively retrieve and input useful information without reminders. This likely contributes to the muted care improvement perceptions revealing residual underutilization limiting HMIS returns. Comparable skill deficit observations are documented across health information system studies in developing countries struggling with change management including knowledge transfer gaps despite discrete digitization potential (Muhanga & Haule, 2021). Addressing lingering capability and motivational limitations is vital to catalyze the next ascent phase leveraging HMIS meaningfully. Literature recommends comprehensive data literacy programs, patient safety culture cultivation through new care model incentives rewarding analytical usage, improved usability, integrated dashboards, and continuous monitoring mechanisms to motivate adoption (Nutley & Reynolds, 2013). Beyond skilling staff, developing internal best practice sharing platforms for high assimilating departments, celebrating analytics usage, and localizing software via participatory design could greatly accelerate optimal HMIS activation at VCRH.

A range of strategies have been proposed in the literature to address gaps in the utilization of Hospital Management Information Systems (HMIS) in hospitals. These include the Hot-Fit Method, which emphasizes the need for appropriate human, organizational, and technological components (Listyorini et al., 2022). Funhiro et al. (2022) highlight the importance of networking, monitoring and evaluation, revenue generation, public-private partnerships, operational planning, and transparency in the selection and appointment of

board members to enhance the functionality of hospital management boards. Change management is also crucial, with Yusif et al. (2019) identifying stakeholder participation, experience, committed change agents, a clear utilization strategy, and post-utilization training as key factors. Finally, Wackers et al. (2021) underscore the significance of strategy, leadership, engagement, reorganization, finances, data and IT, projects, support, skill development, culture, and communication in the successful utilization of hospital-wide strategies. Specifically, VCRH can conduct capability analysis of high performing departments to set benchmarks, establish digitization tasks force, mobilize resources and provide motivational platforms to showcase HMIS gains. Finally, continuous monitoring mechanisms tracking usage metrics can maintain momentum post activation.

5.3 Discussion of Findings on Influence of Technological, Managerial, Operational and Organizational Factors

The second study objective sought to determine associations between four key factors - technology, organization, operations and management - on HMIS utilization at Vihiga County Referral Hospital. Bivariate regression indicated all factors individually predict adoption – technology ($F(1,133) = 62.33$, $p<0.0001$), organization ($F(1,133) = 48.44$, $p<0.0001$), operations ($F(1,133) = 29.63$, $p<0.0001$), and leadership ($F(1,133) = 32.32$, $p<0.0001$). However, in combined models, only technology remained significant. These findings reiterated that a diversity of factors must be considered in the utilization of technologies in healthcare. The utilization of any new intervention in the healthcare field is dependent upon several factors. Setbacks associated with these factors, as already described above, equate to utilization challenges. Such issues may be categorized as technological, managerial, operational, and organizational factors (Farah & Mohamed, 2022).

The predominance of technology echoes prior literature on requisite software, hardware and infrastructure laying the groundwork for HMIS activation, without which assimilation falters irrespective of workflows, policies or resources (Gladwin et al., 2003; Smith et al., 2008). If systems exhibit unreliability, frequent downtimes, complex interfaces, or inadequate customization limiting usability for end-users, adoptions declines (Luna et al., 2014). Many times, senior managers in a bureaucratic leadership structure like the case of

Kenyan government systems may not understand the implemented systems and therefore become setbacks in the proper utilization of HMIS (Farah & Mohamed, 2022).

These findings align closely with existing Health Information Systems (HIS) Strengthening frameworks highlighting technology and infrastructure as the foundation for data capture, production and sharing - a precursor for utilization (MEASURE Evaluation, 2023). Without functional tools and networks, activities enabled through better information use remain constrained. The dimensions covered under organizational, operational, and managerial factors intricately map onto indicators in said model spanning governance, standard processes and capabilities (MEASURE Evaluation, 2023; Kimaro & Sahay, 2007) - just as individually predictive separately, but overpowered by technology reliability collectively. This highlights the notion that while all factors interplay, addressing tech barriers provides the impetus for forward momentum.

However, the findings failed to explain the complete variability in the variables under study. Contrary to existing models attributing nearly 50-60% predictive capacity to the assessed determinants (Kamadjeu et al., 2005), only about 40% of variability in the factors was explained by the model. This suggests the presence of unseen confounders whose role must be investigated through holistic adoption frameworks traversing individual, social, administrative and policy dimensions in the environment simultaneously using qualitative approaches (Kihuba et al., 2014). For instance, exploring lived experiences reveals subtler emotional barriers among older staff towards digitization, peer usage cues that motivate gradual self-initiated learning, and communication gaps in the initial transition phases that normalized teething troubles (Wager et al.,2021). Such multi-level insights explain additional variance while revealing targeted intervention points.

