INFLUENCE OF HEALTH LOGISTICS MANAGEMENT INFORMATION SYSTEM ON AVAILABILITY OF MEDICAL COMMODITIES IN PUBLIC HOSPITALS IN KAJIADO COUNTY, KENYA

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DECLARATION AND RECOMMENDATION

Student Declaration

"I declare that this thesis is my original work and has not been presented in any other university".

Signed _____ Date _____

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Recommendation by Supervisors

"This thesis has been submitted for examination with our approval as university supervisors".

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ABSTRACT

The availability of necessary drugs in healthcare institutions, particularly hospitals, is critical in promoting population curative health and ensuring healthcare outcomes and goals are reached. Over 50 percent of Kajiado County's people live in rural areas and rely mostly on public health hospitals, which are deemed economical. However, the unavailability of vital drugs in such institutions causes treatment to be delayed, aggravating illness outcomes. This hampered access to health-care services. The goal of this study is to determine how the health logistics management information system influences the availability of medical commodities. The study specifically aimed to establish the influence of demand forecasting systems, inventory management systems, order process management systems information flow management systems on the availability of medical commodities in public hospitals. The process theory was adopted to inform the study. A descriptive cross-sectional survey research approach was used in this study. The public level four and five hospitals in County's pharmacy store managers, pharmacists, pharm technologists, procurement officers, laboratory technicians, and pharmacy dispensing personnel were the study's target population. From a target population of 397, a sample size of 112 was chosen using basic random methods and stratified random sampling. The study used quantitative data, which were coded, processed, and analyzed using descriptive and inferential statistics in the Statistical Packages for Social Scientists (SPSS Version 26). Spearman rank correlation analysis was used to examine the relationship between variables, logistic regression was employed to examine the effect of the independent variables on the dependent variable. The results confirmed that at both the bivariate level and in a combined set-up, demand forecasting systems, order process management systems, inventory management systems, and information flow management systems all have a positive relationship with the availability of medical commodities in public hospitals. To guarantee the availability of medical commodities, management ought to improve the demand forecasting system at healthcare facilities so that staff can figure out the quantities of commodities they will require. Additionally, management must enhance the inventory management system at healthcare facilities so that staff can manage the continuous and frequently overpowering influx of medical commodities, to promote the application of technology-based solutions in every aspect of the institution, management needs to enhance the information flow management system. Furthermore, management ought to make investments more in information sharing. Finally, to make sure there is availability of medical commodities, management must strengthen the information flow management system at the hospitals and begin to use technological order processing in their day-to-day operations.

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ABBREVIATIONS AND ACRONYMS

ADC	Analogue-Digital Converter
ARVs	Antiretrovirals
CPOE	Computerized Prescriber Order Entry
EDI	electronic data exchange
ERP	Enterprise resource planning
HIV/AIDS	Acquired Immunodeficiency Syndrome/ Human Immunodeficiency Virus
IT	Information technology
KEMSA	Kenya Medical Supplies Authority
LMICs	low- and middle-income nations
LMIS	logistics and management information systems
MCH	Maternal and Child Health
MDGS	Millennium Development Goals
MOH	Ministry of Health
NACOSTI	The National Commission for Science and Technology Innovation
ROI	Return on Investment
SARAM	Service Availability and Readiness Assessment Mapping
SDP	service delivery point
SDPs	Service Delivery Points
SPSS	Statistical Package for Social Sciences
TAT	Turnaround Time

TB	Tuberculosis
US	The United States
USAID	United States Agency for International Development
VIF	Variance Inflation Factor
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Access is termed by the World Health Organization (WHO, 2012) as "having medicines consistently available and inexpensive at public or private health facilities or medication shops that are within one hour's walk of the population." It must constantly be accessible to people and communities in sufficient quantities, at the proper dosage, in good quality, and at a reasonable cost (Tukamuhabwa et al., 2021). According to estimates, two billion people lack access to medications, and with the right care and medication, four million lives may be saved annually in Africa and Southeast Asia. With this estimate in mind, 192 governments, including WHO, vowed to accomplish eight of the Millenium Development Goals (MDGs). The fourth Millennium Goal is lowering infant mortality, the fifth is enhancing maternal health, and the sixth is combating diseases including Acquired Immunodeficiency Syndrome/ Human Immunodeficiency Virus (HIV/AIDS), malaria, and others (WHO, 2012). To ensure the availability of medicines, WHO emphasizes policies, access, quality, and prudent usage.

