

**INTEGRATED HEALTH CARE INFORMATION SYSTEMS IN
HEALTH SERVICE DELIVERY TENETS IN KENYATTA
NATIONAL HOSPITAL
KENYA**

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**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE AWARD OF A MASTER OF SCIENCE DEGREE IN
HEALTH SYSTEMS MANAGEMENT OF
MOUNT KENYA UNIVERSITY**

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DECLARATION AND APPROVAL

Student Declaration

This thesis is unique with no submissions for credit toward a degree or other honors from any other university.

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DEDICATION

I dedicate this research project to my husband Joel, our son Tulivu, my parents and my siblings for their absolute support during my studies.



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As they say, "it takes a village to raise a child," therefore everyone worked together to finish this thesis. First and foremost, I give thanks to the Almighty God for my life and excellent health during my studies. For their advice and assistance, I am incredibly appreciative of my supervisors, Dr. Jackline Nyaberi and Dr. John Kariuki of Mount Kenya University. A special thank you to my students for their invaluable contribution in creating the investigation tools and to my biostatistics instructors for helping with data analysis. Additionally, I am grateful for the assistance of the Department of Public Health and the whole Mount Kenya University community. My heartfelt thanks go to Kenyatta National Hospital staff and department heads for enabling data collection, and to NACOSTI for approving this study. Lastly, to my husband, parents, siblings, and friends your encouragement kept me going. Thank you all sincerely.

ABSTRACT

According to the World Health Organization(WHO), only 58% of countries worldwide have a national Electronic Health Record should start with capital letters since this is a proper noun (EHR) system in place, and even fewer have fully integrated health information systems across multiple care providers, which affects coordination and quality of care.. In Kenya, healthcare spending accounts for 4.8% of the Gross Domestic Product (GDP). The country has made significant strides in healthcare digitization, with 79% of public hospitals offering Electronic Medical Records (EMRs). However, challenges persist, such as insufficient staff training, with 73% of District Health Information Software(DHIS) staff lacking proper training, and critical gaps in Kenya's Health Management Information System, including 47% staffing levels and 34% storage capacity. As the biggest referral hospital in Kenya, Kenyatta National Hospital (KNH) struggles with disjointed digital systems, which raises operating expenses and causes inefficiencies. The impact of healthcare technology, sociodemographic traits, information system security, and electronic medical health records systems on the provision of medicalcare services in KNH, Kenya, was investigated in this study. Both qualitative and quantitative data were gathered using a descriptive cross-sectional methodology. The research investigation was carried out at KNH, Kenya. A sample of 218 participants was chosen from the study's target population of 480 respondents. Qualitative data was gathered using Key informant interviews, while quantitative data was gathered using a structured questionnaire. The target population for this investigation was Kenyatta National Hospital staff. Quantitative data was analyzed using the Statistical Package for Social Sciences. The data was examined using descriptive statistics, chi-square, and logistic regression. Qualitative data was analyzed using NVivo, and Thematic content analysis was done to identify dominant themes. To ensure ethical consideration, the researcher obtained approvals from relevant authorities. Also secured informed consent from participants. A higher probability of better service delivery was associated with the following factors: the use of Clinical Decision Support Systems (CDSS) (OR=1.518,95% CI [1.016,2.266], p=0.042), the adoption of telehealthcare technology (OR=1.302,95% CI [1.126,1.832], p=0.029), and the implementation of efficient patient administration records systems (OR=1.831,95% CI [1.265,2.652], p=0.001). Expected benefits from the investigation are to the public hospitals, hospital managers, since it stipulates the recommendations, and scholars since it forms a basis for further studies. The investigation concluded that integrated healthcare information systems have a momentous influence on healthcare service delivery tenets in KNH. The study recommended that KNH should invest in continuous training for healthcare providers to ensure uniform usage across departments. KNH should continue to invest in tailored training programs that consider the varying education levels, experience, and professional backgrounds of staff. KNH should strengthen its data protection policies and ensure that all healthcare providers are trained in maintaining data privacy. The hospital should continue integrating advanced healthcare technologies such as mobile health, telemedicine, and cloud computing.

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LIST OF ABBREVIATIONS AND ACRONYMS

CSC	Computer Science Corporation
DHIS	District's Health Information Software
DSS	Decision support systems
EMR	Electronic Medical Records
GOK	Government of Kenya
HIPAA	Health Insurance Portability & Accountability Act
HIS	Hospital information systems
HMN	Health Metrics Network
ICT	Information and communication Technology
IoT	Internet of Things
IT	Information Technology
ITU	International Telecommunication Union
KNH	Kenyatta National Hospital
MOH	Ministry of Health
NHIF	National Health Insurance Fund
OSS	Open Source Software
SPSS	Statistical Package for Social Scientists
WHO	World Health Organization

CHAPTER ONE: INTRODUCTION

1.0: Introduction

The investigation's background, problem statement, research questions and objectives, constraints, scope, assumptions, importance, and rationale are all included in this part.

1.1 Background to the study

Whether in a developed, developing, or third-world country, the medical field is one of the biggest and fastest-growing in the globe. In addition to the fact that every country in the globe is striving to give its residents the greatest medical treatment possible, this has been brought on by the introduction of new diseases as a result of population expansion and climate change (Rađenović & Veselinović, 2017). Improving healthcare for patients, operational effectiveness, and data-driven decision-making all depend on the integration of health information systems (HIS). Lack of interoperability across diverse systems impedes efficient data interchange and may jeopardize care continuity, according to a recent systematic study (Torab-Miandoab et al., 2023). Semantic interoperability and the smooth communication of various systems, including eRecords, laboratory systems, and disease-specific registries, are made possible by standards like HL7 FHIR, CDA, and SNOMED CT (Torab-Miandoab et al., 2023). Lack of national-level policies, fragmented vertical programs, and a lack of resources frequently impede integration efforts in low- and middle-income countries (LMICs); evidence-based methods are still hard to come by (Kumar & Mostafa, 2019).

Cloud-based HIS platforms are becoming prevalent due to their scalability, cost-effectiveness, and ease of maintenance. Market reports indicate a shift from on-premises deployments toward cloud and API-driven systems, enabling real-time data access and

remote collaboration(Torab-Miandoab et al., 2023). The use of ICT has emerged as a force to consider the use of enhanced medical care in conventional techniques, as well as a solution to the global quest for better medical services for its citizens. This admission is made possible by the fact that many developing countries face numerous challenges in providing their population health and medical services, including a shortage of funds and resources as well as a shortage of highly qualified and experienced doctors and nurses (Ghasemi et al.,2021, Mehdiabadi et al.,2021, Spulbar & Birau, et al., 2021).

The healthcare information system is used by a number of governments in their operations. The Computer Sciences Corporation (CSC) took on one of the biggest and most intricate health-related IT projects in the world when America, then headed by President Bush, started working on it in 2004 (Sui, Ding & Wang, 2018). The project's primary issue, though, was a protracted and expensive implementation procedure. France has a reputation for providing high-quality healthcare and is now implementing hospital information systems more advanced than the US (Blackstone & Taylor, 2014). Comparable medical facilities are now in existence in European nations like France before the United States, and the structure of their healthcare system results in higher taxation for France (Barbazza et al., 2019; Kringos et al., 2019; Klazinga & Tello et al., 2019).

According to the African Union Health Ministers (2015), Sub-Saharan Africa has not addressed the concerns of telehealth, telemedicine, and electronic healthcare systems, including privacy and trust difficulties. Many African countries have expanded their access to health information sharing since the introduction of Open Source software (OSS), but more work has to be done (Bosch-Capblanch et al., 2021; Oyo-Ita et al., 2021; Muloliwa et al.,

2021; Samba, Brown et al., 2021). Beginning in 2010, when the Ministry of Health switched the District's health information software (DHIS) from an Excel-based system to a web-based one, Ghana's implementation of health information systems followed Kenya's lead (Odei-Lartey, et al., 2020, Prah, Anane, et al., 2020).

With nearly forty million individuals living in rural regions, Kenya is putting forth extra effort to enhance their health. Kenya's total health spending in 2016 was 4.8%, according to the World Health Statistics Report 2019 (WHO, 2020). By broadening the NHIF contribution schemes, which now target both ambulatory and hospital patients, recent initiatives to reform the NHIF have increased its operations to provide substantial benefits to a sizable portion of the Kenyan population (WHO, 2020).

Patients at public hospitals, according to Evans (2016), have consented to utilize hospital information system components in their everyday practice of patient care delivery. Health information systems (HIS) at hospitals consist of the hardware and software needed to collect, analyze, and store patient data. Doctors who treat the same patients may now share information (Rudin, Goldzweig & Shekelle, 2014). Using technology in the public hospital should also enhance readability, reduce medical mistakes, reduce medical expenses, and improve treatment quality. It's not only a question of conveying the database but also of distributing information to the globally integrated health system across the hospital. Health sector continuity is essential for the exchange of services and information; therefore, the efficient deployment of a health information system has become an absolute requirement (WHO, 2018).

In SSA, HIS integration is evolving from basic HMIS aggregation to multifaceted, interoperable ecosystems that support surveillance, supply chain, EMRs, and mobile-based tools (WHO, 2018). While DHIS2 remains core, true interoperability relies on infrastructure, governance, and skilled personnel (Okello, 2017). There's growing momentum around data use and analytics, yet scaling innovations like AI requires sustained investment and workforce development. Several efforts have been made in public and commercial healthcare to establish an integrated and interoperable health information system with different outcomes (WHO, 2018). The sector as a whole. In commercial and governmental hospitals in Kenya, the health information system is essential for coordinated, integrated, and evidence-informed healthcare (WHO, 2018). In cooperation with the business sector, the Government of Kenya has made significant efforts to create an e-health environment.

The Kenya ICT Policy of 2006, the Health Information Systems Strategic Plan (HIS 2009-2014), and the 2010 introduction of Standard Electronic Medical Records (EEMR) in Kenya demonstrate significant advancements. The Kenyan government's actions mark a significant turning point in the creation of a legal and regulatory framework that encourages the advancement and use of electronic health care in Kenya (GoK, 2016). It is now a must for effective healthcare for patients globally and is no longer a technological option (Gladwin et al., 2018; Dixon & Wilson, et al., 2018).

New technologies like cloud computing have given users the ideal platform to optimize computer resources and simplify administration, which is helpful for healthcare providers looking for cost-saving solutions. New concepts like mobile health (M-Health) have completely changed how public hospitals provide medical care. Safety, security,

dependability, adaptability, and use are some of its key characteristics. According to Chaulagai et al. (2017), Moyo et al. (2017), Koot et al. (2017), and Khunga & Naphini et al. (2017), the system is centered on the patient's delivery process. With the use of technology, patients may have their health status tracked and recorded throughout the day, enabling them to seek medical attention whenever it is most comfortable for them (González-Ferrer et al., 2018; Seara et al., 2018; Cháfer and Mayol et al., 2018). Massive volumes of health data have been gathered via digitization in public hospitals, and their volume is growing at an accelerated rate. Because of the widespread use of laptops, desktop computers, and mobile phones to help patients find doctors and nurses, who can then more easily access patient medical data and make choices right away, internet access and usage at Kenya's public hospitals is growing quickly. According to Cheburet and Odhiambo-Otieno (2016), this is crucial to raising the standard of medical care in Kenya.

A system of health care where patients get therapy and supplies is a vital and first-rate service in public hospitals. 2013 will see the development of an expanding range of consumer electronics and medical sensors that will enable individuals to monitor their physical, mental, and physiological well-being. To do this, he places a strong emphasis on the use of technology, which enables patients and their families to monitor their health status continuously and seek assistance when necessary. Understanding the values of healthcare data is crucial to delivering the highest caliber of patient-centered, accountable, and high-quality medical care, as the amount of healthcare data collected by digitalization in public hospitals continues to increase (Workneh et al., 2019; Teferi & Kumilachew et al., 2019).

Internet connectivity and usage in public hospitals Kenya's Healthcare technology has developed rapidly by using computer laptops and desktops, smartphones (mobile) that have enabled the patient to locate nurses and physicians online, and medical evidence and verdict support that are important to improve and have access to good healthcare in any nation (Ho, *et al.*, 2021; Chou, *et al.*, 2021, Chao, *et al.*, 2021; Hsu & Chung, *et al.*, 2021). With the rapid growth in ICTs, the power of the internet has strongly impacted the provision of services since data is simply imported from various devices, like vital signage, ventilators, infusion, and device monitors, safely stored and displayed in precise tables and sizes, to deliver quick service (Loseto, *et al.*, 2020; Ieva Pinto & Scioscia, *et al.*, 2020).

By physically distributing data and giving a virtual overview, or by centralizing data from a single source inside a health organization, (Cardoso (2014) demonstrates that the majority of medical initiatives seek to create an electronic health record. According to Bashir, *et al.*, 2021; Ashfaq, *et al.*, 2021; Almazroi & Khan *et al.*, 2021, medical security platforms are an essential part of any healthcare system. For example, he mentions the fact that systems have unique weaknesses, such as the inability to properly manage and access original information and the internal state of other agents.

Decision Support Systems (DSS) use medical or knowledge-based models, such diagnostic processes or medications, to deliver patient-specific evaluations and prescriptions. On the other hand, several publications claim that epidemiological simulation, medical care delivery systems, private hospital healthcare systems, and preventative systems are used for comparing the assignment and/or assessing how a certain therapy affects the progression of the illness. Zhang & Koehl, *et al.*, 2021; Song *et al.*, 2021; Zeng *et al.*, 2021).

For SCHRIOs to easily input health data, the Kenyan government launched the District Health Information System (DH.I. S) in 2011. Errors in data transfer and mistakes at the site of creation, however, might affect the reliability of the DHIS's collected information (Oluoch *et al.*, 2014). In 2015, Kenya's H.M.I.S. was evaluated, and it was found to have several holes, such as being too fragmented and not being fully computerized. Staffing levels were assessed at 47%, office space at 40%, storage at 34%, and office supplies at 20%. Approximately 73% of the DH.M.I.S. team lacked the proper training. Thirty percent of the information was deemed accurate, nineteen percent as full, and twenty-six percent as up-to-date. At the time of data collection, confidentiality was assessed at 32%, data utilization at 22%, and security at 48% (Okello, 2017).

If the health information system in hospitals is not properly utilized, it's becoming difficult for each of them to connect effectively to improve service inside and beyond the hospital. They may not integrate properly, such that the exchange of medical data between physicians and practitioners may interfere. For example, the connection between hospital systems such as health records and the pharmacy can be challenging if it is not properly connected and integrated. The capacity to use and accept health information systems by providers and patients is also a problem for physicians and healthcare professionals.

1.2 Statement of the Problem.

With countries attempting to enhance medical services in the face of expanding medical care demands brought on by population expansion, climate change, and the introduction of new diseases, medical services are one of the fastest-growing sectors in the world. In 2020, healthcare expenditures totaled \$9.8 trillion worldwide, or 9.8% of GDP (WHO, 2021).

Improving the delivery of healthcare has been made possible in large part by the adoption of information and communication technology, or ICT. Developing countries, however, have difficulties such as a lack of resources, limited finance, and a scarcity of medical experts. For instance, the WHO-recommended minimum of 1.0 physicians per 1,000 people is far higher than the average of 0.2 physicians per 1,000 people in sub-Saharan Africa.

Worldwide, health information systems (HIS) have been utilized to enhance the delivery of health care. Delays and excessive costs plagued the US medical digitization initiative's 2004 launch. In contrast, France has demonstrated exceptional proficiency in integrating information systems for hospitals, resulting in enhanced health outcomes and higher service quality (Barbazza et al., 2019). Developing nations like Africa still face several obstacles despite these developments, such as interoperability problems and data privacy issues. Just 36% of medical facilities in sub-Saharan Africa have completely digitized medical records (WHO, 2020).

In Kenya, the lack of integration between systems has led to fragmented care, delayed diagnoses, and duplicated testing. Health workers often lack real-time access to critical patient data, compromising decision-making and continuity of care (Kyalo & Odhiambo-Otieno, 2019). This disconnection hampers effective referrals, data accuracy, and disease surveillance, undermining patient safety and resource efficiency. Additionally, the absence of system interoperability limits evidence-based planning and weakens the health system's responsiveness (WHO, 2021). As a result, health service delivery, coordination, and monitoring remain suboptimal, especially in rural and underserved areas.

In Kenya, healthcare digitization efforts have gained traction over the last decade. For instance, the Ministry of Health transitioned from an Excel-based system to a web-based District Health Information Software (DHIS2) in 2010, significantly improving data collection and reporting processes. However, challenges persist. A 2015 evaluation of Kenya's Health Management Information System (HMIS) revealed critical gaps: 47% staffing levels, 40% office space availability, and 34% storage capacity. Additionally, only 30% of health data was found to be accurate, and data confidentiality was rated at a low 32% (Okello, 2017). These issues hinder efficient health service delivery.

Kenya spends 4.8% of its GDP on healthcare, as reported in the World Health Statistics Report 2019. Efforts to enhance universal health coverage (UHC) through initiatives such as the National Hospital Insurance Fund (NHIF) have improved access to services, expanding coverage for both ambulatory and inpatient care. Furthermore, internet connectivity and mobile health technologies have revolutionized service delivery in Kenyan public hospitals. An increasing number of hospitals are utilizing electronic medical records (EMRs), with 79% of public hospitals now offering patient-centered applications to personalize care (Kyalo & Odhiambo-Otieno, 2019).

Similar problems are addressed institutionally at Kenyatta National Hospital (KNH), the largest teaching and referral hospital in Kenya. For patient administration and service delivery, KNH has put in place several digital technologies, however, these are not entirely connected. Although KNH employs several electronic systems, a 2023 audit by the Kenya Health Information Systems Association discovered that these systems function in silos, making it challenging to communicate patient data across departments and delaying clinical

decision-making. The hospital's ability to provide high-quality healthcare has been compromised by this fragmentation, which has resulted in duplication of services, inadequacies in patient care, and higher operating expenses.

While the adoption of ICT in healthcare has shown promising results, challenges remain. These include fragmented systems, limited interoperability between departments (e.g., pharmacy and records), and a lack of training for healthcare workers, as 73% of DHIS staff lack proper training (Okello, 2017). Addressing these gaps is crucial to achieving fully integrated health information systems, improving service quality, and enhancing patient outcomes.

The quality of medical care in Kenya has been below average, even though the government has been making great efforts to create an effective system to meet the Millennium Development Agenda and Vision 2030 (Kyalo & Odhiambo-Otieno, 2019). As a result, the Kenyan healthcare system is now having difficulty keeping up with the growing demand for high-quality medical treatment. Despite its best efforts, Kenyatta National Hospital is unable to meet the growing demand for general and specialized medical services in Nairobi, the capital of Kenya, due to a lack of infrastructure. Long wait times for appointments, slow turnaround times at all service points, a lack of involvement, communication, and participation, as well as poor performance monitoring and supervision, a lack of revenue collection optimization, low budget utilization, high utility costs, and resource waste are other problems with service delivery. The difficulties result in a high population using overburdened services, delayed patient diagnosis and treatment, and excessively lengthy visits that cause noncompliance with treatment.

Operational inefficiency, subpar service delivery, income loss, lack of integration, and continuity are all results of manual systems. The hospital implemented a Strategic Plan 2018–2023 to address this issue, emphasizing the necessity of digitizing its activities (GoK, 2019). The increasing demand for specialty medical services at KNH faces significant challenges such as long wait times, slow service turnaround, lack of provider engagement, and inadequate monitoring, resulting in slow diagnoses, prolonged appointments, poor treatment adherence, and an overburdened system. (GoK, 2019). Without systems for healthcare in place, medical professionals are less able to deliver high-quality treatments. In light of this, the present investigation was conducted to assess the impact of integrating a health information system on service delivery at Kenyatta National Hospital. Few research have been conducted on the integration of health information systems in Kenyan public health institutions.

1.3 Broad Objective

To determine the influence of integrated healthcare information systems on healthcare service delivery tenets in Kenyatta National Hospital, Kenya.

1.3.1 Specific Objectives

- i. To assess the influence of electronic medical health records systems on healthcare service delivery tenets in Kenyatta National Hospital, Kenya.
- ii. To identify the influence of socio-demographic characteristics on healthcare service delivery tenets in Kenyatta National Hospital, Kenya.
- iii. To ascertain the influence of healthcare information security on healthcare service delivery tenets in Kenyatta National Hospital, Kenya.

- iv. To determine the influence of healthcare medical technologies on healthcare service delivery tenets in Kenyatta National Hospital, Kenya.