For practice improvement, it is recommended that persistent software design limitations must be addressed through participatory approaches solicitating end-user perspectives, before infrastructural enhancements (Hapsara, 2016). Locally customized, flexible solutions suit emerging country public health contexts better. Thereafter, capturing usage metrics, monitoring progress through data reviews, building stakeholder momentum via motivational communications, and continuous interface tweaks based on feedback data can enhance sustainable assimilation over time (Degaut, 2015). Finally, beyond technology interventions alone, creating learning forums for workers to share integration knowledge,

demonstrating functional benefits through analytics, and leadership involvement re-emphasizing importance, can accelerate utilization (Moszynski, 2008).

A range of factors influence the utilization of Hospital Management Information Systems (HMIS), including human and technological factors (Wijayati & Achadi, 2019), staff IT skills, IT infrastructure, top-level support, and competitive pressure (Masum et al., 2020). Organizational factors, such as human resource shortages, inadequate computer literacy, and a rigid hierarchical culture, also play a significant role (Meghani et al., 2021). The adoption of Electronic Records Management Systems (ERMS) in Higher Learning Institutions (HLI) is influenced by technology, organizational, and environmental factors, which in turn impact the decision-making process (Mukred, et al., 2021). These findings suggest that a comprehensive approach, considering both technological and organizational factors, is crucial for the successful utilization and utilization of HMIS.

5.4 Discussion of Findings on Perspectives on HMIS Use

The qualitative analysis identified key themes regarding technology considerations, utilization barriers, perceived benefits, and recommendations for optimizing HMIS utilization. Desired system attributes focused on cost-effectiveness, ease of use, customizability, and data protection. However, unstable infrastructure, personnel reluctance, system functionality limitations, and inadequate support imposed adoption barriers. Streamlining workflows, enhancing care coordination and administration, and monitoring abilities facilitated utilization benefits, though sub-optimally overall. Suggested enhancements spanned expanded system scope, improved equipment availability, comprehensive personnel training, and collaborative review for refinements. Conceptual abstraction via axial coding pointed to constraints-driven suboptimal HMIS utilization as the core phenomenon arising from technological, infrastructural, personnel, and administrative barriers. Key contextual factors including leadership support, government mandates, financial constraints, and vendor permissions also shaped assimilation trajectories. Proposed strategic facilitators centered on elevated leadership involvement, infrastructure investments, digitization of workflows, and multi-stakeholder collaborations to regain momentum. Variable system adoption patterns, persisting hybrid manual procedures, care fragmentation, and difficulties tracking ROI were prevalent

outcomes. Finally, the selective coding distilled the constraints-technology utilization connection as the explanatory matrix grounded in the multi-layered barriers, moderating contextual interactions, promising facilitators, and complex adoption consequences. A narrative storyline was outlined conveying the nonlinear assimilation journey across pre-utilization, post-deployment discontinuities, and strategic response efforts to recoup intended utilization levels necessary for HMIS success. In summary, a complex picture emerges from the coding analyses highlighting technology assimilation challenges within the organizational setting, yet strategic pathways hold promise if constraints can be alleviated through concerted mitigation efforts on technological, infrastructural, individual, and administrative dimensions.

The findings link significantly with previous literature and theoretical underpinnings. Firstly, uneven assimilation patterns noted in qualitative findings align with Rogers' Innovation Diffusion model explaining gradual technology acceptance across innovators, early adopters and late majority categories based on willingness and aptitudes (Kaminski, 2011). The reluctant usage attitudes noted among 55% diploma holders likely represent such groups showing delayed uptake. Secondly, constraints imposed by infrastructure unreliability, software issues and support gaps explain staff disinclinations as per the HIS Strengthening Model where ease of use and perceived usefulness shape adoption attitudes (Al-Rahmi et al., 2019). Limitations in said factors risk overriding functional benefits and stall usage momentum. For instance, Australian public health evaluations reveal initial enthusiasm towards digitization frequently stagnated post-utilization due to cost escalations, complex data capture interfaces needing workarounds, limitations accessing insights at points of care, and inadequate change management hampering acceptance despite discrete efficiency upsides (Georgiou et al., 2021). This closely mirrors VCRH's journey. Such linkages determine addressing multi-level adoption barriers across technology robustness, workplace promotion efforts and skill building underpin mainstreaming HMIS use (Wager et al., 2021).

