MANAGEMENT INFORMATION SYSTEM CAPABILITIES AND PERFORMANCE OF HOSPITALS IN MOMBASA COUNTY, KENYA

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DECLARATION

This research project is my original work and never has it been presented elsewhere for the award of a degree in another university

Signature  Date _____

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It is my confirmation that the work in this research project was done by the candidate above with my supervision.

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DEDICATION

I dedicate this research to my late sister Anne Nanjala, who passed on while pursuing a Bachelor's Degree in Clinical Medicine, Surgery, and Community Health. She had all the potential of becoming the best in her area of study. I equally dedicate this work to my wife and family at large for their wholesome support and motivation all along.

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ABBREVIATIONS AND ACRONYMS

AI: Artificial Intelligence

CDSS: Clinical Decision Support System

DBMS: Database Management System

EHR: Electronic Health Records

EMR: Electronic Medical Records

HIS: Health Information System

MIS: Management Information System

HQMP: Health Quality Management Policy

ICT: Information Communication Technology

IoT: Internet of Things

MoH: Ministry of Health, Kenya

NACOSTI: National Commission for Science, Technology, and Innovation

NHIF: National Health Insurance Fund

SPSS: Statistical Package for Social Sciences

TPS: Transaction Processing System

UTAUT: Unified Theory of Acceptance and Use of Technology

WHO: World Health Organization

OPERATIONAL DEFINITIONS OF TERMS

Management information system capabilities:

The functional attributes and technological features of a management information system that enable effective administration and management of resources in a hospital setting, allowing effective patient care, and facilitating informed decision making.

Performance of hospitals: The efficiency and effectiveness of a hospital in healthcare service delivery in the dimensions of patient satisfaction, especially minimal patient waiting time, operational efficiency, for example effective resource utilization, and financial efficiency, specifically a positive profit margin trend on the healthcare services provided.

Service delivery automation: Capability of MIS for hospitals to effectively facilitate automation of the patient's journey within the hospital by supporting and streamlining patient registration and appointment scheduling, clinical documentation and access, integration of patient profiles with diagnostic test results, accurate billing process and insurance claims raising, and patient discharge process and follow-up.

System management: Comprehensive capabilities of MIS for hospitals to allow integrated data storage for reliable and speedy retrieval, internal and external interoperability for seamless data exchange, scalability to accommodate growing data demands in the

integrated hospital ecosystem, and reporting and analytical features, such as customized report generation and real-time data analysis.

Data security: Comprehensive protocols and measures characteristic of MIS for hospitals, that ensure successful protection of patient data, through implementation of access control measures to achieve predefined roles and permissions, username and password authentication, capturing of audit trails, and disaster recovery and backup in case of system security breach or a disaster.

Information quality: The timeliness, completeness, clarity of content, accuracy, and confidentiality of information as a shared resource across different end-users of the system.

Management information system for hospitals:

An abstract computer-based comprehensive management information system that integrates data in a hospital setting by allowing automated administrative, clinical, operational, and financial operations; with the aim of enabling informed decision making, and streamlining processes for efficiency and improved patient care.

Health information system: A broader context information system that spans beyond the hospital operations setting, covering several hospital management information systems across the health sector. It manages aspects of public health, healthcare delivery, and health administration mostly at the national level for

collection, storage, processing, analysis, and reporting of comprehensive health information. More importantly, it permits health information interchange/ interoperability between different healthcare facilities' systems.

ABSTRACT

Uneven progress in the adoption and usage of management information systems in the Kenyan health sector has substantially affected the performance of hospitals. Time lag has been observed in reports submission to the Ministry of Health, contributed by improper documentation. Cyclic medical products' stock-out is now common, and hospitals in Mombasa County are experiencing slow patient turnaround for patients seeking healthcare services. This study, therefore, aimed to examine the influence of MIS capabilities on the performance of level 4 and 5, public and private hospitals in Mombasa County, Kenya. Specifically, the study sought to establish the influence of service delivery automation, system management, data security, and information quality on the performance of hospitals in Mombasa County. The study was anchored on Systems Theory, Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology, and Resource Based View Theory. A descriptive research design was adopted, targeting 318 technical ICT specialists working in 31 level 4 and 5, private and public hospitals in Mombasa County. A sample size of 96 respondents participated in the study, representing 30 percent of the target population and selected using stratified random sampling technique. Primary data was collected using a semi-structured questionnaire. A pilot study was conducted to test the instrument's reliability, measured using Cronbach's Alpha, while expert view was utilized to achieve content validity. Questionnaire distribution was through drop and pick method and using Kobo Toolbox Data Collection link where necessary. Data collected was subjected to descriptive, relational, and inferential analysis. The study revealed that service delivery automation, system management, data security and information quality had a positive significant influence on the performance of hospitals in Mombasa County. The study concludes that service delivery automation enhances the patient flow because automated appointment scheduling as a sub-system can reduce the time patients spend waiting for consultations and treatments. Effective system management ensures optimal resource allocation within hospitals and can help hospitals prioritize the use of medical supplies, equipment, and human resources. Patients are more likely to seek medical care and share sensitive information when they trust that their data is secure. High-quality information ensures that patient records are accurate and up-to-date, which is crucial for effective diagnosis and treatment. The study recommends that the hospitals should transition from paper-based records to comprehensive electronic health records systems. Transitioning to comprehensive EHR systems can streamline patient data management, improve communication among healthcare providers, and enhance patient care coordination. The hospitals should perform thorough assessments of existing data security measures to identify vulnerabilities and areas for improvement.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Effective and efficient healthcare provision is among the primary goals of any responsible government. It is through this provision that a healthy population is achieved; one that is adequately positioned to spearhead the realization of a country's socio-economic development. Public investment in healthcare not only spurs economic growth with an increasing effect on per capita income (Beylik et al., 2022), in the process, it also delivers a well-functional healthcare system. In order to attain this level, healthcare providers are opting for evolutionary improvement through the adoption of modern information and communication technologies, including MIS, in driving innovativeness towards efficient service delivery. In their study on how business continuity can be achieved through information systems, Turulja and Bajgorić (2022) highlight the importance of technology adoption, equating it to the choice to acquire and utilize new innovation. An MIS in the hospital setting, is a comprehensive system that integrates information requirements permitting the collection, storage, retrieval, and analysis of clinical, patient, and financial data.

Globally, human and naturally induced epidemiological changes have contributed to a myriad of emerging health challenges. This condition has necessitated digitalization of healthcare systems to handle the high demand for medical services. A European Region Digital Health Survey conducted by the World Health Organization in 2022 revealed tremendous progress in the implementation of digital health. Digital technologies such as Big Data, Artificial Intelligence (AI), Internet of Things (IoT), Wearable Technologies, Telemedicine, Hospital Management Information Systems, and Health Information Systems, were reportedly a feature of the European Union health sector. In 2022, the region adopted a digital health work plan with the acknowledgement that digital solutions are important in delivering people-centric healthcare. The Regional Committee who spearheaded the action planning cited digital health

as indispensable, but at the same time identified inter-country integration of digital solutions such as health information systems as a major challenge (World Health Organization, 2022). With extensive adoption of MIS for hospitals, the committee fronted users' digital literacy as a key aspect of successful transition to digital healthcare. In order for the digital tools to be meaningful, it also requires proper legislation, functional governance, good policies, and more importantly, training and support to the health workers as the enabler of effective use and end-user satisfaction (WHO, 2022).

Nordic countries are part of the regions where tangible digital technology manifestations has been observed. In 2021, an OECD survey reported maturity and increased use of EHRs, though citing fragmentation as a major concern (Slawomirski et al., 2023). In Norway, we have a National Healthcare System connecting all the hospitals. The system enables electronic health messages interchange, including lab reports, discharge letters, referral letters, section-specific reports within the hospitals, and in extension to the entire health sector (Slawomirski et al., 2023). In South Korea, a study by Lee, Seo, Yoon, Yang, Yi, Kim, and Lee (2022) targeting tertiary and general hospitals reported that 90.5 percent of the targeted facilities had implemented EMR systems, more than 50 percent of the hospitals were also utilizing clinical data warehouse for secondary usage of the data, especially for analytics. Acknowledging the significant individual cost incurred by hospitals to achieve digitalization, the Korean government backed healthcare institutions in implementing EMR-based MIS including a Customer Relationship Management System, Admission-Discharge-Transfer System, Digital Provider-Order-Entry System, a lab system, Activity Based Costing system, a Picture Archive and Communication System, and a Data Warehouse to attain the reported extensive digitalization.

In 2018, WHO urged African countries, majorly comprising developing countries, to utilize digital technologies such as Electronic Health Records (EHR), as a means of improving

healthcare and guaranteeing patient safety (WHO, 2018). This came at a time when WHO had noted loss of lives due to poor healthcare service attributed to medical errors that resulted to astronomical economic costs. It is noteworthy that developing countries have embraced information and communication technologies to improve on service delivery and reduce operational costs. According to Ajayi, Wamae, and Muthee (2021), developing countries such as Nigeria experience several challenges in an effort to achieve quality service delivery. This ranges from use of manual to hybrid systems, limited modules for implemented EMR systems, causing medical errors and poor medical follow-up. Implementing hospital management information systems is termed crucial. Several African countries have, therefore, hugely invested in IS projects, capital intensive projects that warrant evaluation of there success.

In South Africa, there exists a Digital Health Management Information Systems Policy that creates a baseline for MIS implementation across the health sector. The policy lays a monitoring and evaluation framework for the capturing, collation, and ultimate dissemination of health data. The MIS avails data for planning, reporting, and monitoring of health service in South Africa (Department of Health South Africa, 2019). The successful adoption of MIS minimizes cases of duplicated or misplaced patient records and in the ultimate, clinical errors. The system supports healthcare professionals and through its analytics characteristic, avails reports to the management for data-informed decision making across different hospital sections. This integration presents MIS as an inevitable tool that needs to be adopted by any health facility whose interest is offering efficient healthcare services. While hospitals are non-profit making, it is the concern of the management to enhance productivity for adequate returns to run the hospitals. Therefore, an initiative such as MIS implementation, that improves productivity, cuts down on operational costs, and increases chances of quality service delivery is important to adopt.

Both public and private health sectors play a critical role in the provision of healthcare services to the ever-growing population; their significance cannot be overstated. The 2018 World Bank Working Paper on "Improving Transparency and Accountability in Public-Private Partnerships: Diagnostic Report for Kenya", reported public-private partnerships (PPPs) to have become a common engagement in the health sector across Africa. This trend has redirected the skewed focus on public hospitals as the only option for affordable healthcare, to an entirety view of the health system to realize the full spectrum of health outcomes. In Kenya, for instance, 49 percent of health services are provided by the private sector (World Bank, 2018). Considering this statistic, it is indicative that the private and public health sectors have an almost equal share of patients to attend to; a huge demand that poses several challenges that affect their performance. The author additionally reports how extensive the private sector serves the poorer segments of the population, arguing that those who are richer substantially benefit from subsidized costs in the public sector, while the poorer slightly gain from the subsidies because they have to struggle in supplementing through out-of-pocket payments.

The performance of hospitals in Kenya is an issue of concern among several stakeholders, including the government, NGO's, religious institutions, hospital management boards, and patients. Interests range from access to quality medical care for the patients, financial efficiency for sustenance of the hospital's operations by the management, and affordable healthcare for the citizens by the government and other funders. The Kenyan government initiated the Universal Health Coverage (UHC) program in 2018, and this was geared towards providing affordable, efficient, and non-discriminatory access to healthcare services without catastrophic spending that can exacerbate household poverty (Ministry of Health, Kenya, 2020). Besides the UHC program, a mandatory National Health Insurance Fund (NHIF), later on christened to the Social Health Insurance Fund (SHIF) under the Social Health Authority (SHA), is designed to cater for both in-patient and out-patient care costs. SHIF, as a statutory body, has been in the

forefront among other government institutions that have embraced communication technologies through the adoption of an integrated health management information system. Through its system, accredited health facilities have an interface through which they can interact with the insurance service provider for raising claims, achieve effective membership database management, and permit registered members to interact with the system for queries as well as utilize mobile payment technologies integrated with the system. It is noteworthy that health sectors in developing countries have embraced information and communication technologies to improve on service delivery and reduce operational costs as they opt for eHealth. According to Muinga et. al. (2020), public facilities are significantly utilizing systems to make efficient hospital operations, allowing for minimal patient waiting time, data capturing, storage and sharing of hospital data during health service provision in developing countries, Kenya included. This situation is attributable to increased adoption of modern technologies and improved internet access.

On October 20th 2023, the Ministry of Health (MoH) in Kenya recorded a major milestone with the signing of the Digital Health Bill into Law by the Kenyan president. Among other connected purposes, the Digital Health Act 2023 lays the foundational framework for digital health services through the design and implementation of a Comprehensive Integrated Health Information System (CIHIS). The CIHIS enables collection, storage, analysis, usage, reporting, retrieval, and sharing of health data. The system permits several processes including secure sharing of health data to allow for data-informed interfacility health service, collection and reporting of data at varying levels within the health sector, implementation of health data confidentiality, privacy, and security measures, supporting realization of the UHC goals, and standardizing health data management, all geared towards facilitating quality healthcare in the country (Digital Health Bill 2023, Kenya). While this initiative creates a comprehensive platform for public medical facilities information and communication integration, there is

significant implementation of digital technologies at hospitals' level, encompassing patient bookings, records management, patient admission and discharge, and billing, among others.

Muinga et. al. (2020) argued that healthcare providers are meant to benefit from systems through accessing information that is needed for informed decision making, laying an informed background for improvement in quality of care, overall efficiency, patient outcomes, and overall performance. For example, through MIS, doctors are able to access patient data timely; minimizing chances for clinical errors and patient waiting time, comparable to the tedious task of retrieving patient data from physical files in a cabinet. Hospital management information systems have played a key role in operational cost reduction; using storage space effectively by eliminating data redundancy and enabling streamlined stock requisitions of medical items upon reaching replenishment levels. MIS features such as accuracy and reliability of data, friendly interactive interfaces, data sharing, and satisfaction of user requirements across all work processes delivers user satisfaction on the end users' side (Muinga et. al., 2020). It is, therefore, in the interest of the researcher to determine how the performance of Level 4 and 5 public and private hospitals is affected by the capabilities characteristic of hospital management information systems.

1.1.1 Performance of Hospitals

Markazi-Moghaddam et. al (2016) defined hospital performance as the achievement of goals in two perspectives; managerial and medical. A hospital that provides cost effective, easily accessible, and high-quality health services satisfactory to the expectations of the patients is a high performing institution. Viewing a hospital in the context of an organization, various scholars have defined organizational performance in different ways. Chmielewska et al., (2022), viewed organizational performance from the angle of McKinsey's 7-S Model, evaluating hospital performance using the model. Critical areas highlighted include leadership, conflict handling, information systems, internal communication, and staff engagement.

Financial performance of a hospital is unneglectable. According to Chmielewska et al., (2022), financial performance in a hospital setting reflects the optimum combination of effectiveness and efficiency. It is an indication of the facility's medical action quality, showing the ability to utilize the available resources for dissemination of health services that guarantees patient satisfaction (Tran & Vu, 2018). Kaplan and Norton (2001) developed the Balanced Score Card (BSC) tool that structures the assessment of organizational performance in the context of nonprofit organizations by considering internal processes, the customer's perspective, training and development staff, and financial perspective. In line with their model, a sustainable budget growth that ensures the customers, in this case the patients, get the benefits of quality care is commendable. The hospital management information system enables hospitals to track revenue and expenditure, analyzing it as it accrues across different service centers. Through the reporting and analytics tool, the system permits instant generation of financial reports that inform financial investments and budget appropriation for better wages that attract skilled staff who play a key role in improvement of quality of care (Dubas-Jakóbczyk et. al. 2020).

Positive clinical outcomes present a hospital's service delivery as of quality. This revolves around the patient's health status after medical intervention, considering their mental, physical, emotional and symptomatic relief. Improved health outcomes are pivoted on informed treatment with the right decisions taken. The MIS, through the clinical decision support system (CDSS) extension, enables clinicians with clinical diagnosis knowledge that is computer-generated with leveraging of a data warehouse, the information is intelligently filtered using various models to enhance the patient's care and treatment outcomes. However, according to Berner et. al., (2024), CDSS is not entirely relied upon by doctors given that there is a gap in the justification of its economic returns. In a study conducted across three university hospital in Germany, implementation of the CDSS did not show a statistically significant reduction in imaging orders considered inappropriate. Reports generated through the MIS help the

management to identify service areas that require improvement. For instance, long waiting times at the registration point or doctor's waiting lounge to be reduced for more efficiency. Isolation of departmental issues guides the heads in charge to ascertain the resources needed to improve the situation.

Patient satisfaction is a key indicator of hospital performance and it is a subjective evaluation of healthcare services. A patient walking into a medical facility for treatment will desire to receive the highest possible service standards, an experience that determines their rate of service utilization when in need and the possibility of recommending other patients to their healthcare provider (Tao & Liu, 2025). Adoption of hospital management information systems gives the facility's staff the ability to deliver satisfactory services. Asnawi et. al. (2019) suggest that concerns of the patients include comprehensibility and clarity of communication alongside responsiveness to patient requests and queries, seamless coordination amongst sectional services, convenience and easy access through appointment scheduling, reasonable waiting time in line, and confidentiality. MIS features allows healthcare providers to achieve all these requirements. For instance, secure storage of patient data through implementation of authorization and authentication measures ensures confidentiality, guaranteeing patient data is only utilized in the right way. Patients are in position to do bookings through appointment scheduling as well as engage the hospital's customer care for feedback on areas of concern. These limits patient waiting time, which is likely to be encountered on the occasion of unplanned visitation.

1.1.2 Management Information System Capabilities

An MIS in a hospital setting, is an abstract computer-based comprehensive system that integrates data by allowing automated administrative, clinical, and financial operations. According to Farzandipour et. al., (2017), the user's functional requirements including data management, data sharing, processing and storage are supported. The World Health

Organization (WHO) interprets MIS for hospitals as an integrated attempt to collect, process, report and utilize health related information and health knowledge for influencing program action, policy making, and research. MIS utilizes computer software and hardware, linked up by a communication network, to enable healthcare facilities to capture, store, analyze, retrieve and manage patient and hospital data with the aim of enabling informed decision making, and streamlining hospital processes for efficiency and improved patient care. In a simplistic view, a hospital can adopt a simple MIS in the form of a Transaction Processing System (TPS), e.g., a billing system, as well as run a complex system that comprises several modules.

Basel and Majeedy (2023) studied performance indicators of MIS projects, important tasks highlighted by the researchers as indicators included cost of acquisition, time, quality, scope, system reliability and user satisfaction. Data storage and monitoring of the condition of patients, hospital data flow, and financial management aspects align with user satisfaction in the hospital setting. The study postulated that interdepartmental data needs are well catered for by MIS through automated patient data sharing, including digitized images and graphics that are part of the diagnosis. Medical records for the patients are also done electronically and with accuracy, permitting data processing and analysis. On the financial aspect, they argued that MIS allows efficient administration of the hospital's finances through an effective ordering process, and real-time tracking of treatment costs, to inform financial accounting.

Information is important in an organizational setting. Its accessibility, however, determines whether it can be leveraged for relevant action. An effective MIS needs to showcase the capability to avail information that can, without any doubts, be dependent upon by the end users for decision making (Basel & Majeedy, 2023). By leveraging the ACID properties of a Database Management System (DBMS), any potential error-making situations, both by omission or commission, can be detected and barred to ensure correctness and consistency. Information access through MIS needs not to be unlimited in any way, it should be available

where it is needed, when needed, and as needed, considering self-efficacy on the side of the user (Hameed & Arachchilage, 2021). A management information system should adequately perform its purpose for the intended period of time under the encountered operating conditions. In situations where there are many users of the system, the MIS still needs to be usable without radical modification and remain responsive to the end-user requests. The system's utilization negates the concern of system unavailability and guarantees continuity of service delivery in the hospital setting.