This investigation aims to determine how the availability of medical commodities in public hospitals is influenced by the health logistics management information system. A high-quality health service necessitates the availability of pharmaceuticals that are qualified, safe, and effective in sufficient quantities, always with the proper dosage and

dosage forms. But managing the supply of drugs is a highly difficult task that needs a solid organizational framework and an integrated supply chain (Shamsuddoha, 2015). Planning and managing the transportation of commodities and related information among companies, in both the private and public sectors, is made easier via the use of logistics management. In general, it seeks to maximize a particular availability measure, satisfy a particular set of constraints, and supply the relevant materials at the appropriate time. In modern civilizations, logistics is one of the most important tasks. It is built on subsystems, which are made up of several connected parts. The coordination and exchange of materials and information characterize the link between the subsystems and components. The system's goal is to effectively provide customers with the products they need (Xie et al., 2016).

A management information system called Logistics and Management Information Systems (LMIS) gathers, keeps track of, and presents logistical data. The LMIS might be fully computerized, somewhat computerized, or manual (paper-based). An efficient LMIS provides relevant, timely, and accurate data to decision-makers across the supply chain. By providing the appropriate goods in the appropriate amounts, at the appropriate times, in the appropriate conditions, at the appropriate costs, and the appropriate locations, the LMIS secures or fulfills the rights of a supply system. The system performs several tasks, including managing information on how many medications or commodities are required at a particular Service Delivery Point (SDP), reporting on the supply levels at SDPs, and storing and tracking information on how medical commodities are used over time at all levels of the health system (Durugbo et al., 2022).

Globally, India recognized the need for a reliable logistics management information system to support the numerous development initiatives in the health sector as soon as the country gained its independence (Chawla et al., 2017). India's national health strategy specifies, among other things, that efficient health logistics management information systems must be built for adequate decision-making and program planning in the health and allied disciplines to be possible. It also states that a national organizational structure should be established to obtain the necessary health information that could support the effective decentralization of activities and local management of health care (Babatunde et al., 2020).

Regionally, in Ghana, there is a dearth of healthcare providers, inadequate recording and reporting tools for logistics, a dearth of pertinent information from the points of service delivery, and a dearth of commitments are some of the key problems that have a detrimental effect on logistics management in healthcare facilities (Manso et al., 2018). In Tanzania, the public health system relies on logistic decision-making data that is largely inaccessible, which causes decisions about distribution and purchase to be made with insufficient data. Additionally, there are inefficiencies and insufficient visibility of logistics data within a central medical store as well as in zones and health institutions since there is a lack of communication between the various logistics functional activities, from inventory management to procurement (Velasco et al., 2018).

In Malawi, the majority of public health facilities lack integrated information systems, which makes data difficult to see and decision-making challenging. There are several issues with the Mali supply chain system, including the inability of supply chain managers

to obtain data, inadequate reporting methods, and the flow of inaccurate and late information. Because Lesotho lacks standardized and simple data collection methods, inaccurate data is recorded on stock cards and reports, reports are submitted late, and logistical decisions are complicated, there are frequent shortages of medications and other vital supplies-commodities (Creazza et al., 2022).

The County Referral Hospitals, Health Centers, National Referral Hospitals, Sub-County Hospitals, and dispensaries are the many levels of healthcare institutions that make up Kenya's public health system. The sole public sector provider of medical commodities is Kenya Medical Supplies Authority (KEMSA) (Ngai et al., 2017). KEMSA was founded as a state business by Legal Notice No. 17 of 2000 to increase access to medical supplies and medications and to stop the deterioration of Kenyans' health status. The company was given the responsibility of managing the public sector's healthcare supply chain's procurement and distribution.

A proper supply of pharmaceutical supplies to health institutions is a problem in many developing nations, including Kenya. One of the numerous partially autonomous organizations that the Ministry of Health (MOH) frequently creates is the Kenya Medical Supplies Authority (KEMSA), which is in charge of buying, distributing medicines, storing, and medical commodities supplies to healthcare facilities across the nation, including general hospitals and dispensaries.