Respondents noted an initial peak in usage interest around HMIS rollout phases as staff recognized oversight benefits. This concurs with trends per Diffusion models where early adopters with higher technology receptivity first acclimatize towards new systems until limitations surface, often infrastructure or workload related (Rogers, 2003). Thereafter,

subtle discontinuities and workarounds emerge as staff improvise hybrid manual documentation during times of unstable electricity, software outages or when facing hiccups locating patient histories (Kihuba et al., 2014). Such coping tactics allowing continuation of basic workflows entrench over time impeding technology optimization. Gradual workflow redundancies disincentivize peak usage seen earlier, even if functionally beneficial when adopted fully. This prevents optimal HMIS returns, as evidenced by muted holistic quality perceptions among respondents despite coordination gains. Tulu et al. (2021) similarly found stop-start IT assimilation patterns common in emerging health systems marked by persistent infrastructure constraints hampering adoption continuity, preventing institutionalization. Strategic mitigations suggested focus on stabilizing technology, infrastructure and support elements to regain momentum align closely with studies cautioning techno-centric HMIS rollout minus alignment with user environments frequently struggle sustaining utilization (Yusif et al., 2019). Iterative optimization is thus vital.

Recognizing complex assimilation trajectories grounded in multi-level contextual interactions reveals that regaining optimal, self-sustaining HMIS utilization rates over the long-term must combine reinvigorated leadership commitments, digitization task forces addressing technical refinements like improved monitors, motivational enhancements via support personnel, and on-ground infrastructure development (Haux, 2018; Muhanga & Haule, 2022). Beyond technology alone, communication of best practices from the minority steadily assimilating users helps demonstrate functional benefits in peer networks and nudge gradual voluntary learning (Wager et al., 2021). Normalizing technology usage remains essential. Finally, continuous interface tweaks via agile feedback capture mechanisms keeps systems aligned to shifting user requirement (Hapsara, 2016). User-centered design fosters receptivity, shaping adoption lifecycles. In general, HMIS utilization levels follow uneven trajectories imposed by multifaceted barriers. But research recognizes pragmatic mitigation pathways to regain optimal usage patterns necessary for performance and clinical improvements through sustained technology and process refinements centering user perspectives.

5.5 Triangulation of findings

The first objective examining HMIS utilization levels for service improvements revealed moderate enhancements in efficiency, oversight and planning, concurring with evidence on digitization's role in aggregating data for administrative and tactical gains (AbouZahr & Boerma, 2005). However, muted quality improvements contradict literature demonstrating analytics integration significantly assists clinical decision-making, diagnosis and treatment planning (Georgiou et al., 2021). This discrepancy likely owes to lingering skillset barriers noted impeding optimal adoption essential for patient outcome improvements. Strategic elevation of data literacy and change leadership emphasizing peer learning are documented remedies to universalize assimilation (Nutley & Reynolds, 2013).
The second objective analyzed predictive capacities of technological, organizational, operational and managerial factors influencing HMIS adoption. Dominance of technical reliability aligns with Health Information Systems strengthening frameworks underscoring robust infrastructure and networks as the foundation for capturing, processing and disseminating data necessary for utilization (MEASURE Evaluation, 2023). However, the model only explained 40% of variability, conflicting with preceding adoption studies attributing over 50% predictive ability to said determinants (Kamadjeu et al., 2005). This suggests additional unseen confounders like motivational inertia among aging providers require investigation through qualitative approaches exploring subtler assimilation barriers (Kihuba et al., 2014). Still, pragmatic incremental upgrades addressing interface issues and participatory software refinements suit emerging country contexts better before large-scale resource mobilization (Hapsara, 2016).
Finally, uneven assimilation patterns noted in user perspectives mirror trends from innovation diffusion theory which anticipates gradual mainstreaming based on willingness and aptitudes across innovator and laggard groups (Rogers, 2003). Reluctance despite efficiencies compliments technology acceptance research demonstrating ease of use and functional utility shape adoption attitudes, necessitating mitigations easing usage (Venkatesh et al., 2016). Furthermore, an initial peak in interest during early transition phases followed by discontinuities and improvised workflows due to infrastructure limitations or software glitches agrees with studies documenting stop-start technology assimilation journeys in resource-constrained settings struggling to sustain optimal