Turulja and Bajgorić (2022) considered business continuity as another key role of MIS for hospitals. An enterprise, in this context a hospital, is capacitated to maintain its operations in times of a network intrusion or even natural disaster. In the event that the system goes unavailable, system accessibility and timeliness are impacted. Therefore, the timely restoration of operations, characteristic of a well-designed MIS, ensures service continuity. Information security is paramount with patient data. ISO27799:2016 lays out a framework for the best practices and guidelines for the implementation and management of information security in management information systems for hospitals. The framework acknowledges the sensitiveness of patient data, presenting 14 control measures that hospitals require to adopt to achieve the desired integrity, confidentiality, and availability (ISO, 2016). Among the control clauses is access control, asset management, information security policy, human resources security, organization of information security, physical and environmental security, cryptography, communication security, operation security, information security incident management, among others. Through the adoption of MIS, access control and authentication can be achieved. A set up of usernames and their associated passwords limits system access to authorized users only, while access controls using user roles and privileges determines the legitimate users of specific resources or actions within the system (Sari et. al., 2023).

Decisions made by the hospital management can taint the image of the institution or elevate its face amid the competitive healthcare service industry. Growth and performance are highly reliant on data-informed reports, which departmental heads can generate and utilize through MIS. Statistical and mathematical models within the designed system provide a platform where users run reports and analytics using the available hospital data for informed decisions. According to Akbulut and Kaya (2018), the analytical capability of MIS helps in unearthing knowledge with the leverage of a database for supporting decision making. In their research, they suggested that correlational and causational relationships can be captured, for example, in financial reporting, to inform internal and external decision making. At the external level, data sharing capability with other independent systems allows for interfacility service delivery, effective given that the data exchanged is reliable (Akbulut et. al., 2018). This system interoperability feature permits disparate systems to communicate through sharing of health data and information. Besides necessitation of interfacility medical service for patients, collaboration with external laboratories during treatment, and report submission to relevant governmental systems is enabled. Moradipour et. al., (2021) moreover suggested that MIS allows the management to ascertain customer satisfaction by utilizing customer feedback mechanisms, for instance through patient portals or strategically positioned feedback interfaces across service areas in a hospital facility. These feedback offers an opportunity for improvement of service delivery. The patients can at the same time receive reminders on their appointment bookings or relevant medical advice and facility publications through MIS.

1.1.3 Hospitals in Mombasa County

The Mombasa County healthcare ecosystem comprises both public, private-for-profit, and private-not-for-profit hospitals; all being important pillars in the provision of healthcare services in the county. These are categorized in a hierarchical system as stipulated by the Kenya Medical Practitioners and Dentists Council (KMPDC) as follows; Level 1- Community Health

Centers, Level 2- Dispensaries and Clinics, Level 3- Sub-county hospitals, Level 4- County hospitals, Level 5- Regional Referral Hospitals managed by County Governments, Level 6- National Referral Hospitals managed by the National Government. Considering all the above six tiers, Mombasa County has a single Level 5 hospital, the Coast General and Referral Hospital, being the only referral facility serving the coastal region in entirety. According to a statement by Swabah Ahmed, a Health Executive in the County Government of Mombasa, 47 hospitals that comprise the public health sector are limited in their capacity to serve the medical needs of the entire population in the county. 70 per cent of the healthcare needs in the county are catered for by private health facilities (Otieno, 2024).

In Mombasa County, hospitals encounter high patient volumes given a rapidly growing population and the prevalence of the region to vector-borne diseases (WHO, 2018). Disease outbreaks such as Chikungunya and Dengue Fever are unique to Mombasa and the coastal region in general, a situation that has increased the number of patients seeking medical attention in public and private hospitals within the county. Part six of the Mombasa County Health Act 2018 requires all health facilities to establish, utilize and maintain a health information system, a requirement that hospitals have complied with, to improve on operational efficiency and positive patient outcomes.

However, according to the DoHS Mombasa County, hospitals are still grappling with a series of challenges that affect their ability to offer quality service delivery. It is a trait that a lot of focus has been put on efficacy of transaction data for seamless process flow, data storage, retrieval, and archival, focusing less on leveraging the data by processing it into information for improved hospital administration and patient care (DoHS, 2022). Inadequate information use and data demand were reported by the DoHS in the Mombasa County Health Quality Management Policy (HQMP) 2022-2027. Patient's clinical documentation is characteristically poor, exacerbated by inadequate data storage capacity, this often results into slow patient

turnaround (Mombasa County HQMP 2022-2027). Routine data that is resultant from service delivery is unsatisfactorily used in detecting disease trends, drug stock-outs for replenishment, and resource allocation (Njuguna et. al., 2022); a situation that has contributed to poor management of hospital operations and inappropriate decision making. According to Aila (2021), inadequacy in system capabilities and underutilization of MIS extensively affects the quality of healthcare service delivery.

Development and installation of a functional system is a costly affair to hospitals and continued underutilization is poised to jeopardize financial and operational efficiency, and have a negative effect on patient satisfaction and the general performance of hospitals (Muinga et. al. (2020). Despite the benefits of utilizing MIS and the identified weaknesses, there is limited comprehension of how these systems influence the overall performance of hospitals in Mombasa County.

1.2 Statement of the Problem

Uneven progress in the development and adoption of e-health systems across hospitals in the 47 counties in Kenya has substantially affected their performance (Orrell, 2020). According to the Kenya Health Informatics Association, KeHIA (2020), time lags have been recorded in the submission of reports on key health metrics; fueled by a documentation gap with hospitals holding partially digitized records and paper-based records. In addition, health facilities are experiencing poor tracking of commodities due to improper tracking systems; this often leads to unforeseen cyclic stock-outs (MoH, 2020). With routine data captured using hospital management information systems not leveraged to inform timely decision making, patients are compelled to purchase expensive drug prescriptions outside the facilities (Karijo, Otieno, & Mogere, 2021), coupled with occasional long waiting times (Mwang'ombe et. al., 2019) in accessing medical attention.

Data captured in a digital way is fundamental in the identification of problems and existing needs in healthcare service delivery for prioritization. According to Odanga & Wachiuri (2022), MIS allows health facilities to cut down on operational costs through efficient inventory management that reduces incidences of stock-out for prime medical resources. Utilization of data through data analytics and reporting allows for consistency in patient management and low running costs due to reduced recurrence of diseases, (Karijo et. al., 2021). A study by Odanga and Wachiuri (2022) on the determinants of Inventory Management in Public Hospitals in Mombasa County, Kenya, concluded that information technology significantly improves the performance of inventory flow in public hospitals. Abdihakim and Tumuti (2022) examined how information security affects the performance of public hospitals in Garissa County, Kenya, indicating a gap in existing information security measures at the facilities. The study recommended sufficient adherence to IS security protocols besides the general capability of the system to allow data collection, comparison of expected versus actual performance standards, and communication with patients, electronically. Oreni et. al. (2021) studied how technological factors at Kenyatta National Hospital influence data quality. In their findings, they determined that technological concerns such as network issues posed a problem to MIS utilization and thus data quality, recommending the hospital's management to keep up to date with the latest information security measures and innovative technological trends. Orang'i et. al. (2019) looked at the effects of information systems on service delivery in private hospitals in Nairobi, exploring system integration and interoperability policies that can improve healthcare service dispensation. They noted that there is an existing Electronic Data Interchange application that allows collaboration and sharing, but they went ahead to recommend that all medical records should be computerized to permit seamless sharing and reporting by the private facilities under study.

The studies reviewed point at a conceptual gap, with limited conceptualization of the capabilities that a hospital management information system offers. While the studies have addressed issues to do with service delivery in hospitals, focus is on information security, data quality and interoperability policy issues. Undertaking the study in Mombasa County with focus on service delivery automation, system management, data security, and information quality as the capabilities fills this conceptual gap. Mombasa County is additionally yet to be surveyed to comprehend how the identified concepts influence the performance of public and private hospitals; creating a contextual gap. This study, therefore, sought to employ a descriptive research design to survey technical ICT staff in both private and public level 4 and 5 hospitals in Mombasa County and how they perceived the influence of service delivery automation, system management, data security, and information quality on hospital performance.

1.3 Objectives of the study

1.3.1 General Objective

The study seeks to examine the influence of management information system capabilities on the performance of hospitals in Mombasa County, Kenya

1.3.2 Specific Objectives

The following specific objectives guided the study:

i. Establish the influence of service delivery automation on the performance of hospitals in Mombasa County
ii. Examine the effect of system management on the performance of hospitals in Mombasa County
iii. Determine the influence of data security on the performance of hospitals in Mombasa County
iv. Assess the effect of information quality on the performance of hospitals in Mombasa County

1.4 Research Questions

The study's focus was on answering the following research questions:

i. What effect does service delivery automation have on the performance of hospitals in Mombasa County?
ii. What influence does system management have on the performance of hospitals in Mombasa County?
iii. What is the effect of data security on the performance of hospitals in Mombasa County?
iv. What is the influence of information quality on the performance of hospitals in Mombasa County?

1.5 Significance of the Study

The demand for medical care is ever increasing and this elevates the level of operations in the hospitals. To keep up with this growth, industry players need to be up-to-date with modern technologies that ensure efficiency in service delivery in the organizational setting, especially leveraging hospital data through acquisition and implementation of hospital information systems to automate operations and aid in informed decision making. Just like any other investment, reviewing is important to determine whether the objectives are being met. According to Mohdi Fadhil et. al. (2012), assessment of end-user satisfaction with MIS and subsequent monitoring for the long term for surety on their level of satisfaction is critical. It directly relates to usage and is also a determinant of system acceptance. Cases where internal system users encounter delays in information sharing, incomplete information, misplaced data, inability to access and share data, and missing user requirements, jointly lead to poor service delivery subjective to the patients, and at the detriment of the health facility.

Level 4 and 5 hospitals in Mombasa County are to benefit from the findings of this research through identification and prioritization of MIS capabilities for achievement of satisfaction

among their clinical and non-clinical staff for effective and efficient service delivery. Other healthcare providers at lower levels also stand to benefit through insight on how to improve the patient's experience and streamline their processes. Additionally, researchers in the field of healthcare technologies can benefit from the findings of this study in their literature review. Health informatics remains a critical option in the midst of complex hospital settings with multiple medical functions.

1.6 Scope of the Study

The study sought to ascertain the influence of hospital management information system capabilities on the performance of private and public level 4 and 5 hospitals within the boundaries of Mombasa County. The major capabilities of focus were: service delivery, data security, information quality, and data management, being essential capabilities of a MIS in a hospital setting. The scope was limited to Level 4 and 5 hospitals because their required level of operations as per the KMPDC requirements warrants a sturdy hospital management information system. There were 31 level 4 and 5 hospitals comprising both private and public facilities, all will be units of analysis. Respondents of the study comprised hospital workers in the ICT department across the 31 health facilities. The performance of these facilities was assessed by considering patient satisfaction, financial efficiency, and operational efficiency for the period 2019 to 2023 given that it is the most recent 5-year period. The study was conducted in an approximate four-month period, including data collection, data analysis, and report writing.

1.7 Limitations of the Study

Considering the workload that was characteristic of the hospital setting, especially for the ICT staff who were mostly engaged with ensuring the system is up and running, the researcher could encounter delays in data collection. It could, therefore, require follow up to remind the

respondents to fill the questionnaires, even though the researcher allowed adequate time for the respondents to respond.

Secondly, the respondents could have concerns about the confidentiality of the strengths or weaknesses of their facilities' systems; with the fear of exposure to unscrupulous individuals through system intrusion attempts. In an effort to mitigate this limitation, the researcher not only assured but also ensured confidentiality, after informing them about the purpose of the study being strictly academic. An introductory letter from the institution, the Mombasa County Department of Health, and a research permission letter from the National Commission for Science, Technology, and Innovation (NACOSTI) was sufficient to win the confidence of the respondents in the targeted hospitals.

1.8 Organization of the Study

This study is structured in three chapters. Chapter one comprises the introduction and background of the study, discussing in detail the independent variables and dependent variable. In addition, the research problem, research objectives, significance of this study, the questions that will guide the study, the scope and expected limitations are presented. Chapter two details the literature review, both theoretical and empirical, follow by a table summary of the literature review showing existing gaps. A conceptual framework comes at the end of this chapter, a graphical summary of the relationship between the independent variables and the dependent variable. Lastly, chapter three presents the research methodology to be employed including the research design, target population, sampling techniques and the size of the sample. The procedure for determination of validity and reliability of the study is presented, the data collection procedure and instrument, and the data analysis methods and presentation. Chapter four presents the research findings and discussions. Chapter five presents the summary of findings, conclusions, recommendations and suggestions for further studies.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviews existing theories that are relevant to the independent and dependent variables under study, the empirical review which discusses previous studies related to the research topic, and a critique of the relevant literature for identification of research gaps. The chapter ends with a conceptual framework, pictorially representing the relationship that exists between the independent variables and the dependent variable.

2.2 Theoretical Review

The theories adopted in this study are the Systems Theory, Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology, and Resource Based View Theory.

2.2.1 Systems Theory

In his philosophical view on holism, Aristotle argued that the properties of the whole are more than the sum of the properties of its parts. It is upon this premise that the systems theory was formulated as a framework for comprehending phenomena in a holistic approach by Bertalanffy (1968). As propounded, systems theory considers a system as a composition of interconnected and interrelated parts all functioning towards the achievement of a common goal (Teece, 2018). Focus is on the integration, complementarities, and the outcomes resulting from the interactions among the elements of the system. Generally, systems are networked and nested. There are clearly existing boundaries within the system and the output of one sub system is an input for another. The sub-systems are unique in their own capacity and have dynamic capabilities, for instance, an organization in the form of a hospital comprises different sub-units such as the outpatient, emergency, maternity and neonatal, pharmacy, laboratory, and administration departments. Each is connected to others internally and externally where applicable. While still considering a holistic view as the premise of the systems theory, the individual elements that comprise the system are not to be neglected. They need to be comprehended and appreciated. A feedback loop is also a required element in systems theory.

The loop comprises external changes' information that flow into the system for the components to adjust accordingly to the environment, at the same time keeping intact the interdependent internal parts in alignment to existing plans (Teece, 2018).

Systems theory applies contextually as one of the main objectives of MIS for hospitals, which serves to integrate all the interdependent sections that are part of the patient's journey right from patient registration, admission, patient treatment, patient health data documentation, billing, to patient discharge. The components of MIS are interconnected and interrelated, with their common goal being quality healthcare service delivery for patient satisfaction. Interoperability with external systems allows for data exchange and as Leung (2012) suggests, healthcare institutions are capacitated to successfully handle unexpected external events by realigning their strategies as informed by insight from the external environment's data captured by the MIS. The system's environmental adaptability is necessitated by the networked feature of systems as fronted by the systems theory, and the feedback loop which permits external information flow for relevant adjustment of the system.

While boundaries exist within the system, data generated in one subsystem as output is an input in another subsystem. For instance, diagnostic test results from the laboratory are an input in the clinical section for applicable diagnosis. As data emanates across the sub systems, it is integrated for unlimited accessibility by designated end users. For instance, the administration sub system's interaction with the human resource sub-system informs the human resource needs for HR planning, while the clinical inventory enables timely replenishment of medical requirements for uninterrupted health service delivery. Systems theory, therefore, explains system management, detailing how the MIS presents the hospital in an integrated approach allowing for comprehensive reporting and analytics, with internal and external interoperability necessitated. Service delivery is equally explained, as patient data in the form of output in given

sub-systems is used as an input in other subsystems during the patient's journey and engagement.

2.2.2 Technology Acceptance Model

Technology Acceptance Model is a brainchild of Davis (1986). Under this theory, Davis explains the driving force behind end users of an information system accepting usage of technology (Durodou, 2016). Two factors are highlighted by the model, as the contributors to information systems acceptance; perceived ease of use and perceived usefulness. Perceived usefulness is considered as the extent to which an individual is convinced that his performance will improve in reality if they make the decision to use the system. For perceived ease of use, Davis (1989) defines it as the level at which the user is convinced that the information system will eventually ease their physical and mental effort. According to Zhang, Aikman, & Sun (2008), perceived ease of use motivates and captures the users to take up and use the system. The two views create an attitude which translates into a behavior intention that then culminates in their usage of the system at hand. The complexity of the system notwithstanding, if the user perceives it to have the capability of improving on their work performance, they will own it up. For the complex of systems proposed and introduced, the users are likely to accept so long as the system meets the threshold of the perception of a positive impact on the work.

Technology Acceptance Model is relevant to this study because it introduces perceived ease of use and perceived usefulness, which are enablers of system acceptance, and this relates to the quality of the output of the system, in terms of information accuracy, completeness, timeliness, and confidentiality of the output of the system to make task execution easy and relevant by the end users, and improved work performance in the ultimate. For system acceptance to be realized, a user-friendly interface allows the end user to easily utilize the functionalities of the system. It negates the possibility of the user resorting to the manual system as the MIS presents no hurdles both in learning how to use the different modules and the actual usage. A manual

system of operation, e.g. manual patient registration, is likely to translate into longer waiting time in line and increased costs. For an individual's performance to be improved, the system's capabilities play a key role. A medical doctor benefits from information quality; namely timely, complete, accurate, and relevant data; this aligns with the perceived usefulness of the system.

Patient data is bulky as well as sensitive. Therefore, data security, characteristic of the MIS, guarantees integrity and reliability of the data, through access control and authentication, building confidence and individual work performance as an expectation under perceived usefulness. Moore et. al. (2020) suggest that MIS makes it easy for the hospital staff to access relevant information while at the same time protecting the patient's privacy through confidentiality. Audit trails enable the system administrator to keep track of changes to data for accountability purposes. Information quality and data security as MIS capabilities are therefore explained by the Technology Acceptance Model under perceived ease of use and perceived usefulness.

2.2.3 Unified Theory of Acceptance and Use of Technology

Developed by Venkatesh et. al., (2003), the Unified Theory of Acceptance and Use of Technology proposes that the use of technology is influenced by behavioral intention. The theory suggests that technology is likely to be successfully adopted depending on the effect of the following key issues; performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et. al., 2003). These predictors are moderated by experience, gender, age, and voluntariness of using the technology.

Performance expectancy is about the belief that the system helps an individual achieve gains in their work performance. For instance, financial investments are initiated with an ultimate goal; the gains that an investor in an organizational setting expects to achieve. Effort expectancy is the extent of ease an individual has in the use of a system; the mental and physical effort needed to make use of the system. On another hand, social influence entails the extent to

which a person develops the perception that other important people hold the view that they need to use the system. The use of this factor is important where technology use is a mandatory (Venkatesh et. al., 2003). The author considered facilitating conditions as the extent of believe by the user that the respective organization's technical infrastructure, expertise and related capabilities are available to help in the system usage.

UTAUT is applicable in this context, for the automation of service delivery substantially improves task execution, reduces potential medical and administrative errors and increases efficiency, ultimately elevating performance expectancy. MIS for hospitals employs integrity constraints within the system files or database, a feature that ensures all the data captured is accurate, thus reliable. Interdepartmental communication, facilitated through data sharing, enables collaboration and timely task performance as a gain on the side of the system users. According to Arvanitis and Loukis (2016), adoption of Computerized Providers Order Entry (CPOE) and Electronic Medical Records (EMR) modules reduces communication errors and enhances clinical information quality, enabling reliable task execution as a gain in task performance.

With an automated patient's journey, the effort required to perform routine hospital tasks, for example, patient registration and sharing of documents between different nodes on the communication network, significantly reduces. This capability enhances the perceived ease of use. Performance expectancy is additionally enhanced through system integration with an integrated storage, allowing different system modules to seamlessly work together for efficient operations. A centralized and integrated storage paves way for internal and external interoperability, and analytical capabilities for data-informed decisions.

Data security measures, if robustly enforced, form part of the facilitating conditions that serve to guarantee a trustworthy and reliable system; a situation that increases trust and encourages

utilization. This theory is considered accountable for the motivation by hospitals to adopt and use management information systems for its service delivery automation and integrated data management.

2.2.4 Resource Based View Theory

Posited by Penrose (1959), Resource Based View Theory focuses on an organization's internal resources as the main determinant of its performance and source of competitive advantage. Competition is not limited to the non-health industry organizations, hospitals need to have concerted effort in attracting more patients, the best staff, and modern technologies through building a strong brand of quality patient care. Penrose (1959) suggests that for an organization to remain relevant and perform as desired, the resources in their possession need to be firstly valuable, show rarity, be inimitable, and non-substitutable. The resources and capabilities under consideration are better off if they have features of immobility and heterogeneity, for instance, availability of tacit knowledge which the organization is in full control (Bharadwaj, A. S., 2000). Systems are an important and critical resource which organizations can leverage for gaining a competitive advantage comparable to other organizations that have lagged behind in the adoption of technology as an enabler of quality service delivery.