1.4 Research Questions

The corresponding research questions based on the objectives are:

- i. How do electronic medical health records systems influence healthcare service delivery tenets in Kenyatta National Hospital, Kenya?
- ii. To what extent does healthcare information security influence healthcare service delivery tenets in Kenyatta National Hospital, Kenya?
- iii. How does healthcare medical technology influence healthcare service delivery tenets in Kenyatta National Hospital, Kenya?

1.5 Significance of the Study

According to Kyalo & Odhiambo-Otieno (2019), most public hospitals in Kenya lack a solid scientific foundation for integrating health information systems. Public hospital management has been able to increase communication both inside and across hospitals by streamlining and expediting medical resolutions through the integration of medical data systems within the same department or unit. Therefore, the findings of this investigation are important for the following: Public hospitals, as the information they offer creates new opportunities for public hospitals in Nairobi County and across the nation. hospital policies, particularly because an interoperability policy has hindered public hospitals' capacity to communicate effectively, share information, and exchange information as necessary both inside and outside of hospitals. There is no concrete evidence that this was said in Kenya, because the services provided and their role in advising policymakers are the only factors that influence

public hospital decisions. Furthermore, by describing the possible impacts of health information system integration on care delivery in Kenya's public hospitals, the investigation assists physicians, practitioners, and administration of public hospitals in Kenya. The results are significant for academics and investigators in related fields for investigation, instruction, and teaching reasons because they give them a solid literature review that they can use for future studies and a basis for additional investigation. It also helps the representatives of public hospitals create and oversee healthcare information policies that public hospitals can implement successfully.

1.6 Justification of the study

Improving the efficacy, precision, and efficiency of service delivery in healthcare facilities requires the integration of medical care information systems. This study is crucial to filling up the gaps and enhancing service delivery at Kenyatta National Hospital (KNH), the country's main teaching and referral hospital, given the national, regional, and worldwide obstacles to fully integrated medical information systems. In particular, a disjointed information system at KNH leads to inefficiencies including misunderstanding, delayed treatment, and higher operating expenses. To update the system and guarantee that KNH can provide patient-centered, coordinated care that satisfies international standards, this research was required. This project will improve service delivery, lessen operational difficulties, and improve patient outcomes by identifying the gaps and providing solutions for integrated healthcare information systems.

It has been acknowledged that integrated health care information systems, or IHIS, are crucial instruments for enhancing the quality, effectiveness, and coordination of medical treatment.

The integration of laboratory information systems (LIS), radiology information systems (RIS), and electronic health records (EHRs) has improved service delivery, encouraged data-driven decision-making, and greatly improved patient outcomes in developed medical systems. However, little research has been done on the scope, efficacy, and difficulties of integrating health information systems in Kenya, especially at Kenyatta National Hospital (KNH), the country's main teaching and referral hospital.

The continued use of fragmented, stand-alone systems had often resulted in duplicated efforts, delays in care, poor interdepartmental communication, and inefficiencies in service delivery. These challenges had negatively affected the quality of care and hindered the timely use of health data for decision-making. This investigation was therefore necessary to assess the current level of integration at KNH, examine its impact on key health service delivery tenets such as timeliness, accuracy, efficiency, and continuity and identify barriers to full interoperability.

The findings were expected to inform hospital leadership, policymakers, and ICT stakeholders about gaps in system integration and provide evidence-based recommendations for improving digital health implementation. Additionally, the study aimed to contribute to Kenya's broader health information system reform efforts and guide similar interventions in other health facilities.

1.7 Scope of the Study

The research investigation was carried out at the level VI Kenyatta National Hospital Facility. This is because it is the largest hospital in Kenya and East and Central Africa, with a high patient volume and the top medical professionals needed for this study to be successful. Over

the years, this hospital has also made efforts to integrate healthcare information technology with service delivery.

1.8 Limitations and Delimitations of the Study

1.8.1 Limitations

Access to data and information from hospitals may be a barrier to hospital-based research due to the sensitive nature of the investigation subject matter and the tight laws regulating the preservation and use of medical data. And since HMIS integration has not received much attention in Kenya, the respondents may know very little about it. To address respondents' limited knowledge of HMIS integration, the study provided a brief orientation to clarify key concepts before data collection. Research tools were simplified using non-technical language and relevant examples. Additionally, key informants with deeper understanding, such as health IT officers, were included to enrich the findings.

1.8.2 Delimitations

By clearly communicating that the investigations goal is purely academic, the investigator helped participants overcome their fears. When the letter from Mount Kenya University was presented, the participants' confidence levels increased, allowing them to feel at ease when filling out the questionnaire.

1.9 Assumptions of the Study

This investigation on integrated health care information systems at Kenyatta National Hospital assumes that key digital systems, such as Electronic Health Records (EHRs) are functional and in active use. It presumes that respondents, including healthcare staff and system users, will provide honest and accurate information. The study further assumes that the hospital has sufficient ICT infrastructure to support system integration and that relevant

departments utilize these systems consistently. Additionally, it is assumed that the impact of integration on service delivery, such as improved efficiency, coordination, and timeliness measurable through the selected research methods.



1.10 Operational Definition of Key Terms

Decision Support System (DSS)-A tool integrated into HIS that provides clinicians and administrators with data-based insights to guide treatment or operational decisions.

End-Users-Healthcare workers (clinicians, nurses, technicians, and administrators) who interact with the HIS to retrieve or input patient and operational data.

Health ICT Infrastructure- refers to the virtual (software, network, and data storage) and physical (hardware) systems that facilitate the deployment and operation of HIS across hospital departments.

Healthcare information system (HIS): A collection of elements and procedures intended to offer information to improve health management decisions at every stage of the medical system.

HealthCare Service Delivery Tenetsrefers to the qualities of the perfect medical service delivery, including fullness, accessibility, patient pleasure, and prompt service delivery.

Healthcare information security is the use of administrative and managerial procedures, as well as technological and physical safeguards, to ensure the confidentiality, availability, and integrity of the data handled by a computerized system, as well as the system itself and its environment.

Healthcare medical technologies encompass any technology that supports healthcare organizations, including IT systems, medical devices, telemedicine, cloud computing, telehealthcare, and mobile healthcare.

Integrated Health Information System (IHIS)-Refers to a unified digital platform that enables seamless sharing and access of patient data across various departments (e.g., clinical, laboratory, pharmacy, radiology) within the hospital through systems.



CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

An evaluation of important theoretical and empirical research is presented in this chapter. The study's inherent investigation limitations were discovered through reviewing empirical literature on a variety of subjects. Most of this section is devoted to providing an overview and outlining areas for further study. Kothari (2018) uses a systematic approach to conduct a literature review to discover, locate, and assess the issue being studied.

2.1 Electronic Medical Health Records Systems and Health Care Service Delivery Tenets

According to Ismaili et al. (2020), hospital health, financial management, and administrative management are all included in health information systems (HIS). The use of these technologies has led to a swift shift from conventional paper-based procedures to digital ones, guaranteeing effective service provision (Weber-Jahnke & Obry 2020). It has reduced the quantity and frequency of medical mistakes by improving medical teamwork and simplifying complex connections. Additionally, it reduces medical expenses and offers better ways to enhance hospital administration (Palazzo et al., 2018).

Miranda et al. (2017) claim that the Medical Information System provides a variety of enterprises with sophisticated databases, many, scattered, and comprehensive languages, and the ability to integrate medical equipment. The system is designed to help doctors in their day-to-day job and is constructed in silos to reduce the environmental effect of the isolated islands of data. As a result, systems cannot effectively communicate with one another due to a lack of information (Palazzo et al., 2018).

On the other hand, Buntin *et al.* (2016) said that health systems have a significant potential to enhance the performance of healthcare workers. Ketikidis *et al.* (2017) claim that, because health professionals in public hospitals utilize hospital information systems, they can know how the health systems function and how they use the hospital as a whole.

Kenya's 2030 Vision The best quality, economical, and equal medical care is required by the Government of Kenya (GOK) (Luoma, 2010). Following Kenya's 2030 aim, the Ministry of Health (MOH) has made the development of the medical information component specified in the WHO framework a top priority. The need for high-quality health information has increased recently in Kenya, just like in wealthier nations (Luoma, 2020). According to Bell (2019), health information systems may be used in place of medical records to reduce medical errors, improve patient outcomes, and save money. However, he stresses that the advantages may be completely met only when obstacles such as the absence of appropriate informational infrastructure, poor knowledge of healthcare professionals, and health information exchange difficulties have been addressed (Kihuba *et al.*, 2019). The interoperability assessment between health information systems at a hospital enables the evaluation of the system's strengths and shortcomings. It also focuses on improvement areas (Gudria, 2019).

Reducing medical errors, reducing the length of time patients spend in rehabilitation, and improving communication both within and outside the hospital should be the main goals of a hospital medical data system. According to Almunawar & Anshari (2018), the primary objective for medical information systems, is to deliver high-quality healthcare services while simultaneously supporting the expansion, simplification, and enhancement of hospital management. Patients and physicians are looking for more individualized and secure

treatment options as a result of developing technology and the growth of electronic health data. Patients who are now receiving care from the healthcare system are living examples of the paradigm change (Caligtan & Dykes, 2017).

With the advent of EHRs, King, Jamoon and Furukawa (2019) changed the healthcare sector significantly by offering additional services, increasing patient care quality and improving in-real-time data access capabilities, thereby generating a wide array of health data management systems. Historical information on patients includes demographics and personal data, diagnoses and treatments previously received, progress reports, results from lab tests and radiographic scans, allergies, and vaccines, among other things. King, Jamoon & Furukawa (2019) require a shared responsibility and sociotechnical strategy for safe and successful IT healthcare design, development, implementation, and usage (Sittig, 2018).

Other researchers, Biondich *et al.* (2016) argue in support of national development plans, national information communications, and technologies for health care professionals and patients in general, following electronic health standards and methodology for public hospitals. The Kenya ICT Policy (2021), the Electronic Medical Record Standards and Guidelines (EMR), the Strategic Health Information Systems Plan (HIS), and the Kenya Communications Act (2009), all released in 2010, created a regulatory framework for the advancement of Kenya's healthcare sector (Kenya National Electronic Health Strategy 2011-2017).

Electronic Medical Health Record (EMR) systems are integral to improving healthcare service delivery by transitioning from traditional paper-based systems to efficient digital platforms. These systems enhance communication, reduce medical errors, lower healthcare

costs, and support hospital management. However, challenges such as limited interoperability, inadequate infrastructure, and insufficient knowledge among healthcare professionals hinder their full potential. In Kenya, health information systems are central to Vision 2030, emphasizing accessible, affordable, and high-quality healthcare. Supported by regulatory frameworks like the Kenya ICT Policy (2021) and the National Electronic Health Strategy (2011-2017), these systems aim to optimize healthcare delivery, improve patient outcomes, and enable real-time data access while addressing existing limitations.

2.2 Socio-Demographics Characteristics and Healthcare Service Delivery Tenets

The sociodemographic traits of medical professionals have a major impact on the adoption and utilization of Integrated Healthcare Information Systems (IHIS). Their readiness to adopt technologies for digital health and the effectiveness of IHIS deployment are influenced by these attributes, which include gender, age, educational background, job experience, and technological ability.

Investigations have shown that age plays a critical role in the adoption of IHIS. Older healthcare providers tend to be more resistant to adopting new technologies compared to their younger counterparts. Research by Liu *et al.* (2023) found that younger healthcare workers, particularly those in their 20s and 30s, tend to be more open to using IHIS because of their familiarity with digital platforms. On the other hand, older professionals, especially those above 50, may struggle with technology adoption due to lower levels of digital literacy and less exposure to health information systems during their formative education years. Older professionals may also face greater anxiety when using IHIS due to the fear of technological failure or errors in data entry. Ahmad *et al.* (2022) report that continuous training and support

programs help mitigate these challenges by building confidence and digital skills among older healthcare workers.

Gender differences in IHIS adoption have been studied in various settings, with mixed results. Some studies, like that of Yusof *et al.* (2021), suggest that female healthcare providers may be more meticulous and detail-oriented when using IHIS, leading to higher accuracy in data entry. However, they also note that females may face greater stress related to technology adoption, particularly if they perceive the technology as overly complex or difficult to use. On the contrary, Jones *et al.* (2022) observed no significant gender differences in the acceptance of IHIS, arguing that both male and female healthcare providers are equally capable of adopting these systems when given adequate training and support. The study emphasized that factors like workload and familiarity with digital tools are more crucial than gender in determining adoption rates.

Healthcare providers with the highest levels of education or specialized training are more likely to use IHIS effectively. Klein *et al.* (2023) found that providers with advanced degrees or certifications in health informatics, nursing, or medicine were more proficient in IHIS use than those with only basic qualifications. This is largely because more educated providers are often exposed to digital health systems during their training and are more comfortable with data management tasks. The World Health Organization (2021) also highlights that medical professionals who undergo continuous education and technology training are more likely to adopt IHIS. This is particularly true in regions where integrated health systems are mandated for health policy and governance.

Work experience is a double-edged sword when it comes to IHIS adoption. On the one hand, experienced healthcare providers, particularly those with over 10 years of clinical experience, may have developed established routines and clinical workflows that make integrating IHIS more challenging. On the other hand, Hosseini *et al.* (2022) found that experienced healthcare providers often have deeper insights into patient care and healthcare processes, making them potentially valuable contributors to IHIS design and functionality. In a study of U.S. hospitals, Smith *et al.* (2022) noted that providers with more experience are often more selective in their use of IHIS, relying heavily on human judgment when making clinical decisions. These providers may prefer hybrid systems that allow for both manual and automated processes, while less experienced healthcare workers may rely more heavily on the IHIS for decision support.

The technological proficiency of healthcare providers is a significant determinant of how well IHIS is adopted and utilized. Johnston *et al.* (2023) found that healthcare workers with strong computer skills and familiarity with electronic health records (EHRs) or hospital management systems had a smoother transition to using IHIS. This proficiency often correlates with younger age and higher levels of education but can be influenced by other factors such as access to technology and prior exposure. In LMICs, Adeyemi *et al.* (2023) identified that healthcare workers often struggle with IHIS adoption due to limited access to computers and poor internet connectivity, compounded by inadequate training. These obstacles demonstrate how crucial technology infrastructure and assistance are to the success of IHIS, especially in environments with limited resources.

The role that a healthcare provider occupies, as well as their departmental affiliation, has a direct influence on how they use IHIS. Physicians, nurses, and administrative staff interact with IHIS differently. For example, Chen *et al.* (2021) found that administrative staff are often more comfortable using IHIS for patient management, billing, and scheduling, while clinical staff may focus on EHRs and patient care systems. Moreover, certain departments—such as radiology, pathology, and pharmacy—are more reliant on IHIS for specialized functions. Hernandez *et al.* (2022) found that departments dealing with large volumes of diagnostic data, such as labs and imaging centers, benefit more from IHIS, as these systems streamline workflows and enhance data accuracy.

Socio-cultural and regional factors also shape the adoption of IHIS. In many LMICs, Mwangi *et al.* (2021) reported that healthcare providers often encounter resistance to IHIS adoption due to inadequate infrastructure and cultural preferences for paper-based records. Furthermore, differences in healthcare policy and governance across regions, especially in Africa and Southeast Asia, result in varied levels of IHIS integration in healthcare practices. Cultural attitudes towards technology and trust in digital systems further influence how healthcare providers in different regions embrace IHIS. For example, Ali *et al.* (2022) found that healthcare workers in some Middle Eastern countries preferred human-to-human interactions over computerized systems, which limited IHIS utilization.

Heavy workloads and time constraints also affect the adoption of IHIS. Miller *et al.* (2023) found that healthcare providers in fast-paced environments, such as emergency departments, often perceive IHIS as time-consuming and complex, leading to resistance. On the contrary,

in departments with lighter workloads, such as outpatient services, providers may have more time to familiarize themselves with the system, leading to higher adoption rates.

The sociodemographic characteristics of healthcare practitioners, including age, gender, education, job experience, and technical competency, have a significant impact on the adoption and use of Integrated Healthcare Information Systems (IHIS). Because they are more accustomed to using technology, younger doctors are more likely to adopt IHIS, whereas older professionals may encounter obstacles including anxiety related to technology use and deficiencies in digital literacy. While work experience can either facilitate or impede adoption due to established processes and familiarity with medical procedures, education and specialized training boost proficiency with IHIS. Particularly in (LMICs), where obstacles like scarce resources and inadequate internet connectivity are common, technological proficiency and infrastructural accessibility are essential. The way IHIS is utilized is also influenced by job positions and departmental affiliation; administrative workers frequently concentrate on management duties, while clinical staff focus on patient care. Adoption is also influenced by cultural, geographical, and workload characteristics; opposition is shown in environments with poor infrastructure, a strong preference for paper-based solutions, or severe time limitations. These results highlight the necessity of specialized infrastructure, support, and training to increase IHIS uptake and efficacy.

2.3 Healthcare Information Security and Healthcare Service Delivery Tenets

According to Calder & Watkins (2018), different persons have diverse definitions of information system security; for instance, it is restricted to suppliers of security solutions. Many managers and directors view it as a technical problem that is hard to comprehend and

is frequently handled by the IT manager. For many users of IT equipment, it usually means that management has placed unwelcome limitations on their computer and other IT device usage.

Healthcare providers have an obligation to their patients to protect their privacy and confidentiality throughout their interactions. This means protecting the privacy of any information that is collected, created, and disseminated in any manner, form, or context during a patient-healthcare provider partnership. Maintaining patient confidentiality is a professional and ethical duty for all those involved in patient management and medical records. In other words, computer passwords are implemented, access to rooms containing files and servers is controlled by key and lock, and medical data is handled by qualified individuals and utilized exclusively for its intended purpose (Nyaga, 2016).

Public hospitals have a high level of interoperability, enabling medical staff and other authorized parties, such as insurance companies, to exchange information electronically to enhance patient quality care and efficiency and the safety of health service delivery (HIMSS, 2016). As per Pardo and Burke (2019), in particular, the area of leadership and governance interoperability in decision-making, norms, and processes for improved governance is required. Without a strong governance framework, coordinating and aligning electronic health projects with national health objectives would be impossible. It offers political leadership and promotes interaction among the appropriate stakeholders (WHO & ITU, 2021).

There are four layers of interoperability, according to Whitman & Panetta (2021) and the European Telecommunications Standards Institute: technical, syntactic, semantic, and

business-related. Although technical interoperability enables systems that are otherwise incompatible to interact, the receiving system does not guarantee that the data transmitted will be of any value (Whitman & Panetta, 2021). While syntactic interoperability inside hospitals ensures the complete preservation of clinical data throughout healthcare transmission and semantic interoperability, many systems can understand information that is similarly transmitted via pre-defined common significance of ideas in hospitals (Whitman & Panetta, 2021).

One of the four levels of interoperability is organizational interoperability which allows business and activity to be integrated across one frontier (Whitman & Panetta, 2021). In addition to three lesser interoperability levels, an organization's interoperability demands the strong desire and commitment of the organizations involved to work together effectively. Semantic interoperability is the capacity to exchange data across healthcare systems between apps that rely on the sender and recipient who comprehend a common language (Whitman & Panetta, 2021).

The use of medical data and the growth of health data need the inclusion of big data analysis in medical data systems (Raghupathi & Raghupathi, 2019). Additionally, Kuo et al. (2019) emphasized the need of tackling the issue of data aggregation and multi-source preprocessing to provide insight, security of information, and privacy in response to the growing number of data breaches and hacking events in public hospitals. The development of an Internet of Things (IoT) data management system based on sensors and medical equipment makes patient monitoring in healthcare and lifestyle possible (Qu et al., 2019). A user-based

evaluation of medical data management systems necessitates a simple approach to patient involvement and satisfaction (Rau et al., 2017).

According to Wyatt (2016), nearly all general practitioners are now linked to the NHS net and must adhere to a strict connection code since hospital networks contain hundreds of access points and only approved medical staff members are given access to cope with security and privacy issues. Privacy and data-sharing issues have spread outside the healthcare industry with internet growth, which has altered how medical information is created and distributed both inside and outside of institutions (Wyatt, 2016).

The ITU (2017) asserts that the most important element in promoting interoperability and raising the acceptability of electronic medical requirements is standardization. An independent governance structure is required to uphold national norms at the national level. The specifications for an electronic medical record architectural standard (ISO 18308:2011) and ASTM standards for admission and discharge reservation/registration (R-ADT systems) are two examples of computerized medical record standards for hospital system interoperability. Kumar (2013) states that patient data is collected and disseminated across several platforms. The medical sector has a wide spectrum of highly skilled healthcare professionals.