utilization (Tulu et al., 2021). This underscores persistent technology and environment alignment via leadership commitments, integrated health records, motivational initiatives and infrastructure building suggested by respondents to recoup momentum (Haux, 2018). Triangulating findings reveals multi-level adoption barriers spanning individual competencies, system robustness and workplace factors frequently obstruct technology optimization in healthcare limiting quality and performance dividends despite documenting efficiencies. While moderate utilization success surfaces, constraints inflict variable returns. Literature compliments pragmatic strategic change interventions like communication campaigns demonstrating functional benefits, data literacy enhancement driving voluntary learning, and institutionalization of digitized workflows through policies as pathways to regain universality essential for HMIS effectiveness.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

The conclusion chapter synthesizes the study's findings to develop evidence-based conclusions regarding the utilization, utilization, enabling conditions, barriers, and recommendations for enhancing the Health Management Information System in the Vihiga County Referral Hospital healthcare setting. Key highlights of the findings involve the identification of operational benefits alongside persisting personnel, technological, and infrastructural challenges constraining adoption below optimal levels. Significant conclusions distilled relate to the imperatives for an integrated approach simultaneously addressing limitations across multiple dimensions spanning system design factors, infrastructural instability factors as well as motivational and skill-building interventions among end-user groups. Furthermore, structured mechanisms for soliciting user feedback, and enabling customizations and innovations through collaborations among diverse stakeholders can potentiate assimilation and value harvesting from the technology investment. Accordingly, concrete recommendations are presented focused on infrastructural development, system refinements responding to contextual user needs, competency advancement drives, incentivization programs, and cross-functional coordination entities guided by executive leadership commitments. Collectively, a pathway focused on multi-pronged enhancements can accelerate technology assimilation toward transformational gains in efficiency, productivity, and care quality for the hospital.

6.1 Summary of Findings

6.1.1 HMIS Utilization

The study found an adequate definition of HMIS requirements and system-enabled improvements in areas like service delivery, efficiency, and clinical decision-making at VCRH (means of 2.881, 3.622, and 3.562 respectively). However, gaps existed regarding staff skills and attitudes towards usage (means of 3.333 and 2.748). While positives like process enhancements were present, further optimization is possible through personnel capability building and addressing motivational barriers.

6.1.2 Influence of TF, OR, MF, ORF on HT

Regression models revealed technological factors had the strongest link ($F(1,133)=62.33$, $p<0.0001$) followed by organizational ($F(1,133)=48.44$, $p<0.0001$), operational ($F(1,133)=29.63$, $p<0.0001$) and managerial ($F(1,133)=32.32$, $p<0.0001$) drivers. This indicates enhancements across these areas can shape assimilation. Specifically, system testing, leadership involvement, infrastructure investments, and monitoring mechanisms facilitate utilization.

6.1.3 Perspectives on HMIS Use

Despite workflow and oversight benefits, barriers like infrastructure unreliability, software issues, unwillingness among the 55.56% diploma holders, and support gaps constrained adoption. Non-linear HMIS assimilation patterns were observed. Strategic initiatives highlighted were leadership commitments, design refinements based on user feedback, comprehensive digitization, and infrastructure upgrades to regain optimal utilization essential for HMIS success.

6.2 Conclusions

6.2.1 Objective 1 Conclusion: HMIS Utilization

The study determines that HMIS utilization has led to moderate service improvements at VCRH about delivery efficiency, transparency, and clinical decision support. However, residual gaps persist regarding comprehensive staff skills and reluctant usage attitudes constraining assimilation. Strategic investments in motivational enhancements, change management, and personnel capability building can potentiate the foundation for the next phase of usage ascent.

6.2.2 Objective 2 Conclusion: Influence of TF, OR, MF, ORF on HT

Technological, organizational, operational, and managerial dimensions significantly influence HMIS utilization with technological factors exhibiting the strongest linkage. Enhancements to design aspects, leadership involvement, infrastructure, and monitoring mechanisms can thus accelerate adoption. However, a substantial proportion of variation remains unexplained, highlighting space for a systemic approach addressing multi-level adoption barriers.