MIS is a valuable internal resource that has the potentiality of being designed to be inimitable, non-substitutable, and have elements of rarity. In a hospital setting, a comprehensively designed and implemented MIS considerate of all use cases as gathered during user requirements determination gives satisfactory experience to both the patients and hospital staff. Acknowledging that the system itself as a resource requires other resources for implementation and successful utilization, talented human resources in the form of IS staff is a leverage for a hospital. A well-functioning system implies effectiveness and efficiency in healthcare service delivery among peers in the healthcare industry. This theory supports the general objective of

ascertaining MIS capabilities' influence on the performance of hospitals in Mombasa County in Kenya.

2.3 Empirical Review

This sub-section covers past empirical studies by other researchers. The focus is on literature about MIS capabilities and the performance of healthcare facilities, systematically reviewed on the basis of service delivery, system management, data security, information quality and the performance of hospitals in Mombasa County.

2.3.1 Service delivery automation and performance of hospitals

Wandie and Muathe (2022) argued that organizational efficiency in the healthcare industry is a necessity for it ensures quality of service, which directly affects consumer satisfaction. It is prudent that patients receive the service they seek. Patient-centered healthcare service delivery incorporates the patient's medical experiences and adequate attention to their welfare. Service delivery in a hospital setting entails a series of administrative activities that are mandatory for the dissemination of clinical treatment. The patient's initial journey at a hospital starts with submission of their demographic data at the registration desk; a step that paves way for transition to the waiting bay as they await consultation with the doctor. The process involves filling out forms, manual or digital, as designed by the hospital management to keep record of the patient data for informing the patient's journey within the facility.

A study by Mwaniki (2018) found that hospitals are opting for incorporation of ICT in capturing health data considering the shortcomings presented by a manual system of capturing and transmitting data during the patient's journey at a hospital. MIS for hospitals provides a platform for capturing the patient's demographic, personal, and insurance or pay-out-of-pocket details. The recorded data informs the creation of a unique patient ID that will be the primary key used for tracking the patient's details in their subsequent interactions with the hospital. Records ranging from patient's notes, patient's registers and indexes, ward and nursing records,

and pharmacy records are captured digitally for convenience (Mwaniki, 2018). In a study by Perdana and Mokhtar (2023) on leveraging digital technologies for information technology-enabled healthcare transformation in Singapore, the researchers acknowledged that operations such as medication ordering and medical appointments can be tedious in a large public health organization. Recommendation from the doctor for patients' admission, if digitized, ensures consistency in offering high-quality care. In their study involving Sing-Health, the largest public health facility in Singapore, Perdana and Mokhtar (2023) suggested that with a functional MIS, bed allocation and occupancy can be conducted and monitored for efficiency. MIS allows the staff in charge to ascertain bed availability for assigning depending on the care requirements and patient's condition, i.e., whether ICU, HDU, or General. Bed occupancy can be tracked in real-time, categorically as uncopied, occupied, or under maintenance.

In their study, Abolhallaj et. al. (2021) highlighted the benefits of financial management system, as a subsystem of a hospital MIS, in providing an integrated platform for processing, recording, and producing accrual and standard financial information. As a patient interacts with different sections within the hospital, the billing process can be automated right from the start using the financial management module. Charges for the series of services rendered to the patient are calculated, insurance claims raised where applicable, and invoices generated (Zhang, 2022). The patient then processes payment through the platform using e-payment options, e.g., mobile payments and they are issued with receipts, printed out at the billing desk. Zhang (2022) claimed that payment processing through a financial management system broadens the connotation of what it means by financial management; it allows for revenue and cost management, enhances integrity in financial issues in an organization, and permits integration of hospital management and financial management. The MIS ensures transparency and accuracy of financial transactions, by centralizing all transactions into auditable and accountable payment platforms.

Through the system, patient engagement is enabled as patients have the option of scheduling their appointments for treatments, consultation, or follow-up visitations (Hermes et. al., 2020). In this case, both the healthcare provider and patient can be enabled to view the current doctor's schedules and make appropriate bookings as per the days available. Rescheduling and cancellations are allowed by the system, allowing for flexibility whenever the situation demands. Through the provided contact details, the patients can also be automatically reminded, e.g., through email, for booked sessions that are almost due for timely preparation.

A customer feedback subsystem, which is a module on the MIS, allows patients to raise concerns, comments and respond to customer satisfaction surveys. Hu et. al. (2019) highlighted that patient satisfaction deserves adequate attention in any given healthcare setting given that most customers are reasonably aware of their personal rights when accessing medical care. As customers, their concerns revolve around the waiting times, quality of the environment around the facility including general ambience, the conduct of the medical staff, how involved they are in treatment decisions, the accessibility of different sections of the facilities, and convenience in accessing them (Hu et. al., 2019). Moreover, patient satisfaction is a product of the interplay and interaction between the perspective of healthcare providers and patients on quality of care (Sun et. al., 2020). The key metrics that customers consider on quality of care include communication, technical quality, time spent, and interpersonal aspects characteristic of the physicians. The MIS allows patients to rate the services as rendered, and their general experience. Through the feedback received, the hospital management is able to improve on the patient satisfaction level by implementing measures to optimize process management. Patients are then able to witness reduced waiting times in line, improved humanism among the medical staff, and enhanced ambience within the hospital premises. In the aspect of communication as suggested by Sun et. al. (2020), patient education is perceived as an important element of quality care even after the patient is discharged. Hospitals can prepare relevant education

content that is then communicated through the system to patients, whether still at the hospital or discharged, via their contact details.

MIS for hospitals allows for clinical documentation through Electronic Health Records (EHR). The patient's treatment plans, any related medical history, and lab test results are captured to inform clinical decisions and at the same time facilitate confidentiality in the access of patient data. Modi et. al. (2024) in their study noted that reduced readmission incidences and improved operating margins contribute to higher adoption of HER. Accuracy, reduced cost benefits, and efficiency are achieved as patients traverse the hospital departments. In laboratory management, lab attendants are allowed to receive orders for conducting diagnostic and laboratory tests. The results are then sent directly to the relevant parties for action, including patient-specific prescription for the pharmacy department. At the pharmacy, the system manages inventory and medication orders, tracking inventory flow for timely replenishment. The pharmacy attendant is able to access the prescribed medications for respective patients for dispensation upon fulfillment of the billing request. According to Orang'i et. al (2019), networked communication between the patient administration system and the electronic health records (EHR) permits accurate capturing of substantial amounts of patient data for storage and accessibility. Upon treatment, patients who are medically fit for discharge are required to comply with several administrative requirements, a process that can be managed through the computerized system. The system allows the discharge team to ensure all the clinical and administrative criteria are met prior to successful release of the patient. Liaison with the financial management module ensures billing is finalized and the subsequent appointments are scheduled where applicable. Collectively, these measures enhance patient experience and improvement of healthcare service quality.

2.3.2 System management and performance of hospitals

Hospitals generate a lot of data in the course of providing medical care to patients. While this data informs the type and level of medical attention to be dispensed to patients, leveraging it enables the management to develop insights which are fundamental in making decisions related to healthcare service delivery improvement. Holding heterogenous data in data silos poses an operational challenge and as Jayaratne et. al. (2020) suggested in his study on data integration for patient-centered e-healthcare, clinicians are limited in their efforts to build a comprehensive picture of the patient's medical history, and patient's having a holistic awareness of their health condition.

Management information systems utilize databases to offer an integrated storage platform for storing huge amounts of data, enough to accommodate the ever-growing amount of data amid hospital expansion and unending demand for medical care. Centralization of data assets allows for data accessibility and equips every relevant stakeholder in the hospital setting to actively and effectively play their role in decision making towards patient-centered healthcare (Jayaratne et. al., 2020). Data integration permits implementation of data security measures, including username-password authentication, privilege and role-based access to system resources, and comprehensive tracking of audit logs within the system. Considering the sensitiveness of patient data, accuracy is achieved; presenting the data as reliable for clinical and administrative decisions. According to Oliveira et. al. (2023), healthcare systems, policymakers, and hospitals benefit from data integration by accessing a seamless combination of hospital data spanning across multiple sources, offering substantial benefits which contribute to patient care improvement and enhancement of public health efforts. Zhang et. al. (2020) argued that integration of data evades the challenge of effectively conducting data mining as a solution for improved healthcare service. Patterns within the data, if extracted, inform decision making. With data aggregated from different sources into a central repository, data accessibility

is uncompromised. System users are enabled to access, upon authentication and authorization using their login credentials.

Often times, collaborative engagements arise between the hospital and external stakeholders, e.g., patients, other healthcare facilities, insurance agencies, or government bodies calling for interoperability. Data integration makes data interoperability effective for all patient and hospital data are centralized for data sharing and exchange. Data interoperability is the ability of independent systems to communicate and exchange data for collaboration. In their study on healthcare interoperability across European borders, Gavrilov et. al. (2020) indicated that interoperability of systems plays a fundamental role in the delivery of healthcare and at the same time reduces healthcare related costs between independent systems in different countries. The researchers addressed the concept of Health Level Seven (HL7) specifications on the transfer of administrative and clinical data across hospitals, which includes semantic interoperability, technical interoperability, and process interoperability as the key measures to be adhered to, for instance through standardized data formats, terminologies, and vocabularies. Okemiri et. al. (2020) suggested that a hospital management information system is better if it is compliant to the HL7 standards as advanced by the International Standardization Organization (ISO), for healthcare interoperability. Hospitals with an interoperable MIS are in position to exchange health data with external stakeholders for interfacility treatment and other relevant purposes.

Hospital operations scale up as time goes by due to the several factors, including high patient turn up that demands for acquisition of new facilities or expansion. It requires a scalable solution. This comes with huge demands for processing needs as well as growth in the volume of data as more patients stream in for medical care. MIS offers the capability of increasing the storage capacity and processing power for the huge data loads. Additional hardware such storage arrays, database servers, and networking infrastructure substantially help in handling

the increased transaction volumes. Aldwairi et. al. (2023) suggested that adoption of non-relational databases (NoSQL) as part of the MIS provides more scalability since the structure is loosely defined, has a flexible schema and is not restricted to a strict schema and tables as for a relational database. Hospitals with a MIS have the option of utilizing non-relational databases for scalability but at the same time, relational databases offer scalability through hardware and software expansion which is effective unlike for legacy systems which require additional cabinets presenting bulkiness. Additionally, Munjal and Bhatia (2022) pointed out the concept of cloud computing in their research as safer, unlimited, and economically feasible alternative for storage of health data. 'Cloud' is used symbolically to denote the Internet, whereby users upload data to a secure online server that offers unlimited storage space for vast amounts of data. Tahir et. al. (2020) defined cloud computing as a large-scale online computing platform which allows users to compute on dynamically configurable, highly available, and scalable resources. This storage solution offers a scalable option amid the growing amounts of data. Through a system with a cloud-based database, patient records are stored, encrypted to make it accessible and interpretable to the service providers and authorized users, and made available for processing. Homomorphic encryption, if implemented, permits processing of encrypted data and sharing of encrypted results (Munjal and Bhatia, 2022). The researchers argue that cloud computing increases efficiency in healthcare.

Organizations that leverage availability of data benefit from data analytics and reporting solutions. Through the system's analytics tools, insights can be generated from the centralized data assets spanning across all the departments within the hospital. Senitan and Alzahrani (2025) noted significant improvement in emergency department efficiency with a decline in waiting times, workflow optimization, and scalability enabled through analytics. Among the tools adoptable are data mining and optimization modelling that MIS incorporates for the analytical needs of the end users. According to Jayaratne et. al. (2020), MIS users have

predictive analytics tools, interactive dashboards, and data warehousing tools at their disposal, enabled by the integrated data, reflective of all the sections within the hospital. Further, Zhang et. al. (2020) emphasized that the quality of the patient data and hospital data is critically important in performing data analysis effectively, for the extraction of meaningful insights for decision making. Analyzed data requires a platform for presentation to enable easy comprehension. Through MIS, data visualization and reporting are enabled via contemporary reporting systems which include interactive dashboards. Users can create the latest reports and run updates of customized reports, uniquely presented in graphical displays to highlight any relevant historical trends and performance metrics for the hospital. According to Ogundele et. al. (2018), the interactive dashboards are effectively designed to enable the users direct their focus on data that is relevant to their roles, reports presented in tables and graphs that are understandable for interpretation. Ogundele et. al. (2018) also suggested that with volumes of data in the databases, hospitals can utilize data mining techniques to extract insights from the complex data. Data mining tools enable the analysis data to discover knowledge on aspects such as survivability of patients, detection of fraud, treatments, etc., for informing patient and management processes improvement.

2.3.3 Data security and performance of hospitals

In their study on EHR and how IS researchers can contribute to healthcare transformation, Kohli and Tan (2016) considered privacy of health-related data as the main concern of patients, being the direct recipients of healthcare services. They further categorized stakeholders into two levels; primary and secondary stakeholders. Primary stakeholders are the ones who generate and have the privilege to directly access patient data in the EHR, including healthcare providers, patients, and purveyors. On the other hand, secondary stakeholders have indirect access to patient data, this includes insurance agencies, researchers in the health industry, local and state agencies, technology vendors, etc. Patient data revolves around the personal life of

individuals thus the need for privacy. While some data sets have no harm being publicly available, other types have differing privacy levels. Patient data is considerably among the highly sensitive, required to be accessed by authorized users only (Al-Muhtadi et. al., 2019).

Access control is necessary to prevent unauthorized disclosure of patient data on sensitive issues such as communicable diseases or mental health, for this can end up interfering with their social life and employment opportunities (Kohli and Tan, 2016). In the providers perspective, inaccurate records invite the risk of missing out important clues while treating their patients. Collectively, therefore, patients and providers would be concerned about data accessibility control, authentication and digital foot-printing, and the capability to recover from a possible data breach or disaster.

User authentication is an effective method of verifying a potential system user's identity. Users of MIS are required to have a username and password combination. A match of these two identifiers is what allows authorized personnel to access the system and view or amend the patient's data as applicable. According to Haleem and Khan (2024), single factor authentication is to an extend insecure, compelling health facilities to opt for attribute-based control, biometric technologies and smart cards as viable options for attaining the triad of Authentication, Authorization, and Availability. Advanced MIS systems prioritize biometric verification ranging from retina scans, gait recognition, facial recognition, finger print scanning, or iris scanning. Given that it is based on unique physical characteristics, biometric authentication has become the most sought-after method for verifying the user's identity. Two-factor authentication is another alternative preferable to single-level username-password approach. As suggested by Al-Muhtadi et. al. (2019), the method allows for addition of an extra security layer, for instance, using a one-time-password (OTP) that is send to a submitted contact address e.g., email or phone, to further verify the user's identity.

While a user can be authenticated as the authorized personnel to access the system, access control is important for it restricts the level of interaction a user has with the system. Considering user authentication, Haleem and Khan (2024) fronted that strict control on the accessibility of health information is important, regardless of whether the records are paper-based or electronic. In the case of traditional paper-based records, records being moved between departments by administrative staff are vulnerable to being accessed, including private data which is not needed in their capacity for it is beyond their comprehension and usage in fulfillment of their duties. Hospital management information systems incorporate access control measures that are tailor-designed to the needs of every system user. A report by the Health Insurance Portability and Accountability Act (HIPAA) cited both external and internal threats as worth of attention, with a third of the reported incidents attributed to internal threats such as poor credential management and mis-configuration (Amod, 2025). To curb these threats, user privileges setting is provided by the MIS, allowing the system administrator to grant permission on what actions users can do and which resources they can access in the system. These privileges include read, write, execute, create, delete, modify, grant privileges to other users, execution with elevated privileges, and administrative privileges. Internal users pose a reasonable threat to patient data security yet most organizations focus more of their attention on detecting and preventing external attacks (Amod, 2025). The researchers commend the major role user privileges play in maintaining data security, for it ensures sensitive information is accessed by the applicable medical professionals and individuals are allowed to perform authorized tasks only. MIS also allows for role-based access control where a system user's job function or roles are used to allocate them to a bundle of roles assigned to several users of equal rank. For instance, administrators, physicians, doctors, are assigned roles distinct from each other depending on privileges applicable to their positions.

According to Argaw et. al. (2019), the motive behind data breaches is often financial gain because patient data and health data in general is of high value online. Patient records include personal details such as residential addresses, dates of birth, contact information, medical conditions history, thus it can aid in criminal activities. Other motives for security attacks can be hacktivist interests, terrorist interests, and retribution. The system utilizes encryption technologies during transmission of data from one node to another in a communication set up within the system. This is also applicable to the data stored in the database. Even with unauthorized access to patient data, encrypted content guarantees non-comprehension of the data until it is deciphered using the requisite decryption keys. Data security is further enhanced with the combination of authentication measures.

Considering the HIPAA report on internal system security threats, user privileges and roles can be used to enter or modify patient data maliciously. Information whose base is dishonest is not reliable enough for informing decision making, accuracy needs to be given priority. An audit trail of the actions taken by different authorized system users is important for accountability purposes. Auditing is the attempt to trace different stages of a process by identifying the persons involved, their locations during the different stages, and the exact times. In their research on how blockchain technologies can be utilized in HER access auditing, Ullah et al. (2024) proposed how who, why, when resources are accessed, utilizing Purpose Access Based Control (PABC) to detect any tampers in real time. These includes patient records accesses, login attempts, and any modifications done to the data in the database. Audits need to be performed transparently and independently for classification of all relevant information on the flow of transactions in transaction management (Ullah et al., 2024). In a digital data audit, the contents of the files are verified for a selected period in the past. MIS allows for audit trails to be conducted regularly by tracking the audit logs, as it is the recommendation of Regueiro (2021) that audit trails need to be done as a normal procedure for internal systems control.

A research study conducted by Kumar et. al. (2021) on disaster recovery of data applications towards cyber security attacks found out that risk management through anticipation, assessment, identification, and control for unforeseen system outages or breakdown guarantees continuity of communication and system access. Vulnerability exists in different ways and this can be exploited by attackers who might deny utilization of system resources or even delete the entire data in the databases linked to the system. Data replication is among the common alternatives for back-up in case disaster strikes in the cyber world. Data available in the database where primary processing runs is copied to another storage that functions as a secondary processing platform (Ruhang, 2023). MIS additionally permits cloud storage where a back-up copy of data in the primary processing database is stored on cloud servers unlike physical servers. Prior to being transferred to the cloud storage service, the data is encapsulated in the form of back up data streams. A special recovery back up system allows the data to be accessed whenever it becomes necessary (Kumar et. al., 2021).

2.3.4 Information Quality and performance of hospitals

Rumisha et. al. (2020) asserted that effective planning towards healthcare dispensation for positive patient outcomes requires correctly captured, analyzed, and timely data presented for interpretation into information. Reliable and safe healthcare delivery requires high quality data which the WHO recommends it has the dimensions of timeliness, completeness, reliability, accessibility, validity, accuracy, legibility, confidentiality, and usefulness (Endriyas et. al., 2019). The system's ability to integrate data collection for processing and reporting facilitates decision making for improved healthcare service. However, the researchers advocated that information needs to be of good quality in terms of accuracy, timeliness, completeness, and consistency. Information that is satisfactory in all the above aspects is substantial in monitoring, evaluation, and prioritization of interventions for healthcare service improvement (Rumisha et. al., 2020). One of the factors that compromise the quality of information is the presence of

system users with a limited understanding of MIS functionalities due to inadequate skills. This category of users is prone to errors while entering data in the system. However, the system provides features that ensure data captured, stored, and retrieved in the system for use is of the desired quality. In a study conducted by Overrange et. al. (2019), the researchers opined that transition from paper-based systems to an electronic system contributed to improvements in data quality for reporting, monitoring and evaluation purposes in the Health Management Information System data in Ethiopia. With high quality information, Ouedraogo et. al. highlighted that areas highly burdened with disease and high mortality rates among children and women benefited a lot from high quality information especially in Jimma Zone in Ethiopia.