Berry (2018) Individuals' health information is protected by HIPAA, which enjoins the development of government standards to ensure the security of digital health information. The safety requirements for electronic health records between those who are covered and those who do not guarantee that records are available, are intact and are private.

The provision of medical care depends heavily on medical information security, which calls for strong safeguards to guarantee the privacy, accuracy, and accessibility of patient data. Security perceptions differ across stakeholders, with vendors viewing it as a product feature, managers as a technical challenge, and users as restrictive measures. Healthcare professionals have an ethical obligation to safeguard patient data through secure systems, password protection, restricted access, and qualified personnel handling sensitive information (Nyaga, 2016). Interoperability in public hospitals enhances patient care by enabling electronic information exchange among stakeholders, but it demands strong governance frameworks for alignment with health objectives (WHO & ITU, 2021). Interoperability encompasses technical, syntactic, semantic, and organizational levels, with semantic interoperability ensuring a shared understanding of transmitted data (Whitman & Panetta, 2021). The integration of big data and IoT technologies has transformed health data management, and improved patient monitoring but also increased risks of breaches, emphasizing the need for stringent security protocols (Raghupathi & Raghupathi, 2019). Standards like HIPAA and national governance frameworks are essential to maintain data security, protect privacy, and foster interoperability in healthcare systems (Berry, 2018).

2.4 Healthcare Medical Technology and Healthcare Service Delivery Tenets

The usage of technology in public hospitals has brought numerous advantages to the provision of health services. It has enhanced services, cut costs, and increased the safety of the delivery of medical care in industrialized countries (Yen & Bakken, 2017). Medical records stored on computers in hospitals are designed to deliver the proper information to a person who is appropriate at the appropriate timing, in the appropriate place, and in a secure

way. But even while hospitals place a high value on patient data quality, the Audit Committee (2017) estimates that only around 25% of hospital personnel devote time to data collection and information usage.

These numbers are still very modest. Until wide networking was established, Hammond *et al.* (2015) claimed that computer systems in general practice would not be a significant issue for hospitals because of the complicated workflow, job definition, and job division that produces varied and complex patterns of data usage security and privacy. Teixeira *et al.* (2015) suggest there are difficulties linked to the usage of ICTs, such as a lack of systematic consideration in the design or implementation process of human and non-technological concerns. Pai and Huang (2016) suggest that human aspects are seldom dealt with. For example, accepting computers in their work by nurses and other medical personnel is a problem occasionally.

Increased satisfaction with the quality of medical care services increases the perceived utility and simplicity of use for customers. A considerable distance has to be done before hospitals and other healthcare providers are fully reliant on information and communications technology (ICT) (Pai & Huang, 2016). Pai und Huang (2016) claim that this is because networking and communication innovations are less attentive or focused, partially because of worries about breaches of the security and privacy of patients, making it difficult to adopt them quickly. Despite delayed acceptance of the healthcare information system, IT has revolutionized healthcare (Gupta, 2018).

Diagnostic services including x-rays, mammograms, and expert consultations are increasingly being outsourced, according to Gupta (2018). Telemedicine's ability to reduce

hospital expenses and divide work is key to its future. Gupta (2019) asserts that rather than cooperating to produce a medical record that patients and healthcare practitioners can easily access and interchange, health information systems typically operate as silos with their regulations, formats, and global integration along with the accessibility of information.

Using cloud computing in healthcare offers numerous advantages according to Ahuja, Sindhu and Jesus (2017), such as cooperation amongst health professionals, decreased IT costs in public hospitals, and better service provision. Healthcare resources are restricted due to the value of human life, according to Wang (2018), and the usage of cloud services makes service delivery more cost-effective. Cloud computing has stormed into the healthcare industry in poor nations like Kenya since it is a simple method to do a growing number of jobs because services are readily accessible even in distant regions. The patient gets paid for the time spent (by payment), thus the services are affordable (Dinh *et al.*, 2018).

According to Schubert, telemedicine is utilized to provide patients with access to data and healthcare services (2020). Using robotic technologies like video-conferencing, or satellite technology to broadcast consultations between service providers, is as easy as two physicians discussing a case over the phone (WHO, 2013). By 2030, chronic obstructive pulmonary disease (COPD) will be the third leading cause of mortality worldwide. According to Steventon *et al.* (2017), a number of technology initiatives have been assessed to see whether alternatives are cost-effective when compared to traditional therapy and, when utilized appropriately, are safe and practical for patients with chronic illnesses. According to Jacobsen *et al.* (2017), telemedicine solutions directed exclusively at patients with COPD

may significantly reduce ED visits and hospital readmissions while simultaneously improving health-related life quality.

Medical technology has significantly enhanced service delivery for medical services by boosting efficiency, reducing costs, and ensuring better patient care. Digital medical records offer quick and safe access to information, however issues including minimal staff participation in data use, intricate procedures, and sluggish ICT adoption because of privacy concerns still exist. Healthcare services are becoming more affordable and accessible thanks to innovations like cloud computing, especially in rural and underdeveloped areas. By facilitating remote consultations, strengthening the treatment of chronic illnesses, lowering readmission rates to hospitals, and improving patient quality of life, telemedicine has further transformed healthcare. Despite persistent obstacles, technological developments are revolutionizing healthcare by encouraging effectiveness, teamwork, and better results.

2.5 Challenges Facing HIS and HMT and Healthcare Service Delivery Tenets

Complicated medical procedures, standardization, legal issues, resistance to change, privacy issues, and safety considerations are further problems (Iroju et al., 2013). For instance, a patient undergoes many procedures throughout therapy, and information is required at each stage. For instance, the doctor reviews the laboratory technician's report on the laboratory examination to determine whether there is a problem and what treatment option could be best. Inadequate management of this process might lead to problems and compromise the provision of services (Iroju et al., 2023). Interoperability of hospital information and other custom systems may be a headache, especially if they are developed without clear standards. According to Iroju et al. (2023), medical data security, availability, and integrity are crucial

and should be protected.

According to Shusaku (2019), hospital systems were developed in the early 1980s to record more general data, such results from laboratory tests. Real-time informational exchange and the receipt of clinical data from hospital information systems promote improved clinical recording, reduced duplication of medical procedures, and better decision-making. The usage of hospital information system components in day-to-day patient care operations in public hospitals has been extensively acknowledged, according to Lammintakanena, Sarantoa, and Kivinenb (2016).

According to Austin, Bentkover, and Chait (2016), medical supply companies face challenges such as a shortage of physicians and the need for affordable alternatives to hospital stays or doctor's appointments due to medical and technological breakthroughs. According to Van Deursen, Buchanan, and Duff (2023), healthcare security should be handled carefully to protect patient privacy and confidentiality when sharing or accessing patient information. This is achieved by anonymizing the data and retaining the permission privileges for access to all or only a subset of the data.

According to Saslow (2016), patient data is under increasing strain due to strict privacy and safety regulations, fast-developing clinical technology increasing expenses, and other reasons hospital executives should seek new approaches to properly handle and preserve information. According to Andel et al. (2021), hospitals have been using a variety of quality improvement methodologies for service delivery for more than thirty years in an effort to increase quality and operational efficiency while lowering costs. The WHO and ITU state that the Hospital Legal Framework encourages the effective exchange of health information

and electronic medical regulations, which need to be periodically reviewed to ensure they continue to be in line with the interoperability objectives. Adequate training and training programs are required to create staff competency, implementing and running electronic health systems (WHO & ITU, 2021).

In the United States, the Kaiser Family Foundation has highlighted the need to move between plans since insurers require time to react to reversal changes and reassess how customers purchase hospital insurance (Gomes, 2016). Therefore, when coverage changes occur, health authorities must be ready to address them (Wood, 2020). Medical executives are also under more pressure to adhere to HIPAA, the Joint Commission on Accreditation of Medical Facilities (JCAHO) regulations, and Medicaid and Medicare Services Centers (CMS), according to a recent poll (Wood, 2020).

The degree to which a national electronic health strategy establishes interoperability goals relates to the nation's healthcare priorities and provides a plan to achieve those goals will determine its success (WHO & ITU, 2021). Hospitals must have the policies, rules, and funding necessary to encourage the broad implementation of interoperable electronic medical devices in their buildings (WHO & ITU, 2021). This is another crucial component. Hospital information systems (HIS) and healthcare medical technology (HMT) face numerous challenges, including complex medical processes, lack of standardization, legal issues, resistance to change, and concerns over privacy and security. Poorly managed workflows and interoperability issues can jeopardize service delivery, while advancements in medical technology demand more affordable and efficient alternatives to traditional care models. Safeguarding patient information through secure access controls and anonymization is

essential, as privacy regulations and technological advancements increase pressure on healthcare facilities. Through improved training and the use of interoperable electronic health systems, hospitals aim to increase operational efficiency, save costs, and further enhance service quality. For electronic health systems to be implemented successfully and remain sustainable, national health plans that are in line with medical objectives and backed by laws, rules, and funding are essential.

2.5.1 Service Quality

There are three elements to having access to high-quality hospital health care: coverage, service, and timeliness. People may access the healthcare system more easily with health insurance coverage, since not having health insurance makes it more difficult for patients to get the medical treatment they need (Hadley, 2017). Timeliness means that the health system is capable of providing excellent health care swiftly once needs are identified and measures in the hospital may adversely influence the health and hospital expenses by a delay in identifying a need for a particular test or treatment quicker (National Healthcare Quality Report, 2018).

This is supported by the data in this article (National Healthcare Quality Report, 2018). The distribution of medical resources, the creation of creative solutions, and the effectiveness and efficiency of health issues are all widely acknowledged as elements of high-quality medical care, and they all significantly rely on the appropriate gathering, administration, and use of medical information systems. All public health care institutions, including the smallest neighborhood clinic, are required by Kenya's Ministry of Health to provide electronic health trend monitoring data for evaluation. Using patient-centered applications, which enable them

to address each patient as an individual, Kenyan hospitals may offer their patients superior treatment (Isern et al., 2017). Environmentally intelligent concepts regarding medical care, according to Sahli, Jabeura, and Badra (2015), are based on various sensor systems that identify and forecast the behaviors of subjects, such as keeping track of the elderly, in which professionals are alerted if an abnormal state of affairs is detected. Most hospital programs are made to gather and deliver the most relevant medical information at the appropriate moment for treatment when required, claim Bouzguenda and Turki (2018). Consequently, the apps or systems are made to evaluate the medical pictures or validate the patient's medical information (Sokolova & Fernandez-Caballero, 2017).

By keeping physical data and viewing virtually, or by integrating data from many sources in a healthcare institution's central node, the majority of healthcare efforts are focused on creating an electronic health record, according to Cardoso (2021). Medical security platform systems, according to Rashvand *et al.* (2017), are an essential part of a healthcare system's provision. Agent-based systems have several flaws, including the inability to manage original information, access control issues, and insecure communication between agents.

Isern, Sánchez, and Moreno (2017) state that the hospital's DSS (decision support systems) collects patient data and offers patient-specific evaluations and recommendations based on knowledge-based models or health processes, such as diagnosis or therapy. An in-hospital simulation is a helpful tool for analyzing patient-related systems, human resource assignments, providing medical care, disease prevention, or assessing how a certain therapy affects hospitalized illness. The application of simulation to medical care was illustrated by Wang and Paranjape (2018), who showed how systems can mimic the impact of both short-

term and long-term therapies and comprehend the behavior of some complicated diseases, like diabetes or a corpus of patient situations.

Investigations on health service quality and measurement are carried out both domestically and abroad. The national hospital's service quality was evaluated by Roland et al. (2017) at UK hospitals. Conversely, Budiwan (2016) assessed patient satisfaction in contrast to their expectations in Singapore. Akdere et al. (2018) examined the quality of public and private hospitals in Turkey. The investigation conclusions indicate that patients favored private hospitals' service quality over public hospitals'. According to Yesilada and Direktor (2010), there is virtually little difference in the quality of care that public hospitals in Cyprus offer compared to private hospitals. Kondasani and Panda (2015) investigated how customers in Indian private healthcare perceived loyalty, satisfaction, and service quality. According to Ujjain, Amjeriya, and Malviya (2020), patient satisfaction was positively and significantly impacted by medical services.

Research at 300 Malaysian health institutions (Ihaamie, 2018) anticipated that 100 points would be allocated to various 5 aspects of tangible services quality, dependability, empathy, credibility, and responsiveness. It showed dependability (20.63), tangibility (21.10), reactivity (20.51), empathy (18.11), and believability (20.05). He came to the conclusion that customer happiness was impacted by the quality of the service, as shown by the measurements derived from the findings. Even though empathy was shown to be the least significant factor, other factors were found to be relevant.

In Kenya, Wanjau, Muiruri, and Ayodo (2017) found that personnel competence, technology adoption, communication, and financial resources all had an impact on service quality. The research showed that the staff capacity is closest to the quality of healthcare, while financial resources have the least impact. In his assessment of the quality of services in reference hospitals in Yegon (2016), he concluded that patient satisfaction is a factor in the measurement of the medical system and the management of different available resources. These include people resources, money, and healthcare resources. According to Barake (2015), improving customer attention, leadership, continuous improvement, and employee involvement at Avenue Hospital in Kisumu County would lead to better service quality. Akacho (2018) found that the quality of health care delivered at Uasin Gishu County Hospital was influenced by financial resources and infrastructural availability.

The current literature about the quality of services in the medical sector shows that health services pay great attention to the quality of services as they believe that it adds to the satisfaction of patients. These studies demonstrate a positive relationship between patient satisfaction and the quality of received services (Saravanan & Rao, 2017; Wicks & Roethlein, 2015). As Yegon (2016) stated, patient happiness is a factor in managing the different healthcare resources. Akacho (2018) and Wanjau *et al.* (2017) identified variables that affect the quality of service in Kenya. Communication, financial resources, staff capacity, technological adoption, and the availability of health facilities are some of the variables highlighted. When they conducted their study, they neglected to include the administration of these factors, which, according to Yegon (2016), are crucial for providing high-quality healthcare services.

Service quality in healthcare hinges on coverage, service, and timeliness, ensuring patients can access needed care efficiently and effectively. High-quality healthcare relies on proper management of health information systems, patient-centered apps, and innovative technologies such as sensor systems and decision support systems (DSS). These tools aid in diagnosis, treatment, and managing complex diseases, contributing to better resource allocation and patient satisfaction. International and local studies have linked factors such as staff competence, technology adoption, communication, and financial resources to service quality, with private hospitals often outperforming public ones in perceived quality. In Kenya, research highlights the impact of infrastructure, leadership, and continuous improvement on healthcare service quality, while also stressing the need for effective management of resources and variables to sustain improvements. Patient satisfaction remains a critical indicator of service quality, underscoring the importance of addressing both systemic and operational challenges in healthcare delivery.

2.6 Theoretical Perspective

2.6.1 Complexity Theory.

Social sciences are at the foundation of complexity theory. Theorems drew on chaos theory, information theory, and cybernetics, among others. In the 1950s, Newtonian models evolved to include nonlinear dynamics instead of linear ones. In management, complex thinking techniques were later employed, as shown by Mick and Wyttenbach (2013). Studying social circumstances in many fields of social sciences, both for development and political analysis (Swanson & Bhadwal, 2014).

At the start of the millennium, the health sector was given a lot of attention, which led to demands for the application of sophisticated ideas in sector management (Virtanen & Stenvall, 2017). The emphasis was on the complexity of health services administration and management (Damschroder *et al.*, 2014). The idea of complexity has taken time to materialize in the traditional works of health care delivery. The World Health Organization has published research on the limitations of healthcare provision and complexity and system thinking (de Savigny & Adam, 2014). This circulation was aimed at strengthening the world's health system. This delay was due to the conceptual combination concerning the meaning of the term 'complexity' and the dispersed application of the theory in the provision of medical services (Rickles, 2018).

Financial barriers in the use of maternal mortality and medical services both auger well with Zimmerman's assessment of the complicated issue as they are interconnected and have many variables (2017). Pregnant women are exempted from a charge policy so that they have access to maternity care. Initially, it was seen as a simple procedure aimed at improving prenatal participation. However, minimum charges are introduced, known as simple administrative costs, which are expected to increase hospital finances to guarantee that the process works well and minimize delays, particularly logistics. The purpose of these expenses is to cut down on pregnancy complications throughout pregnancy and delivery, thus lowering death and morbidity rates. This new burden on the government may mean less attention paid to mother and child health care, especially in rural areas where poverty is widespread. The underutilization of pregnancy-related health services.

The real implementation and acceptability of health policy thus depends ultimately on many variables in the health sector. They are likely to acclimatize or adjust according to the location of their place. Existing contextual variables, as well as characteristics like health system exposure and coverage, health care quality, and poverty levels, influence the strategy's outcomes.

2.6.2 Criticism of the theory

In its application to organizational management, the idea has received criticism from many academics. According to Crabtree (2016), there is no explanation as to how complexity in research attracts difficulties in drawing findings in studies on the delivery of health care. Such a study can grasp how complexity may be used to discover answers to problems of critical health care. It's impossible to predict how complexity theory will be utilized in future studies without clear and explicit descriptions of how it was previously employed. According to Leykum (2014), the theory of complexity should be used in health care research and study together with other theories. There are many ideas available to healthcare researchers, including the concept of complexity. However, other studies have found that complexity theory offers a suitable alternative, examining issues relating to communications, relationships, and diversity specifically on how such characteristics may impact change in the health system.

2.4.3 Health Metrics Network Framework

The study's cornerstone will be the Health Metrics Network (HMN) framework, which was created in 2006 as a WHO-sponsored initiative. Hospital and public health information systems, alerting communication services, event identification services, surveillance data

services, analysis services, and the Public Health Grid Services Ecosystem are just a few examples of how different facets of medical care can be integrated to better serve patients (HMN, 2016). The objectives for integrated systems must be met if healthcare service delivery as a whole is to be successful. The health management information System that is currently in place will affect the service delivery that takes place inside the hospital. In addition, the Health Metrics Network argues that a hospital's information system is made up of a variety of modules that, when they are not properly connected, hinder the delivery of services but, on the other hand, promote them when the integration is done correctly. Understanding what KNH has implemented with respect to HMN measurements will serve as the basis for the research, along with the reasons that encourage HMIS adoption and the advantages in service delivery concerning HMN Metrics.

The study's theoretical framework was inspired by the World Health Organization's 2012 report on healthcare issues and hospital activity integration to improve service delivery, utilizing computer systems. The study's independent variables are the various demands and challenges that hospitals like KNH must face. In light of constrained healthcare funding, there is a dire need to improve service delivery, Human Resource management, data analysis, and the distribution of medical goods. According to the Kenya Health Sector Strategic Plan, the best course of action would be to fully automate the country's Health Information System (2018-2023). By integrating HMIS into the workflow of healthcare organizations, both essential and ancillary tasks may be automated, resulting in full automation. Improving service delivery is a key goal of the HMIS modules for inpatient/outpatient management, laboratories, pharmacies, supply chain management, registrars, radiologists, clinician

managers, and accountants. It is not the primary function of the HMIS to handle patient registration, imaging, or the financial and clinical management modules. The advantages anticipated from HMIS adoption, as well as the incentive techniques employed to increase its uptake, have an impact on service delivery.

The level of service a hospital can give is inversely related to the amount to which HMIS is employed across a wide range of departments, including clinical management, radiology, finance supply chain management, patient management, and labs. Motivating techniques include human resource capacities, restricted funding, leadership, information usage, the desire to enhance service delivery, and the requirement to effectively use medications and other supplies, all of which either stimulate or impede this in hospitals. The level of service provided also depends on the hospital's expected benefits, with those benefits boosting the likelihood that additional services would be provided (Demiris, Oliver, Porock & Courtney, 2014).

2.7 Summary of Literature Review

The opinions of different scholars about the current status of medical technology, health policy, and public hospital health information systems are covered in this chapter. The chapter started by going over the elements that go into creating hospital information systems. Next, it went over the different information systems that public hospitals use to provide services. Finally, it covered healthcare policies and public hospital medical technology. The investigation's approach is covered in the next chapter.

2.8 Knowledge Gap

Vest et al. (2016) studied health information exchange: persistent challenges and strategies focused on individual health consumption of data for the support of effective treatment because of fragmented information creation and storage. In an investigation on the creation and adoption of electronic health standards by African nations, Adebessin et al. (2018) looked at the choice of leading standards for electronic health interoperability. Although the investigation focused on the African population, its findings point to a management strategy that establishes recognition based on clinical pathways to support treatment procedures and improve hospital medical procedures (Adebessin et al., 2018).