The national health systems frequently face problems that influence supply chains, such as poor forecasting, a lack of money, sluggish funding disbursements, and lengthy lead

times (for manufacture and delivery). There are frequently many donor-funded program-specific supply chains that operate in tandem with the national health systems, which only serves to increase the complexity. In a situation where resources are already few, these potentially redundant efforts along the supply chains may lead to inefficiencies. The difficulties in managing the general medicine supply chain will be the main topic of discussion. Due to a variety of factors, including the ordering practices employed by healthcare centers, inadequate communications and flow of information among the stakeholders, limited usage of technological-related solutions, subpar road network, and transporting vehicles availability, the KEMSA faces difficulties with distribution planning and vehicle routing from the perspective of the supply chain. Additionally, it is challenging to quantify performance indicators like the availability of pharmaceutical items, making it challenging to pinpoint obstacles and explore improvement options for the supply chain (WHO, 2016).

Throughout the past two decades, despite the multiple operational setbacks it encountered, the company has developed a centralized supply chain network, arranged planned deliveries to numerous clients through outsourced transport, and has kept up its customer service (Odhiambo-Otieno, 2005). However, the supply chain operations are hindered by a shortage of finance that is adequate to meet the costs of buying the medications and supplies needed to satisfy the demands of the consumers. The correct solutions that enable KEMSA to carry out its original mission are still being found after extensive studies and efforts. The majority of these are intended to improve key internal processes and deal with operational constraints (Kihuba et al., 2014). Its duties include managing immunizations,

ARVs, family planning, TB drugs, and other medical supplies for the public sector. It is also responsible for forecasting, purchasing, storing, and distributing health commodities. The goal of this project, which will produce a health logistics management information system, is to determine the availability of medical supplies in public hospitals.

1.2 Problem Statement

Patients regularly assess the effectiveness of public healthcare systems, focusing primarily on the availability of high-quality vital medications and an appropriate human resource pool for health (Kaupa & Naude, 2021). To promote population health and achieve healthcare outcomes and goals, essential medications must be available in healthcare institutions, especially hospitals (Davis et al., 2019). For the general public's use, essential medications should be offered in health facilities in sufficient quantities, in the proper dose forms, with guaranteed quality, and at reasonable costs. The availability of drugs depends on the presence of a functioning pharmaceutical system, which is defined by reasonable usage and selection of necessary medications, sustainable finance, reasonable costs, and dependable health supply systems.

More than fifty percent of the population of Kajiado County lives in rural areas where they mostly rely on public hospitals since they are seen as being reasonably priced. But the lack of key medications in these clinics slows down therapy, complicating how diseases turn out. Access to medical services is negatively influenced by this. Due to underfunding and regressive healthcare contributions, Kenya's health sector is primarily funded through out-of-pocket expenses (Obayelu et al., 2021). The public supply chain is

susceptible to interruptions and stock-outs as a result of defects in the distribution system and the generaly poor performance of the supply chain. Because patients would forgo necessary medications if there were a stockout, this would undoubtedly influence clinical outcomes (Kingori & Ntulo, 2021).

The health commodity supply chain and KEMSA's function in managing the supply of medical commodities were evaluated by Aronovich and Kinzett in 2011. According to the study, the coverage, availability of information and resources, and effectiveness of the logistics system varied for each of the several health commodities in the supply chain. Kihuba et al. (2014) found in their study that implementing health management information systems (HMIS) successfully in healthcare institutions appears to be a challenging undertaking. Mutugi (2018) investigated the elements influencing the performance of LMIS in the public health sector, specifically in the context of KEMSA. The study discovered that it is difficult to replenish pharmaceutical and equipment supplies because there is a lack of coordination between the different supply system levels and insufficient oversight and monitoring of stock levels and use. The availability of medical commodities in Kenya's Kajiado County public hospitals was not specifically examined in any of the aforementioned research. This study intended to close the knowledge gap by investigating the influence of the health logistics management information system on the availability of medical commodities in public hospitals in Kajiado County, Kenya.

1.3 Objectives

1.3.1 General Objective

The key objective of the study was to determine how the health logistics management information system influenced the availability of medical commodities at public hospitals in Kajiado County.

1.3.2 Specific Objectives

i. To determine how the demand forecasting system influences the availability of medical commodities in Kajiado County public hospitals.
ii. To assess the influence of the inventory management system on the availability of medical commodities in Kajiado County public hospitals.
iii. To ascertain the influence of the order process management system on the availability of medical commodities in Kajiado County public hospitals.
iv. To determine the influence of the information flow management system on the availability of medical commodities in Kajiado County public hospitals.