Accurate data presents a reliable resource which can be leveraged for patient experience improvement. Stacek and Kovac (2019) stated that accuracy is about the quantitative exactitude of the values of the relevant variable's attributes. McGreevy et. al. (2023) postulated that accurate information captured for storage at the point of care positively impacted treatment outcomes, immunization recommendations and disease risk assessment among the local customer base in their area of study. Utilization of electronic systems for data storage, e.g., EHR, which interface digitally with other existing electronic systems in the health sector ensure accuracy and confidentiality of information. A study conducted by Abbasi et. al. (2019) on accuracy and timeliness of information shared through MIS in Iran revealed that timely and accurate data entry were 99.87 percent and 97 percent respectively. Detailing that information transmission delays were only observed when it came to causes of patient's death and final diagnosis. MIS was demonstrated to have the capability of a high rate of accuracy and timely communication. In the development of a system, a logical structure is set up to create integrity constraints which ensure information quality. Database designers have the option of implementing domain constraints, check constraints, unique constraints, primary key and unique constraints, not null constraint, etc. to make the data reliable (Susanto & Meiryani,

2019). The check constraint follows a logical expression in validating the values being captured to ensure they meet a certain criterion for a specific column. It functions close to the domain constraint which identifies the permissible values based on a specific data type or domain in a given part of the database tables., these ensures that only valid data is captured by the end user for storage. To ensure consistency, the unique constraint negates the possibility of having two rows with the same value in a single column in a relational database. The MIS has a configured feedback communication that raises an error notice to the end user to prevent the operation of entering inaccurate data in the database. Integrity constraints effectively ensure data is accurate, consistent, and reliable.

Stacek and Kovac (2019) considered information completeness as the adequacy of user data in terms of structure, relations, and attributes. For completeness, the captured data needs to be all inclusive, leaving no gap in the patient's administrative data, medical history, progress notes, and treatment plans to allow informed decision making. Kawu et. al. (2023) highlighted that complete and detailed data enables provision of effective and safe patient-centered service. With a hospital management information system, the researchers pointed out that a longitudinal tracking of the patient, recording of patient generated and related health data and its integration into a central database allows access to a complete set of data for relevant action.

Timely information permits timely service delivery for medical and administrative services within a hospital. In his study on the importance of effective communication in the health sector, Ratna (2019) indicated that poor inter-departmental communication disrupts comprehension of the prevailing healthcare issues by the patient, highlighting that untimely and inconsistent communication negatively affects the patient's experience. According to Råberus et. al. (2019)**,** long waiting time characteristic of inefficient hospitals is as a result of untimely dispensation of information, unintegrated bookings for consultation and unsatisfactory communication. A management information system is a networked system, a

feature that allows for timely information exchange among system users without the limit of physical distance. Data captured at the reception desk for patient registration is instantly accessible by the billing department or patient relationship management department in record time. This might not be the case for legacy systems where information sharing takes long as the sender encounters various barriers to reach out to the receiver.

Confidentiality of data in the health sector is paramount; a sensitive subject nowadays considering the fact that patients have little knowledge of where their data is stored (George & Bhila, 2019). Confidentiality yields privacy whereby patients are assured that the information that emanates from their discussion with the medical staff cannot be accessed by unauthorized persons. Patients opt for confiding pieces of information that are potentially embarrassing if laid out in public (Wadmann, 2023). Even though the sensitiveness can vary across cultures, Wadmann argues that mental health issues, sexuality, and substance abuse are considered as sensitive largely. Their needs to be a level of control and consent prior to the information being shared by third parties. In his study, Wadmann states that the full digitization of patient information through computers and integrated networks shifted the focus to digital data and how data protection can be enforced. Medical practitioners have the option of capturing prescription notes, capturing ailments, drafting the treatment plans and handling related processes through a functional MIS. Conducted by specific hospital staff, this information is captured in the system by a specific end user who has the ability to authenticate their identity through a designated username and password to ensure reliability of the information captured as the initial step towards patient data protection. Role based privilege access in the MIS ensures that only the authorized medical staff can record, read, update, and delete the patient's health information as an assurance of confidentiality of the patient's information.

2.4 Summary of Literature Reviewed and Research Gaps

Table 2.1: Summary of Literature Reviewed and Research Gaps

Author	Study	Methodology	Focus of Past Study	Focus of Present Study
Abdihakim & Tumuti (2022)	Information Security and Performance of Public Hospitals in Garissa County, Kenya	Descriptive research design, Target population; 62 information technology specialists in 2 public hospitals, Study area; Garissa, Kenya	The study seeked to determine the state of information security in two public hospitals and how information security affects the performance of public hospitals.	The current study puts focus on service delivery automation, information quality, data security, and system management as the independent variables of the study; thus, filling a thematic gap.
Kilimo et. al (2022)	Impact of health management information systems on service delivery among healthcare workers at Iten County Referral Hospital	Cross sectional study design; Target population;185 healthcare workers Study area; Iten, Kenya	Study focused on assessing the impact of the utilization of Health Management Information Systems on service delivery among the hospital's healthcare workers	The study area of the proposed study was in a city county, targeting level 4 and 5 private and public hospitals, thus there was a contextual gap
Oreni et. al. (2021)	Data Quality in Health Management Information Systems at Kenyatta National Hospital in Nairobi City County, Kenya	Cross sectional descriptive research design, Target population; 195 health information department staff, Study area; Nairobi, Kenya	The study sought to examine existing technological factors that influence data quality in the Health Management Information System utilized at the hospital	The study focused on information quality as one among four independent variables and how they influence performance of level 4 and 5 hospitals. The current study filled a scope gap by focusing on a broader landscape across Mombasa county.
Orang'i et. al (2019)	Effect of healthcare information systems on service delivery in private hospitals in Nairobi County, Kenya	Descriptive research design; Target population; 1617 respondents from four private hospitals Study area; Nairobi, Kenya	The study seeked to explore healthcare management information system integration and interoperability policies for improved service delivery	Focus was on MIS capabilities and performance of both private and public level 4 and 5 hospitals. A scope gap exists whereby the past study is limited to assessing policies without practicality.
Author	Study	Methodology	Focus of Past Study	Focus of Present Study

Haule et. al. (2019).	Towards Data Exchange between Health Information System and Insurance Claims Management System	Cross-sectional descriptive research design, Target population; 12 physicians And 2 technical respondents Questionnaire, interview, and document review data collection methods, Study area; Tanzania	The study aimed at gathering requirements necessary for development of a data exchange module between a national HIS and an Insurance Fund Claims Management System	The current study focused on MIS capabilities; with system interoperability as an indicator to system management as an independent variable. The current study filled a thematic gap since the past study solely focused on technical interoperability with an external system.
Peltola (2019)	On Adoption and Use of Hospital Information Systems in Developing Countries: Experiences of Health Care Personnel and Hospital Management in Tanzania	Qualitative user study Target population; 35 hospital personnel Study area; Tanzania	Study focused on user perceptions that have influence on HIS adoption in order to offer supportive information in the selection of the appropriate HIS for use in hospitals.	The proposed study was a quantitative study, focusing on MIS capabilities and performance of private and public hospitals
Nkanata et. al. (2018)	Comparative Analysis of Hospital Information Management Systems Among Healthcare Workers in Two Selected Hospitals in Kenya	A comparative research design (private and public hospital) Target population; 120 departmental healthcare workers Study area; Nairobi, Kenya	The study purposed to examine the extent of accuracy and relevance of information provided by MIS for hospitals, the perception of the end users, challenges encountered in the use of MIS, and determine possible solutions for improvement	The study approach was a descriptive research design, addressing a methodological gap.

Author	Study	Methodology	Focus of Past Study	Focus of Present Study
Peltonen et. al. (2018)	Front-Line Physicians' Satisfaction with Information Systems in Hospitals	Cross-sectional survey, Target population; 111 front-line physicians, Study area; Finland	The study aimed to ascertain the level of satisfaction among front-line physicians with the existing MIS in nine hospitals	The study area was in Mombasa, Kenya; a city within a developing country with healthcare challenges. The proposed study therefore filled a geographical gap.
Onyando and Kandiri (2018)	Hospital information systems capability and end-user satisfaction in hospitals of Nairobi County, Kenya	Descriptive research design, Target population; 375 hospital staff in selected major hospitals Study area; Nairobi, Kenya	Study focused on examining HIS capabilities, specifically how service quality, system quality, and information quality influence end user satisfaction in a hospital setting	The proposed study spans beyond user satisfaction, focusing on performance of level 4 and 5 hospitals as the dependent variable
Mwaniki & Mugambi (2017)	Influence of Health Information Systems (HIS) on Service Delivery in Public Health Facilities in Kenya: A Case of Imenti North Sub County, Meru County	Descriptive survey research design, Target population; 445 hospital staff in 25 public healthcare facilities Study area; Imenti North, Kenya	Study purposed to determine the influence of financial management systems, disease management systems, record keeping systems, and human resource management systems on service delivery in public healthcare facilities	The scope covered both private and public level 4 and 5 hospitals and how MIS capabilities affect their performance. The current study filled a scope gap by focusing on both private and public hospitals, enhancing generalizability of the findings

2.5 Conceptual Framework

This model diagrammatically illustrates the key variables and the relationships that exist between them. It is a theoretical structure serving as a roadmap for understanding the connection between the elements of the research problem, showing service delivery, data management, information quality, and data security as the independent variables and performance of hospitals in Mombasa County, Kenya, as the dependent variable.

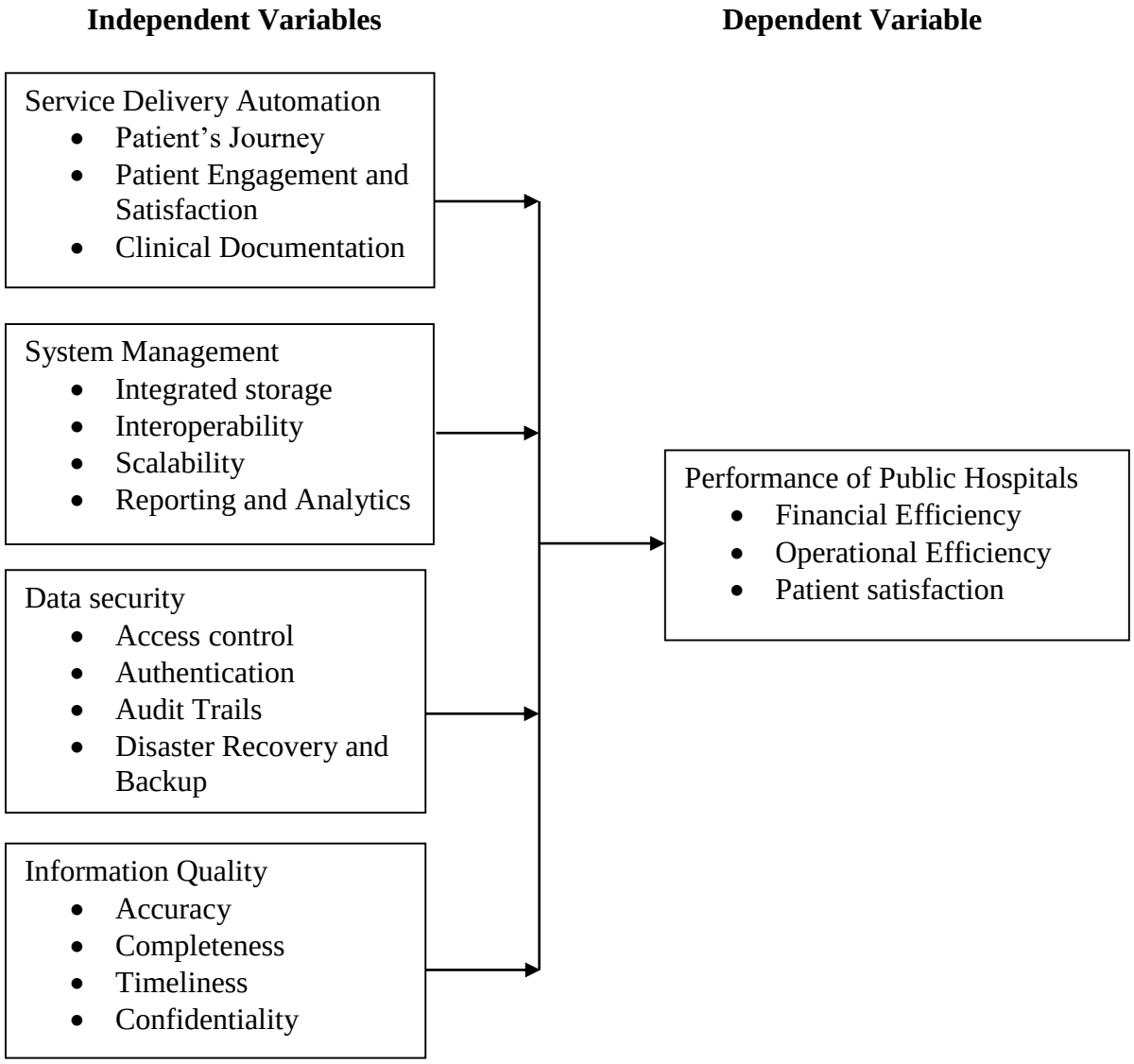

Figure 2.1: Conceptual Framework

Source: Author (2024)

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter explains the approaches and methods that the study adopted. A detailed description of the research design is given followed by specification of the target population, the sampling design, and computation of the sample size. The chapter further outlines the data collection procedure and the instrument to be utilized in the process. It then winds up by covering how reliability and validity was ensured in the study, the data analysis and results presentation approach, and the ethical considerations to be adhered to by the researcher.

3.2 Research Design

A cross sectional descriptive research design was adopted by the researcher in this study. A descriptive research design suits the description of the characteristics of a given phenomenon under study, where the researcher has no intention to manipulate, and they have zero control over the variables being examined (Mugenda & Mugenda, 2019). Descriptive research design defines the phenomenon under study, detailing their related features (Suzuki, 2020). With the objective of the study being to examine how the capabilities of MIS affect the performance of hospitals, focus is on description of the relationship between the independent variables and dependent variable, therefore presenting a descriptive design as the most effective.

3.3 Target Population

A study population refers to all individuals whom the researcher intends to generalize the findings of the study to (Kothari, 2023). This study sought to assess the performance of hospitals vis-à-vis the capabilities of MIS in level 4 and 5 private and public hospitals in Mombasa County, Kenya. The target population was ICT staff obtained from thirty-one level 4 and 5, private and public hospitals in Mombasa County comprising of five (5) public and twenty-six (26) privately-owned hospitals as per the MoH Master Health Facility List. The scope was limited to Level 4 and 5 hospitals because they utilize MIS in their operations. Moreover, the required level of operations for level 4 and 5 hospitals as per the KMPDC

requirements warrants a sturdy hospital information system. According to the 2019 Health Facilities Inspection Checklist by KMPDC, Level 4 and 5 hospitals are required to have a minimum of 10 and 12 ICT officers respectively; including health records information management officers, the ICT manager, and other relevant categories of technical personnel. With twenty-seven level 4 and four level 5 hospitals in Mombasa County, a total of 318 ICT specialists, who have the responsibility of supporting the implementation and use of MIS in the hospitals formed the target population.

3.4 Sampling Size and Technique

Lee and Landers (2022) consider sampling as the identification and selection of cases for analysis with the intention of drawing conclusions in a research process. It focuses on statistical representativeness of the entire population by a selected sample for the purpose of arriving at valid conclusions about a given target population. Stratified random sampling technique was used in this study (considering the heterogenous nature of the target population) to get representation from subgroups within the ICT department. The subgroups were based on the criterion of ICT manager, system administrator, and Health Records Information Management Officer, and IS Support Staff.

A sample size is a group of units of analysis selected in a research study about whom data is provided (Casteel & Bridier, 2021). Mugenda and Mugenda (2019) assert that for descriptive research, a 10-30 percent sample size obtained from the target population is acceptable. A sample size of 96, representing 30 perecent of the target population, was extracted to be part of the study. Results generated from the data provided from the sample would be generalized to the entire population. Stratified random sampling technique was utilized to obtain representation from the varying categories of ICT Technical staff in the hospitals as follows;

Table 3.1: Distribution of the sample size

Category	Sample size	percent of the sample size
IS Support Staff	19	20
Health Records Information Management Officer	19	20
System Administrator	29	30
ICT Manager	29	30
Total	**96**	

Source: Author (2023)

3.5 Data Collection Instrument

The researcher utilized a semi-structured questionnaire to collect data from the respondents. Besides consistency of the questions and simplicity in administration, the semi-structured questionnaire was comfortable for respondents who might have shied from interviews with the fear of the management. The method was drop-and-pick-later at the study locations, giving the respondents uninterruptible time to respond to the questionnaire. Where necessary, the researcher emailed respective respondents a link to the e-copy of the questionnaire to be filled through Kobo Toolbox Data Collection Tool. The questionnaire adopted a 5point Likert scale, requiring the respondents to rate their level of disagreement or agreement with statements regarding the independent variables and the dependent variable.

3.5.1 Pilot Test

A pilot study was conducted prior to embarking on the actual study to identify any imminent hitches that might arise and pose a challenge to the data collection process. Sreejesh et. al. (2014) suggests that pilot testing permits the researcher to limit potential errors during research by ascertaining the time taken by respondents to respond to the entire questionnaire, the clarity of the instructions, the clarity of the questions for highlighting any elements of ambiguity, any relevant omissions, and the outmost layout and articulation of the questionnaire. As recommended by Connelly (2016), 10 percent of the sample size of the parent study is effective

for a pilot test. A total of 10 participants were selected from the ICT departments across three level 4 hospitals in Kwale County, namely Kwale Sub County Hospital, Palm Beach Hospital, and Kinango Sub County Hospital and questionnaires administered to them. The results obtained from this pilot study informed the researcher in implementing necessary adjustments. The inclusion criteria for the three hospitals was that they had a functional MIS, integrating data from all functional departments.

3.5.2 Validity of the instrument

Validity entails the accuracy and meaningfulness of the inferences arrived at based on the research results. It is the degree to which the results obtained from the analysis actually represent the variables of the study and the phenomenon being studied (Mugenda & Mugenda, 2019). Content validity, which is about the degree to which research questions represent the contents of a specific domain or concept, was achieved by developing questions informed by intensive review of relevant literature for ensuring their content aligns with MIS capabilities and how they determine the productivity of hospitals. To test for both face and content validity, the researcher additionally consulted experts in the applicable area of study. This included the research supervisor, whose comments on whether the item sets in the instrument accurately represent the concept under study was incorporated prior to deploying the instrument for data collection. To test for construct validity, Factor Analysis (FA) was done to determine the degree at which the data obtained during the pilot study is consistent with the theoretical expectations of the concept being studied, considering the assumptions of normality and linearity.

3.5.3 Reliability of the Research Instrument

Reliability entails the level at which a data collection instrument yields the same results consistently (Mugenda & Mugenda, 2019). The aim is to reduce deviation from the true measurement. To ensure data reliability, data collected during pre-testing using the selected sample was subjected to analysis to compare how scores of items correlate with scores of other

items on the research instrument. Internal consistency was measured using Cronbach's Coefficient Alpha, computed using SPSS. Using a scale of 0 to 1, a coefficient closer to 1 implies high reliability, showing consistency among the items on the instrument in measuring the concept being studied, while a coefficient closer to 0 implies low internal consistency. Specifically, a Cronbach's coefficient of 0.70 and above denoted that the instrument was reliable for adoption in this study. The results of reliability tests are presented in Table 3.2.

Table 3.2: Results of Reliability Test

Variable	Cronbach Alpha Test	Remarks
Service delivery automation	0.715	Reliable
System management	0.794	Reliable
Data security	0.746	Reliable
Information quality	0.770	Reliable
Performance	0.754	Reliable
Aggregate score	**0.756**	**Reliable**

Source: Pilot Study (2024)

The study established that the variables had a Cronbach alpha value ranging from 0.715 to 0.794 which resulted to an aggregate score of 0.756. Therefore, the study concluded that the questionnaire items were reliable.

3.6 Data Analysis and Presentation

Taherdoost (2020) defined data analysis as the process involving application of computational and statistical techniques in the examination, cleaning, transformation, and extensive interpretation of data for the purpose of extracting relevant insights and trends. In this study, qualitative and quantitative data collected were compiled, sorted, and coded accordingly. Quantitative data was analyzed using SPSS version 27, while thematic analysis was utilized in analyzing qualitative data regarding the open-ended questions in the instrument. Both descriptive, relational, and inferential analysis was computed. Means, percentages, and standard deviations were computed in the context of descriptive analysis. Karl Pearson's correlation coefficient was computed to measure the direction and strength of the linear

relationships between each independent variable and the dependent variable. In order to examine the relationship between each of the independent variables and the dependent variable, the researcher used multiple linear regression, generating the beta coefficients to inform this. The empirical model below was used to understand how the dependent variable is affected by changes in the predictor variables;

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (1)}$$

Where;

Y= Performance of hospitals

B_0 = Y-intercept/ Constant

$B_{(1\text{-}4)}$ = Beta Coefficients

X_1= Service delivery automation

X_2= System management

X_3= Data security

X_4= Information quality

ε= Error term (captures unexplained variations in the empirical model)

Prior to conducting regression, the researcher ran a diagnostic test using Variance Inflation Factor (VIF) to test for the level of multicollinearity among the independent variables. A VIF value between 1 and 5 was acceptable. Results from this analysis were presented in tabular form, bar graphs, and pie chart form, for easy understandability.