An interoperability study was built by Sadeghi *et al.* (2017) using a conceptual model that is built on top of a collaborative case study to construct an interoperability study that permits healthcare providers and patients to communicate through web apps made possible by mashups. Mouttham *et al.* (2012) have created ontology as a framework to describe the interoperability needs for collaborative care because of policy (interoperability policies) limitations in the provision of collaborative care (2017). Consent management techniques used by Weber-Jahnke and Obry (2020) exclude the information system in favor of peer-to-peer clinical information instead. This article addresses the management mechanism's deficit in systems interoperability, but also limits access to sensitive medical data based on specified permission directives and enables rules to be overridden if necessary.

The research conducted by Huryk (2015) focuses on the development of healthcare and wellness practices for patients. In the current healthcare environment, where information technology is an integral component of daily operations, the research offers insight into

modern nursing practices. Using new apps may be hindered by a lack of knowledge and misunderstanding about the necessary abilities (Huryk, 2015). The most frequent challenges in hospitals without a health information system were insufficient purchasing capital, maintenance expenses, resistance from physicians, unclear return on investment, and a shortage of staff with sufficient information expertise, according to a 2017 study on electronic medical records by Nguyen, Bellucci, and Nguyen. Using the information, service, and quality systems provided by De Lone and Mclean's Information System Success Model, Pai and Huang (2016) offered a conceptual model that was appropriate just for the use of information systems. To the best of their understanding, therefore, relatively few research have been conducted on the effects of health information systems and policies on rising nations in Kenya and Africa.

Despite global recognition of the importance of integrated health information systems (IHIS) in improving healthcare delivery, Kenya's implementation remains fragmented and underexplored, particularly in major public institutions like Kenyatta National Hospital (KNH). Existing studies in Kenya have largely focused on individual components of health information systems, such as electronic health records (EHRs) or disease surveillance platforms, but there is limited empirical evidence on how full system integration influences core service delivery tenets such as efficiency, timeliness, data accuracy, and continuity of care. Moreover, most available literature emphasizes technical and infrastructural challenges, while few studies examine the institutional, operational, and user-level dynamics that affect the performance of integrated systems in real clinical settings. This leaves a critical knowledge gap in understanding how integration or the lack thereof impacts day-to-day

service delivery, decision-making, and patient outcomes at a high-volume tertiary facility like KNH. By assessing the present state, impacts, and obstacles of hospital health information system integration, this investigation aimed to close this gap and provide data to support system development and policymaking.

2.9 Conceptual Framework

The basis for the investigation is one of the theoretical framework's components in the conceptual framework (Kumar, 2013). As inputs to the model, these four criteria will be used to objectively analyze health information systems, legislation, problems, and medical care technology. In this case, the dependent variable is services rendered.



Independent variables

Dependent variables

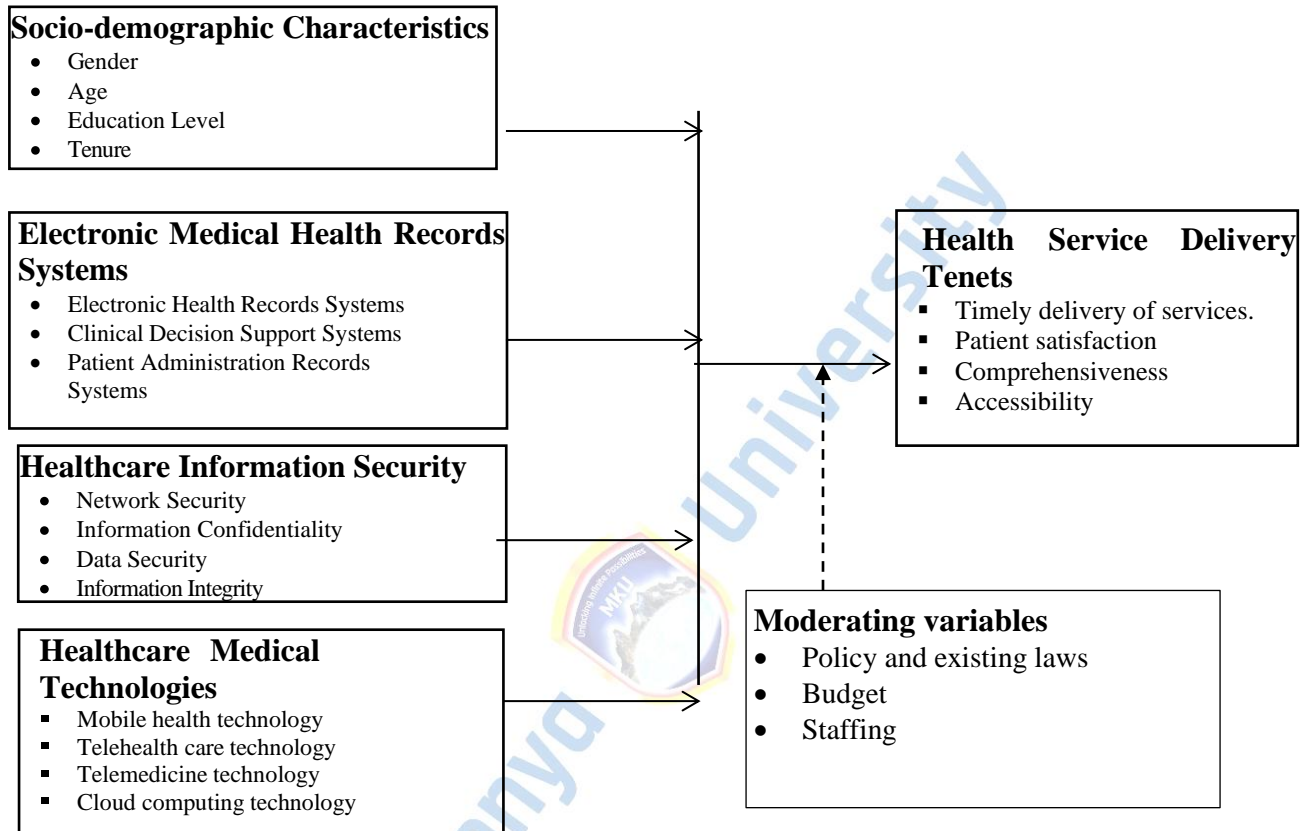


Figure 2.1: Conceptual Framework

Source: Adopted and modified from Rudawska (2022).

CHAPTER THREE: MATERIALS AND METHODS

3.0 Introduction

Research methods, area of research, research design, subject population, sampling strategies, and sample size are all covered in this chapter. Additionally, the chapter discusses the study instrument, its validity and reliability, and the process of data collecting and analysis.

3.1 Research Design

The study was a descriptive cross-sectional design was used to collect both quantitative and qualitative data. Depending on the study's objectives and research concerns, data may be collected from the whole population or simply a portion of it. The researcher may draw a complete conclusion using this research technique. This design is excellent because it provides a comprehensive description of the event, which ensures that the data gathering is restricted, as well as where, how, and what happens (Kothari, 2014).

3.3 Location of Study

In Nairobi County, Kenya, at the Kenyatta National Hospital (KNH), the investigation was carried out. Nairobi County's Hospital Road, off Ngong Road, is where Kenyatta National Hospital is located (Appendix VIII). The building faces the Ngong Road to the north at the intersection of Mbagathi Road. Nairobi-Kisumu Railway Line to the south, Mbagathi Road to the east, and Hospital Road to the west. KNH has 50 wards, 24 theaters (16 of which are specialty), 22 outpatient clinics, and an accident and emergency department. There are 209 beds in the Kenyatta Prime Care Centre (KPCC), out of a total of 1800 beds. The hospital's wards can house 1800–2500 patients per day (KNH Records Department, 2020). The main teaching and referral hospital in Kenya is Kenyatta National Hospital (KNH), which is situated in Nairobi, the nation's capital. KNH is approximately 1,795 meters (5,889

feet) above sea level and is located at latitude -1.2921° S and longitude 36.8219° E. With a population of over 4.5 million (KNBS, 2025), Nairobi is a significant center for politics, the economy, and culture. KNH is essential to the city's citizens' access to specialist medical services. While Nairobi is home to other well-established hospitals such as Nairobi Hospital and Aga Khan Hospital, KNH holds a unique position as the largest public healthcare provider in Kenya. Its role as a national referral hospital is vital, as it serves not only Nairobi but also patients from across the country and even from neighboring East African nations. The hospital's catchment area extends well beyond the capital city, offering specialized services that make it a central healthcare resource for a vast population.

3.4 Target Population

The 480 employees of Kenyatta National Hospital were the investigation's target demographic. The hospital has been employing computer technology to deliver healthcare services for some time now. As indicated in Table 3.1, the investigation's target group consisted of health-related practitioners (including but not limited to nurses, clinical officers, and medical physicians), hospital ICT officers, health information officers, laboratory technologists, pharmacists, finance, and reception personnel.

Table 3. 1: Target Population

Respondents	Target Population
General practitioners	225
Hospital ICT Officers	42
Health Information Officers	44
Laboratory Technologists	54
Pharmacists	75
Finance	25
Receptions	15
Total	480

Source: Kenyatta National Hospital Human Resource Department (2020)

3.5.1 Inclusion and Exclusion Criteria

Inclusion Criteria

Subjects who had used one or more components of the hospital's health information systems (such as Electronic Health Records, Laboratory Information Systems, or Radiology Information Systems) for at least six months were eligible.

The study included clinical and administrative staff (e.g., doctors, nurses, lab technicians, radiologists, pharmacists, records officers, and IT officers) who were employed at Kenyatta National Hospital during the study period.

Only individuals who voluntarily consented to participate and signed informed consent forms were included.

The investigation included staff working in departments where HIS integration had been implemented or was actively in use, such as outpatient, inpatient, laboratory, pharmacy, radiology, and records departments.

Exclusion Criteria

Interns, students, or temporary staff with less than six months of work experience at KNH were not included in the study.

During the data collecting period, health professionals who were absent due to illness, leave, or other reasons were not included.

3.6 Sampling procedures and Sample size determination

3.6.1 Sample Size Determination

The size of the sample of the research was calculated using the proportional sampling method formula of Taro Yamane. A sample size is thus determined according to the formula of Taro Yamane given below:

$$n = N / (1 + N(e)^2)$$

Where n = Sample size

N = population under study

e = margin error (0.05)

I = constant

Therefore;

$$n = 480 / (1 + 480(0.05)^2)$$

$$n = 218.18 \text{ rounded off to } 218$$

3.6.2 Sampling techniques

The sampling frame for the study listed the General practitioners (this includes but is not limited to Nurses, Clinical Officers, and Medical Doctors), Hospital ICT Officers, Health Information Officers, Laboratory Technologists, Pharmacists, and Finance and Reception Staff of Kenyatta National the sampling frame. Respondents were chosen by systematic random selection from a registry that was sought from each of the seven strata. Based on the

computation, the population sample size for each stratum was determined using a research sample size, as shown in table 3.2 below.

Table 3. 2: Sample Size

Respondents	Target Population	Proportional Sampling Method	Sample Size
General practitioners	225	$225/480*218$	102
Hospital ICT Officers	42	$42/480*218$	19
Specialist Consultants	44	$44/480*218$	20
Laboratory Technologists	54	$54/480*218$	25
Pharmacists	75	$75/480*218$	34
Finance	25	$25/480*218$	11
Receptions	15	$15/480*218$	7
Total	480		218

3.7 Data Collection Methods and Tools

The tools and techniques for gathering data are discussed in this part to help the investigator get data.

3.7.1 Data collection methods

To ensure impartiality, generalizability, and reliability, quantitative research employs methods created in the natural sciences (Park & Park, 2016). To evaluate hypotheses on the relationship between variables, studies that are quantitative use techniques including statistical analysis, standardized questionnaire or intervention administration, and objective sample selection from the investigation's population. To acquire quantitative data for this study, the questionnaires contained closed-ended questions (Appendix II).

Qualitative research is distinguished by its emphasis on features of objects and processes and on interpretations rather than on numerical data (Oun & Bach, 2014). Qualitative research

helps people learn more about themselves and get deeper insight into the human experience (Appendix III). The primary objective of qualitative research is to get an intense understanding of human behavior and experience.

3.7.2 Data collection tools

The quantitative and qualitative instruments utilized in the investigation to gather data for additional analysis are highlighted in this section.

3.7.2.1 Quantitative tools

Quantitative information was gathered in the form of questionnaire responses for the research (Kircher & Zipp, 2022). I utilized questionnaires since they may either be self-administered or delivered with support from another person. In this particular research, the use of questionnaires was selected since the participants in the study are literate and fully capable of providing sufficient responses to the questions that are asked. A five-point Likert scale—five for strongly agreeing, four for agreeing, three for neutral, two for disagreeing, and one for severely disagreeing—formed the basis of the survey.

3.8.2.2 Qualitative tools

Respondents were given semi-structured questionnaires to complete to gather data that is qualitative (Adeoye-Olatunde & Olenik, 2021). Respondents were allowed to offer more information about particular research variables by answering an open-ended statement in a semi-structured questionnaire.

3.8 Validity and Reliability of Instrument

Twenty-two Kenyatta National Hospital volunteers were selected by the researcher to take part in the pilot study; they were not included in the main investigation. This represents 10%

of the whole sample size used in the investigation. This was done to properly pre-test the data collection tool (Ruslin, Alhabsyi & Syam, 2022). The pre-tests were administered at random, and the results were not part of the study.

3.9.1 Validity

According to Robinson (2002), the validity and trustworthiness of the collected data are largely determined by the data collection equipment. To what extent the study's phenomena are reflected in data analysis conclusions (credibility or believability of the research)? It's also important to look at how accurate an instrument is by evaluating how much attention it devotes to gathering the data it needs. Validity as pointed out by Leung, (2015) is the extent to which the data analysis truly reflects the phenomena under investigation (valid for the desired outcome). The validity of the objective questions contained in the questionnaire was guaranteed. Furthermore, the investigator sought the supervisor's perspective on the issues. The surveys are evaluated to detect and modify any unclear or objectionable questions and methods highlighted by (Cooper & Schundler, 2014).

3.9.2 Reliability

Reliability is the extent to which instruments for research yield consistent results (Kothari, 2014). Reliability issues, according to Wilson (2010), are most often caused by subjectivity, and once a investigator adopts a subjective method of research, the work's dependability suffers. To obtain the dependability of the data, the research utilized the test-test techniques. The alpha of Cronbach was obtained using SPSS to assess the data's dependability. In statistical terms, Alpha Cronbach's alpha coefficient tells us how closely linked the items in a collection are. Internal consistency has a higher dependability coefficient if it is around 1.

A Cronbach's alpha of 0.8 is usually good, a 0.7 is acceptable, and an alpha of 0.6 and below is bad (Kothari,2014).

3.9.2.1 Reliability analysis

Since a measure or scale's consistency is referred to as reliability, the tenacity of this section's reliability study was to determine whether the scale in question consistently represented the construct it measured. Electronic medical systems, information system security, health care medical technology, and service delivery are the four variables in this study that we examined using the Cronbach Alpha method (Cronbach, 1951), as designated in Table 3.3 below. With a Cronbach Alpha of 0.815 and above, the constructions surpass the suggested statistical cutoff of 0.7. Thus, the research variables establish a solid foundation for additional statistical analysis and are dependable and consistent for subsequent analysis.

Table 3. 3: Cronbach Alpha reliability test

Construct	Cronbach's Alpha	No. of items	Status	N
Electronic medical health records systems	0.825	4	Reliable	210
Information system security	0.904	6	Reliable	210
Health care medical technologies	0.815	4	Reliable	210
Service delivery	0.862	5	Reliable	210

3.10 Data Collection Procedure

Research authorization from NACOSTI (Appendix VI) as well as KNH-UoN ERC (Appendix VII) and a letter from Mount Kenya University was obtained by the researcher before beginning the process for data collection (Appendix IV). Before to exercise, formal

permission sought from the relevant hospital administrative authorities before accessing the identified respondents. The investigator explicitly described the purpose and aim of the investigation thereafter the identified respondents were required to fill consent form (Appendix I). The identified participants were required to respond to a semi-structured questionnaire either in hardcopy or online within two weeks. The hard copy questionnaires were to be delivered using the drop and pick technique while online were sent via their email. The physical visit and phone conversations followed.

3.11 Data Management and Analysis

The data gathered was carefully reviewed and verified for completeness and integrity. Primary data is gathered via questionnaires that are given by the drop-and-pick technique. Statistical inference and descriptive analysis summarized, analyzed, tabulated, and assessed the results. Descriptive statistics should include the frequency distribution including the mean, and standard deviation. The multidisciplinary regression analysis was used to make connections between dependent and independent variables. To summarize, multiple regressions are a versatile data analysis technique that analyzes one quantitative variable (the dependent one) in connection to any number of other variables (expressed as independent or predictor variables). Graphs like frequency tables, pie charts, and bar graphs are utilized to display the data. Making ensuring that the information gathered is easily understandable is one of the main goals. Descriptive analysis tools like frequency tables and graphs produced by the SPSS software were used to do this. Up until the time for data processing, the questionnaire was secured in locked cabinets. After the data was retrieved from the questionnaire, it was cleaned, coded, and entered using software known as the Statistical

Package for Social Sciences (SPSS) version 25. To assess the reliability of the data, a Cronbach alpha of 0.7 was considered suitable. The data was summarized using bar graphs, pie charts, percentages, and frequencies.

To ascertain the link between the independent and dependent variables, inferential statistics like logistic regression tests and chi-square were utilized. A continuous or discrete scale was used to quantify the independent variables. The coding for the dependent variable was "1" for adherence to self-care practices and "0" for non-adherence. For the purposes of logistic regression analysis in SPSS version 27, the questionnaire responses with scores of 1 through 3 were combined and coded "0" to indicate dissatisfaction with the delivery of health services, while those with scores of 4 and 5, or pleased and extremely satisfied, indicate satisfaction with medical service delivery.

The dependent variable in this investigation is the most useful analytical instrument, according to a variety of independent criteria (Cohen, West, & Aiken, 2003). The three unconnected variables are merged to form the dependent variable, which is a predictor of service delivery. The determination coefficient (R^2), which is obtained by regression analysis, indicates the extent to which the independent variables account for the variation (Chatterjee & Hadi, 2015). To ascertain the importance of the study variables in impacting service delivery, investigators examined the p-value of 5% (Chatterjee & Hadi, 2015).

3.12 Ethical Considerations

An introduction letter from Mount Kenya University's School of Post-Graduate Studies was submitted. The National Commission for Science, Technology & Innovation granted the investigator an investigation permit, the Kenyatta National Hospital-University of Nairobi

Ethics Review Committee granted an ethics review certificate, and the Mount Kenya University Ethics and Research Committee granted ethical permission. The administrators of Kenyatta National Hospital granted permission for the study to be conducted. Furthermore, respondents' informed agreement was acquired before the questionnaires being distributed (Appendix I). No respondent's identity was revealed on any of the questionnaires that were given out, and participation in the study was entirely optional for all Kenyatta Hospital employees. When sharing any material acquired throughout the study, the researcher maintains objectivity. Respondents can duplicate the study's findings if necessary. Data for the investigation was collected both in-person and online because to COVID-19 and the mitigation measures put in place in reaction to it. Covid 19 mitigating measures, including face masks and other hygienic procedures, were rigorously adhered to in person.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.0 Introduction

This chapter focuses on the analysis and presentation of research findings, to summarize the collected data, to analyze and present the research findings. Hence this chapter was structured into three parts: the introduction, the presentation, the interpretation, and finally, the discussion.

4.1.1 Response Rate and Reliability Analysis

In this section, the analysis of how the participants responded to the questionnaires is given. The reliability of the data collection is also addressed.

4.1.2 Response Rate

We distributed 218 questionnaires through a drop-and-pick model of distribution. There was good cooperation from the employees of Kenyatta National Hospital, Kenya whereby we had 210 questionnaires received back out of 218 questionnaires distributed which account for a 96% response rate as shown in Table 4.1 below.