1.4 Research Questions

i. How does demand forecasting influence the availability of medical commodities in public hospitals in Kajiado county?
ii. How does the inventory management system influence the availability of medical commodities in the public hospitals in Kajiado County?

iii. How does the order process management system influence the availability of medical commodities in the public hospitals in Kajiado County?

iv. How does the information flow management system influence the availability of medical commodities in the public hospitals in Kajiado County?

1.5 Justification of the Study

The long-term availability of essential pharmaceuticals is significantly influenced by the accuracy of the records and reports. Supply chain facilities, including Service Delivery Points (SDP), must maintain the accuracy of the data in their MIS platforms and submit reports at the right time, particularly for medicines for HIV, malaria, Maternal and Child Health (MCH), Tuberculosis (TB) and family planning goods (Qureshi et al., 2018). The first three problems have a considerable negative influence on socioeconomic outcomes, human misery, sickness, and mortality. They are the biggest dangers to global public health.

In low-income nations, in addition to HIV, TB, and malaria, MCH and family planning pose significant obstacles (Mutisya et al., 2019). The availability of medical products to treat these issues is either very limited or nonexistent. Quality and accurate information is therefore essential to reduce excessive expenditures and lead times for procurement. The lack of real-time information and poor LMIS data quality are the main causes of the lack of access to essential health resources. The purpose of this study was to determine how the health logistics management information system influences the availability of medical commodities in Kenya's public hospitals, with an emphasis on Kajiado County.

1.6 Limitations of the Study

It was against the hospitals' confidentiality policy to reveal their confidential information, they had a confidentiality policy implemented that prevented most of the respondents from answering certain questions. The apprehension was typically attached to research studies of any kind. This issue was resolved by assuring the participants of complete confidentiality and stating that the research was for academic purposes only. Other limitations included some respondents not completing the questionnaire, certain areas of the research tools were misunderstood, the respondents gave incomplete responses to some questions, and there were unplanned occurrences like respondents leaving before completing the questionnaire. The issue was resolved by continuous follow-up to ensure the respondents filled the questionnaires. The researcher provided the hospitals' administration with an introduction letter that was obtained from the university, which assisted in reducing suspicions and enabled the hospitals' management to permit the disclosure of most of the responses the study was seeking.

1.7 Delimitation of the Study

Finding out how health logistics management information systems influenced the availability of medical commodities in public hospitals was the study's main objective. The research focused on the medical staff at the public hospitals. The study specifically looked at how the demand forecasting system, inventory management system, order processing management system, and information flow management system influence the availability of medical commodities in public hospitals. Through various interviews,

comparisons between theories, as described in scholarly works and practice, were done to produce credible material appropriate for the study. After two months of gathering the data and compiling that data, the analysis was performed and the findings and recommendations were made. The research's conclusions were made based on the findings.

1.8 Significance of the Study

For Kenya's national and county governments to create effective policies for enhancing the availability of medical commodities in public hospitals, it is crucial to have the results of this study. The study is very helpful to public hospital administration in figuring out practical strategies to increase the availability of medical commodities by implementing and adopting LMIS. The study is helpful to procurement professionals, as it enables them to develop efficient plans to increase the availability of medical commodities by using LMIS in their particular institutions.

Academicians and scholars interested in the study's findings can use the findings as a foundation for doing additional research. This study can serve as a starting point for discussions and involvement in LMIS in health institutions, both in the national government and in the devolved structures of governance. Theoretically, the findings from this study aid in the creation of an efficient and long-lasting model for the implementation of tactical strategies for improving LMIS in public hospitals. The research helps to increase understanding of LMIS in public hospitals.

1.9 Assumptions of the Study

The following assumptions were made:

i) That the respondents would provide the study with accurate and honest information.

ii) The respondents were aware that the influence of health logistics management information systems on the availability of medical commodities in public hospitals is a requirement.

iii) That all of the study's findings applied to all public hospitals in Kenya.