3.7 Ethical Considerations

This research study was conducted with adherence to the standards provided by Kenyatta University in research, including maximum plagiarism of 16 percent. There was informed consent for all the participants, making clear the purpose, methods to be used, and possible uses of the findings of this research study. The researcher assured respondents of their responses' confidentiality and privacy, with no coercion to participate in the study.

Respondents were advised to ensure anonymity by not writing their names anywhere on the data collection instrument. In addition, a research approval letter from Kenyatta University Graduate School was attached to achieve confidence among the participants. A research permit from the National Commission for Science, Technology and Innovation (NACOSTI) was among the attachments, further communicating authorization to conduct research.

CHAPTER FOUR: RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter presents a comprehensive overview of the research findings, detailing the methodologies employed and the data collected throughout the study. Following the presentation of the results, the chapter delves into a critical discussion of their implications. This involves interpreting the findings in the context of existing literature, exploring how they align with or challenge previous studies.

4.2 Response Rate and Descriptive Statistics

4.2.1 Response Rate

The questionnaires were administered to 96 respondents drawn from various hospitals in Mombasa County, Kenya, and the results are presented in Table 4.1.

Table 4.1: Response Rate

Questionnaires	Frequency	Percentage
Returned	90	93.8
Not returned	6	6.3
Total	**96**	**100**

Source: Survey Data (2024)

The research indicated that the returned questionnaires constituted 93.8 percent, while those that were not returned represented 6.3 percent. Baruch and Holtom (2014) suggested that a response rate of 80 percent or higher is sufficient for data analysis. Therefore, the study's response rate of 93.8 percent was deemed adequate for this purpose. This high response rate contributed to the acceptance and credibility of the research findings.

4.2.2 Respondent's Demographic Data

The demographic information of the participants was meticulously examined, focusing on several key factors: gender, professional experience, duration of service in the Information and Communication Technology (ICT) sector, and their current roles within the hospital. The results are presented in the following sub-sections.

4.2.2.1 Gender

The finding obtained according to gender representation of the respondents in the study is shown in Figure 4.1.

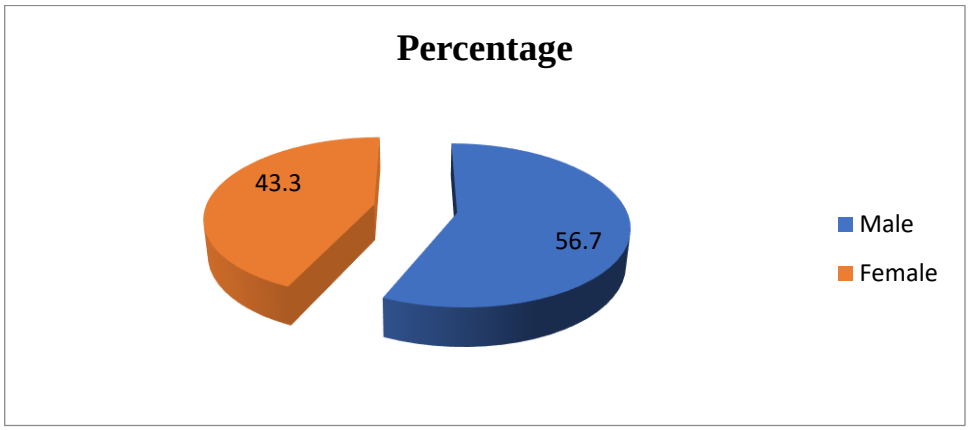

Figure 4.1: Gender

Source: Survey Data (2024)

The results in Figure 4.1 shows there was a good representation of the respondents in terms of gender since male and female respondents accounted for 56.7 percent and 43.3 percent respectively. Understanding these dynamics is crucial, as gender diversity can impact team performance, innovation, and decision-making processes.

4.2.2.2 Professional Experience

The finding obtained according to the professional experience of the respondents in the study is shown in Table 4.2.

Table 4.2: Professional Experience

Years	Frequency	Percentage
Less than 1 year	9	10.0
2 to 4 years	18	20.0
5 to 8 years	27	30.0
Over 8 years	36	40.0
Total	**90**	**100**

Source: Survey Data (2024)

The results as represented in Table 4.2 indicate that majority (40.0%) of the respondents had a professional experience of over 8 years. On the other extreme, 10.0 percent accounted for the

respondents with less than 1 year. This shows that most of the respondents had worked for longer years. This was important to the study because more experienced professionals may possess a deeper understanding of the complexities involved in healthcare IT, which could enhance the overall performance of the hospital's information systems. According to Tambunan and Iqbal (2024), accumulated work experience strengthens commitment to the organization, exposing professionals to a growing career path and job satisfaction. Long serving staff gain a detailed comprehension of the organization's culture and operations.

4.2.2.3 Duration of Service in the ICT sector

The results on duration of service in the ICT sector are presented in Figure 4.2.

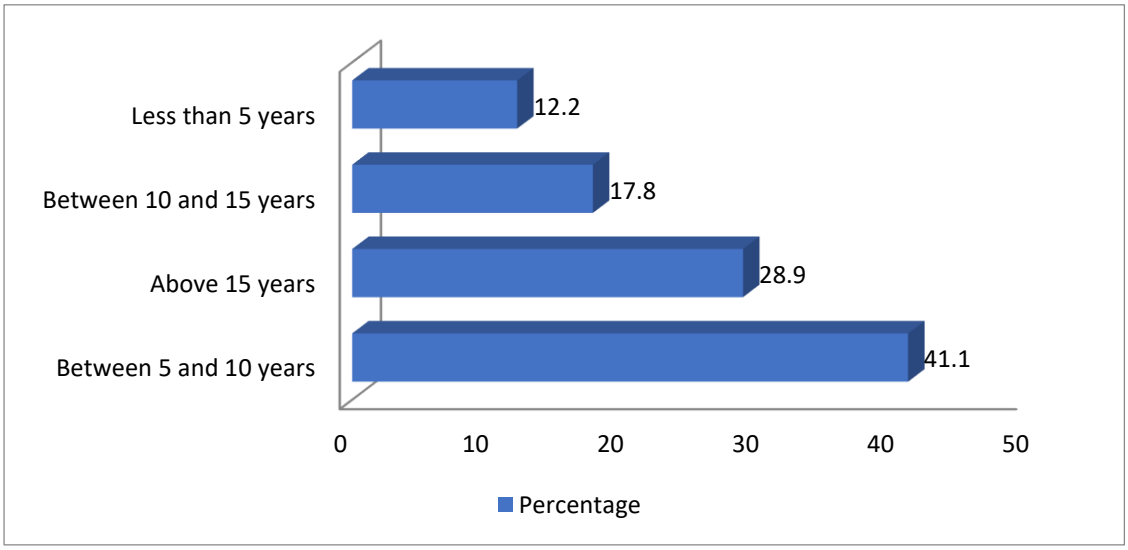

Figure 4.2: Duration of Service in the ICT Sector

Source: Survey Data (2024)

The results in Figure 4.2 show that majority (41.1%) of the respondents had worked in the ICT sector for a period ranging from 5 to 10 years. On the other extreme, 12.2 percent had less than 5-year period of work in the ICT sector. This shows that most respondents had served in the ICT sector for long. These findings are consistent with Wandie and Muathe (2022) which hold that organizational efficiency is attainable through quality of service, in this case contributed to by experience gained in a specialization within the ICT sector. Patient-centered care is

achieved through the long-serving employees, who may have developed a more profound institutional knowledge and familiarity with the specific challenges faced by hospitals in Mombasa County, which can significantly influence the effectiveness of MIS.

4.2.2.4 Current Role within the Hospital

The results on the current role with the hospital are presented in Table 4.3.

Table 4.3: Current Role within the Hospital

Role	Frequency	Percentage
IS Support Staff	18	20.0
System Administrator	28	31.1
ICT Manager	27	30.0
Health Records Information Management Officer	17	18.9
Total	**90**	**100**

Source: Survey Data (2024)

The results indicate that majority (31.1%) of the respondents were system administrators while on the other extreme 18.9 percent of the respondents were from health records information management officer category. This information was important because it could help to identify which roles are most critical in leveraging technology to improve hospital performance and patient care. These findings align with Argaw et. al. (2019), who considered not only external but also internal threats to data security within an organizational setting as a concern. The role played by staff significantly affects the potentiality of posing an internal threat, either purposefully or not. With all categories well represented, insight from every role type was significant.

4.3 Descriptive Statistics Results

The research employed descriptive statistics, specifically Mean (M) and Standard Deviation (SD), to illustrate the findings derived from the quantitative data analyzed using the Statistical Package for Social Sciences (SPSS). The subsequent section presents these results.

4.3.1 Service Delivery Automation

The study sought to establish the influence of service delivery automation on the performance of hospitals in Mombasa County. The respondents were given a list of statements to indicate

their level of agreement on each based on a Likert scale. The results are presented in terms of percentages, mean and standard deviations in Table 4.4.

Table 4.4: Service Delivery Automation

Statements	SD (%)	D (%)	N (%)	A (%)	SA (%)	M	SD
The system effectively supports the patient's smooth navigation through the required stages of their healthcare journey	3.3	2.2	0	51.1	43.3	4.58	0.42
MIS adequately facilitates timely assistance and support for patients during their hospital visit	6.6	12.2	0	42.2	38.9	4.05	0.95
ICT system enables seamless provision of clear information to the patients concerning their treatment plans	2.2	2.2	0.5	50	42.2	4.30	0.70
MIS enables comprehensive documentation of the patient's data; treatment procedures and medical histories	0	0	6.7	57.7	35.6	4.50	0.50
MIS ensures effective communication of patient's concerns and preferences for address by healthcare providers	11.1	3.3	1.1	44.4	40	3.63	1.37
The ICT system enables active engagement of patient's, through applications and digital platforms, in the decision-making processes regarding their health	7.8	4.4	2.2	40	45.6	3.94	1.06
The MIS significantly contributes to enhancing patient satisfaction relative to their service experience	3.3	0	0	51.1	45.6	4.75	0.25
Aggregate mean score						**4.25**	**0.75**

Source: Survey Data (2024)

Table 4.4 reveals strong support for the healthcare system among participants, with 94.4 percent agreeing it effectively assists patients through their healthcare journeys. Only 5.5 percent disagreed, indicating widespread perceived benefits. Additionally, 81.1 percent of respondents found the Management Information System (MIS) effective in providing timely support during hospital visits, while 18.8 percent disagreed, suggesting some users may not fully recognize its benefits. Furthermore, 92.2 percent affirmed that the Information and Communication Technology (ICT) system effectively communicates treatment plans, highlighting its role in patient understanding. Only 4.4 percent disagreed, indicating broad approval of the ICT system's value. Finally, 93.3 percent agreed that the MIS facilitates comprehensive documentation of patient data, essential for continuity of care, though 6.7 percent remained unconvinced.

A significant 84.4 percent of respondents agreed that the Management Information System (MIS) greatly improves communication of patients' concerns to healthcare providers, indicating strong support for its effectiveness. Only 14.4 percent disagreed. Additionally, 85.6 percent recognized the Information and Communication Technology (ICT) system's role in promoting active patient engagement, highlighting its importance for patient autonomy and satisfaction. Furthermore, 96.7 percent affirmed that the MIS enhances patient satisfaction with their service experience, with only 3.3 percent dissenting.

A substantial majority of the respondents, amounting to 84.4 percent, expressed agreement that the Management Information System (MIS) significantly enhances the communication of patients' concerns and preferences to healthcare providers. This indicates a strong belief in the system's ability to bridge the gap between patients and providers, ensuring that important information is effectively relayed and considered in the care process. In contrast, only a small fraction, 4.4percent, voiced disagreement, highlighting a general consensus on the MIS's effectiveness in this area. Moreover, the findings reveal that 85.6 percent of participants

recognized the role of the Information and Communication Technology (ICT) system in fostering active patient engagement. This engagement is facilitated through a variety of applications and digital platforms, which empower patients to take an active role in their healthcare decisions. The ability to participate in decision-making processes is crucial for patient autonomy and satisfaction, and the high percentage of acknowledgment suggests that respondents value the opportunities provided by ICT for the patients' involvement in their health management. In addition to these points, an impressive 96.7 percent of respondents affirmed that the MIS is instrumental in enhancing patient satisfaction regarding their service experience. This overwhelming support indicates that the system not only improves communication and engagement but also contributes significantly to the overall satisfaction of patients with the healthcare services they receive. Only 3.3 percent of respondents disagreed, further underscoring the positive perception of the MIS's impact on patient experiences.

The overall mean score of 4.25, accompanied by a standard deviation of 0.75, reflects a strong consensus among respondents about the beneficial effects of service delivery automation on hospital performance in Mombasa County. This statistical data suggests that the majority of participants believe that the implementation of automated systems, such as the MIS, leads to improved service delivery, ultimately enhancing the quality of care provided to patients. The findings highlight the importance of these technological advancements in the healthcare sector, particularly in promoting effective communication, patient engagement, and satisfaction.

The finding agrees with the findings of a study by Mwaniki (2018) who found that hospitals are opting for incorporation of ICT in capturing health data considering the shortcomings presented by a manual system of capturing and transmitting data during the patient's journey at a hospital. The finding also agrees with the findings of a study by Perdana and Mokhtar (2023) on leveraging digital technologies for information technology-enabled healthcare

transformation in Singapore, the researchers acknowledged that operations such as medication ordering and medical appointments can be tedious in a large public health organization.

4.3.2 System Management

The study sought to examine the influence of system management on the performance of hospitals in Mombasa County. The respondents were given a list of statements to indicate their level of agreement on each based on a Likert scale. The results are presented in terms of percentages, mean and standard deviations in Table 4.5.

Table 4.5: System Management

Statements	SD (%)	D (%)	N (%)	A (%)	SA (%)	M	SD
The MIS enables efficient integrated data storage for all necessary functions in the hospital	16.7	11.1	6.7	31.1	34.4	4.65	0.35
The data captured and stored by the system is easily accessible, in lesser time, when needed	0	0	0	52.2	47.8	3.58	1.42
Data can be easily shared between different users within and across departments	7.8	7.8	2.2	35.6	45.6	4.05	0.95
When necessary, there is seamless data exchange with external partners and healthcare systems	10	3.3	0	42.2	44.4	4.28	0.72
As the hospital expands, data storage is efficiently scalable, the system allows scaling up to accommodate increasing data demands	23.3	12.2	8.9	26.7	28.9	4.12	0.88
The MIS maintains performance and remains reliable even when the volume of data increases	11.1	22.2	1.1	32.2	33.3	4.55	0.45

The MIS provides adequate customized reporting and analytical tools that aid in decision making	5.6	5.6	0	44.4	44.4	4.52	0.48
Analytics availed by the system are fundamental in improving patient outcomes and hospital performance	6.7	14.4	4.4	22.2	52.2	3.99	1.01
Aggregate mean score						**4.22**	**0.783**

Source: Survey Data (2024)

The results in Table 4.5 indicate that the respondents agreed that the MIS enables efficient integrated data storage for all necessary functions in the hospital as presented by majority (65.5%) of the respondents, 27.8 percent disagreed and 6.7 percent were neutral. All the respondents agreed that the data captured and stored by the system is easily accessible, in lesser time, when needed. Most (81.2%) of the respondents agreed that data can be easily shared between different users within and across departments, 15.6 percent disagreed and 2.2 percent were neutral. The study revealed that majority (86.6%) of the respondents agreed that when necessary, there is seamless data exchange with external partners and healthcare systems while 13.3 percent disagreed.

The statement that as the hospital expands, data storage is efficiently scalable, the system allows scaling up to accommodate increasing data demands was agreed by majority (55.6%) of the respondents. 35.5 percent disagreed and 8.9percent indicated neutral. Majority (65.5%) of the respondents agreed that the MIS maintains performance and remains reliable even when the volume of data increases with 33.3 percent and 1.1percent disagreeing and indicating neutral respectively. 88.8 percent of the respondents agreed that the MIS provides adequate customized reporting and analytical tools that aid in decision making and 11.2 percent disagreed. The statement that analytics availed by the system are fundamental in improving

patient outcomes and hospital performance was agreed by majority (74.4%) of the respondents while 21.1 percent disagreed and 4.4 percent were neutral.

The aggregate mean and standard deviation of 4.22 and 0.783 respectively indicate that the respondents agreed on all the statements examining the influence of system management on the performance of hospitals in Mombasa County based on the Likert scale.

These findings concur with Munjal and Bhatia (2022) who pointed out the concept of cloud computing in their research as safer, unlimited, and economically feasible alternative for storage of health data. 'Cloud' is used symbolically to denote the Internet, whereby users upload data to a secure online server that offers unlimited storage space for vast amounts of data. The finding also agrees with Tahir et. al. (2020) who found that storage solution offers a scalable option amid the growing amounts of data. Through a system with a cloud-based database, patient records are stored, encrypted to make it accessible and interpretable to the service providers and authorized users, and made available for processing.

4.3.3 Data Security

The study sought to determine the influence of data security on the performance of hospitals in Mombasa County. The respondents were given a list of statements to indicate their level of agreement on each based on a Likert scale. The results are presented in terms of percentages, mean and standard deviations in Table 4.6.

Table 4.6: Data Security

Statements	SD (%)	D (%)	N (%)	A (%)	SA (%)	M	SD
The MIS ensures that only authorized users can view and modify data	0.0	0.0	0.0	41.5	58.5	4.51	0.487
Access to sensitive patient data is effectively controlled based on user roles	6.6	12.2	0	42.2	38.9	4.05	0.95

Only verified users gain access to the system, considering there is authentication	7.8	7.8	2.2	35.6	45.6	4.05	0.95
Potential data breaches and unauthorized access are adequately handled by MIS	1.5	7.3	3.8	48.5	42.4	3.67	1.33
Audit trails of data access, modifications, and other user activities are comprehensively captured	0.0	0.0	0.9	48.3	50.8	4.36	0.64
The MIS facilitates traceability and accountability of user actions within the system	0.0	0.0	0.7	39.2	60.1	4.66	0.34
Disaster recovery protocols are in place for timely data restoration in case of system failure	0.0	0.0	2.1	47.6	48.3	4.78	0.22
The system's disaster recovery mechanisms ensure continuity of hospital operations by preventing data loss during unforeseen events	0.0	2.4	0.0	41.6	52.4	4.56	0.44
Patient data is regularly backed up to secure off-site locations to mitigate effects of system failure	0.0	5.7	0.0	56.8	43.1	4.28	0.72
All MIS hardware are securely managed with antivirus installed for protection against malware	1.5	7.3	3.8	48.5	42.4	3.67	1.33
Few incidences of data security breach in the MIS have been reported	8.6	10.5	2.5	35.8	42.6	4.32	0.68
Aggregate Score						**4.26**	**0.736**

Source: Survey Data (2024)

Table 4.6 presents strong evidence of participants' perceptions regarding the Management Information System (MIS) and its effectiveness in ensuring data integrity and security. A significant 81.1percent of participants believe the MIS restricts access to authorized users, highlighting confidence in its role-based access control. However, 18.8 percent disagreed,

indicating a need for further investigation into their concerns. Additionally, 81.2 percent of respondents feel that access is limited to authenticated users, suggesting robust authentication measures, though 15.6 percent opposed this view and 2.2 percent remained neutral, indicating varying awareness of these processes. Furthermore, 90.9 percent of participants trust the MIS's ability to mitigate risks of data breaches and unauthorized access, reflecting high confidence in its security measures. Conversely, 8.8 percent disagreed, and 3.8 percent were neutral, suggesting differing experiences or perceptions.