6.2.3 Objective 3 Conclusion: Perspectives on HMIS Use

In conclusion, HMIS assimilation at VCRH manifests an uneven trajectory constrained by infrastructural, personnel, workflow, and policy limitations inflicting discontinuities, despite discernible coordination and oversight benefits. Rectifying elements of existing design, infrastructure building, motivational enhancements, and administrative flexibility through cross-functional efforts can regain momentum toward universal staff adoption critical for optimal returns from the technology investment.

6.4 Recommendations

The study findings underscore the need for concerted strategic interventions encompassing multiple dimensions to foster an enabling environment and alleviate prevailing constraints for resuming ascent to optimal Health Management Information System (HMIS) assimilation and value harvesting at Vihiga County Referral Hospital (VCRH). To start with, significant infrastructural investments aimed at system stability, accessibility, availability, and integration upgrades constitute crucial foundation-strengthening imperatives. Specific recommendations include the acquisition of enhanced data storage and backup capabilities. Such would include an expanded local server with a larger capacity for data storage and retrieval to overcome the challenge of capacity limitation. For a level 5 hospital like VCRH, a server with a capacity of around 7 terabytes would be sufficient. Other key action points include strengthening internet connectivity via bandwidth improvements, and the deployment of additional end-user devices. Guaranteed onboarding support expanding digital access to currently underserved departments is necessary.

Beyond foundational elements, extensive workflow digitization initiatives focused on complete paper-to-electronic transitions covering reporting, documentation, and administrative subsystems can significantly bolster productivity and continuity by leveraging the technology capabilities. Structured change management protocols can ease assimilation across user groups during such digitization drives. Notably, comprehensive training programs mandated for all staff coupled with recruiting specialist informatics skills must accompany expansions in digital modalities to equip personnel at large with updated

competencies that form viral vectors carrying technology utilization forward into operational settings.

Additionally, strategic organizational realignments equally warrant strong consideration. Leadership steering committees with medical, technical, and administrative representation can institute policies fostering technology-supported accountability while providing directionality on priorities and resource allocation for HMIS augmentation. Furthermore, structured user experience assessment cycles institutionalized organization-wide feeding insights back into development furnish invaluable participatory refinement pathways for system enhancements responding to emergent user needs and preferences. In tandem, incentivization schemes reinforcing technology-supported best practices create motivational pull alignment. Lastly, expansions of custom development latitude through negotiated agreements with technology vendors enable the realization of contextually optimized solutions. Overall, addressing limitations and cultivating facilitated technology assimilation requires concerted interventions simultaneously targeting technological, operational, administrative, policy, and motivational dimensions within VCRH's healthcare system hierarchy. A systemic orientation guiding multi-focal tactical upgrades can accelerate progress toward the vision of a digitally transformed hospital.

6.5 Future Research Suggestions

While this study offers valuable insights into Health Management Information Systems (HMIS) utilization at the Vihiga County Referral Hospital, further research hold immense promise for enriching understanding and informing practice toward technology-enabled healthcare transformation nationally.

Firstly, large-scale national-level surveys of healthcare facilities can elicit perspectives across wider geographies using the dimensions explored in this study encompassing technological, infrastructural, operational, administrative, personnel, and other barriers constraining assimilation. Comparative assessment across facilities can determine differential trajectories shaping success. Additionally, impact evaluations centered on HMIS interventions can quantify outcomes regarding efficiency gains, care enhancements, and cost savings, guiding investment prioritizations.

Furthermore, an intriguing direction lies in piloting unified government led HMIS solutions allowing interoperability, portability, and coordinated care across provider networks. New infrastructural configurations integrating decentralized blockchain-based patient health records with oversight controls can be experimented with to balance accessibility with data protection. Pilot testing innovative architectural models can unfold generalizable insights before statewide rollouts.

6.6 Study Contributions to Literature

Ultimately, HMIS optimization constitutes a complex, multi-stakeholder agenda necessitating consolidated efforts. This initial study contributed through three key aspects. First, the study demonstrated the positive yet below-potential influence of existing HMIS on hospital outcomes due to socio-technical limitations thereby highlighting improvement avenues. Secondly, the study elucidated the synergistic roles technological, managerial, operational, and organizational factors play as drivers and barriers shaping uneven assimilation trajectories thus emphasizing a systemic approach. Finally, the research centered user experiences and perspectives to inform recommendations focused on infrastructure building, digitization, personnel capability enhancement, and customization for contextually attuned solutions transferrable across utilization settings.