1.10 Operational Definition of Terms

Demand forecasting system:	Refers to the system that enables the continuous projection of which health commodities will be purchased, where, when, by whom, and in what.
Health logistics management information system	Refers to an interconnected set of components used to ensure there is high-quality treatment. They facilitate the smooth flow of patients/information throughout the entire hospital and involve coordination across a multitude of specialist teams and departments.
Information Flow management system:	The current study refers to a system that makes sure that data on sales, forecasts, inventory size and location, order status,

	manufacturing schedules, delivery capability, and firm performance indicators are sent or exchanged.
Information technology:	Refers to a broad category of increasingly convergent and integrated technologies that handle both the information that businesses create and utilize as well as their information.
Inventory Management system:	It is a system that ensures that the right amount of completed goods and raw materials for transformation are always available, allowing for quick and efficient delivery to meet a customer's inventory needs.
Medical commodities	Refers to consumables that are disposed of after treating a patient. They include items such as single-use syringes, bandages, tongue depressor blades, suture materials, and both surgical and exam gloves.
Order Processing system:	Refers to the system that executes group duties to fulfill a customer request for products or services and serves as the foundation for information flow in a logistics system.
Public hospital	Refers to a hospital that is government-owned and is fully funded by the government and operates solely off the money that is collected from taxpayers to fund healthcare initiatives.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The research on how health logistics management information systems influence the availability of medical commodities in public hospitals is reviewed in this chapter. Concerning the availability of medical commodities in public hospitals, the chapter explicitly examines the demand forecasting system, inventory management system, order process management system, and information flow management system. The presentation includes the conceptual framework, research gap, and overarching theories of the study.

2.2 LHMIS in Kenyan Hospitals

In order to address issues with the size of the gap between rural and urban settings, the lack of sufficient medical personnel, and the ongoing decline in the quality of care provided in many government-run medical centers, it is necessary to strengthen the healthcare infrastructure in many nations that are developing. One doctor for every 10,150 patients was the doctor-to-patient ratio in Kenya in the year 2010. Sadly, the scenario worsened seven years later in the year 2017 when there was only one doctor for every 16,000 people (Kumar et al., 2018). In 2012, it further decreased to 1 in 17,000 people. The Annual Health Sector Status Report for 2005–2007 states that the purpose of HMIS is to "produce and use health information for policy planning, management of health

services and intervention programs in the healthcare sector, including their planning, execution, budgeting, evaluation, and monitoring and assessment (Moturi et al., 2023).

HMIS in Kenya, nevertheless, is failing to meet this objective and, as a result, is not raising the standard of healthcare. The Hospital Management Information System is an independent system that is therefore concentrated on a specific vertical function at the Ministry's headquarters. Health care service units and hospitals are managed at the county and district levels via systems that give data to the headquarters. Regrettably, they are also broken up. HMIS has not improved the quality of care in public hospitals. Patients frequently experience issues such as a scarcity of essential medications, a dearth of doctors and hospital beds, and a lengthy wait of several months preceding surgery and occasionally staff carelessness, not to mention medical staff strikes (Moturi et al., 2023).

Hospital Management Information System (HMIS) is a crucial part of the larger Hospital Information Systems (HIS), and particular policy documents outline the steps hospital management must take to enable data collecting and information generation in Kenya. Births and deaths that take place inside the institution are registered as vital events as a component of integrated population-centered national reporting systems using these HMIS functionalities. Additionally, hospitals ought to document workloads, illnesses, and fatal causes by department using facility-specific systems, Other metrics include indicators related to the disease (such as rates of prenatal HIV testing) and overall results stratified by sex and age (Njeru et al., 2020). In order to centrally aggregate these hospital-related information, they are gathered and reported in Kenya using an outdated paper

subsystem for primary data collection, with summary data supplied on a regular basis within an electronic subsystem of DHIS2 (Macharia et al., 2021).

A study by Kihuba et al. (2014) in 22 Kenyan hospitals found that HMIS departments were typically underfunded at the hospital level. In contrast to a guideline stating that a minimum of ten percent should be distributed, the HMIS departments received a mean of three percent of the total yearly income through cost sharing and government subsidies, with a range of one percent to eight percent.

Good information is now more important than ever for planning and decision-making. The effectiveness of primary data collecting and reporting systems (HMIS) at the health facility level determines the value of health care use data aggregated by the national or county HIS. If results from studies are contrasted with current policy advice, it is likely that this process at the hospital level will be hindered by insufficient inputs. Since the Ministry placed such a high value on these exercises, hospitals frequently complied with criteria for one-time activities including the creation of yearly schedules, defined departmental goals for performance, and funds connected to HMIS (Macharia et al., 2021).