The survey results show strong agreement among participants on the effectiveness of the Management Information System (MIS) in maintaining audit trails and enhancing accountability. An impressive 99.1 percent noted that audit trails for data access and modifications are well-documented, highlighting the importance of transparency in data management. Only 0.9 percent expressed neutrality, indicating near-universal recognition of the need for thorough documentation. Regarding traceability and accountability, 99.3 percent affirmed that the MIS significantly aids in tracking user actions, reflecting high confidence in its capabilities for operational efficiency and regulatory compliance. Just 0.7 percent remained neutral. Additionally, 90.9 percent acknowledged the MIS's positive impact on traceability and accountability, while 5.9 percent disagreed, suggesting some concerns that may need further exploration. On data security breaches, 78.9 percent agreed that incidents are rare, indicating a general sense of security in the system, 19.1 percent disagreed while 2.5 percent remained neutral, suggesting some respondents may have had negative experiences.

The mean score of 4.26 indicates strong agreement among respondents about the positive impact of data security on hospital performance in Mombasa County. This high score suggests that most participants view data security as a crucial factor. The standard deviation of 0.736 shows low variability in responses, indicating a consensus on the importance of data security

in hospital operations. These findings emphasize the need for healthcare stakeholders to prioritize data security to enhance performance and maintain patient trust.

These findings are in line with Haleem and Khan (2024), whose study indicated the vulnerability posed by single factor authentication, compelling health facilities to opt for attribute-based control and in extension biometric technologies. A combination of which bolsters system security guaranteeing authentication, authorization and system availability. Advanced MIS systems prioritize biometric verification ranging from retina scans, gait recognition, facial recognition, finger print scanning, or iris scanning. Given that it is based on unique physical characteristics, biometric authentication has become the most sought-after method for verifying the user's identity. Two-factor authentication is another alternative preferable to single-level username-password approach. As suggested by Al-Muhtadi et. al. (2019), the method allows for addition of an extra security layer, for instance, using a one-time-password (OTP) that is send to a submitted contact address e.g., email or phone, to further verify the user's identity

4.3.4 Information Quality

The study sought to examine the effect of information quality on the performance of hospitals in Mombasa County. The respondents were given a list of statements to indicate their level of agreement on each based on a Likert scale. The results are presented in terms of percentages, means and standard deviations in Table 4.7.

Table 4.7: Information Quality

Statements	SD (%)	D (%)	N (%)	A (%)	SA (%)	M	SD
Information provided by the MIS is consistently accurate and error free	16.7	2.2	4.4	52.2	24.4	4.05	0.95
The captured patient information contains all relevant data elements during	3.3	4.4	0	58.9	33.3	4.11	0.89

retrieval, for a holistic view of patient's health							
The MIS avails information in a timely manner, allowing the users to access up-to-date patient data	0	5.6	0	60	34.4	3.67	1.33
MIS enables prompt updates on patients' records for up-to-date interventions	6.7	2.2	1.1	57.8	32.2	4.33	0.67
Confidentiality of sensitive patients' medical information is maintained by the MIS	10	7.8	0	32.2	50	3.57	1.43
Secure encryption of patient data in the MIS preserves its confidentiality by ensuring authorized access	27.8	18.9	11.1	16.7	25.6	4.09	0.91
There are a few incidences of inaccurate information being provided by the MIS	12.2	0	6.7	27.8	53.3	4.26	0.74
Aggregate Score						**4.01**	**0.99**

Source: Survey Data (2024)

Table 4.7 reveals participants' perceptions of the Management Information System (MIS) in patient data management. A significant 76.6 percent agreed that the MIS consistently provides accurate information, indicating confidence in its data integrity, essential for informed healthcare decisions. However, 18.9 percent disagreed, suggesting concerns about inaccuracies, while 4.4percent remained neutral. Regarding the comprehensiveness of patient information, 92.2 percent affirmed that the MIS captures all relevant data for understanding a patient's health, though 7.7 percent disagreed, indicating potential gaps in data collection. Timeliness is also a strength, with 94.4 percent agreeing that the MIS delivers information promptly, crucial for quick decision-making in patient care. Nonetheless, 5.6 percent disagreed, pointing to possible delays in information retrieval.

A substantial majority of the participants, specifically 90.0 percent, indicated their agreement with the statement that the Management Information System (MIS) plays a crucial role in facilitating timely updates to patient records. This capability is essential as it directly supports ongoing medical interventions and ensures that healthcare providers have access to the most current information when making decisions about patient care. In contrast, a smaller portion of the participants, 8.9 percent, expressed disagreement with this assertion, while a minimal 1.1 percent chose to remain neutral, suggesting that the overwhelming consensus is in favor of the MIS's effectiveness in this area.

In terms of data security, 82.2 percent of respondents concurred that the MIS is effective in safeguarding the confidentiality of sensitive medical information. This high level of agreement underscores the importance of data protection in healthcare settings, where the privacy of patient information is paramount. Conversely, 17.8 percent of participants disagreed with this statement, indicating some concerns about the system's ability to maintain confidentiality. When it comes to the specific feature of secure encryption within the MIS, which is designed to ensure that only authorized personnel can access patient data, the responses were more divided. Only 42.3 percent of respondents agreed that the encryption measures effectively guarantee confidentiality, while a significant 46.7 percent disagreed, suggesting skepticism about the robustness of these security measures. Additionally, 11.1 percent of participants remained neutral on this issue, reflecting uncertainty or ambivalence regarding the effectiveness of encryption in protecting sensitive information. Lastly, the reliability of the MIS in presenting accurate information was also assessed. A notable 81.1 percent of respondents acknowledged that instances of inaccurate information being displayed by the MIS are infrequent, which points to a general confidence in the system's accuracy. However, 12.2 percent disagreed with this assessment, indicating that there are concerns about the potential

for errors, while 6.7 percent of participants chose to remain neutral, suggesting that some may not have enough experience with the system to form a definitive opinion.

The mean score of 4.01 with a standard deviation of 0.99 indicates strong agreement among participants on the positive impact of information quality on hospital performance in Mombasa County. This score, above the midpoint of the Likert scale, suggests that respondents generally view high-quality information as beneficial. The low standard deviation shows that responses were closely aligned, reflecting a consensus on the importance of information quality. This collective belief highlights the need for hospital administrators and policymakers to prioritize information quality in their strategic planning, potentially improving service delivery and patient outcomes

The finding is in line with Stacek and Kovac (2019) who considered information completeness as the adequacy of user data in terms of structure, relations, and attributes. For completeness, the captured data needs to be all inclusive, leaving no gap in the patient's administrative data, medical history, progress notes, and treatment plans to allow informed decision making. The finding also is in line with Kawu et. al. (2023) who highlighted that complete and detailed data enables provision of effective and safe patient-centered service. With a hospital management information system, the researchers pointed out that a longitudinal tracking of the patient, recording of patient generated and related health data and its integration into a central database allows access to a complete set of data for relevant action.

4.3.5 Performance of Hospitals

The study sought to examine the performance of hospitals in Mombasa County. The respondents were given a list of statements to indicate their level of agreement on each based on a Likert scale. The results are presented in terms of percentages, means and standard deviations in Table 4.8.

Table 4.8: Performance of Hospitals

Statements	SD (%)	D (%)	N (%)	A (%)	SA (%)	M	SD
MIS has enabled effective management of financial resources to ensure profitability and sustainability	50	25.6	2.2	11.1	11.1	3.01	1.09
MIS has enabled efficient allocation of resources across departments to maximize operational effectiveness	41.1	45.6	0	5.6	7.8	2.98	2.02
MIS has streamlined and optimized hospital operational processes for efficiency	30	40	5.6	10	14.4	3.43	1.57
Utilization of technology through service automation has enhanced operational efficiency	16.7	35.6	11.1	13.3	23.3	2.77	2.03
Patients seeking medical care experience minimal waiting times and delays during their visits	24.4	48.9	2.2	4.4	20	3.07	1.93
MIS has enabled hospital staff to demonstrate high competency levels in their roles	45.6	22.2	10	2.2	20	3.01	1.99
Patients feel satisfied and well-cared for in the access of healthcare services at the hospital	28.9	37.8	5.6	6.7	21.1	2.22	2.78
The MIS enables active seeking of feedback from patients for continuous improvement of service delivery	40	27.8	2.2	7.8	22.2	3.11	1.89
Aggregate Score						**2.95**	**1.91**

Source: Survey Data (2024)

Table 4.8 summarizes participants' views on the effectiveness of Management Information Systems (MIS) in financial and operational management. Notably, 75.6 percent disagreed that

MIS significantly aids in effective management of financial resources, indicating skepticism about its positive impact on profitability and financial sustainability. Only 22.2 percent agreed, with 2.2 percent neutral, suggesting most do not see MIS as valuable in this area. Similarly, 86.7 percent disagreed that MIS facilitates efficient resource allocation across departments, highlighting a belief that current systems fail to enhance operational effectiveness. Only 13.4 percent agreed, reinforcing the disconnect between MIS's intended benefits and user experiences. Regarding hospital operations, 70.0 percent disagreed that MIS optimizes processes for improved efficiency, suggesting it is not viewed as a transformative tool. While 24.4 percent agreed and 5.6 percent were neutral, the overall sentiment leans towards skepticism. Finally, 52.3 percent of respondents disagreed with the effectiveness of MIS in other areas.

The survey results indicate significant concerns among respondents about healthcare services at the hospital. A substantial 73.3 percent disagreed that patients experience minimal waiting times, suggesting widespread issues with patient flow and delays. Only 2.2 percent were neutral, while 24.4 percent agreed, indicating that the majority face significant delays. Regarding the Management Information System (MIS), 67.8 percent of respondents disagreed that it empowers staff to demonstrate high competency, highlighting doubts about its effectiveness in supporting staff development. Only 22.2 percent agreed, with 10.0 percent neutral, reflecting a divide in perceptions. On patient satisfaction, 66.7 percent disagreed that patients feel satisfied and well-cared for, raising concerns about care quality. In contrast, 27.8 percent agreed, and 5.6 percent were neutral, suggesting that positive experiences are not representative of the majority.

The mean score of 2.95, near the midpoint of the Likert scale, indicates that respondents generally held a neutral view on the performance of hospitals in Mombasa County, with no strong agreement or disagreement on service quality. The standard deviation of 1.91 suggests

moderate variability in responses, indicating that while some had positive or negative views, most clustered around the mean, reflecting a lack of consensus. This variability points to differing individual experiences and perceptions of hospital performance.

The finding is in contrary to studies by Abolhallaj et. al. (2021) who study's findings suggested that financial management greatly improves with an integrated platform for transaction processing. While a financial management system eases processing and reporting of financial statements, limited utilization denies full benefits to the health institutions. Similarly, the findings by Jayaratne et. al. (2020) are contrary, considering that patient wait times, a parameter that is expected to improve through effective resource allocation informed by analytics is negatively rated by 66.7% of the respondents.

4.4 Multiple Regression Analysis Results

The analysis utilizing multiple regression techniques was performed to examine the relationships between the several independent variables and the dependent variable. The results are presented as follows;

Table 4.9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.894	0.799	0.756	0.0245

Source: Survey Data (2024)

The model's summary results reveal key statistical indicators for assessing hospital performance in Mombasa County. The R value of 0.894 indicates a strong positive correlation between independent variables; service delivery automation, system management, data security, and information quality and hospital performance. This suggests that improvements in these areas can enhance hospital performance. The R square value of 0.799 shows that about 79.9 percent of the variance in hospital performance is explained by the model, highlighting the relevance of the studied factors. The adjusted R square value of 0.756 indicates that a significant portion of the variance (75.6%) remains explained even after accounting for the

number of predictors. The remaining 24.4 percent of the unexplained variance is attributed to other factors not included in this study's model. Additionally, the standard error of 0.0245 suggests high precision in the model's predictions, as lower values indicate that predicted values closely align with actual values. This aligns with study findings by Mwaniki and Mugambi (2017), where the reported R squared was 0.687 (68.7%) in a study evaluating the influence of health information systems on service delivery in public health facilities in Imenti North Sub County, Meru County, concluding that 68.7% of the variance in the dependent variable was explained by the model.

Table 4.10: Analysis of Variance

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	258.236	4	64.559	88.657	0.002
	Residual	61.896	85	0.728		
	Total	320.132	89			

Source: Survey Data (2024)

The ANOVA results indicate significant factors influencing hospital performance in Mombasa County. The F value of 88.657 shows a substantial variance between groups compared to within groups, suggesting that performance differences are not due to chance but reflect the impact of the independent variables studied. The mean square value of 64.559 indicates greater variability among group means, supporting the idea that factors like service delivery automation, system management, data security, and information quality contribute to performance differences. With a significance level of 0.002, well below the 0.05 threshold, the results are statistically significant, indicating a strong likelihood that these effects are genuine. This suggests that effective service delivery automation, robust system management, stringent data security, and high information quality are positively linked to improved hospital performance.

Table 4.11: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.645	0.254		2.53937	0.003
	Service delivery automation	0.715	0.335	0.0674	2.134328	0.002
	System management	0.811	0.291	0.1097	2.786942	0.001
	Data security	0.796	0.306	0.0229	2.601307	0.004
	Information quality	0.764	0.227	0.0511	3.365639	0.003

Source: Survey Data (2024)

Table 4.11 shows that service delivery automation has a beta value of 0.0674 and a significance value of 0.003, indicating a positive impact on hospital performance in Mombasa County. The beta value indicates that each unit increase in automation correlates with improved performance metrics, supported by the low p-value of 0.002, which confirms the reliability of the findings. This aligns with Wandie and Muathe (2022) research suggesting that automated systems enhance operational efficiency, patient outcomes, and satisfaction for both patients and providers.

The study finds that system management significantly influences hospital performance in Mombasa County, with a beta value of 0.1097 indicating a positive relationship between effective management practices and improved performance metrics. This suggests that utilizing enhanced system management capabilities leads to better hospital outcomes. The significance value of 0.001 confirms that this relationship is statistically significant, emphasizing the critical role of robust management systems in healthcare. These results align with Aldwairi et. al. (2023) research, which highlighted the correlation between effective system scalability, a system management practice, and improved performance in healthcare institutions, underscoring the need to prioritize data management strategies, especially in challenging regions with an ever-growing patient population, thus patient data, like Mombasa County.

The study finds that data security significantly impacts the operational performance of hospitals in Mombasa County, with a beta value of 0.0229 indicating a positive relationship. As data security improves, so does operational performance, supported by a significance value of 0.004, which confirms that this effect is statistically significant. These results emphasize the need for hospitals to prioritize data security, as it can lead to better patient's privacy and operational efficiency in service delivery. Consistent with Al-Muhtadi et. al. (2019) research, the findings highlight that effective data security is both a regulatory necessity and a strategic imperative for healthcare organizations.

The study finds that information quality significantly impacts hospital performance in Mombasa County, with a beta value of 0.0511 indicating a positive relationship. The significance value of 0.003 confirms that this relationship is statistically significant. The findings suggest that enhancing information quality is essential for hospitals aiming to improve performance and service delivery. These results align with Overrange *et al.* (2019), whose study emphasized the importance of accurate and timely information in healthcare reporting, monitoring, and evaluation, which leads to better decision-making and improved patient outcomes.

4.4 Qualitative Data Analysis Results

The qualitative data was collected from the open-ended questions and analyzed thematically as per the research objectives. The following are the results;

4.4.1 Service Delivery Automation

The respondents were asked to indicate their opinion whether there were any improvement areas regarding service delivery automation as facilitated by MIS within the hospital. The responses given are presented as follows;

'Implementing standardized protocols and APIs to ensure seamless data exchange between systems can enhance the flow of information, reduce errors, and improve patient care. Staff

may not be fully trained on how to utilize MIS effectively, leading to underutilization of available features. Many MIS systems provide data retrospectively rather than in real-time, which can hinder timely decision-making. Developing and integrating patient engagement tools (e.g., mobile apps for appointment scheduling, telehealth services, and patient portals) can enhance the patient experience and streamline service delivery.'

4.4.2 System Management

The respondents were asked to indicate their opinion whether the current state of system integration/ management is capable of improving the hospital's performance. The responses given are presented as follows;

'Effective system integration allows for seamless access to patient data across various departments. Integrated management systems can streamline hospital operations by automating routine tasks, such as scheduling, billing, and inventory management. System integration fosters better communication among healthcare teams. Advanced integrated systems often come equipped with analytics tools that can provide insights into patient care trends, operational efficiency, and resource allocation. Integrated systems can enhance patient engagement through portals that allow patients to access their health information, schedule appointments, and communicate with their healthcare providers.'

4.4.3 Data Security

The respondents were asked to indicate whether there were adequate data security measures in their organization to improve on performance. The responses given are presented as follows;

'Strong security measures help ensure that sensitive data, such as customer information, financial records, and intellectual property, is protected from unauthorized access and breaches. By employing advanced security protocols, organizations can significantly reduce their vulnerability to cyberattacks, such as phishing, ransomware, and data breaches. Implementing data security measures often involves the adoption of new technologies and processes that can

streamline operations. Customers are more likely to engage with organizations that demonstrate a commitment to data security.'

4.4.4 Information Quality

The respondents were asked to indicate whether the impact of information quality in the aspects of accuracy, timeliness, confidentiality, and completeness has improved effectiveness of the hospital's operations. The responses given are presented as follows;

'Accuracy is paramount in healthcare settings. When information is precise and reliable, it allows healthcare professionals to make informed decisions regarding patient care. Timely access to information can be a matter of life and death. Rapid retrieval of patient data, test results, and medical histories enables healthcare teams to respond swiftly to changing patient conditions. Confidentiality is essential in maintaining patient trust and complying with legal and ethical standards. Enhanced information quality ensures that sensitive patient data is protected from unauthorized access and breaches. Completeness of information is equally important. Comprehensive patient records that include all relevant medical history, treatment plans, and follow-up care instructions enable healthcare providers to have a holistic view of a patient's health.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION

5.2 Introduction

This chapter encompasses a summary, conclusions, recommendations for further research, and suggestions.

5.3 Summary

The general objective of this study was to examine the influence of management information system capabilities on the performance of hospitals in Mombasa County, Kenya. The management information system capabilities examined were; service delivery automation, system management, data security and information quality. The study collected data using a semi-structured questionnaire. Data analysis was done using descriptive analysis and inferential statistics. The summary of the results is presented as follows;

5.2.1 Service Delivery Automation

The study sought to establish the influence of service delivery automation on the performance of hospitals in Mombasa County. The study revealed that service delivery automation had a positive significant influence on the performance of hospitals in Mombasa County. The system effectively supports the patient's smooth navigation through the required stages of their healthcare journey, MIS enables comprehensive documentation of the patient's data; treatment procedures and medical histories, the MIS significantly contributes to enhancing patient satisfaction relative to their service experience and ICT system enables seamless provision of clear information to the patients concerning their treatment plans.

5.2.2 System Management

The study sought to examine the effect of system management on the performance of hospitals in Mombasa County. The study found a positive significant relationship between system management and the performance of hospitals in Mombasa County. The MIS enables efficient integrated data storage for all necessary functions in the hospital, when necessary, there is seamless data exchange with external partners and healthcare systems, the MIS provides

adequate customized reporting and analytical tools that aid in decision making and the MIS maintains performance and remains reliable even when the volume of data increases.

5.2.3 Data Security

The study sought to determine the influence of data security on the performance of hospitals in Mombasa County. The data security was found to have a positive significant influence on the performance of hospitals in Mombasa County. The MIS ensures that only authorized users can view and modify data, the MIS facilitates traceability and accountability of user actions within the system, disaster recovery protocols are in place for timely data restoration in case of system failure and the system's disaster recovery mechanisms ensure continuity of hospital operations by preventing data loss during unforeseen events.

5.2.4 Information Quality

The study sought to assess the effect of information quality on the performance of hospitals in Mombasa County. The study revealed that information quality significantly influences the performance of hospitals in Mombasa County. There are a few incidences of inaccurate information being provided by the MIS, MIS enables prompt updates on patients' records for up-to-date interventions and the captured patient information contains all relevant data elements during retrieval, for a holistic view of patient's health.

5.3 Conclusion

The following are conclusions of the study;

5.3.1 Service Delivery Automation

The study concludes that service delivery automation enhances the patient flow because automated appointment scheduling systems can reduce the time patients spend waiting for consultations and treatments. Automation facilitates the digitization of patient records, making it easier for healthcare providers to access and share information. Automated billing systems can ensure accurate invoicing and faster payment processing, which is essential for the financial sustainability of hospitals. Service delivery automation enhances communication

among healthcare teams and between providers and patients through tools such as patient portals, messaging systems, and telehealth platforms which facilitate better interaction, allowing for timely follow-ups and consultations.