Table 4.1: Response Rate

Questionnaires	Frequency	Percentage
Administered	218	100.00
Returned	210	96.33
Not Returned	8	3.67

4.2 Socio-Demographics of the respondents

The second objective was to ascertain the influence of socio-demographic characteristics on healthcare service delivery tenets in Kenyatta National Hospital, Kenya

4.2.1 Socio-demographic Characteristic Descriptive Statistics

There were 210 responses out of 218 questionnaires distributed which account for 96% response. Regarding gender, the majority of respondents were female (56.2%), while male respondents accounted for 43.8%. The nurses (30.5%) constituted the highest number of respondents in the study, followed by health information officers (25.7%), and then clinical officers (11.4%). Others are hospital ICT officers (9%), laboratory technologists (9%), medical doctors (5.2%) pharmacists (3.8%), finance officers (3.3%), and reception staff (1.9%). These different levels and categories of hospital cadres mean that information systems that can share data and information between medical professionals and patients are crucial to improving service delivery. There is a generally good representation of all the cadres of the workers as respondents in the study, a means to capture the importance of health systems in service delivery at Kenyatta National Hospital, Kenya. The largest percentage of responders (61.4%) had a diploma, while the next largest percentage (30.5%) had a degree. A mere 1.9% held a certificate qualification, while just 6.2% held a master's degree. At Kenyatta National Hospital, the vast majority of the staff members have at least a diploma. It is simpler to teach and mentor an educated personnel to embrace a new system inside a business. The majority of Kenyans live in rural regions, and the introduction of mobile and general technical advancements has made it possible to expand access to medical treatment for these individuals. With these educational levels, it should be easy for the medical staff to get training on information health systems and how to use them to enhance the quality of treatment provided at Kenyatta National Hospital.

Many employees were relatively new to the workforce, as evidenced by the fact that the majority of respondents (60.5%) had 0–8 years of experience. Nine percent had nine to sixteen years of experience, 14.8% had seventeen to twenty-four years, and 13.3% had twenty-five to thirty-two years. More seasoned workers were in the minority, as just 2.4% of the workforce had 33–40 years of experience. According to table 4.2 below, the majority of health personnel have eight years or less of work experience. There is proof that hospital staff can be taught to use information related to health care when education level and years of experience are combined. The quality and delivery of services are influenced by a number of factors, including financial resources, communication, technology adoption, staff expertise, and experience. At Kenyatta National Hospital in Kenya, staff capacity is directly correlated with the standard of care.



Mount Kenya University

Table 4.2: Descriptive statistics of the socio-demographic characteristics of the respondents

Variable	Measure	Percent (%)	Frequency
Gender	Male	92	43.8
	Female	118	56.2
Education	Certificate	1.9	4
	Diploma	61.4	129
	Degree	30.5	64
	Masters	6.2	13
Years of employment	0 – 8	127	60.5
	9 – 16	19	9.0
	17 – 24	31	14.8
	25 – 32	28	13.3
	33 – 40	5	2.4
Job title	Clinical officer	11.4	24
	Health information officer	25.7	54
	Lab technologist	9.0	19
	Nurse	30.5	64
	Reception staff	1.9	4
	Finance	3.3	7
	Hospital ICT	9.0	19
	Medical officer	5.2	11
Pharmacist	3.8	8	

4.2.2 Association between Socio-demographic Characteristics and Service Delivery

The chi-square (χ^2) test was used to examine the association between sociodemographic characteristics and the provision of medical services at Kenyatta National Hospital, Kenya, as indicated in Table 4.3. One statistical technique for figuring out whether there is a significant correlation between categorical variables is the chi-square test. The findings show that there is no statistically significant relationship between gender and satisfaction with service delivery ($\chi^2(2)=2.154, p=0.142$). Among the satisfied respondents, 47.9% were male, while 52.1% were female. Similarly, among dissatisfied respondents, 42.6% were male, and 57.4% were female. These results suggest that gender differences do not significantly influence perceptions of healthcare service delivery, as satisfaction levels appear relatively balanced between male and female respondents.

However, a statistically noteworthy relationship was observed between education level and service delivery satisfaction ($\chi^2(2)=18.852, p=0.000$). Among satisfied respondents, 18.8% held a certificate, 50% had a diploma, 22.9% held a degree, and 8.3% had a master's degree. Among dissatisfied respondents, 2.5% had a certificate, 51.9% had a diploma, 30.9% held a degree, and 14.8% had a master's degree. These findings suggest that higher levels of education are associated with greater expectations and potential dissatisfaction with healthcare service delivery. Patients with advanced education levels may have a higher awareness of healthcare standards, leading to increased scrutiny of service quality.

Additionally, years of employment were found to have a statistically noteworthy association with service delivery satisfaction ($\chi^2(2)=10.304, p=0.036$). Among satisfied respondents, 58.3% had 0–8 years of employment, 8.3% had 9–16 years, 27.1% had 17–24 years, and

6.3% had 25–32 years of experience. Among dissatisfied respondents, 61.1% had 0–8 years, 9.3% had 9–16 years, 11.1% had 17–24 years, 15.4% had 25–32 years, and 3.1% had 33–40 years of experience. These results suggest that healthcare workers with more years of experience tend to have a more critical perspective on service delivery, possibly due to their deeper understanding of healthcare processes and patient care expectations.



Table 4. 3: Association between Socio-demographic Characteristics and Service Delivery

Variable	Satisfied	Not satisfied	χ^2	Df	<i>p</i> -value
Gender					
Male	23(47.9%)	69(42.6%)	2.154	1	.142
Female	25(52.1%)	93(57.4%)			
Total	48(100%)	162(100%)			
Education					
Certificate	9(18.8%)	4(2.5%)			
Diploma	24(50%)	84(51.9%)	18.852	3	.000
Degree	11(22.9%)	50(30.9%)			
Masters	4(8.3%)	24(14.8%)			
Total	48(100%)	162(100%)			
Years of Employment					
0 – 8	28(58.3%)	99(61.1%)			
9 – 16	4(8.3%)	15(9.3%)			
17 – 24	13(27.1%)	18(11.1%)	10.304	5	.036
25 – 32	3(6.3%)	25(15.4%)			
33 – 40	0(0%)	5(3.1%)			
Total	48(100%)	162(100%)			

4.2.3 Multivariable Logistic Regression Analysis of Socio-demographic Characteristics

To determine the extent to which sociodemographic factors predict the likelihood of delivery of services satisfaction, a binary logistic regression equation was utilized. As can be seen below, the model takes the shape of binary regression.

$$Y (0, 1) = f(\text{Gender, Educational Level, Years})$$

Where: Y = Binary function for adherence, where "0" represents the log of the chances against satisfaction of health service delivery.

1 is the log of the probabilities in favor of satisfaction with health service delivery.

The model is significantly different according to the Omnibus Tests of Model Coefficients ($\chi^2=10.410$, $df=3$, $p=0.015$), as indicated in Table 4.4. This indicates that satisfaction with service delivery is substantially predicted by the combination of sociodemographic factors, including years, education level, and gender. With a Cox & Snell R² of 0.048 and a Nagelkerke R² of 0.073, the model explains a moderate amount of the variance in satisfaction, according to the model summary.

The findings for years of employment [OR=1.096,95% CI [0.829,1.449], $p=0.518$] suggest that each additional year of employment slightly increases the odds of reporting improved service delivery. However, the effect is not statistically significant ($p>0.05$), meaning that the number of years a person has worked does not meaningfully influence their perception of service delivery quality.

Similarly, the results for gender [OR=1.548,95% CI [0.762,3.144], $p=0.227$] indicate that males were 1.548 times more likely to report improved service delivery than females.

However, since the confidence interval includes 1.0 and the p-value is greater than 0.05, the relationship is not statistically significant. This suggests that gender does not play a decisive role in determining perceptions of service quality at the hospital.

On the other hand, education level was found to be a statistically significant predictor of service delivery [OR=1.886,95% CI [1.192,2.983], p=0.007]. Compared to people with fewer educational qualifications, individuals with higher education levels were 1.886 times more likely to report better service delivery. The p-value is statistically significant (p<0.05) and the confidence interval excludes 1.0, indicating that education level significantly affects evaluations of service delivery.

Table 4. 4: Binary Logistic Regression for Socio-Demographic Characteristics

	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Years	.092	.142	.417	1	.518	1.096	.829	1.449
Gender	.437	.361	1.462	1	.227	1.548	.762	3.144
Education Level	.634	.234	7.356	1	.007	1.886	1.192	2.983
Constant	-1.213	.851	2.031	1	.154	.297		

Model Summary: Cox & Snell R Square=.048; Nagelkerke R Square=.073
Omnibus Tests of Model Coefficients: Chi-Square=10.410; P=0.015

4.2.4 Discussion on socio-demographic characteristics

The findings from the study at Kenyatta National Hospital align with existing research on the importance of socio-demographic characteristics in the adoption and effectiveness of integrated healthcare information systems (IHIS). The predominance of female healthcare workers (59.5%) and the strong representation of nurses (30.5%) is consistent with the global trend, where women form the majority of the healthcare workforce, particularly in nursing, which plays a crucial role in patient care and IHIS usage (Squires *et al.*, 2016). The professional diversity, including a significant proportion of health information officers (25.7%), underscores the multidisciplinary nature required for IHIS to succeed, as a range of healthcare roles need to interact and share data seamlessly (Blijleven *et al.*, 2017).

The study's findings that 61.4% of the workforce holds a diploma or higher also resonate with existing literature, which suggests that higher educational attainment among healthcare workers is positively correlated with the adoption of health information systems (Asangansi, 2012). A more educated workforce tends to be more adaptable to new technologies, which is crucial for the effective implementation of IHIS. Additionally, the fact that 65.7% of the staff have eight years or less of work experience indicates a younger workforce, which is more receptive to technology and quicker to adapt to new systems (Cresswell & Sheikh, 2013). This creates an environment conducive to IHIS adoption, as younger healthcare workers tend to have higher digital literacy, which is essential for system utilization and improving service delivery (Greenhalgh *et al.*, 2017).

Socio-demographic characteristics are statistically significant ($\chi^2 = 10.410$, $df = 3$, $p = 0.015$), meaning that the combination of socio-demographic variables gender, education level, and

years worked significantly predicts health service delivery. The model explains a modest proportion of the variance in health service delivery, 4.8% to 7.3%. Studies have found that the composition of the workforce, including education level, professional diversity, and experience, is critical to the successful implementation of IHIS (Yusif *et al.*, 2020). The statistically significant impact of a unit increase in socio-demographic characteristics leading to a 0.933-unit improvement in service delivery indicates that workforce characteristics are not just supportive of technology adoption but actively enhance healthcare outcomes (Mohammed *et al.*, 2021). These results underscore the importance of aligning workforce development with technological innovations to improve healthcare service delivery in institutions like Kenyatta National Hospital.

The only variable that shows statistical significance in predicting satisfaction with service delivery is education level. A higher chance of satisfaction is linked to higher education levels, according to the positive correlation ($B = 0.634$, $p = 0.007$). According to the $\text{Exp}(B)$ value of 1.886, the likelihood of being happy with service delivery rises by around 88.6% for every unit increase in educational attainment. On the other hand, contentment is not strongly predicted by years of employment or gender. Numerous investigations back up these conclusions. For instance, Pana *et al.* (2016) investigated how the sociodemographic traits of healthcare practitioners affected the use of new technology, such as electronic health records. They discovered that healthcare practitioners' readiness to embrace new systems was impacted by age, education, and technological familiarity, all of which had an effect on the quality of care. In a similar vein, Cheng *et al.* (2015) investigated the ways in which patients' sociodemographic attributes—such as age, educational attainment, and socioeconomic

standing—influenced their engagement with health care providers. They came to the conclusion that these elements had a major impact on patients' capacity to interact with digital health tools, which in turn affected the effectiveness and caliber of the delivery of healthcare. The notion that sociodemographic characteristics are important in service delivery is further supported by Chin et al.'s (2019) findings that better results in the adoption and efficient use of electronic health systems were linked to greater income and education levels.

Certain investigations, however, present an opposing viewpoint. In his 2009 study on the adoption of health information systems, Hersh made the case that infrastructural and technology aspects like system usability had a greater influence on the provision of healthcare services than sociodemographic traits. According to his research, the system's architecture and resource availability were more important for success than the sociodemographic characteristics of patients or healthcare professionals. Similarly, Baker et al. (2011) discovered that organizational elements—like staff training and leadership support—were more important to the effective implementation of electronic medical records than sociodemographic traits. They maintained that emphasizing organizational preparedness rather than only sociodemographic characteristics will improve the delivery of healthcare services. Gagnon et al. (2014) also discovered that organizational preparedness and technological infrastructure were more crucial in influencing the performance of electronic medical facilities, even if sociodemographic traits did play a part.

4.3 Healthcare Service Delivery

4.3.1 Descriptive statistics for Service delivery constructs

Regarding KNH facility, services are delivered to patients promptly, as evident by the low number of patients waiting at any given time; 77.6% of subjects agreed or strongly agreed

with this statement, indicating widespread recognition of the hospital's efficiency in delivering services promptly. This high level of agreement reflects the hospital's ability to manage patient flow effectively and minimize waiting times. Only 8.6% of respondents disagreed or strongly disagreed, suggesting minor concerns about service efficiency. These concerns could arise from isolated incidents of delays or inefficiencies in service delivery. The mean score of 3.90 and median of 4.0 reflect strong agreement with the statement, highlighting the overall efficiency of the hospital's services. However, the SD of 0.90 and CV of 22.97% indicate moderate variability in responses, suggesting that while most respondents agree, there are still some differences in their perceptions. This variability could be due to varying experiences with service delivery across different departments or roles.

Concerning patients are pleased with the care they receive at our facility, as shown by the high rate of repeat visits and returning patients, indicating their trust and satisfaction with our services; 89.5% of respondents agreed or strongly agreed, showing strong confidence in the quality of care provided by the hospital. This high level of agreement reflects the hospital's commitment to delivering high-quality care and building trust with patients. Only 3.8% of respondents disagreed or strongly disagreed, indicating minimal concerns about patient satisfaction. These concerns could stem from isolated incidents or a lack of awareness about the hospital's efforts to improve patient care. The mean score of 4.18 and median of 4.0 reflect the highest level of agreement among all statements, while the SD of 0.79 and CV of 18.94% indicate the lowest variability, suggesting greater consistency in responses. This consistency highlights the widespread recognition of the hospital's efforts to ensure patient satisfaction.

For the services provided at our facility comprehensively meet patients' needs, as evidenced by the wide array of services available; 80.9% of subjects agreed or strongly agreed, highlighting the hospital's ability to provide a comprehensive range of services that meet patient needs. This suggests that the hospital offers a diverse set of services to address various healthcare needs. Only 6.2% of respondents disagreed or strongly disagreed, suggesting minor concerns about the comprehensiveness of services. These concerns could arise from gaps in service offerings or a lack of awareness about available services. The mean score of 4.05 and median of 4.0 reflect strong agreement with the statement, while the SD of 0.92 and CV of 22.80% indicate moderate variability in responses. This variability suggests that while most respondents agree, there are still some differences in their perceptions, possibly due to varying experiences with the range of services offered.

Concerning it is easy for patients to access services at our facility, as shown by the steady increase in the number of patients visiting our facility; 68.1% of subjects agreed or strongly agreed, indicating satisfaction with the accessibility of services. This suggests that the hospital has made significant efforts to ensure that patients can access the services they need without unnecessary barriers. However, 10.4% of respondents disagreed or strongly disagreed, pointing to some concerns about delays or barriers in accessing services. These concerns could stem from issues such as long waiting times or limited availability of certain services. The mean score of 3.78 and median of 4.0 suggest general agreement with the statement, while the SD of 0.99 and CV of 26.20% indicate moderate variability in responses. This variability highlights some differences in perceptions, possibly due to varying experiences with service accessibility across different departments or roles.

Table 4.5: Summary statistics for Service delivery constructs.

N=210	SA %	A%	N%	D%	SD%	Mean	Median	SD	CV (%)
In our facility, services are delivered to patients promptly, as evident by the low number of patients waiting at any given time- (Timely delivery of services)	23.3	54.3	13.8	6.7	1.9	3.90	4.0	0.90	22.97
Patients are pleased with the care they receive at our facility, as shown by the high rate of repeat visits and returning patients, indicating their trust and satisfaction with our services- (Patient satisfaction)	34.3	55.2	6.7	1.9	1.9	4.18	4.0	0.79	18.94
The services provided at our facility comprehensively meet patients' needs, as evidenced by the wide array of services available - (comprehensiveness)	33.3	47.6	12.9	3.3	2.9	4.05	4.0	0.92	22.80
It is easy for patients to access services at our facility, as shown by the steady increase in the number of patients visiting our facility- (Accessibility)	22.4	45.7	21.4	7.1	3.3	3.78	4.0	0.99	26.20
Composite Score						3.92	4	0.94	24.07

4.4 Electronic medical health records systems on healthcare service delivery

4.4.1 Electronic Medical Health Records Systems Descriptive Statistics

The first particular goal is to evaluate how electronic medical health record systems affect the principles of healthcare service delivery at Kenyatta National Hospital. Table 4.6 below summarizes the constructs of the electronic medical health records system using the coefficient of variance, mean, median, and standard deviation. With a range of 27.02% to 30.28%, the median score for the five Likert scale questions was 4.0. "The hospital analyzes patient clinical records and uses clinical decision support systems in the decision-making process" is the question with the highest mean score, 3.87. This shows that Kenyatta National Hospital's medical staff values electronic medical health records systems for the provision of medical services.

For the statement that clinical services in hospitals now make use of electronic health record systems, which are used by medical professionals such as doctors and nurses; 67.6% of subjects agreed or strongly agreed with this statement, indicating widespread recognition of the use of EMHR systems in clinical services. This high level of agreement reflects the successful integration of EMHR systems into the hospital's clinical operations, enabling medical professionals to deliver more efficient and effective care. However, 17.7% of respondents disagreed or strongly disagreed, suggesting some resistance or challenges in adoption. These concerns could arise from technical issues, such as system usability or lack of training, or from resistance to change among some staff members. The mean score of 3.76 and median of 4.0 reflect strong agreement with the statement, highlighting the overall effectiveness of EMHR systems in clinical services. However, the SD of 1.14 and CV of 30.22% indicate moderate variability in responses, suggesting that while most respondents agree, there are still some differences in their perceptions. This variability could be due to varying experiences with EMHR systems across different departments or roles.

Regarding creating and maintaining clinical information at the hospital is done so via the usage of electronic medical records systems, 67.7% of subjects agreed or strongly agreed, reflecting a positive perception of the role of EMHR systems in managing clinical information. This suggests that EMHR systems have improved the efficiency and accuracy of creating and maintaining clinical records. However, 15.7% of respondents disagreed or strongly disagreed, indicating potential gaps in implementation or usability. These concerns could stem from technical challenges, such as system downtime or data entry errors, or from a lack of familiarity with the systems among some staff members. The mean score of 3.66

and median of 4.0 suggest general agreement with the statement, while the SD of 1.11 and CV of 30.28% indicate moderate variability in responses. This variability suggests that while most respondents agree, there are still some differences in their perceptions, possibly due to varying levels of experience with EMHR systems.

For the patient administration system at the hospital is used to keep track of clinical patients' appointments; 70.0% of respondents agreed or strongly agreed, highlighting the effectiveness of EMHR systems in patient administration. This suggests that EMHR systems have improved the efficiency of managing patient appointments and tracking clinical information. However, 13.8% of respondents disagreed or strongly disagreed, suggesting room for improvement in this area. These concerns could arise from issues such as system errors, delays in updating records, or a lack of awareness about the full capabilities of the system. The mean score of 3.71 and median of 4.0 reflect general agreement with the statement, while the SD of 1.12 and CV of 30.09% indicate moderate variability in responses. This variability highlights some differences in perceptions, possibly due to varying experiences with the patient administration system.

Regarding the clinical records of patients analyzed at the hospital and clinical decision support systems used in the process of decision-making; 74.7% of respondents agreed or strongly agreed, demonstrating strong support for the use of EMHR systems in clinical decision-making. This high level of agreement reflects the hospital's success in leveraging EMHR systems to enhance clinical decision-making and improve patient outcomes. Only 10.4% of respondents disagreed or strongly disagreed, indicating a high level of acceptance for this aspect of EMHR systems. These issues could be the result of sporadic instances in

which the system failed to offer sufficient assistance or of inadequate instruction on how to utilize the system efficiently. While the SD of 1.05 and CV of 27.02% show less variability in comparison to other claims, the mean score of 3.87 and median of 4.0 show substantial agreement with the statement. This reduced variability indicates more consistent replies, underscoring the general acceptance of clinical decision support systems' advantages.

Table 4.6: Summary statistics for electronic medical health records systems constructs.