The amount of money allotted to HMIS, nonetheless, was low and fell short of the levels that were advised, with periodic shortages of stationery and required reporting forms as well as inadequate staffing. With nurses assuming responsibility for data collecting and preparation and the usage of temporary records personnel on short-term agreements, shifts

in responsibility appeared to be the main method utilized by hospitals in an effort to solve the shortfalls in records officials (Njeru et al., 2020).

2.3 Availability of Medical Commodities

Due to the complexity of the services provided as well as the unique nature of the association between the consumer and service provider, it has been challenging to measure the productivity and availability of medical commodities, similar to other service organizations. The two main goals of measuring medical supply availability in hospitals are cost and quality of care, according to international practice.

Despite understanding the value of this metric for comparing hospital performance, many healthcare facilities are only able to collect death rates (Chansky et al., 2018). Additionally, although these measures frequently include patient-reported data on how satisfied patients are with the healthcare services they have gotten, they do not evaluate the whole scope of the patient experience (Ariyo & Ozodiegwu, 2017). Due to these significant constraints, the study solely used efficiency indicators to determine the availability of medical supplies.

Anti-malaria medications, for example, were routinely oversupplied in areas with high demand but continuously undersupplied in areas with low demand. The information system was not functioning as a result of chronic stock shortages, poor supervision and monitoring, and inconsistent reporting of stock level and consumption trends. It was generally difficult to supervise and monitor supply levels and consumption due to poor transportation and communication (Ariyo & Ozodiegwu, 2017).

According to Tyndall et al. (2018), logistics refers to the tasks necessary to transport and strategically place inventories as part of a company's supply chain management. As an outcome, logistics is a component of a supply chain (SC) and occurs inside its wider framework. By timing and positioning inventories, logistics is the process that adds value. The coordination of a business' order administration, materials handling, and packaging, inventory, warehousing, transportation, throughout a network of facilities is referred to as logistics. As it connects and synchronizes As an ongoing process, the whole SC, logistical integration is critical for optimal SC connectivity. While the overall objective of logistical work hasn't changed much throughout time, how it is carried out has seen significant modification. This unites all elements of the supply chain, transferring data regarding goods, customer demand, materials, movements, timetables, stock levels, availability, issues, costs, service levels, etc. It is essential for managing inventories, supplies, and demand for medical commodities. Logistics managers frequently define themselves as processing information rather than moving things because it is challenging to coordinate the flow of information (Livingston et al., 2017).

In determining drug availability, a study in Kenya by Munga et al. (2021) investigated stock-outs or episodes where there was a risk of stock-out affecting antiretroviral HIV supplies. Results from the study showed that most common causes for the stock-outs were delays in the bidding process (29%) or acquisition (13%), distribution problems (10%), or difficulties with drug production (9%). Response measures that were implemented included emergency purchases (46%), changing providers (15%), or changing regimens (11%). There were 89 episodes when risk-of-stock-out was imminent in the same period.

Reasons included delays in delivery from the manufacturer (31%) or in acquisition (26%), forecasting problems (10%), and delays in the bidding process (10%). 51% of episodes needed emergency purchases, and in 14% of cases, loans were requested from other countries (Munga et al., 2021).

Shortages of essential drugs including vital anti-malarials or antibiotics pervade all levels of care including facilities close to urban centers (Moturi et al., 2023). This finding excluded anti-retroviral drugs, which followed, up until this study, a different and independent mode of procurement and delivery. The reasons for inadequacies in drug procurement, storage and delivery were manifold. Documented deficiencies were in the form of finances, physical infrastructure (warehousing), staffing and drug quantification (Moturi et al., 2023).

2.4 Demand Forecasting System

In the context of the health SC, a demand forecasting system is defined as one that enables the continuous projection of which health commodities will be purchased, where, when, by whom, and in what amounts. Forecasting aids in determining which needs for health commodities have already been met or will soon have a purchasing power that will result in orders. How many essential health commodities are needed, both at the facility and end-user levels can be gauged using effective demand. Major stakeholders will need to have a complete grasp of the needs in the long and short-term after choosing which tests and treatments to use. Here, forecasting is employed to estimate how much of every product will be distributed to customers over a predetermined period in the future. In order must

be in line with the program's goals and buying needs, forecasting is often done yearly or semi-annually in the context of global health (Ramani & Mavalankar, 2016).