5.3.2 System Management

The study concludes that effective system management ensures optimal resource allocation within hospitals and can help hospitals prioritize the use of medical supplies, equipment, and human resources. Implementing robust inventory management systems can reduce waste and ensure that essential supplies are available when needed. This is particularly important in emergency situations where timely access to resources can save lives. System management also involves financial oversight, which is critical for maintaining operational efficiency. The quality of patient care is directly influenced by the efficiency of hospital operations.

5.3.3 Data Security

The study concludes that patients are more likely to seek medical care and share sensitive information when they trust that their data is secure. Hospitals that prioritize data security can enhance patient satisfaction and loyalty. A breach in data security can lead to negative publicity, damaging a hospital's reputation. Maintaining robust data security measures helps hospitals build a positive image in the community. Hospitals with strong data security measures are less likely to experience downtime, ensuring that patient care is not interrupted. Investing in data security can lead to long-term cost savings by preventing data breaches that require expensive remediation efforts.

5.3.4 Information Quality

The study concludes that high-quality information ensures that patient records are accurate and up-to-date, which is crucial for effective diagnosis and treatment. Inaccurate or incomplete information can lead to medical errors, adversely affecting patient safety. Quality information allows for the development of tailored treatment plans based on individual patient histories and needs, enhancing the effectiveness of care provided. High-quality information supports

evidence-based decision-making, enabling healthcare professionals to apply the best available research to clinical practice. This can lead to improved treatment protocols and patient outcomes.

5.4 Recommendations

The study arrived at the following recommendations;

5.4.1 Service Delivery Automation

The study recommends that the hospitals should transition from paper-based records to comprehensive electronic health records systems. Implement online booking systems that allow patients to schedule, reschedule, or cancel appointments autonomously. Utilize software solutions to monitor and manage patient flow through various departments in the hospital. Develop Apps that allow patients to access health information, medication reminders, and educational resources. Implement automated inventory tracking systems to manage medical supplies and pharmaceuticals. Utilize data analytics to monitor performance metrics, patient outcomes, and operational workflows.

5.4.2 System Management

The study recommends that transitioning to comprehensive EHR systems can streamline patient data management, improve communication among healthcare providers, and enhance patient care coordination. Regular training sessions for healthcare professionals on the latest medical practices, technology use, and patient management can enhance service delivery. Implementing lean methodologies can help identify waste in processes, streamline operations, and improve patient flow within hospitals. Establishing systems for collecting and analyzing patient feedback can help hospitals understand patient needs and improve service quality.

5.4.3 Data Security

The study recommends that the hospitals should perform thorough assessments of existing data security measures to identify vulnerabilities and areas for improvement. Analyze potential threats specific to the hospital environment, including cyberattacks, insider threats, and natural

disasters. Use strong encryption protocols for data at rest and in transit to protect patient information from unauthorized access. Conduct ongoing training sessions for staff on data security best practices, including recognizing phishing attempts and handling sensitive information. Create a comprehensive incident response plan that outlines procedures for responding to data breaches or security incidents.

5.4.4 Information Quality

The study recommends that the Hospitals should establish standardized performance indicators that all hospitals must report on, such as patient wait times, readmission rates, infection rates, and patient satisfaction scores. Encourage the adoption of EHR systems that facilitate real-time data entry and retrieval, improving the accuracy and accessibility of patient information. Provide training for hospital staff on data collection methods to ensure consistency and accuracy in reporting. Implement regular patient satisfaction surveys to gather feedback on their experiences and perceptions of care quality.

5.5 Suggestion for Further Research

From the results in regression analysis, the study concluded that there is a remaining 24.4 percent that could account for other variables not studied. Therefore, this study suggests that further studies should be carried out focusing on other variables not studied to address this conceptual gap.

REFERENCES

Abdihakim, D. H., & Tumuti, J. (2022). Information Security and Performance of Public Hospitals in Garissa County, Kenya. International Journal of Scientific and Technological Research, 5(1), 10-22.

Abbasi, R., Khajouei, R., & Jabali, M. S. (2019). Timeliness and accuracy of information sharing from hospital information systems to electronic health record in Iran. Journal of Health Administration, 22(2), 28–40.

Ajayi, S., Wamae, P., & Muthee, D. (2021). Implementation of Electronic Medical Records for Service Delivery in Selected State Hospitals in Southwest Nigeria. *International Journal of Current Aspects*, *5*(2), 75-94. https://doi.org/10.35942/ijcab.v5i2.174

Ajwang' Bernadette, Komen Anthony, Douglas Ngaira, & Wanjala Pepela. (2018). *Health Information System Policy Brief* (pp. 1–8). THE HEALTH SECTOR MONITORING AND EVALUATION UNIT, MINISTRY OF HEALTH, KENYA.

Akbulut, D. H., & Kaya, I. (2018). Big data analytics in financial reporting and accounting. Pressacademia, 7(1).

Alice Mwang'ombe. (2021). *DETERMINANTS OF UTILIZATION OF ELECTRONIC MEDICAL RECORDS SYSTEMS IN CLINICAL MANAGEMENT IN PUBLIC HEALTHCARE FACILITIES IN MOMBASA COUNTY, KENYA*. Kenyatta University.

Al-Muhtadi, J., Shahzad, B., Saleem, K., Jameel, W., & Orgun, M. A. (2019). Cybersecurity and privacy issues for socially integrated mobile healthcare applications operating in a multi-cloud environment. Health Informatics Journal, 25(2).

Aldwairi, M., Jarrah, M., Mahasneh, N., & Al-khateeb, B. (2023). Graph-based data management system for efficient information storage, retrieval and processing. Information Processing and Management, 60(2).

Argaw, S. T., Bempong, N. E., Eshaya-Chauvin, B., & Flahault, A. (2019). The state of research on cyberattacks against hospitals and available best practice recommendations: A scoping review. BMC Medical Informatics and Decision Making, 19(1).

Arvanitis, S., & Loukis, E. N. (2016). Investigating the effects of ICT on innovation and performance of European hospitals: an exploratory study. European Journal of Health Economics, 17(4).

Asnawi, A. A., Awang, Z., Afthanorhan, A., Mohamad, M., & Karim, F. (2019). The influence of hospital image and service quality on patients' satisfaction and loyalty. Management Science Letters, 9(6).

Balaraman, P., & Kosalram, K. (2013). E –Hospital Management & Hospital Information Systems – Changing Trends. International Journal of Information Engineering and Electronic Business, 5(1).

Barnes, J., O'Hanlon, B., Feeley III, F., McKeon, K., Gitonga, N., & Decker, C. (2010). *Private Health Sector Assessment in Kenya*. World Bank Working Paper.

Basel, O., & Majeedy, K. (2023). *Key performance indicators (KPI) of information systems project management*. *International Journal of Finance, Accounting and Economics Studies, 2*(6), 1–15. https://doi.org/10.59992/IJFAES.2023.v2n6p1

Berner, E. S., Becker, M., Downs, S. M., & London, N. (2024). Evaluation of a clinical decision support system for imaging requests: A cluster randomized clinical trial. *JAMA Network Open, 7*(4), e243010. https://doi.org/10.1001/jamanetworkopen.2024.3010

Beylik, U., Cirakli, U., Cetin, M., Ecevit, E., & Senol, O. (2022). The relationship between health expenditure indicators and economic growth in OECD countries: A Driscoll-Kraay approach. *Frontiers in Public Health, 10*, Article 1050550. https://doi.org/10.3389/fpubh.2022.1050550

Casteel, A., & Bridier, N. L. (2021). Describing populations and samples in doctoral student research. International Journal of Doctoral Studies, 16.

Cline, G. B., & Luiz, J. M. (2013). Information technology systems in public sector health facilities in developing countries: The case of South Africa. *BMC Medical Informatics and Decision Making*, *13*(1). https://doi.org/10.1186/1472-6947-13-13

Connelly, L. M. (2016). Pilot studies. Medsurg Nursing, 17(6), 411-2.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, *35*(8). https://doi.org/10.1287/mnsc.35.8.982

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research*, *3*(1). https://doi.org/10.1287/isre.3.1.60

DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems, 19*(4). https://doi.org/10.1080/07421222.2003.11045748

Department of Health, R. of S. A. (2019). *National Digital Health Strategy for South Africa, 2019-2024*.

Dubas-Jakóbczyk, K., Kocot, E., & Kozieł, A. (2020). Financial performance of public hospitals: A cross- sectional study among polish providers. International Journal of Environmental Research and Public Health, 17(7).

Durodolu, O. (2016). Technology Acceptance Model as a predictor of using information system' to acquire information literacy skills. *Library Philosophy and Practice*, *2016*(1).

Endriyas, M., Alano, A., Mekonnen, E., Ayele, S., Kelaye, T., Shiferaw, M., Misganaw, T., Samuel, T., Hailemariam, T., & Hailu, S. (2019). Understanding performance data: Health management information system data accuracy in Southern Nations Nationalities and People's Region, Ethiopia. BMC Health Services Research, 19(1).

Farzandipour, M., Meidani, Z., Gilasi, H., & Dehghan, R. (2017). Evaluation of key capabilities for hospital information system: A milestone for meaningful use of information technology. Annals of Tropical Medicine and Public Health, 10(6).

Frank Verbeke et al. (2010). Patient identification and hospital information management systems in sub-Saharan Africa: a field study in Rwanda and Burundi. *A BISI: Department of Biostatistics and Medical Informatics, Faculty of Medicine and Pharmacy, Vrije Universiteit Brussel, Brussels, Belgium b Regional e-Health Center of Excellence, Kigali Health Institute, Kigali, Rwanda c Belgian Technical Cooperation*, *69*(December), 7–12. http://www.bioline.org.br/pdf?rw12002

Gatero, G. (2011). Utilization of ICTs for Accessing Health Information by Medical Professionals in Kenya: A Case Study of Kenyatta National Hospital. *Journal of Health Informatics in Developing Countries*, *5*(1).

Gatotoh, A., Omulema, B., & Nassiuma, D. (2011). Correctional Attitudes: An Impetus for a Paradigm Shift in Inmate Rehabilitation. *International Journal of Humanities and Social Science*, *1*(4).

Gavrilov, G., Vlahu-Gjorgievska, E., & Trajkovik, V. (2020). Healthcare data warehouse system supporting cross-border interoperability. Health Informatics Journal, 26(2).

Haleem, M. A., & Khan, M. A. (2024). Access control solutions in electronic health record systems: A systematic review. *Informatics in Medicine Unlocked*, *49*, 101552. https://doi.org/10.1016/j.imu.2024.101552

Hameed, M. A., & Arachchilage, N. A. G. (2021). The role of self-efficacy on the adoption of information systems security innovations: A meta-analysis assessment. *Personal and Ubiquitous Computing*, *25*(5), 911–925. https://doi.org/10.1007/s00779-021-01560-1

Haule, A., Ally Dida, M., & Elikana Sam, A. (2019). Towards Data Exchange between Health Information System and Insurance Claims Management System. International Journal of Information Engineering and Electronic Business, 11(2), 28–34.

Hayajneh, Y. A., & Zaghloul, A. A. (2010). Barriers to the Adoption of Health Information Technology in Arab Countries' Hospitals: Practitioners' Perspective. *Quality of Life through Quality of Information*, *24*.

Hermes, S., Riasanow, T., Clemons, E. K., Böhm, M., & Krcmar, H. (2020). The digital transformation of the healthcare industry: exploring the rise of emerging platform ecosystems and their influence on the role of patients. Business Research, 13(3), 1033–1069.

Hu, L., Ding, H., Hu, G., Wang, Z., Liu, S., & Liu, Y. (2019). How Perceived Quality of Care Affects Outpatient Satisfaction in China: A Cross-Sectional Study of 136 Tertiary Hospitals. Inquiry (United States), 56.

Ibeneme, S., Karamagi, H., Muneene, D., Goswami, K., Chisaka, N., & Okeibunor, J. (2022). Strengthening Health Systems Using Innovative Digital Health Technologies in Africa. In *Frontiers in Digital Health* (Vol. 4). Frontiers Media S.A. https://doi.org/10.3389/fdgth.2022.854339

Jayasiri K.C.N., Thathsarani W.R.V.K., de Silva D.I., & Vidhanaarachchi S. (2022). Design and Implementation of an Automated Hospital Management System with MERN Stack. International Journal of Engineering and Management Research, 12(5), 197–202.

Jeff Barnes, Barbara O'Hanlon, Frank Feeley III, Kimberly McKeon, Nelson Gitonga, & Caytie Decker. (2010). *Private Health Sector Assessment in Kenya* (No. 193).

Karijo, E. K., Otieno, G. O., & Mogere, S. (2021). Determinants of Data Use for Decision Making in Health Facilities in Kitui County, Kenya. *Quest Journal of Management and Social Sciences*, *3*(1), 63–75. https://doi.org/10.3126/qjmss.v3i1.37593

Karitis, K., Gallos, P., Triantafyllou, I. S., & Plagianakos, V. (2021). Chios Hospital Information System Assessment. *Studies in Health Technology and Informatics*, *287*, 158–162. https://doi.org/10.3233/SHTI210837

Kenya Medical Practitioners and Dentists Council. (2019). Checklist for categorization of health facilities. KMPDC. Retrieved from https://kmpdc.go.ke/resources/level5.pdf

Kenya Medical Practitioners and Dentists Council. (2019). Checklist for categorization of health facilities. KMPDC. Retrieved from https://kmpdc.go.ke/resources/level4.pdf

Khalifa, M., & Alswailem, O. (2015). Hospital information systems (HIS) acceptance and satisfaction: A case study of a Tertiary Care Hospital. *Procedia Computer Science*, *63*. https://doi.org/10.1016/j.procs.2015.08.334

Kohli, R., & Tan, S. S. L. (2016). Electronic health records: How can is researchers contribute to transforming healthcare? In MIS Quarterly: Management Information Systems (Vol. 40, Issue 3).

Kothari, M. (2023). Social Science Research; Theory and Principles. Nairobi. In *Technology, Pedagogy and Education*.

Kumar, K. P., Pillai, V. J., Chandra, K. S., & Chowdary, C. R. (2021). Disaster recovery and risk management over private networks using data provenance: Cyber security perspective. Indian Journal of Science and Technology, 14(8), 725–737.

Kwon, J., & Johnson, M. E. (2014). Proactive versus reactive security investments in the healthcare sector. MIS Quarterly: Management Information Systems, 38(2).

Lee, K., Seo, L., Yoon, D., Yang, K., Yi, J. E., Kim, Y., & Lee, J. H. (2022). Digital health profile of South Korea: A cross-sectional study. *International Journal of Environmental Research and Public Health*, *19*(10), 6329. https://doi.org/10.3390/ijerph19106329

Leung, R. C. (2012). Health information technology and dynamic capabilities. Health Care Management Review, 37(1).

Liang, J., Li, Y., Zhang, Z., Shen, D., Xu, J., Zheng, X., Wang, T., Tang, B., Lei, J., & Zhang, J. (2021). Adoption of electronic health records (EHRs) in China during the past 10 years: Consecutive survey data analysis and comparison of Sino-American challenges and experiences. *Journal of Medical Internet Research*, *23*(2). https://doi.org/10.2196/24813

Lipson, H. F., & Fisher, D. A. (1999). Survivability - A new technical and business perspective on security. Proceedings New Security Paradigm Workshop.

Littlejohns, P., Wyatt, J. C., & Garvican, L. (2003). Evaluating computerised health information systems: Hard lessons still to be learnt. *British Medical Journal*, *326*(7394). https://doi.org/10.1136/bmj.326.7394.860

Marek, B. T., Farrell, C. O., Yamamoto, C., & Zable, I. (2005). Trends and Opportunities in Public-Private Partnerships to Improve Health Service Delivery in Africa. *Health Systems for Outcomes Publication*.

Martin, A. P., & Khazanchi, D. (2006). Information availability and security policy. Association for Information Systems - 12th Americas Conference on Information Systems, AMCIS 2006, 2.

Meiyana, N. S., Susanto, T., Rokhmah, D., Yunanto, R. A., Rahmawati, I., & Hernawati, S. (2023). Analysis of hospital management information system satisfaction using the end-user computing satisfaction method: A cross-sectional study. *Jurnal Keperawatan Padjadjaran*, *11*(1). https://doi.org/10.24198/jkp.v11i1.2099

Ministry of Health, Kenya. (2020). *Health sector annual performance review report, financial year 2020/2021*. Ministry of Health, Kenya. http://guidelines.health.go.ke:8000/media/Health_Sector_Annual_Performance_Review_Report_Financial_Year_2020-2021_-October2022.pdf

Ministry of Health. (2019). Kenya Health Service Delivery Indicator Survey 2018 Report. The World Bank.

Ministry of Health, Kenya. (2020). *Kenya Universal Health Coverage Policy 2020–2030: Accelerating attainment of universal health coverage*. Ministry of Health. https://repository.kippra.or.ke/handle/123456789/3566

Modi, S., Feldman, S. S., Berner, E. S., Schooley, B., & Johnston, A. (2024). Value of electronic health records measured using financial and clinical outcomes: A quantitative study. *JMIR Medical Informatics, 12*, e52524. https://doi.org/10.2196/52524

Mohdi Fadhil NF, Jusop M, & Abdullah AA. (2012). Hospital Information System (SIS) Implementation in a Public Hospital: A Case Study from Malaysia. *Fareast Journals*.

Mombasa County Government. (2022). Mombasa County Health Management Policy 2022-2027.

Mombasa County Government. (2018). Mombasa County Health Act 2018.

Moore, M., Anthony, C., Lim, Y.-W., Jones, S., Overton, A., & Yoong, J. (2020). The Future of Health Care in the Kurdistan Region — Iraq: Toward an Effective, High-Quality System with an Emphasis on Primary Care.

Moradipour, M., Javidi, M., & Sadeghi, T. (2021). Effects of Hospital Information System on the Performance of Management Units in Public Hospitals Analysis in Southwestern Iran. Jundishapur Journal of Health Sciences, 14(1).

Mugenda, A. G. (2008). Social science research: Theory and principles. *Technology, Pedagogy and Education*.

Mugenda, M.O., & Mugenda, G. A. (2019). *Research Methods; Quantitative and Qualitative Approaches*. Nairobi City, Kenya: Acts Press.

Mugenda, M. O., & Mugenda, G. A. (2003). Research methods: Qualitative and quantitative approaches. *Journal of Co-Operative and Business Studies (JCBS), 1*(1).

Mugo, D. M., & Nzuki, D. (2014). Determinants of Electronic Health in Developing Countries. In *International Journal of Arts and Commerce* (Vol. 3, Issue 3). www.ijac.org.uk

Muinga, N., Magare, S., Monda, J., English, M., Fraser, H., Powell, J., & Paton, C. (2020). Digital health Systems in Kenyan Public Hospitals: A mixed-methods survey. In *BMC Medical Informatics and Decision Making* (Vol. 20, Issue 1). https://doi.org/10.1186/s12911-019-1005-7

Munjal, K., & Bhatia, R. (2023). A systematic review of homomorphic encryption and its contributions in healthcare industry. Complex and Intelligent Systems, 9(4).

Mwang'ombe, A., Yitambe, A., & Waithaka, S. (2019). *International Journal of Economics, Commerce and Management DETERMINANTS OF IMPLEMENTING ELECTRONIC MEDICAL RECORDS IN CLINICAL MANAGEMENT IN PUBLIC HEALTHCARE FACILITIES IN MOMBASA COUNTY, KENYA*. http://ijecm.co.uk/

MWANGI, J. G. (2016). FACTORS INFLUENCING MEDICAL PRACTITIONERS' USE OF INFORMATION COMMUNICATION TECHNOLOGY IN PROVISION OF HEALTH SERVICES IN KENYA. *Strategic Journal of Business & Change Management*, *3*(1). https://doi.org/10.61426/sjbcm.v3i1.208

Nicole Archangel. (2008). *The critical issues affecting the introduction of Health Management Information Systems in developing countries in Africa*.

Njuguna, D. C., Muiruri, L., & Njoroge, K. (2022). Utilization of health information data in Nairobi County public health facilities; lessons from the field. *International Journal Of Community Medicine And Public Health*, *10*(1). https://doi.org/10.18203/2394-6040.ijcmph20223523

Nkanata, M. G., Makori, E. O., & Irura, G. (2018). Comparative analysis of hospital information management systems among healthcare workers in two selected hospitals in Kenya. Library Philosophy and Practice, December 2018.