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APPENDICES

APPENDIX 1: STUDY QUESTIONNAIRE

Utilization of Health Information Management System in Vihiga County Referral Hospital

Introduction and Consent

Investigator's name: **Duncan Juma Matini** School Reg. No. **MBA HCM 149079**

Affiliation: **Strathmore Business School**

Contacts: matinidan@gmail.com **; 0716510820**

The above-mentioned is conducting a research study on the Utilization of Health Information Management Systems (HMIS) in Vihiga County Referral Hospital (VCRH).

The need for this study sprouts from the constant need to implement quality improvement technologies in Kenya's healthcare facilities with the goal of increasing speed and efficiency of care as well as facilitating more evidence-based decision making. HMIS utilization is one such technology that has ability to not only increase speed and efficiency of care but also facilitated improved decision making among top managers by providing key data at the click of the button.

Despite VCRH having implemented an HMIS system, the researcher observes that its utilization nis still low and the healthcare workers and patients of VCRH are yet to reap maximum benefit from the system. Thew question of why this is so continues to arise and the present research targets to determine the challenges blocking full utilization of the HMIS system and recommending strategies for improvement that are going to help better HMIS use at VCRH.

This study is part of the requirements for the award of the Master of Business Administration degree in Healthcare Management of Strathmore University. As such, I

By signing this, you consent to participate in this study. The researcher wishes to assure you that your participation is voluntary and your responses will only be used for the sole purpose of this study. All responses will also be kept confidential. Please do not hesitate to contact them via the above contacts in case of any questions.

Signature ……Date……

kindly request that you respond to all the questions in this questionnaire truthfully and honestly. Your response will be kept confidential and will only be used for this study. No harm of any level is expected from this study except for the little time you will spend.

Instructions

- ✓ Use a tick (✓) or cross (x) to mark the appropriate boxes.

PART A: DEMOGRAPHIC DATA

1. Gender:

   Male ☐

   Female ☐

   Prefer not to say ☐

2. Age bracket:

   Below 30 ☐

   30-39 ☐

   40-49 ☐

   Above 50 ☐

3. Level of Education:

   Certificate ☐

   Diploma ☐

   Bachelors ☐

   Postgraduate ☐

4. How Many Years Have you been Working at VCRH?

   Less than 1 years ☐

   1-5 years ☐

   6-10 years ☐

   Over 10 years ☐

5. In what department of VCRH do you work?

   Laboratory ☐

   Pharmacy ☐

   MCH/FP ☐

   Medicine ☐

   Emergency ☐

Other ……

6. What is your area of training?

Medical Doctor ☐

Clinical Officer ☐

Nurse ☐

Med Lab Technologist ☐

Pharmacist ☐

Health Records ☐

Other ……

PART B: HMIS UTILIZATION

Please indicate the extent to which you agree with the following statements by marking the appropriate box. (1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly agree)

Statement	1	2	3	4	5
HT1: Adequate definition of system requirements was done before procurement of the current HMIS system					
HT2: VCRH staff have negative attitudes towards the use of HMIS					
HT3: The HMIS system has greatly improved service delivery					
HT4: The HMIS has fastened service delivery significantly					
HT5: VCRH staff have the needed skills and knowledge to use the HMIS					

PART C: TECHNOLOGICAL FACTORS

Please indicate the extent to which you agree with the following statements by marking the appropriate box. (1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly agree)

Statement	1	2	3	4	5
TF1: The HMIS user interface is friendly to use					

TF2: File conversion formats are effective and easy to retrieve in the HMIS					
TF3: Adequate hardware and software evaluation is done regularly					
TF4: There instable ICT infrastructure like internet to allow use of HMIS					
TF5: The management organizes regular system testing to ensure current tasks match the HMIS functionalities					

PART D: MANAGERIAL FACTORS

Please indicate the extent to which you agree with the following statements by marking the appropriate box. (1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly agree)

Statement	1	2	3	4	5
MF1: All HoDs support HMIS utilization					
MF2: There is a proper strategic framework for HMIS adoption and use					
MF3: There is effective communication between HoDs and Users to ensure HMIS effectiveness					
MF4: HoDs are aware and fully involved in using the HMIS					
MF5: There is effective sharing of duties among department HoDs to monito the HMIS					

PART E: OPERATIONAL FACTORS

Please indicate the extent to which you agree with the following statements by marking the appropriate box. (1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly agree)

Statement	1	2	3	4	5
OF1: System compatibility and interoperability issues are pointed out and resolved promptly					