Statement	SA%	A%	N%	D%	SD%	Mean	Median	SD	CV (%)
Clinical services in hospitals now make use of electronic health record systems, which are used by medical professionals such as doctors and nurses.	27.1	40.5	14.8	11.0	6.7	3.76	4.0	1.14	30.22
Creating and maintaining clinical information at the hospital is done so via the usage of electronic medical records systems.	21.0	46.7	16.7	9.0	6.7	3.66	4.0	1.11	30.28
The patient administration system at the hospital is used for the purpose of keeping track of clinical patients' appointments.	22.9	47.1	16.2	6.2	7.6	3.71	4.0	1.12	30.09
The clinical records of patients are analyzed at the hospital, and clinical decision support systems are used in the process of decision making.	27.6	47.1	14.8	5.2	5.2	3.87	4.0	1.05	27.02
Composite Score						3.75	4	1.11	29.4

4.4.2 Association Between Electronic medical health records systems and Service Delivery

The chi-square (χ^2) test was used to examine the connection between Kenyatta National Hospital's service delivery and electronic medical health records (EMHR) systems, as indicated in Table 4.7. One statistical technique for figuring out whether there is a significant correlation between categorical variables is the chi-square test. The use of electronic medical records (EMHR) systems by medical professionals, clinical decision support systems, and patient administration records systems, as well as their connection to service delivery, are the variables under examination in this instance.

Regarding utilization by healthcare providers ($\chi^2(2)=16.222, p=0.001$), a strong correlation was observed between EMHR system use and service delivery satisfaction. Among respondents who reported satisfaction with service delivery, 27.1% agreed, 27.1% were neutral, and 45.8% disagreed with the utilization of EMHR systems. Conversely, among dissatisfied respondents, only 5.6% agreed, 11.1% were neutral, and a substantial 83.3% disagreed with the system's utilization. These findings suggest that the effective use of EMHR systems by healthcare providers plays a crucial role in enhancing service delivery outcomes.

Similarly, the use of Electronic Health Records (EHR) systems exhibited a significant association with service delivery satisfaction ($\chi^2(2)=20.137, p=0.000$). Among those who were satisfied with service delivery, 29.2% agreed, 29.2% were neutral, and 41.7% disagreed with the effectiveness of EHR systems. Among dissatisfied respondents, only 11.1% agreed, while 13% were neutral, and a notable 75.9% disagreed with the system's effectiveness.

These results indicate that a well-implemented and efficient EHR system contributes significantly to patient satisfaction by streamlining healthcare documentation and accessibility.

The Clinical Decision Support Systems (CDSS) also showed a highly significant association with service delivery satisfaction ($\chi^2(2)=44.504, p=0.000$). Among satisfied respondents, 31.3% agreed, 37.5% were neutral, and 31.3% disagreed with the system's utilization. In contrast, among dissatisfied respondents, only 8.6% agreed, 9.9% were neutral, and a striking 81.5% disagreed with its effectiveness. This suggests that CDSS plays a crucial role in improving clinical decision-making and healthcare service efficiency, ultimately influencing patient satisfaction levels.

Furthermore, the Patient Administration Records Systems (PARS) demonstrated a significant relationship with service delivery satisfaction ($\chi^2(2)=29.745, p=0.000$). Among satisfied respondents, 27.1% agreed, 27.1% were neutral, and 45.8% disagreed with the effectiveness of PARS. On the other hand, among dissatisfied respondents, only 5.6% agreed, 11.1% were neutral, and a large 83.3% disagreed. These findings highlight that efficient patient administration and records management significantly impact service delivery, ensuring streamlined operations and improved patient experiences.

Table 4.7: Association Between Electronic Medical Health Records Systems and Service Delivery

Variable	Satisfied	Not satisfied	χ^2	Df	<i>p</i> -value
Utilization by Healthcare provider					
Agree	13(27.1%)	9(5.6%)	16.222	2	.001
Neutral	13(27.1%)	18(11.1%)			
Disagree	22(45.8%)	135(83.3%)			
Total	48(100%)	162(100%)			
Electronic Health Records Systems					
Agree	14(29.2%)	18(11.1%)	20.137	2	.000
Neutral	14(29.2%)	21(13%)			
Disagree	20(41.7%)	123(75.9%)			
Total	48(100%)	162(100%)			
Clinical Decision Support Systems					
Agree	15(31.3%)	14(8.6%)	44.504	2	.000
Neutral	18(37.5%)	16(9.9%)			
Disagree	15(31.3%)	132(81.5%)			
Total	48(100%)	162(100%)			
Patient Administration Records Systems					
Agree	13(27.1%)	9(5.6%)	29.745	2	.000
Neutral	13(27.1%)	18(11.1%)			
Disagree	22(45.8%)	135(83.3%)			
Total	48(100%)	162(100%)			

4.2.3 Multivariable Logistic Regression Analysis of Electronic medical health records systems

The degree to which electronic medical health records systems predict the likelihood of service delivery satisfaction was determined using a binary logistic regression equation. As seen below, the model assumes the form of binary regression.

$$Y (0, 1) = f(U, E, C, P)$$

Where: Y = Binary function for adherence, where "0" represents the log of the chances against satisfaction of health service delivery.

1 is the log of the probabilities in favor of satisfaction with health service delivery.

U is Utilization by Healthcare provider

E is the Electronic Health Records Systems

C is the Clinical Decision Support Systems

P is the Patient Administration Records Systems

The model is statistically significant, according to the Omnibus Tests of Model Coefficients in Table 4.8 below ($\chi^2=39.298$, $df=4$, $p=0.000$). This indicates that service delivery is strongly predicted by the combination of clinical decision support systems, electronic health records systems, patient administration records systems, and EMHR system factors used by healthcare practitioners. With a Cox & Snell R² of 0.171 and a Nagelkerke R² of 0.259, the model explains a significant amount of the variation in service delivery, according to the Model Summary. According to these figures, the model can explain between 17.1% and

25.9% of the variation in service delivery, demonstrating a respectable level of predictive power.

According to the investigation, there is no statistically significant impact of healthcare providers' use of EMHR systems on the provision of services [OR=1.088,95% CI[0.725,1.633], p=0.684]. Even if the odds ratio of 1.088 points to a marginally favorable effect, the impact is not significant because the p-value is higher than 0.05 and the confidence interval encompasses 1.0. Likewise, there was no discernible impact of Electronic Health Records (EHR) systems on service delivery [OR=1.035,95% CI[0.661,1.622], p=0.880]. The high p-value and confidence interval encompassing 1.0 show that this link is not statistically significant, despite the odds ratio of 1.035 suggesting merely a small impact.

For instance, one respondent highlighted the efficiency gains: *"With EMHR, we can now access patient records in seconds, which has drastically reduced turnaround time. It allows us to dedicate more time to patient care rather than shuffling through paperwork."* (KII2, Health information officer,2024).

Another respondent also noted that;

"I would say EMHRs have provided healthcare professionals with immediate access to comprehensive medical histories, facilitating informed decision-making and reducing the likelihood of errors. This real-time access streamlines workflows, minimizes redundant tests, and accelerates diagnosis and treatment processes, leading to improved patient care..."(KII 1, Health information officer,2024).

In contrast, Clinical Decision Support Systems (CDSS) demonstrated a statistically significant impact on service delivery [OR=1.831,95% CI [1.265,2.652],p=0.001]. The odds ratio of 1.831 suggests that the use of CDSS increases the likelihood of improved service delivery by approximately 83.1%. The confidence interval does not include 1.0, confirming

the positive and significant contribution of CDSS in enhancing healthcare decision-making and overall service quality.

Additionally, Patient Administration Records Systems (PARS) also exhibited a statistically significant effect on service delivery [OR=1.518,95% CI [1.016,2.266],p=0.042]. The odds ratio of 1.518 suggests that implementing efficient patient administration records systems increases the likelihood of improved service delivery by 51.8%. Since the confidence interval remains above 1.0, the results confirm that PARS positively contributes to service delivery outcomes by improving data accessibility and administrative efficiency.

Table 4.8: Binary Logistic Regression for Electronic Medical Health Records Systems

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Utilization by Healthcare provider	.084	.207	.166	1	.684	1.088	.725	1.633
Electronic Health Records Systems	.035	.229	.023	1	.880	1.035	.661	1.622
Clinical Decision Support Systems	.605	.189	10.260	1	.001	1.831	1.265	2.652
Patient Administration Records Systems	.417	.205	4.155	1	.042	1.518	1.016	2.266
Constant	-2.854	.780	13.384	1	.000	.058		

Model Summary: Cox & Snell R Square=.171; Nagelkerke R Square=.259
Omnibus Tests of Model Coefficients: Chi-Square=39.298; P=0.000

4.3.4 Discussion on Electronic Medical Health Records Systems

The medical workers “agreed” that clinical services in the hospital make use of electronic health record systems (mean=3.76, median=4, SD=1.14). The findings are similar to those of Weber-Jahnke & Obry (2020) who observed that the transition from paper-based processes to digital ones ensures efficient service delivery. The study noted that clinical records of patients are analyzed at the hospital and clinical decision support systems are used in the process of decision-making (mean=3.87 median=4.0 and SD=1.05). The work of Palazzo *et al.*, (2018) observed that electronic systems help doctors with their everyday jobs with significant potential to enhance the performance of healthcare workers. Clinical services in hospitals now make use of electronic health record systems, which are used by medical professionals such as doctors and nurses. These similar sentiments are observed in Bell (2012), medical records may be replaced with health information systems to save money while also improving patient outcomes and decreasing medical mistakes. Usage of the electronic system is followed up by the usage of data generated to make decisions. Therefore, the clinical records of patients are analyzed at the hospital, and clinical decision support systems are used in the process of decision-making. The other observations are that creating and maintaining clinical information at the hospital is done so via the usage of electronic medical records systems. On how the medical staff track patient appointments, they found that the patient administration system at the hospital is used to keep track of clinical patients' appointments. Therefore, the hospital utilized electronic medical health record systems for decision-making and tracking patient appointments to improve service delivery at Kenyatta National Hospital, Kenya.

The combination of electronic medical health records systems, clinical decision support systems, patient administration records systems, and EMHR system variable utilization by healthcare workers significantly predicts service delivery, as evidenced by the statistical significance of the electronic medical health records system ($\chi^2 = 39.298$, $df = 4$, $p = 0.000$). Between 17.1% and 25.9% of the variance in service delivery can be explained by the model, which is a substantial amount. Electronic records have a profound positive influence on service delivery at Kenyatta National Hospital. Caligtan & Dykes (2017) had similar sentiments where electronic health data has led patients and doctors to seek out a more customized and secure type of treatment with superior healthcare services delivery. These findings are supported by the Kenya ICT Policy (2021), the Electronic Medical Record Standards and Guidelines (EMR), the Strategic Health Information Systems Plan (HIS), and the Kenya Communications Act (2009), all released in 2010, created a regulatory framework for the advancement of Kenya's healthcare sector (Kenya National Electronic Health Strategy 2011- 2017).

Among the variables, Clinical Decision Support Systems emerge as a significant predictor of service delivery. The Exp(B) value of 1.831 suggests that the odds of satisfaction with service delivery increase by approximately 83.1% with the use of these systems. Similarly, the Exp(B) value of 1.518 suggests that the odds of satisfaction increase by approximately 51.8% with the use of patient administration records systems. In contrast, Utilization by Healthcare Providers and Electronic Health Records Systems do not significantly predict service delivery. This study's findings align with the conclusions of several researchers who have documented the positive influence of EHR systems on healthcare service delivery. For

instance, Caligtan & Dykes (2017) emphasized the role of EHR in enhancing patient care by enabling more personalized and secure treatments, which leads to superior healthcare delivery. This sentiment is reflected in the present study, where the EHR system's implementation is linked to improved service efficiency and accuracy at Kenyatta National Hospital. Similarly, Buntin *et al.* (2020), in a comprehensive review of studies on EHR adoption, found that EHR systems improve care coordination, reduce medical errors, and enhance patient outcomes, particularly in large healthcare settings. These findings further support the results of this study, confirming that EHR systems have a positive influence on service delivery.

Furthermore, the Kenya National Electronic Health Strategy (2011-2017) emphasizes how EHR technologies may revolutionize healthcare delivery. In accordance with the results of this study, the approach emphasizes how EHR technologies simplify patient information management, lower mistakes, and provide prompt access to medical records. The Electronic Medical Record Standards and Guidelines (EMR), the Kenya ICT Policy (2021), and other national health policies have built regulatory frameworks that have made it possible for EHR systems to be successfully integrated into medical facilities such as Kenyatta National Hospital.

However, some studies offer a contrasting perspective, highlighting challenges associated with EHR adoption. For instance, Miller & Sim (2021) examined the barriers to EHR implementation and found that, while EHR systems have clear potential benefits, their introduction could temporarily disrupt service delivery. They noted that initial costs, training requirements, and issues with system integration could hinder the effectiveness of EHR

systems in improving healthcare services. Mendelson et al. (2013) similarly reviewed the challenges faced by hospitals in low-resource settings and suggested that the transition to EHR could lead to workflow disruptions and resistance from healthcare staff, which might negate the expected benefits of the system. This perspective contrasts with the positive outcomes observed in this study at Kenyatta National Hospital, where the adoption of EHR has been shown to improve service delivery.

Furthermore, McCullough et al. (2012) found mixed results regarding the impact of EHR systems on healthcare delivery. While they acknowledged improvements in administrative efficiency, they argued that the expected gains in clinical outcomes were less evident, particularly in hospitals that faced challenges with system interoperability and user adoption. This contrasts with the findings of this investigation, which demonstrates a clear positive impact of EHR on service delivery at KNH.

4.5 Healthcare information security on healthcare service delivery

The third specific objective is to ascertain the influence of healthcare information security on healthcare service delivery tenets in Kenyatta National Hospital, Kenya.

4.5.1 Healthcare information security Descriptive Statistics

The summary statistics are provided for the information system security constructs as extracted from the questionnaire. The median score for the constructs is 4.11, with a coefficient of variation ranging between 23.93% and 27.11%, an indication that the variability in the responses did not differ among the constructs. That means the respondents

agreed on their responses on their perception of the information system security. A mean score of 4.19 it that: “passwords have been put in computers for protection of data”.

In order to prevent unwanted access to hospital information systems or data, this is a crucial step in information system security. As seen in Table 4.9 below, "the hospital ensures sensitive information is protected and only authorized individuals can have access" is another response with a high mean of 3.98. This goes hand in hand with the significance of password-protecting the systems to guarantee that information privacy and confidentiality are preserved. Thus, according to the comments in this area, both management and staff at Kenyatta National Hospital believe that information system security is essential. There is broad awareness of the hospital's efforts to secure medical records and avoid data loss, as seen by the 76.2% of those who participated who agreed or strongly agreed with the statement that the hospital ensures the accuracy of medical records by preserving the information from losses. This high degree of agreement shows that people have faith in the hospital's capacity to keep medical data accurate and up to date. The fact that just 11.0% of respondents disagreed or strongly disagreed suggests that data privacy is a modest concern. These worries may be the result of sporadic data loss events or weaknesses in the security mechanisms put in place. Strong agreement with the statement is demonstrated by the mean score of 3.90 and median score of 4.0, which emphasize the overall efficacy of the hospital's medical record security safeguards. The coefficient of variation (CV) of 25.39% and standard deviation (SD) of 0.99, however, show substantial diversity in replies, indicating that although the majority of respondents agree, there are still some variances in their

perspectives. This discrepancy may result from various departments' or positions' differing experiences with safeguarding data procedures.

Concerning the hospital ensuring the medical records are protected against distortion when transmitting through electronic media, i.e., emails or fax, 68.6% of respondents agreed or strongly agreed, showing confidence in the hospital's ability to protect data during electronic transmission. This suggests that the hospital has implemented effective measures to ensure data integrity during transfers. However, 12.8% of respondents disagreed or strongly disagreed, pointing to some concerns about data distortion during electronic transfers. These concerns could arise from technical issues, such as data corruption during transmission, or a lack of awareness about the security measures in place. The mean score of 3.72 and median of 4.0 suggest general agreement with the statement, though the agreement is slightly lower compared to other statements. The SD of 1.01 and CV of 27.11% indicate moderate variability in responses, reflecting some inconsistency in how respondents perceive the effectiveness of data protection during transmission.

Regarding the hospital's data privacy and security policy has been of great assistance in maintaining the confidentiality of patient information and keeping it secure, 72.4% of subjects agreed or strongly agreed, highlighting the effectiveness of the hospital's data privacy and security policies in safeguarding patient information. This high level of agreement reflects trust in the hospital's policies and their implementation. However, 12.4% of respondents disagreed or strongly disagreed, suggesting room for improvement in policy implementation. These disagreements could stem from gaps in policy enforcement or a lack of awareness about the policies among some staff members. The mean score of 3.83 and

median of 4.0 reflect strong agreement with the statement, while the SD of 1.01 and CV of 26.47% indicate moderate variability in responses. This variability suggests that while most respondents agree, there are still some differences in their perceptions, possibly due to varying levels of experience with the policies.

For, the hospital to ensure that issues of information security are addressed promptly, 73.3% of subjects agreed or strongly agreed, indicating satisfaction with the hospital's responsiveness to information security issues. This suggests that the hospital has effective mechanisms in place to address security concerns promptly. However, 9.5% of respondents disagreed or strongly disagreed, suggesting some delays or inefficiencies in addressing security concerns. These disagreements could arise from isolated incidents where security issues were not resolved promptly or a lack of communication about the resolution process.

The mean score of 3.83 and median of 4.0 reflect strong agreement with the statement, while the SD of 0.99 and CV of 25.80% indicate moderate variability in responses. This variability highlights some differences in perceptions, possibly due to varying experiences with the hospital's responsiveness.

Regarding the hospital ensures sensitive information is protected, and only authorized individuals can have access, 79.6% of respondents agreed or strongly agreed, demonstrating strong confidence in the hospital's access control measures. This high level of agreement reflects trust in the hospital's ability to restrict access to sensitive information and ensure that only authorized personnel can access it. However, 10.0% of respondents disagreed or strongly disagreed, indicating minor concerns about unauthorized access. These concerns could stem from isolated incidents of unauthorized access or a lack of awareness about the

access control measures in place. The mean score of 3.98 and median of 4.0 reflect the highest level of agreement among all statements, while the SD of 1.04 and CV of 26.09% indicate moderate variability in responses. This variability suggests that while most respondents agree, there are still some differences in their perceptions, possibly due to varying experiences with access control measures.

For passwords have been put in computers for the protection of data, 82.9% of respondents agreed or strongly agreed, showing strong support for the use of passwords as a security measure. This high level of agreement reflects widespread recognition of the importance of password protection in safeguarding data. However, 7.6% of respondents disagreed or strongly disagreed, suggesting minor concerns about the effectiveness of passwords. These concerns could arise from issues such as weak passwords, password sharing, or a lack of awareness about password best practices. The mean score of 4.19 and median of 4.0 reflect the strongest agreement among all statements, while the SD of 1.00 and CV of 23.93% indicate the lowest variability, suggesting greater consistency in responses. This consistency highlights the widespread acceptance of password protection as a key security measure.

Table 4.9: Summary statistics for the information system security constructs

N=210	SA	A	N	D	SD	Mean	Median	SD	CV (%)
By safeguarding the data from loss, the hospital guarantees the accuracy of medical records.	27.6	48.6	12.9	8.1	2.9	3.90	4.0	0.99	25.39
The hospital makes sure that when medical records are sent via electronic means, such faxes or emails, they are shielded against distortion.	20.0	48.6	18.6	9.0	3.8	3.72	4.0	1.01	27.11
The hospital makes sure that private data is safeguarded and that only those with permission may access it.	32.9	46.7	10.5	5.2	4.8	3.98	4.0	1.04	26.09
Computers now have passwords installed to secure data.	46.7	36.2	9.5	4.3	3.3	4.19	4.0	1.00	23.93
Composite Score						3.91	4	1.01	25.8

4.5.2 Association Between Healthcare Information Security and Service Delivery

The chi-square (χ^2) test was used to examine the connection between healthcare information security and healthcare service delivery at Kenyatta National Hospital, Kenya, as indicated in Table 4.10 below. A statistical technique for assessing whether categorical variables significantly correlate with one another is the chi-square test. The factors under examination in this instance include network security, data security, information integrity, and confidentiality, as well as their connection to the provision of healthcare services.

The findings indicate that network security ($\chi^2(2)=30.274, p=0.001$) is significantly associated with service delivery satisfaction. Among respondents who were satisfied with service delivery, 29.2% agreed, 22.9% were neutral, and 47.9% disagreed with the hospital's efforts in securing medical records during electronic transmission. On the other hand, among those dissatisfied with service delivery, only 5.6% agreed, while 9.9% were neutral, and a substantial 84.6% disagreed. This suggests that ensuring medical records are well-protected

during electronic transmission (e.g., emails or fax) plays a crucial role in improving patient satisfaction.