Nyangena, J., Rajgopal, R., Ombech, E. A., Oloo, E., Luchetu, H., Wambugu, S., Kamau, O., Nzioka, C., Gwer, S., & Ndiritu Ndirangu, M. (2021). Maturity assessment of Kenya's health information system interoperability readiness. *BMJ Health and Care Informatics*, *28*(1). https://doi.org/10.1136/bmjhci-2020-100241

Odanga, S. W., & Wachiuri, E. (2022). Determinants of Inventory Management in Public Hospitals in Mombasa County. *Kenya. Journal of Procurement and Supply Chain*, *2*(1), 21–37.

Odini, S., & Omuke, A. (2014). Use of Information Communication Technologies (ICTs) by medical professionals in accessing information for healthcare delivaery at the MOI Teaching and Referral Hospital (MTRH) in Eldoret, Kenya. *Journal of International Academic Research for Multidisciplinary*, *2*(5).

Olu, O., Muneene, D., Bataringaya, J. E., Nahimana, M. R., Ba, H., Turgeon, Y., Karamagi, H. C., & Dovlo, D. (2019). How Can Digital Health Technologies Contribute to Sustainable Attainment of Universal Health Coverage in Africa? A Perspective. *Frontiers in Public Health*, *7*. https://doi.org/10.3389/fpubh.2019.00341

Orrell, T. (2020, August 7). Joining data for universal healthcare in Kenya: A view from the Ministry of Health. Data for SDGs. https://www.data4sdgs.org/resources/joining-data-universal-healthcare-kenya-view-ministry-health

Oreni, K. B., Andre, Y., Otieno, O. G., & Iwaret, O. M. (2021). Data Quality in Health Management Information Systems at Kenyatta National Hospital in Nairobi City County, Kenya: Influence of Technological Factors. Issue 3 Ser. I, 10(February).

Otieno, B. (2024, May 3). Mombasa seeks public-private partnerships for better healthcare. *The Star*. https://www.the-star.co.ke/counties/coast/2024-05-03-mombasa-seeks-public-private-partnerships-for-better-healthcare/

Peltonen, L. M., Junttila, K., & Salantera, S. (2018). Front-line physicians' satisfaction with information systems in hospitals. Studies in Health Technology and Informatics, 247.

Perdana, A., & Mokhtar, I. A. (2023). Leveraging digital technologies for information technology- enabled healthcare transformation at SingHealth. Journal of Information Technology Teaching Cases, 13(1), 97–103.

Råberus, A., Holmström, I. K., Galvin, K., & Sundler, A. J. (2019). The nature of patient complaints: a resource for healthcare improvements. International Journal for Quality in Health Care, 31(7).

Regueiro, C., Seco, I., Gutiérrez-Agüero, I., Urquizu, B., & Mansell, J. (2021). A blockchain-based audit trail mechanism: Design and implementation. Algorithms, 14(12).

Reis, Z. S. N., Maia, T. A., Marcolino, M. S., Becerra-Posada, F., Novillo-Ortiz, D., & Ribeiro, A. L. P. (2017). Is there evidence of cost benefits of electronic medical records, standards, or interoperability in hospital information systems? overview of systematic reviews. In *JMIR Medical Informatics* (Vol. 5, Issue 3). JMIR Publications Inc. https://doi.org/10.2196/medinform.7400

Roratto, R., & Dias, E. D. (2014). Security information in production and operations: a study on audit trails in database systems. Journal of Information Systems and Technology Management, 11(3).

Ruhang, W. (2023). Disaster Recovery Backup and Privacy Protection Algorithm of Hotel HRM Information System. International Journal of Science and Engineering Applications.

Rumisha, S. F., Lyimo, E. P., Mremi, I. R., Tungu, P. K., Mwingira, V. S., Mbata, D., Malekia, S. E., Joachim, C., & Mboera, L. E. G. (2020). Data quality of the routine health management information system at the primary healthcare facility and district levels in Tanzania. BMC Medical Informatics and Decision Making, 20(1).

Saha, T., Bhuiya, R. H., Masum, Z. U., Islam, M. R., & Chowdhury, J. A. (2018). Hospital Pharmacy Management System and Future Development Approaches in Bangladeshi Hospital. Bangladesh Pharmaceutical Journal, 20(2).

Salte, T. (2014). *ICTs and access to health care in Kenya Thesis submitted in partial fulfillment of the requirements for the Degree of Master of Philosophy in Culture, Environment and Sustainability Centre for Development and the Environment*.

Schoenfelder, T., Klewer, J., & Kugler, J. (2011). Determinants of patient satisfaction: A study among 39 hospitals in an in-patient setting in Germany. International Journal for Quality in Health Care, 23(5).

Sebetci, Ö. (2018). Enhancing end-user satisfaction through technology compatibility: An assessment on health information system. *Health Policy and Technology*, *7*(3). https://doi.org/10.1016/j.hlpt.2018.06.001

Senitan, A., & Alzahrani, M. (2025). Impact of big data analytics on emergency department efficiency in Saudi Ministry of Health hospitals: A retrospective data analysis. *International Journal of Healthcare Analytics*. Advance online publication. https://pubmed.ncbi.nlm.nih.gov/40066234/

Slawomirski, L., Lindner, L., de Bienassis, K., Haywood, P., Hashiguchi, T. C. O., Steentjes, M., & Oderkirk, J. (2023). *Progress on implementing and using electronic health record systems: Developments in OECD countries as of 2021* (OECD Health Working Papers No. 160). OECD Publishing. https://doi.org/10.1787/4f4ce846-en

Sun, Z., Wang, S., Zhao, H., & Yu, H. (2020). Does Descending Resources Reform Improve Patient Satisfaction and Reshape Choice of Care Providers? A Cross-Sectional Study in Zhejiang, China.

Suzuki, J. (2020). Resampling. In *Statistical learning with math and R* (pp. 39–60). Springer. https://doi.org/10.1007/978-981-15-7568-6_4

Taber, K. S. (2013). Ken Springer: Educational Research: A Contextual Approach. *Science & Education*, *22*(5). https://doi.org/10.1007/s11191-011-9420-x

Taherdoost, H. (2020). Different Types of Data Analysis Data Analysis Methods and Techniques in Research Projects. International Journal of Academic Research in Management (IJARM), 9(1), 1–9.

Tambunan, A., & Iqbal, M. A. (2024). The influence of work environment, career development and organizational commitment on employee job satisfaction: Study at Bank "M" IT Group. *Dinasti International Journal of Management Science*, *5*(3), 352–359. https://doi.org/10.31933/dijms.v5i3.2177

Tao, W., & Liu, T. (2025). Evaluating the Effectiveness of Patient-Centered Standardized Prophylaxis Processes in Enhancing Patient Satisfaction and Return Intentions. *Behavioral Sciences*, *15*(1), 24. https://doi.org/10.3390/bs15010024

Teece, D. J. (2018). Dynamic capabilities as (workable) management systems theory. *Journal of Management and Organization*, *24*(3), 359–368. https://doi.org/10.1017/jmo.2017.75

Turulja, L., & Bajgorić, N. (2022). Business continuity and information systems: A systematic literature review. In *Research anthology on business continuity and navigating times of crisis* (pp. 1–23). IGI Global. https://doi.org/10.4018/978-1-6684-4503-7.ch001

Tran, M. D., & Vu, T. Sen. (2018). Determinants Influencing Financial Performance of Public Hospitals: The Case of Vietnam. Asian Business Research, 3(1).

Yusof, M. M., Kuljis, J., Papazafeiropoulou, A., & Stergioulas, L. K. (2008). An evaluation framework for Health Information Systems: human, organization and technology-fit factors (HOT-fit). *International Journal of Medical Informatics*, *77*(6). https://doi.org/10.1016/j.ijmedinf.2007.08.011

Ullah, F., He, J., Zhu, N., Wajahat, A., Nazir, A., Qureshi, S., Pathan, M. S., & Dev, S. (2024). Blockchain-enabled EHR access auditing: Enhancing healthcare data security. *Heliyon, 10*(16), e34407. https://doi.org/10.1016/j.heliyon.2024.e34407

U.S. Department of Health and Human Services. (1996). *Health Insurance Portability and Accountability Act of 1996 (HIPAA)*. https://www.hhs.gov/hipaa/index.html

Wandie, R. W., & Muathe, S. M. (2022). What enhances service delivery in public hospitals in Kenya? The role of total quality management practices. International Journal of Research in Business and Social Science (2147- 4478), 11(7).

Williams, P. A. H., & Mahncke, R. J. (2006). Shared Electronic Health Records: A changing landscape for security in medical practice. Journal of Information Warfare, 5(2), 61-72.

World Bank. (2018). *Improving transparency and accountability in public-private partnerships: Disclosure diagnostic report – Kenya*. World Bank Group. https://hdl.handle.net/10986/36582

World Health Organization. (2022). *Digital Health in Europe.*

Van Stam, G. (2022). Conceptualization and practices in digital health: voices from Africa. *African Health Sciences*, *22*, 664–672. https://doi.org/10.4314/ahs.v22i1.77

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly: Management Information Systems*, *27*(3). https://doi.org/10.2307/30036540

Venkatesh, V., Zhang, X., & Sykes, T. A. (2011). "Doctors do too little technology": A longitudinal field study of an electronic healthcare system implementation. Information Systems Research, 22(3), 523–546.

Zhang, P., Aikman, S. N., & Sun, H. (2008). Two types of attitudes in ICT acceptance and use. *International Journal of Human-Computer Interaction*, *24*(7). https://doi.org/10.1080/10447310802335482

Zhao, L. (2010). Study on online banking adoption and its predictors. *2010 International Conference on MultiMedia and Information Technology, MMIT 2010, 1*. https://doi.org/10.1109/MMIT.2010.149

APPENDICES

Appendix I: Letter of Introduction

Innocent Wanyonyi Masika

Email: masikamabachi@gmail.com

Phone number: 0724-666052

To whom it may concern;

Dear Sir/Madam,

RE: ACADEMIC RESEARCH DATA COLLECTION

I am Masika Innocent W., a Master of Business Administration student at Kenyatta University specializing in Management Information Systems. I am currently conducting a research study on ***Management Information System Capabilities and Performance of Hospitals in Mombasa County, Kenya.*** This is a pre-requisite for completion of this postgraduate degree.

I am, therefore, kindly requesting you to be part of my sample population by responding to the provided questionnaire. All the information provided will be treated with utmost confidentiality. The data shall be solely used for academic purposes. Moreover, your identity will be anonymous.

Thank you for your cooperation.

Yours sincerely,

Innocent Masika W.

Appendix II: Questionnaire

Please tick or shade in the appropriate box and, where applicable, fill in the blank spaces provided for the questions where elaborate answers are required. You are kindly requested to complete this questionnaire as objectively and honestly as possible.

PART A: DEMOGRAPHIC DATA

1. What is your gender?
   Female [ ]
   Male [ ]
   Prefer Not to Say [ ]
2. What is your working experience in this institution?
   Less than 1 year [ ]
   2 to 4 years [ ]
   4 to 6 years [ ]
   6 to 8 years [ ]
   Above 8 years [ ]
3. How long have you served in the ICT industry?
   Less than 5 years [ ]
   Between 5 and 10 years [ ]
   Between 10 and 15 years [ ]
   Above 15 years [ ]
4. What is your current position in this hospital?
   IS Support Staff [ ]
   System Administrator [ ]
   ICT Manager [ ]
   Health Records Information Management Officer [ ]
   Others (Specify) …….

SECTION B: SERVICE DELIVERY AUTOMATION

Kindly indicate your level of agreement or disagreement with the following statements regarding the role of service delivery automation in hospital performance. Use the Likert's Scale of 1-5, where: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

	Statements	1	2	3	4	5
5.	The system effectively supports the patient's smooth navigation through the required stages of their healthcare journey					
6.	MIS adequately facilitates timely assistance and support for patients during their hospital visit					
7.	ICT system enables seamless provision of clear information to the patients concerning their treatment plans					
8.	MIS enables comprehensive documentation of the patient's data; treatment procedures and medical histories					
9.	MIS ensures effective communication of patient's concerns and preferences for address by healthcare providers					
10.	The ICT system enables active engagement of patient's, through applications and digital platforms, in the decision-making processes regarding their health					
11.	The MIS significantly contributes to enhancing patient satisfaction relative to their service experience					

12. In your opinion, do we have any improvement areas regarding service delivery automation as facilitated by MIS within the hospital? Please explain

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SECTION C: SYSTEM MANAGEMENT

Using a scale of 1-5, please indicate your level of agreement and disagreement with the statements below regarding the role of system management on your hospital's performance, where: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

	Statements	1	2	3	4	5
13.	The MIS enables efficient integrated data storage for all necessary functions in the hospital					
14.	The data captured and stored by the system is easily accessible, in lesser time, when needed					
15.	Data can be easily shared between different users within and across departments					
16.	When necessary, there is seamless data exchange with external partners and healthcare systems					
17.	As the hospital expands, data storage is efficiently scalable, the system allows scaling up to accommodate increasing data demands					
18.	The MIS maintains performance and remains reliable even when the volume of data increases					
19.	The MIS provides adequate customized reporting and analytical tools that aid in decision making					
20.	Analytics availed by the system are fundamental in improving patient outcomes and hospital performance					

21. In your view, is the current state of system integration/ management capable of improving the hospital's performance? Kindly explain

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SECTION D: DATA SECURITY

Use a Likert Scale to indicate your level of agreement or disagreement with the following statements regarding the role of data security on hospital performance, consider the following; 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

	Statements	1	2	3	4	5
22.	The MIS ensures that only authorized users can view and modify data					
23.	Access to sensitive patient data is effectively controlled based on user roles					
24.	Only verified users gain access to the system, considering there is authentication					
25.	Potential data breaches and unauthorized access are adequately handled by MIS					
26.	Audit trails of data access, modifications, and other user activities are comprehensively captured					
27.	The MIS facilitates traceability and accountability of user actions within the system					
28.	Disaster recovery protocols are in place for timely data restoration in case of system failure					
29.	The system's disaster recovery mechanisms ensure continuity of hospital operations by preventing data loss during unforeseen events					
30.	Patient data is regularly backed up to secure off-site locations to mitigate effects of system failure					
31.	All MIS hardware are securely managed with antivirus installed for protection against malware					
32.	Few incidences of data security breach in the MIS have been reported					

33. In your view, are there adequate data security measures in your organization to improve on performance? Please explain.

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SECTION E: INFORMATION QUALITY

Please indicate your level of agreement or disagreement with these statements regarding the role of information quality on hospital performance. Use a Likert Scale of 1-5, where; 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree.

	Statements	**1**	**2**	**3**	**4**	**5**
34.	Information provided by the MIS is consistently accurate and error free					
35.	The captured patient information contains all relevant data elements during retrieval, for a holistic view of patient's health					
36.	The MIS avails information in a timely manner, allowing the users to access up-to-date patient data					
37.	MIS enables prompt updates on patients' records for up-to-date interventions					
38.	Confidentiality of sensitive patients' medical information is maintained by the MIS					
39.	Secure encryption of patient data in the MIS preserves its confidentiality by ensuring authorized access					
40.	There are a few incidences of inaccurate information being provided by the MIS					

41. In your opinion, has the impact of information quality in the aspects of accuracy, timeliness, confidentiality, and completeness improved effectiveness of the hospital's operations? Please explain.

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SECTION F: PERFORMANCE OF HOSPITALS

Please indicate your level of agreement or disagreement with the following statements regarding the performance of the hospital. Use a Likert Scale of 1-5, where; 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

	Statements	**1**	**2**	**3**	**4**	**5**
42.	MIS has enabled effective management of financial resources to ensure profitability and sustainability					
43.	MIS has enabled efficient allocation of resources across departments to maximize operational effectiveness					
44.	MIS has streamlined and optimized hospital operational processes for efficiency					
45.	Utilization of technology through service automation has enhanced operational efficiency					
46.	Patients seeking medical care experience minimal waiting times and delays during their visits					
47.	MIS has enabled hospital staff to demonstrate high competency levels in their roles					
48.	Patients feel satisfied and well-cared for in the access of healthcare services at the hospital					
49.	The MIS enables active seeking of feedback from patients for continuous improvement of service delivery					

Appendix III: Research Approval Letter

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 4150

Internal Memo

FROM: Executive Dean, Graduate School

DATE: 25th October, 2024

TO: **Innocent Wanyonyi Masika**
C/o Management Science Dept.

REF: D53/OL/MSA/21112/2022

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

We acknowledge receipt of your revised Research Proposal as per our recommendations raised by the Graduate School Board of 14th August, 2024 entitled **"Management Information System Capabilities and Performance of Hospitals in Mombasa County, Kenya."**

You may now proceed with your Data Collection, Subject to Clearance with Director General, National Commission for Science, Technology and Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking and Progress Report Forms per semester. The forms are available at the University's Website under Graduate School webpage downloads.

Also, please ensure that you publish article(s) from your project before submitting it to Graduate School for examination as per the Commission for University Education and Kenyatta University guidelines.

Thank you.

ANNBELL MWANIKI
FOR: EXECUTIVE DEAN, GRADUATE SCHOOL

C.c. Chairman, Department of Management Science

Supervisors:

1. Dr. Josphat Kyalo (PhD)
   C/o Department of Management Science
   Kenyatta University

AM/fc

Appendix IV: Authorization Letter

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: D53/OL/MSA/21112/2022

DATE: 25th October, 2024

Director General,
National Commission for Science, Technology
and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR INNOCENT WANYONYI MASIKA – REG. NO. D53/OL/MSA/21112/2022

I write to introduce **Innocent Wanyonyi Masika** who is a Postgraduate Student of this University. The student is registered for M.B.A degree programme in the **Department of Management Science.**

Wanyonyi intends to conduct research for a M.B.A Project Proposal entitled, **"Management Information System Capabilities and Performance of Hospitals in Mombasa County, Kenya."**

Any assistance given will be highly appreciated.

Yours faithfully,

PROF. ELIUD NJAGI
EXECUTIVE DEAN, GRADUATE SCHOOL

AM/lc

Appendix V: List Of Level 4 & 5 Private and Public Hospitals in Mombasa County

S/No.	Hospital Name	Category	Level	Sub County
1.	Coast General Hospital	Public	5	Mvita
2.	Port Reitz Hospital	Public	4	Changamwe
3.	Tudor District Hospital	Public	4	Mvita
4.	Mewa Hospital	Private	4	Mvita
5.	Jocham Hospital	Private	4	Kisauni
6.	Mombasa Hospital	Private	4	Mvita
7.	Pandya Memorial Hospital	Private	4	Nyali
8.	Sayyida Fatmah Hospital	Private	4	Nyali
9.	H.H. Aga Khan Hospital	Private	5	Mvita
10.	Alfarooq Hospital Limited	Private	4	Mvita
11.	Nyali Children's Hospital	Private	4	Nyali
12.	Bomu Medical Center	Private	4	Changamwe
13.	Seaside Medical Facility Nursing Home	Private	4	Mvita
14.	Nairobi Women's Hospital, Mombasa	Private	4	Mvita
15.	Lighthouse for Christ Eye Center	Private	4	Mvita
16.	Premier Hospital	Private	5	Nyali
17.	Alliance Medical Center, Mombasa	Private	4	Mvita
18.	Ganjoni Hospital, Mombasa	Private	4	Mvita
19.	Beyondscope Hospital	Private 4	4	Kisauni
20.	Mikindani Hospital	Private	4	Jomvu
21.	Mombasa Breeze Hospital (MBH) Limited	Private	4	Mvita
22.	Coast General Mombasa Amenity Wing	Private	5	Mvita

23.	Gertrudes Garden Children Hospital, Nyali	Private	4	Nyali
24.	Arawa Hospital	Private	4	Kisauni
25.	Nyali Bridge Hospital	Private	4	Kisauni
26.	Montana Hospital	Private	4	Kisauni
27.	Kiembeni Community Hospital	Private	4	Kisauni
28.	Diani Beach Hospital	Private	4	Likoni
29.	Shelly Beach Hospital	Private	4	Likoni
30.	Mrima Maternity Hospital	Public	4	Likoni
31.	Likoni Sub County Hospital	Public	4	Likoni

Source; MoH, Master Health Facility List

Appendix VI: NACOSTI

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **667536**

Date of Issue: **29/November/2024**

RESEARCH LICENSE

This is to Certify that Mr.. Wanyonyi Innocent Masika of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Mombasa on the topic: Management Information System Capabilities and Performance of Hospitals in Mombasa County, Kenya for the period ending : 29/November/2025.

License No: **NACOSTI/P/24/414279**

667536

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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See overleaf for conditions