OF2: All departmental operations are automated and computerized in the HMIS					
OF3: One needs technological competence to manipulate and use the HMIS					
OF4: Every staff member can access a working computer in my department					
OF5: Financial investment is done to ensure enough gadgets are installed to meet the technological demands of HMIS use					

PART F: ORGANIZATIONAL FACTORS

Please indicate the extent to which you agree with the following statements by marking the appropriate box. (1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly agree)

Statement	1	2	3	4	5
ORF1: There is a proper institutional policy that guides HMIS utilization at VCRH					
ORF2: The institution encourages accountability on collecting and using information for further HMIS improvement					
ORF3: The institution sponsors employee training on how to use the HMIS					
ORF4: There are proper internal policies for continuous quality improvement at VCRH					
ORF5: The HMIS has promoted financial accountability at VCRH					
ORF6: The organizational structure of VCRH favors HMIS					
ORF7: VCRH's routines, processes, and culture are favorable for HMIS utilization					
ORF8: HIMS has automated all routines and processes at VCRH that were formally performed manually					

PART G: KEY PERFORMANCE INDICATORS

Please indicate the extent to which you agree with the following statements by marking the appropriate box. (1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly agree)

Indicator	**1**	**2**	**3**	**4**	**5**
KPI1: There is availability of a sufficient number of qualified and competent HIS and service management personnel to operate, compile, and analyze health information					
KPI2: There is existence of a hospital level strategic plan developed through a participatory process with engagement of key stakeholders, and widely accepted					
KPI3: There is existence of policies, laws, and regulations on HMIS use and reporting of key performance indicators					
KPI4: There is availability of a standard minimum set of core indicators that the HMIS must report periodically.					
KPI5: There is availability of an SOP that contains HIS information, analysis, and interpretation details for staff to use					
KPI6: There is use of data for planning, budgeting, or advocacy activities in the past year					
KPI7: Data or results of analyses are used to inform health system's performance evaluation					

The End

Thank You

APPENDIX 2: INTERVIEW GUIDE

1. What do you think are they factors that need to be considered in the utilization of HMIS and how would they affect HMIS?
2. Please detail some of the key challenges facing effective use of HMIS at VCRH. Mention staffing and utilization of the HMIS data.
3. What is your opinion on the role of HMIS in improving services at VCRH?
4. Is VCRH enjoying maximum benefit from HMIS utilization? Why or why not?
5. What issues do you believe if implemented or corrected would help the hospital to get maximum benefit from its HMIS?
6. How do you think the organizational structure of VCRH favors or blocks the successful utilization of HMIS?
7. What is the impact of the overall organizational culture and processes or routines of VCRH on the success of HMIS at the hospital?
8. How do you think the management can facilitate better adoption and use of HMIS at VCRH?

APPENDIX 3: LETTER OF INTRODUCTION

Strathmore University,

P.O. Box 59857, 00200

City Square, Nairobi, Kenya

To whom it may concern

Dear Respondent,

RE: PERMISSION TO CONDUCT RESEARCH WORK

I am a student of Strathmore University Business School, doing a Master of Business Administration degree in Healthcare Management. As part of my coursework, I am required to conduct a research study focused on healthcare improvement. The title of my research project is **"Utilization of Health Information Management System in Vihiga County Referral Hospital."** I would be grateful if you could spend a few minutes of your time to honestly complete the questionnaire. I assure that all information to be collected will be strictly for academic purposes and will be kept confidential.

Thank you in advance for your participation.