Similarly, the results reveal a significant relationship between information confidentiality and service delivery ($\chi^2(2)=30.518, p=0.000$). Among respondents who were satisfied with service delivery, 31.3% agreed, 31.3% were neutral, and 37.5% disagreed with the hospital's efforts in protecting sensitive patient information. Among dissatisfied respondents, only 7.4% agreed, 14.8% were neutral, and 77.8% disagreed, indicating that ensuring only authorized individuals have access to medical records contributes to patient trust and overall service satisfaction.

The strongest association was observed in data security ($\chi^2(2)=45.759, p=0.000$), which measures whether computers are protected with passwords to safeguard patient data. Among satisfied respondents, 33.3% agreed, 18.8% were neutral, and 47.9% disagreed that the hospital has sufficient security measures in place. However, among dissatisfied respondents, only 3.1% agreed, while 8% were neutral, and a significant 88.9% disagreed. This suggests that strengthening data security mechanisms is crucial in ensuring patient confidence in the hospital's record management systems.

Furthermore, it was shown that there was a strong correlation between service delivery satisfaction and information integrity ($\chi^2(2)=20.706, p=0.000$). The hospital successfully maintains the accuracy and preservation of medical records, according to 20.8% of respondents who were happy with service delivery, 16.7% of respondents who were indifferent, and 62.5% of respondents who disagreed. Just 3.7% of those who expressed dissatisfaction agreed, compared to 7.4% who were indifferent and 88.9% who disagreed.

These results highlight how important it is to guarantee the dependability and correctness of medical records in order to improve service delivery.

Table 4.10: Association Between Healthcare Information Security and Service Delivery

Variable	Satisfied	Not satisfied	χ^2	Df	p-value
Network Security					
Agree	14(29.2%)	9(5.6%)	30.274	2	.001
Neutral	11(22.9%)	16(9.9%)			
Disagree	23(47.9%)	137(84.6%)			
Total	48(100%)	162(100%)			
Information Confidentiality					
Agree	15(31.3%)	12(7.4%)	30.518	2	.000
Neutral	15(31.3%)	24(14.8%)			
Disagree	18(37.5%)	126(77.8%)			
Total	48(100%)	162(100%)			
Data Security					
Agree	16(33.3%)	5(3.1%)	45.759	2	.000
Neutral	9(18.8%)	13(8%)			
Disagree	23(47.9%)	144(88.9%)			
Total	48(100%)	162(100%)			
Information Integrity					
Agree	10(20.8%)	6(3.7%)	20.706	2	.000
Neutral	8(16.7%)	12(7.4%)			
Disagree	30(62.5%)	144(88.9%)			
Total	48(100%)	162(100%)			

4.5.3 Multivariable Logistic Regression Analysis of Healthcare information security

Healthcare information security's predictive power for service satisfaction was determined using a binary logistic regression equation. As can be observed in the figure below, the model adopts a binary regression format.

$$Y (0, 1) = f(N, I, D, I2)$$

Where: Y = Binary function for adherence, where "0" represents the log of the chances against satisfaction of health service delivery.

1 is the log of the probabilities in favor of satisfaction with health service delivery.

N is the Network Security

I is the Information Confidentiality

D is the Data Security

I2 is the Information Integrity

The model is found to be statistically significant ($\chi^2=46.798$, $df=4$, $p=0.000$) according to the Omnibus Tests of Model Coefficients in Table 4.11. Satisfaction with service delivery is therefore strongly predicted by the interplay of four variables pertaining to healthcare information security: network security, information confidentiality, data security, and information integrity. With a R^2 of 0.200 for Cox and Snell and a R^2 of 0.303 for Nagelkerke, the model explains a substantial amount of the variation in satisfaction, as seen in the Model Summary. Approximately 20.0% to 30.3% of the variance in satisfaction can be explained by these values, indicating that the model has acceptable predictive potential. Based on these

findings, it appears that healthcare information security is significantly influencing how people view the quality of service they receive.

The results show that there is no statistically significant influence of network security on service delivery in the equation's variables [OR=1.130,95% CI[0.701,1.822]], p=0.615].

With a p-value higher than 0.05 and a confidence interval that includes 1.0, it is clear that network security does not have a substantial impact on service delivery outcomes, even if the odds ratio of 1.130 indicates a little positive effect.

Similarly, information integrity was not found to be a significant predictor of service delivery [OR=1.064,95% CI [0.671,1.687],p=0.792]. The odds ratio of 1.064 suggests only a marginal effect, but the high p-value and confidence interval covering 1.0 indicate that this relationship is not statistically meaningful.

In contrast, information confidentiality demonstrated a statistically significant impact on service delivery [OR=1.770,95% CI [1.109,2.825],p=0.017] The odds ratio of 1.770 suggests that ensuring information confidentiality increases the likelihood of improved service delivery by approximately 77.0%. The confidence interval does not include 1.0, confirming that strict data access controls and confidentiality policies contribute positively to healthcare service delivery.

Similarly, data security also exhibited a statistically significant effect on service delivery [OR=1.789,95% CI [1.034,3.096],p=0.038]. The odds ratio of 1.789 indicates that enhancing data security measures increases the likelihood of improved service delivery by 78.9%. Since the confidence interval remains above 1.0, the results confirm that implementing strong

security protocols, such as password protection and encryption, plays a crucial role in improving healthcare service quality.

The qualitative data was in agreement with this findings where One key informant narrated that;

“Let me say the integration of security measures has been a game-changer in maintaining patient data confidentiality. Previously, physical records were prone to unauthorized handling, and digital systems lacked sufficient protection. Now, with role-based access controls and secure electronic health records, only authorized personnel can retrieve sensitive data. This has reduced cases of data leaks and improper handling of patient information....”(KII 3,Nurse,2024)

Secondly, respondents reported improved safety of data, highlighting that robust security protocols have minimized the risk of data breaches and loss.

“For sure I rely on accurate and secure patient records for effective treatment. In the past, paper records were prone to damage, loss, and unauthorized access. Now, with digitized and encrypted records, data safety has greatly improved. Secure login systems prevent unauthorized access, and automatic backup solutions protect against data loss....”((KII 4,MO,2024).

Table 4.11: Binary Logistic Regression for Healthcare Information Security

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Network Security	.123	.244	.253	1	.615	1.130	.701	1.822
Information Confidentiality	.571	.239	5.724	1	.017	1.770	1.109	2.825
Data Security	.582	.280	4.322	1	.038	1.789	1.034	3.096
Information Integrity	.062	.235	.070	1	.792	1.064	.671	1.687
Constant	-3.698	.926	15.963	1	.000	.025		

Model Summary: Cox & Snell R Square=.200; Nagelkerke R Square=.303

Omnibus Tests of Model Coefficients: Chi-Square=46.798; P=0.000

4.5.4 Discussion on Healthcare Information Security

The healthcare workers “agreed” that passwords have been put in computers for the protection of data (mean=4.19, median=4.0 and SD=1.0). The hospital ensures sensitive information is protected and only authorized individuals can have access (mean=3.98, median=4.0, SD=1.04). Another observation from the workers is that the hospital ensures that issues of information security are addressed promptly. Similar sentiments are observed by Nyaga (2016) that health professionals have a responsibility to their patients to keep the patients’ information private and confidential. Anyone involved in a patient’s medical records management has a professional and ethical obligation to keep the information confidential. Further, computer passwords must be in place to control access to computer files, and servers and that medical data is only handled by qualified personnel and used for the intended purpose only. The hospital ensures the accuracy of medical records by protecting the information against losses. Even if the patient data is gathered and shared across several platforms, due diligence is required to protect the information against losses (Kumar, 2013). The interoperability in hospital systems increases the exchange of information electronically,

but there is need for strong governance framework (Pardo and Burke, 2019). The exchange of information enhances patient quality care and efficiency and the safety of health service delivery (HIMSS, 2016).

The health information security is statistically significant ($\chi^2 = 46.798$, $df = 4$, $p = 0.000$), indicating that the combination of healthcare information security variables network security, information confidentiality, data security, and information integrity significantly predicts health service delivery outcome. The model explains a moderate proportion of the variance in health service delivery ranging from 20.0% to 30.3%, suggesting that healthcare information security plays a meaningful role in health service delivery outcomes. Similar findings by HIMSS (2016) and Kumar (2013) noted that the exchange of information electronically enhances patient quality care and efficiency, with data security and privacy measures in place having a positive influence in health service delivery. The hospital ensures the accuracy of medical records by protecting the information against losses, and distortion maintaining the confidentiality of patient information, and keeping it secure. Information systems are known to enhance the transmission of electronic files, efficiency, accuracy, and confidentiality when security policy exists and is adhered to. Privacy and data-sharing issues have spread outside the healthcare industry with internet growth, and this has altered how medical information is created and distributed (Wyatt, 2016).

Information Confidentiality emerged as a significant predictor of health service delivery. The Exp(B) value of 1.770 suggests that the odds of being satisfied with health service delivery increase by approximately 77.0% with enhanced information confidentiality. Similarly, the Exp(B) value of 1.789 suggests that the odds of being satisfied with health service delivery

increase by approximately 78.9% with better data security. Several studies support the significance of information systems, particularly health information security, in enhancing healthcare service delivery. For instance, research by Alharthi *et al.* (2020) found that robust information security measures in healthcare systems directly improved the quality of service delivery by ensuring data privacy, accuracy, and accessibility. Similarly, a study by Tulu *et al.* (2018) highlighted that secure information systems are essential in building trust among healthcare providers and patients, leading to better service delivery outcomes. The implementation of secure health information systems also enables healthcare workers to access critical patient data in real-time, improving decision-making and the overall quality of care. Furthermore, a study by Kuo *et al.* (2019) on the relationship between health information systems and service delivery found that improved security mechanisms positively impacted healthcare efficiency by reducing errors and enhancing the continuity of care. The study concluded that the more secure the health information system, the more effective the healthcare delivery, as it fosters confidence in the system among both patients and healthcare professionals.

However, not all studies fully align with the view that information security is the key driver of improved service delivery. For example, Kim *et al.* (2017) conducted research on the adoption of electronic health records (EHRs) in healthcare settings and found that while information security is important, factors such as user training, organizational readiness, and infrastructure were more critical to successful implementation. They argued that without addressing these foundational elements, even the most secure systems would not result in significant improvements in service delivery. Similarly, the work of Jha *et al.* (2016)

emphasized that the focus on secure information systems should be balanced with attention to other elements, such as system usability and integration with existing workflows.

4.6 Healthcare medical technologies on healthcare service delivery

The fourth specific objective is to determine the influence of healthcare medical technologies on healthcare service delivery tenets in Kenyatta National Hospital, Kenya.

4.6.1 Healthcare Medical Technologies Descriptive Statistics

In Table 4.13 below, the coefficient of variation varies between 24.48% and 33.71%. The variability in healthcare medical technologies is higher than that observed in the information system security and electronic health records system. The median on the constructs is 4.0, a perception of “Agree” among the respondents. The highest mean of 3.92 indicates that: “Utilization of mobile technology has led to improvements in the provision of healthcare services” at the hospital. This statement is in line with the current advancements in Kenya’s mobile technology. The penetration of mobile technology is very high and this provides an ideal landscape to utilize the technology for medical services delivery. There is an observation that telemedicine is used in hospitals (mean of 3.71), implementation of telehealth systems (mean of 3.70), and usage of cloud computing (mean of 3.50) as shown in below Table 4.13. Therefore, healthcare medical technologies are utilized for healthcare service delivery at Kenyatta National Hospital, Kenya.

For, utilization of mobile technology has led to improvements in the provision of healthcare services, 79.5% of respondents agreed or strongly agreed with this statement, indicating widespread recognition of the positive impact of mobile technology on healthcare service delivery. This high level of agreement reflects the successful integration of mobile

technology into the hospital's operations, enabling improvements in efficiency, accessibility, and patient care. Only 9.0% of respondents disagreed or strongly disagreed, suggesting minor concerns about the effectiveness of mobile technology. These concerns could arise from technical issues, such as connectivity problems, or a lack of familiarity with mobile solutions among some staff members. The mean score of 3.92 and median of 4.0 reflect strong agreement with the statement, highlighting the overall effectiveness of mobile technology in enhancing service delivery. However, the SD of 0.96 and CV of 24.48% indicate moderate variability in responses, suggesting that while most respondents agree, there are still some differences in their perceptions. This variability could be due to varying experiences with mobile technology across different departments or roles.

For the usage of cloud computing has made it easier for patients as well as practitioners to access their medical records anytime they want and wherever they are, 60.0% of respondents agreed or strongly agreed, showing confidence in the benefits of cloud computing for accessing medical records. This suggests that cloud computing has improved the accessibility and convenience of medical records for both patients and practitioners. However, 21.0% of respondents disagreed or strongly disagreed, pointing to concerns about the implementation or usability of cloud computing. These concerns could stem from technical issues, such as data security or system downtime, or a lack of awareness about how to effectively use cloud-based systems. The mean score of 3.51 and median of 4.0 suggest general agreement, though the agreement is lower compared to other statements. The SD of 1.18 and CV of 33.71% indicate higher variability, reflecting significant differences in perceptions. This variability

highlights the need for further optimization of cloud computing systems and targeted training to address specific concerns.

Regarding the use of telemedicine in hospitals helps in the archiving, exchange, and evaluation of medical data, 67.7% of respondents agreed or strongly agreed, highlighting the effectiveness of telemedicine in managing medical data. This suggests that telemedicine has improved the archiving, sharing, and analysis of medical data, contributing to better decision-making and patient care. However, 14.3% of respondents disagreed or strongly disagreed, suggesting room for improvement in the implementation of telemedicine systems. These disagreements could arise from technical challenges, such as system integration issues, or a lack of training on how to use telemedicine effectively. The mean score of 3.71 and median of 4.0 reflect general agreement with the statement, while the SD of 1.12 and CV of 30.19% indicate moderate variability in responses. This variability suggests that while most respondents agree, there are still some differences in their perceptions, possibly due to varying levels of experience with telemedicine systems.

The implementation of telehealth systems has contributed to an improvement in the quality-of-service delivery, 67.7% of respondents agreed or strongly agreed, indicating satisfaction with the impact of telehealth systems on service quality. This suggests that telehealth systems have enhanced the quality of healthcare services by enabling remote consultations, monitoring, and follow-ups. However, 15.3% of respondents disagreed or strongly disagreed, suggesting some concerns about the effectiveness of telehealth systems. These concerns could stem from technical issues, such as connectivity problems, or challenges in adapting to remote healthcare delivery. The mean score of 3.70 and median of 4.0 reflect general

agreement with the statement, while the SD of 1.13 and CV of 30.55% indicate moderate variability in responses. This variability highlights some differences in perceptions, possibly due to varying experiences with telehealth systems across different departments or roles.

Table 4.12: Summary statistics for healthcare medical technologies constructs.

N=210	SA	A	N	D	SD	Mean	Median	SD	CV (%)
Utilization of mobile technology has led to improvements in the provision of healthcare services.	25.7	53.8	11.4	5.2	3.8	3.92	4.0	0.96	24.48
The usage of cloud computing has made it easier for patients as well as practitioners to access their medical records anytime they want and wherever they are.	20.0	40.0	19.0	12.9	8.1	3.51	4.0	1.18	33.71
The use of telemedicine in hospitals helps in the archiving, exchange, and evaluation of medical data.	24.8	42.9	18.1	7.6	6.7	3.71	4.0	1.12	30.19
The implementation of telehealth systems has contributed to an improvement in the quality-of-service delivery.	24.8	42.9	17.1	8.6	6.7	3.70	4.0	1.13	30.55
Composite Score						3.71	4	1.1	29.73

4.6.2 Association Between Healthcare Medical Technologies and Service Delivery

The relationship between Healthcare Medical Technologies and Healthcare Service delivery tenets in Kenyatta National Hospital, Kenya was analyzed using the chi-square (χ^2) test, as shown in Table 4.14. The study examined four key aspects of medical technology: mobile health technology, telehealth care technology, telemedicine technology, and cloud computing technology, all of which demonstrated a meaningful impact on healthcare service delivery.

The findings indicate that mobile health technology ($\chi^2(2)=27.347, p=0.001$) is significantly associated with service delivery satisfaction. Among respondents who were satisfied with service delivery, 25% agreed, 20.8% were neutral, and 54.2% disagreed that mobile technology has improved healthcare services. Conversely, among dissatisfied respondents, only 4.3% agreed, 8.6% were neutral, and a substantial 87% disagreed. These results suggest that the effective utilization of mobile health technology significantly enhances healthcare accessibility and patient engagement.

Similarly, the results reveal a significant relationship between telehealthcare technology and service delivery ($\chi^2(2)=12.944, p=0.000$). Among respondents who were satisfied with service delivery, 37.5% agreed, 22.9% were neutral, and 39.6% disagreed that telehealth systems have improved service quality. Among those dissatisfied with service delivery, only 16% agreed, 17.9% were neutral, and a significant 66% disagreed. This suggests that integrating telehealth services can improve the quality and efficiency of healthcare delivery by expanding access to remote medical consultations and monitoring.

The use of telemedicine technology also showed a significant association with service

delivery ($\chi^2(2)=7.105, p=0.029$). Among satisfied respondents, 22.9% agreed, 25% were neutral, and 52.1% disagreed that telemedicine helps in archiving, exchanging, and evaluating medical data. Among those dissatisfied, only 11.7% agreed, 16% were neutral, and a large 72.2% disagreed. These results highlight that while telemedicine is beneficial, its adoption and effectiveness may still face challenges, such as technological limitations, training gaps, or resistance from healthcare practitioners.

Additionally, cloud computing technology exhibited a significant association with service delivery ($\chi^2(2)=16.219, p=0.000$). Among those satisfied with service delivery, 27.1% agreed, 29.2% were neutral, and 43.8% disagreed with the claim that cloud computing has facilitated easier access to medical records. Among dissatisfied respondents, only 11.7% agreed, 13.6% were neutral, and 74.7% disagreed. These findings indicate that enhancing cloud computing infrastructure could significantly improve medical record accessibility for both patients and healthcare providers.

Table 4.13: Association Between Healthcare Medical Technologies and Service Delivery

Variable	Satisfied	Not satisfied	χ^2	Df	p-value
Mobile health technology					
Agree	12(25%)	7(4.3%)	27.347	2	.001
Neutral	10(20.8%)	14(8.6%)			
Disagree	26(54.2%)	141(87%)			
Total	48(100%)	162(100%)			
Telehealth care technology					
Agree	18(37.5%)	26(16%)	12.944	2	.000
Neutral	11(22.9%)	29(17.9%)			
Disagree	19(39.6%)	107(66%)			
Total	48(100%)	162(100%)			
Telemedicine technology					
Agree	11(22.9%)	19(11.7%)	7.105	2	.029
Neutral	12(25%)	26(16%)			
Disagree	25(52.1%)	117(72.2%)			
Total	48(100%)	162(100%)			
Cloud computing technology					
Agree	13(27.1%)	19(11.7%)	16.219	2	.000
Neutral	14(29.2%)	22(13.6%)			
Disagree	21(43.8%)	121(74.7%)			
Total	48(100%)	162(100%)			

4.6.3 Multivariable Logistic Regression Analysis of Healthcare Medical Technologies

To determine how well Healthcare Medical Technologies predicts the likelihood of service delivery satisfaction, a binary logistic regression equation was employed. Binary regression is the model's form, as may be seen below.

$$Y (0, 1) = f(M, TCT, TT, C)$$

Where: Y = Binary function for adherence, where "0" represents the log of the chances against satisfaction of health service delivery.

1 is the log of the probabilities in favor of satisfaction with health service delivery.

M is the Mobile health technology

TCT is the Telehealth care technology

TT is the Telemedicine technology

C is the Cloud computing technology

The model fit analysis in Table 4.15 shows that satisfaction with service delivery is substantially predicted by the combination of healthcare medical technology factors. Omnibus Tests of Model Coefficients provide an outcome with statistical significance ($\chi^2 = 26.994$, $df = 4$, $p = 0.000$) that supports this. With a Cox & Snell R² of 0.121 and a Nagelkerke R² of 0.183, the Model Summary also shows that the model explains a moderate amount of the variance in satisfaction. These figures, which explain between 12.1% and 18.3% of the variation in satisfaction, imply that the model has some predictive ability. Mobile technology has a statistically important impact on service delivery, according to the results of the equation's variable analysis [OR=1.703, 95% CI [1.123, 2.581], $p=0.012$]. Adoption of mobile health technology raises the chance of better service delivery by around 70.3%, according to the odds ratio of 1.703. The positive and significant influence of mobile technology in improving access to health care and efficiency is confirmed by the fact that the confidence interval excludes 1.0.