Yours faithfully,

Duncan Juma Matini

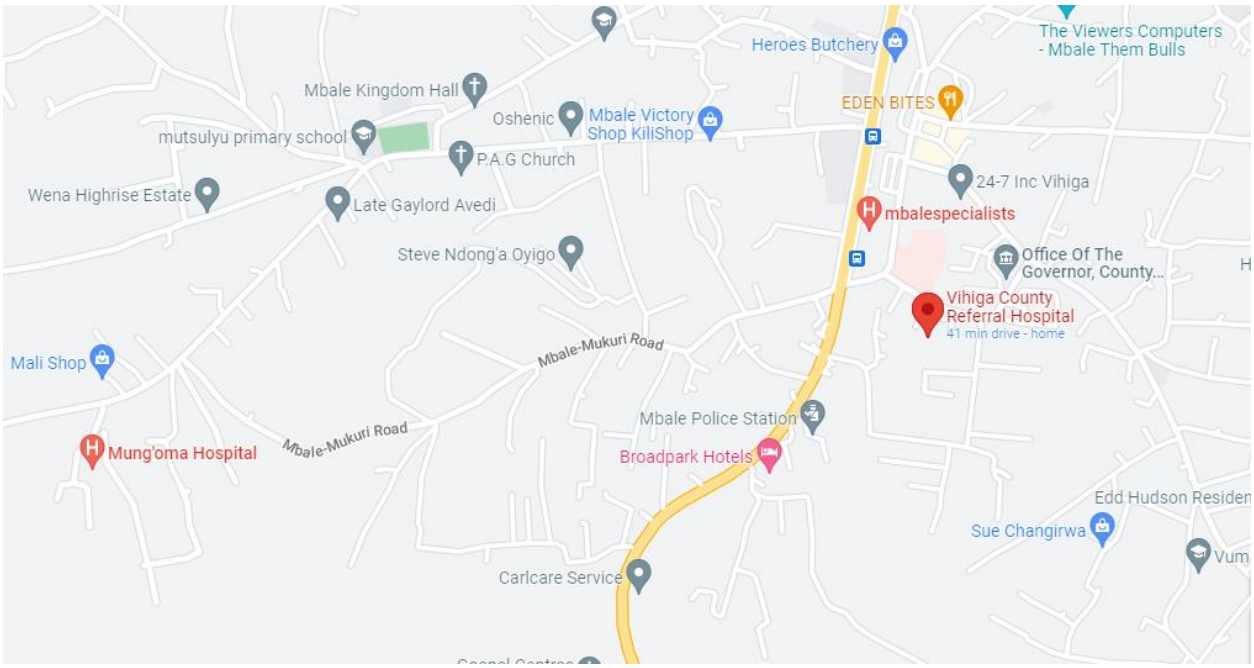
APPENDIX 4: STUDY BUDGET

Item	**Description**	**Amount**
Ethical Approval	Charges for obtaining ethical approval	Ksh. 5,000
Transport	Transport to and from Vihiga	Ksh. 25,000
Research Assistants	One research assistant to help with administering questionnaires, data cleaning and analysis	Ksh. 25,000
Communication	Costs of internet and calls through the whole project	Ksh. 10,000
Printing and Binding	Printing questionnaires, proposal, final dissertation, plus binding	Ksh. 10,000
Miscellaneous	10% of the budget to cover eventualities	Ksh. 10,000
TOTAL		**Ksh. 85,000**

APPENDIX 5: STUDY TIMEFRAME

	2022/2023					2024								
ACTIVITY	Dec	Jan	Feb	March	Apr	May	Jun	Jul	Aug	sep	Oct	Nov	Dec	Jan
Proposal development														
Ethical approval & revision														
Real Study														
Data analysis and dissertation writing														
Publishing or presentation of findings														

APPRNDIX 6: MAP OF THE STUDY SITE



Source: Google Maps

APPENDIX 7: NACOSTI License

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 155448

Date of Issue: 12/December/2023

RESEARCH LICENSE

This is to Certify that Dr.. DUNCAN JUMA MATINI of Strathmore University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Vihiga on the topic: FACTORS AFFECTING THE UTILIZATION OF HEALTH MANAGEMENT INFORMATION SYSTEMS IN VIHIGA COUNTY REFERRAL HOSPITAL for the period ending : 12/December/2024.

License No: NACOSTI/P/23/31746

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Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

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See overleaf for conditions

APPENDID 8: Ethical Approval

Strathmore UNIVERSITY

20th November 2023

Dr Matini Duncam Juma,
matinidan@gmail.com

Dear Dr Matini,

RE: Factors Affecting the Utilization of Health Management Information Systems in Vihiga County Referral Hospital

This is to inform you that SU-ISERC has reviewed and **approved** your above **SU-masters** research proposal. Your application reference number is **SU-ISERC1910/23**. The approval period is from **20th November 2023 to 19th November 2024**.

This approval is subject to compliance with the following requirements:

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-ISERC.
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-ISERC within 72 hours of notification.
iv. Any changes anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-ISERC within 72 hours.
v. Clearance for the export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to the expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days of completion of the study to SU-ISERC.

Before commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation (NACOSTI) https://research-portal.nacosti.go.ke/ and obtain other clearances needed.

Yours sincerely,

Mr Ambrose Rachier,
Chairperson; SU-ISERC

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20-Nov-2023
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