For instance one of the key informants narrated that;

“I would say technology has revolutionized how we diagnose and refer patients. With improved digital screening tools, we can detect illnesses at an early stage, leading to prompt interventions. In the past, delays in diagnosis and referrals often resulted in complications,

but now, automated systems ensure patients are quickly referred to specialists...” (KII 2, Health information officer,2024).

Similarly, telehealth care technology was found to be statistically significant in improving service delivery [OR=1.302,95% CI [1.126,1.832],p=0.029]. The odds ratio of 1.302 suggests that the implementation of telehealth care technology increases the likelihood of improved service delivery by approximately 30.2%. This highlights the importance of telehealth in facilitating remote patient consultations and enhancing healthcare service provision.

One of the key informants noted that;

“Integrating telemedicine into our healthcare system has proven to be a cost-effective solution for both patients and providers. Many patients, especially those in rural areas, previously struggled with transportation costs and long wait times for in-person visits. With virtual consultations, they can now receive timely medical advice from the comfort of their homes...” (KII 1, Health information officer,2024)

In contrast, telemedicine technology did not exhibit a statistically significant effect on service delivery [OR=0.900,95% CI [0.586,1.382],p=0.630]. The odds ratio of 0.900 suggests a slight negative association, implying that telemedicine alone does not necessarily enhance service delivery in a meaningful way. The p-value ($p>0.05$) and confidence interval covering 1.0 indicate that this relationship is not statistically significant.

Likewise, there was no discernible effect of cloud computing technology on service delivery [OR=1.321,95% CI [0.857,2.035], p=0.207]. The p-value ($p>0.05$) shows that this impact is not statistically significant, despite the odds ratio of 1.321 suggesting a positive link. This

implies that although cloud computing could increase data accessibility, its ability to directly enhance service delivery may be limited by other reasons like implementation difficulties or security issues.

Table 4.14: Binary Logistic Regression for Healthcare Medical Technologies

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Mobile Technology	.532	.212	6.293	1	.012	1.703	1.123	2.581
Telehealth Care Technology	.264	.174	2.301	1	.029	1.302	1.126	1.832
Telemedicine Technology	-.105	.219	.232	1	.630	.900	.586	1.382
Cloud Computing Technology	.278	.221	1.589	1	.207	1.321	.857	2.035
Constant	-2.279	.760	8.985	1	.003	.102		

Model Summary: Cox & Snell R Square=.121; Nagelkerke R Square=.183
Omnibus Tests of Model Coefficients: Chi-Square=26.994; P=0.000

4.6.4 Discussion on Healthcare Medical Technologies

The medical professionals “agreed” that the utilization of mobile technology has led to improvements in the provision of healthcare services (mean=3.94, median=4.0, SD=0.96). The use of telemedicine in hospitals helps in the archiving, exchange, and evaluation of medical data (mean=3.71, median=4.0, SD=1.12) as well as improvement in the quality of service delivery (mean=3.70, median=4.0, SD=1.13). Similar findings by Schubert (2020), telemedicine utilization improves the provision of medical information and services and this decreases hospital readmissions and trips to the emergency department (Jakobsen *et al.*, 2017) which have a beneficial impact on the health-related life quality. The utilization of mobile technology has led to improvements in the provision of healthcare services. Yen & Bakken (2017) observed that the usage of technology information in public hospitals has brought numerous advantages to the provision of health services. It has enhanced services, cut costs and increased safety of the delivery of medical care in industrialized countries. In Kenyatta National hospital, the use of telemedicine in hospitals helps in the archiving, exchange, and evaluation of medical data. Jakobsen *et al.*, (2017) noted that telemedicine solutions that are used much more specifically to COPD patients may substantially decrease hospital readmissions and trips to the emergency department and also have a beneficial impact on the health-related life quality.

According to the Exp(B) value of 1.703, using mobile health technology raises the likelihood of being pleased by almost 70.3%. Similarly, the Exp(B) value of 1.302 indicates that using telehealthcare technology increases the likelihood of being pleased by about 30.2%. Similar findings noted that the usage of information technology in hospitals brought numerous

advantages to the provision of health services by enhancing services, cutting costs, and increasing the safety of the delivery of medical care (Yen & Bakken, 2017). Ahuja, Sindhu, and Jesus (2017) claim that cloud computing in healthcare improves service delivery, lowers information technology expenses in public hospitals, and fosters more collaboration among medical experts. Patients can get medical information and services through telemedicine, which is delivered by healthcare medical technology (2020). It is as simple as having two doctors talk about a case over the phone or using satellite technology to transmit consultations between providers using robotic technologies or video-conferencing (WHO, 2013). According to the WHO, chronic obstructive pulmonary disease (COPD) will rank as the third most common cause of death globally in 2030. According to Steventon et al. (2017), a number of technology initiatives have been assessed to see whether alternatives are cost-effective when compared to traditional therapy and, when utilised appropriately, are safe and practical for patients with chronic illnesses. Therefore, health care significantly influences service delivery at Kenyatta National Hospital.

The Omnibus Tests of Model Coefficients indicate that the model is statistically significant ($\chi^2 = 26.994$, $df = 4$, $p = 0.000$). This means the combination of healthcare medical technology variables significantly predicts satisfaction with service delivery. Several studies support the notion that medical technologies enhance service delivery in healthcare settings. For instance, a study by Muenchen *et al.* (2017) demonstrated that the introduction of advanced medical technologies, such as diagnostic imaging systems and electronic health records, significantly improved patient outcomes by facilitating more accurate diagnoses and timely interventions. Additionally, investigation by Zhang *et al.* (2020) found that the use of medical

technologies, including telemedicine and robotic surgery, contributed to more efficient workflows, better patient management, and overall improvements in healthcare delivery.

In a similar vein, the study by Patel *et al.* (2018) explored the role of medical technologies in reducing medical errors and enhancing service delivery. They concluded that the integration of cutting-edge technologies such as automated medication dispensing systems and real-time patient monitoring devices improved both the accuracy and speed of care, thereby enhancing patient satisfaction and outcomes. This aligns with the results of this investigation, suggesting that medical technologies play a vital role in optimizing healthcare service delivery.

However, some studies raise concerns about the challenges associated with implementing and maintaining medical technologies. For example, an investigation by Carayon *et al.* (2019) emphasized that while medical technologies can improve service delivery, they also pose challenges such as system complexity, high costs, and the need for extensive training. These barriers can undermine the positive effects of technology if not adequately addressed. Additionally, Korpela *et al.* (2018) found that in some healthcare settings, the over-reliance on medical technologies led to a decrease in personalized care, as healthcare providers became more dependent on technology rather than direct patient interaction.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section highlights the summary of the results, conclusions, and recommendations to the authorities, the service users, stakeholders, and gaps for future research.

5.2 Summary

The analysis of socio-demographic factors influencing medical care service delivery revealed that years of employment had a statistically significant impact on service delivery satisfaction. Similarly, education level also showed a significant relationship with service satisfaction. However, gender did not have a significant association with service delivery satisfaction.

Concerning the influence of electronic medical health records systems on healthcare service delivery tenets; The use of Electronic Medical Health Records (EMHR) systems showed a strong correlation with service delivery satisfaction. Likewise, Electronic Health Records (EHR) systems had a significant association with service satisfaction. Additionally, Clinical Decision Support Systems (CDSS) exhibited a highly significant impact, while Patient Administration Records Systems (PARS) also demonstrated a notable relationship with service delivery satisfaction.

Regarding the influence of healthcare information security on healthcare service delivery tenets; The findings indicate that network security had a significant association with service delivery satisfaction. Similarly, information confidentiality and information integrity both showed a significant relationship with service satisfaction. Additionally, data security measures were also significantly linked to service delivery satisfaction.

Concerning the influence of medical care medical technologies on healthcare service delivery tenets; mobile health technology was significantly associated with service delivery satisfaction; The findings indicate that mobile health technology had a significant association with service delivery satisfaction. Similarly, telehealthcare technology and telemedicine technology both showed significant relationships with service delivery. Additionally, cloud computing technology also exhibited a notable association with service delivery.

5.3 Conclusions

Regarding socio-demographic factors influencing healthcare service delivery; Individuals with higher education levels were 1.886 times more likely to report improved service delivery compared to those with lower education levels.

Concerning the influence of electronic medical health records systems on healthcare service delivery tenets; Implementing efficient patient administration records systems increases the probability of improved service delivery by 1.518. The use of CDSS increased the probability of improved service delivery by approximately 1.831.

Regarding the influence of healthcare information security on healthcare service delivery tenets; Ensuring information confidentiality increases the probability of improved service delivery by 1.77. Enhancing data security measures increases the probability of improved service delivery by 1.789.

Concerning the influence of healthcare medical technologies on healthcare service delivery tenets; the adoption of mobile health technology increases the probability of improved

service delivery by approximately 1.7. the implementation of telehealthcare technology increases the likelihood of improved service delivery by 1.3.

5.4 Recommendations

1. To maximize the benefits of electronic medical records and related systems, Kenyatta National Hospital should invest in continuous training for healthcare providers to ensure uniform usage across departments. It is also recommended to regularly update the systems to improve their user-friendliness and ensure interoperability between different electronic platforms. Regular assessments should be conducted to identify areas where these systems can further streamline clinical services and decision-making, particularly in patient administration and decision support.
2. To harness the potential of its diverse workforce, Kenyatta National Hospital should continue to invest in tailored training programs that consider the varying education levels, experience, and professional backgrounds of staff. Focusing on the ongoing professional development of younger healthcare workers, particularly in the area of healthcare information systems, can further improve service delivery. Additionally, providing opportunities for mentorship and leadership development for both female and male staff will help create a more dynamic and inclusive workforce, enhancing the hospital's overall performance.
3. Given the critical role of information security in healthcare delivery, it is recommended that Kenyatta National Hospital strengthen its data protection policies and ensure that all healthcare providers are trained in maintaining data privacy. Implementing advanced security protocols, such as encryption and multi-factor

authentication, will further safeguard sensitive patient information. Regular audits and updates of security systems are essential to mitigate emerging threats and maintain the trust of patients and healthcare providers alike.

4. To further improve service delivery, the hospital should continue integrating advanced healthcare technologies such as mobile health, telemedicine, and cloud computing. Expanding telemedicine and telehealth services can help improve access to healthcare for patients in remote areas, while mobile technologies can support real-time patient monitoring and data sharing. Investment in infrastructure and training is crucial to ensure that healthcare providers can effectively utilize these technologies, ultimately enhancing the quality of care provided at the hospital.

5.5 Suggestions for Further Studies

1. The study focused on Kenyatta National Hospital, a level six hospital in Kenya; therefore, further studies should focus on other health facilities in Kenya for comparative analysis.
2. The study was delimited to a public hospital in Kenya; therefore, further studies should be conducted in private hospitals since the current findings may not be generalized to private hospitals in Kenya.
3. The study focused on integrated health care information systems for service delivery tenets in Kenyatta National Hospital, this implies that integrated health care information systems were the independent variable while service delivery tenets were the dependent variable. Further studies should focus on how integrated healthcare information systems influence employee performance.

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APPENDICES

APPENDIX I: Informed Consent

Participant's statement

I've either read this permission form or had the material read to me. I've got the chance to discuss this research topic with a study counsellor. They have answered my questions in a language I understand. The benefits and risks have been explained to me. I understand that participation in this study is completely optional and that I may discontinue participation at any time. I willingly agree to participate in this research. I am aware that every effort was taken to protect the confidentiality of any information that may be used to identify me. By signing this permission form, I have not given up any of my legal rights as a study subject.

I agree to partake in this investigation:	Yes	No
I approve to have (define specimen) preserved for later investigation:	Yes	No
I approve to provide contact info for follow-up:	Yes	No

Participant signature / Thumb stamp: _____ **Date:** _____

Researcher's statement

The participant listed above has received a thorough explanation of the pertinent elements of this research project from me, the undersigned, and I think that the person has comprehended and voluntarily and freely provided his or her permission.

Researcher's Name: Susan Ngugi **Date:** _____ **Signature**

Role in the study: _____ [i.e. study staff who explained informed consent form.]

For more information contact: Susan Ngugi at 0723 821950 from 8.00Am to 5.00Pm

Witness Printed Name (If witness is necessary, A witness is a person mutually acceptable to both the researcher and participant)

Name _____ Signature /Thumb stamp: _____ Contact information _

Date; _____



APPENDIX II: Questionnaire

In order to participate in this study project, I would appreciate it if you could answer the following questions. Your provided information will be kept completely confidential and used exclusively for scholarly reasons. Kindly respond to the following inquiries.

Section 1: Preliminary Information

Gender: (Male) (Female)

What exactly is your job title there at the hospital?

How long have you been employed at the hospital? (years worked)

What is your educational background?

Certificate () Diploma ()

Degree () Masters ()

SECTION 1

PART A: Influence of Electronic Medical Health Records Systems on service delivery

Statements on the various forms of healthcare information system integration now used in medical facilities are included in this section. Please respond by checking the box (√) next to the response and choosing the option that best represents your position.

Strongly Disagree (1) Disagree (2) Neutral (3) Agree (4) Strongly Agree (5)

Statement	1	2	3	4	5
Clinical services in hospitals now make use of electronic health record systems, which are used by medical professionals such as doctors and nurses.					
Creating and maintaining clinical information at the hospital is done so via the usage of electronic medical records systems.					
The patient administration system at the hospital is used for the purpose of keeping track of clinical patients' appointments.					
The clinical records of patients are analyzed at the hospital, and clinical decision support systems are used in the					

process of decision making.					
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PART B: Information System Security on service delivery

This section contains assertions addressing the implications of using information system security in the medical facility. Please indicate the degree to which you agree with each statement by placing a checkmark (√) next to the corresponding response. Strongly Disagree (1) Disagree (2) Neutral (3) Agree (4) Strongly Agree (5)

Statement	1	2	3	4	5
By safeguarding the data from loss, the hospital guarantees the accuracy of medical records.					
When sending medical records via electronic means, such as faxes or emails, the hospital makes sure they are shielded against distortion.					
The hospital makes sure that private data is safeguarded and that only those with permission may access it.					
Computers now have passwords installed to secure data.					

Do you think that hospital information system security has an impact on the hospital's decision-making process for patient care operations, both internally and externally?

Explain.....

PART C: Healthcare Medical Technologies on service delivery

This section discusses healthcare medical technology intended for hospital service delivery. With a checkmark (√) next to the response you think is best, please indicate how much you agree with each statement.

Strongly Disagree (1) Disagree (2) Neutral (3) Agree (4) Strongly Agree (5)

Statement	1	2	3	4	5
The delivery of healthcare services has improved as a result of the use of mobile technologies.					

The usage of cloud computing has made it easier for patients as well as practitioners to access their medical records anytime they want and wherever they are.					
The use of telemedicine in hospitals helps in the archiving, exchange, and evaluation of medical data.					
The quality of service delivery has improved as a result of the deployment of telehealth technologies.					

PART D: Service delivery in Kenyatta National Hospital, Kenya

Please indicate the degree to which you agree with each statement by placing a checkmark (√) next to the corresponding response.

Very Dissatisfied (1) Dissatisfied (2) Neutral (3) Satisfied (4) Very satisfied (5)

Statement	1	2	3	4	5
In our facility, services are delivered to patients promptly, as evident by the low number of patients waiting at any given time – (Timely delivery)					
Patients are pleased with the care they receive at our facility, as shown by the high rate of repeat visits and returning patients, indicating their trust and satisfaction with our services – (Patient satisfaction)					
The services provided at our facility comprehensively meet patients' needs, as evidenced by the wide array of services available – (Comprehensiveness)					
It is easy for patients to access services at our facility, as shown by the steady increase in the number of patients visiting our facility – (Accessibility)					

THANK YOU AND GOD BLESS YOU.

APPENDIX III: Online Question On Qualitative Analysis.

1. Electronic Medical Health Records

KNH has deployed an electronic medical health record to keep patient health records and data electronically. In your view how has this impacted the service delivery?

2. Health Care Information Security.

Healthcare information security at KNH has been at the fore front on all IT systems with patients' data. What is your observation on how this has influenced service delivery?

3. Health Care Medical Technologies

KNH has invested in various healthcare medical technologies such as tele medicine, mobile technology among others. In your own opinion how has this impacted service delivery?

APPENDIX IV: ERC Certificate



REF: MKU/ISERC/2504

Date: 23 November 2022

TO: NGUGI SUSAN NJERI

REG: MHSM/2017/75026

Dear Sir/Madam,

RE: INTEGRATED HEALTHCARE INFORMATION SYSTEMS AND HEALTHCARE SERVICE DELIVERY TENETS IN KENYATTA NATIONAL TEACHING AND REFERRAL HOSPITAL, KENYA

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **1577**. The approval period is **22/11/2022 - 21/11/2023**.

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 **Mount Kenya University**
- 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 **Mount Kenya University** within 72 hours of notification
- iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
- v. Clearance for 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 expiry of the approval period. Attach a comprehensive progress report to support the renewal
- vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Prior to 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 also obtain other clearances needed.

Yours sincerely,

The Chairman
Mount Kenya University
Ethics Review Committee
Dr. Peter G. Kiriga, Thika
Chairman, Mount Kenya University ISERC

Main Campus, General Kago Road, P.O. Box 342-01000 Thika. Tel: +254 67 2820 000.

APPENDIX V: MKU Introductory Letter



Mount Kenya University

DIRECTORATE OF GRADUATE STUDIES

MHSM/2017/75026

28th November, 2022

*The Director, Research Coordination Division
National Commission for Science, Technology & Innovation
Utalii House, 8th & 9th Floor
P.O Box 30623- 00100
NAIROBI*

Dear Sir/Madam,

RE: NGUGI SUSAN NJERI- REGISTRATION NO. MHSM/2017/75026


The purpose of this letter is to introduce the above named student who is pursuing **Master of Science in Health Systems Management** in the **Department of Public Health** in the **School of Public Health**.

The title of her research is *"Integrated Healthcare Information Systems and Healthcare Service Delivery Tenets in Kenyatta National Teaching and Referral Hospital, Kenya."*

She has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data for her research between **November, 2022 and February, 2023**.

Any assistance accorded to her will be highly appreciated.


Thank you.


Dr. Samuel M. Karega, Ph.D.
Director, Graduate Studies
Enc.

Mount Kenya University
P. O. Box 342 - 01000, THIKA
Office of the Director
Graduate Studies

Main Campus, General Kago Road, P.O. Box 342-01000 Thika.
Tel: 020-2878 000, Cell: +254 709 153 000
Email: info@mku.ac.ke, Web: www.mku.ac.ke
Chartered and ISO 9001 : 2015 Certified Institution.
Unlocking Infinite Possibilities


APPENDIX VI: NACOSTI License



REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION


RefNo: **507159**



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Date of Issue: **09/December/2022**

RESEARCH LICENSE



This is to Certify that Ms. SUSAN NJERI NGUGI of Mount Kenya University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: INTEGRATED HEALTHCARE INFORMATION SYSTEMS AND HEALTHCARE SERVICE DELIVERY TENETS IN KENYATTA NATIONAL TEACHING AND REFERRAL HOSPITAL, KENYA for the period ending : 09/December/2023.


License No: **NACOSTI/P/222579**

Applicant Identification Number: **507159**

W. Mutisya
Director General

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

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See overleaf for conditions

APPENDIX VII: KNH – UON ERC Approval



UNIVERSITY OF NAIROBI
FACULTY OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel: (254-020) 2726300 Ext 44355

KNH-UON ERC
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Website: <http://www.erc.uonbi.ac.ke>
Facebook: <https://www.facebook.com/uonknh.erc>
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC



KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/129

Susan Njeri Ngugi
Reg.No.MHSM/2017/75026
School of Public Health
Mt. Kenya University

Dear Susan



27th March, 2023

RESEARCH PROPOSAL: INTEGRATED HEALTHCARE INFORMATION SYSTEMS AND HEALTHCARE SERVICE DELIVERY TENETS IN KENYATTA NATIONAL HOSPITAL, KENYA (P934/12/2022)

This is to inform you that KNH-UoN ERC has reviewed and approved your above research proposal. Your application approval number is **P934/12/2022**. The approval period is 27th March 2023 – 26th March 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 KNH-UoN ERC.
- 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 KNH-UoN ERC 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 KNH-UoN ERC within 72 hours.
- v. Clearance for 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 expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to KNH-UoN ERC.

Prior to 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 also obtain other clearances needed.

APPENDIX VIII: Similarity Index Report

Susan Thesis
by Susan Njeri

Submission date: 08-Jul-2025 04:56PM (UTC+0300)
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Susan Thesis

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APPENDIX IX: Map Of Study Area



KENYATTA NATIONAL HOSPITAL