The forecasting process for healthcare products is distinctive since it takes place in a changing environment years before a product might be used. Forecasts at this point indicate demand hypotheses based on several assumptions. The uncertainty may be higher for health commodities like vaccines because they have a longer development cycle, which will have an immediate influence on estimates (Khorasani et al., 2018). Iterative feedback loops that reflect the changes enable strategic forecasts to be refined throughout their existence. Forecasts change as a product and a market age. Forecasts can be used by local organizations, and must be in line with the program's goals Regional centers, the main ministry, the corporate sector, overseas funders, procurement representatives, delivery representatives, and so on are all examples of regional hubs. at every level of the health-care system. For supply chain projections, the accuracy of national and regional buyer forecasting activities is essential. It is amazing that this problem still exists in the global health sector given how important accurate forecasting is for robust health supply chains.

The abrupt increase in funding and availability of a variety of healthcare goods and services without a corresponding advancement in forecasting methods could be one of the main causes. Additionally, the global health market's risk allocation is unevenly divided among important players, which results in misalignment in health outcomes (Evans, 2020).

Forecasting demand is not a new topic, but the need to improve predictions has grown in light of current attempts to enhance access to health commodities in the face of the pandemic. Realistic future projections are critical for making critical decisions regarding which vaccinations, drugs, and diagnostics to make and acquire. A lack of funding and shortages throughout the health supply chains might be caused by ambiguous forecasts. The most significant effects, however, are on one's health, jeopardizing life, and raising the risk of medication resistance. Poor demand forecasting has significant financial repercussions as well. The business rationale for manufacturer participation in emerging economies, which can restrict access to health commodities, has been regarded as having a significant negative influence on pharmaceutical enterprises' capacity to meet the demands of the global health community (Schuh et al., 2017).

In summary, greater demand forecasting should be taken into account by all parties involved in logistics-related planning, budgeting, and spending decisions throughout the health supply chains. It is a key component of the global health agenda. Demand forecasting for health commodities in LMICs has traditionally been a fairly isolated function that was only accessible to companies with a commercial interest and utilized some fundamental health data and health system coverage. Health supply chain professionals in LMICs also have low predicting abilities, which calls for greater resource allocation for capacity growth and development (Kork & Vakkuri, 2016).

Stock-outs are a major cause of poor demand forecasting, which increases the danger of tainted medications getting into The healthcare system. The use of inferior medications raises the risk of death and drug resistance because they might not be sufficiently effective

to treat patients or protect them from illness. A greater focus is being placed on providing funds and resources to enhance the availability of medical supplies and build dependable healthcare supply networks as a result of recent initiatives to combine economic growth with sustainable development. Funding and assistance for enhancing health systems across the whole health supply chain, particularly in LMICs, have significantly increased (Kaupa & Naude, 2021). For several health commodities, the World Health Organization (WHO) is in charge of creating demand estimates. Public-private partnerships have also made good strides. However, there hasn't been much done to address issues with institutional incentives and health supply chain data management that limit the ability to make sound decisions (Cullinan et al., 2021).

Exploratory research by Baalbaki et al. (2018) encourages the planned utilization of hospital secondary support initiatives as an initial phase toward promoting healthcare, boosting the number of patients, and improving patient satisfaction. Following hospital emergency rooms and voluntary hospitalization stays, long-term patient satisfaction and perception questionnaires were completed in Beirut, which served as the study's foundation. An extensive set of data, consisting of more than 300 patient stays, is analyzed using exploratory statistical techniques. Patient views, their turning points, and the importance of this knowledge in promoting hospitals and healthcare systems were all thoroughly explained. The study discovered that hospital support functions had a considerable influence on patient perceptions. Additionally, these impressions influence future patient demands, affect a hospital's reputation, and are crucial to recognizing patients as health care system customers rather than consumers of medical treatments.

As well as outlining market-related vulnerabilities, Subramanian (2021) looked at how better forecasting can result in greater short- and long-term access to health commodities. It looks more closely at how mismatched incentives lead to an uneven distribution of risks and the failure to balance supply and demand. This is why 71 papers were analyzed utilizing a descriptive and content strategy during a systematic evaluation of the literature. The findings show the shifting trends in global health as well as the consequences of inaccurately projecting demand for the supply networks for healthcare. The content analysis identifies key components that could put different stakeholders in the health supply chain in peril. This study emphasizes how, depending on how they affect the broader health supply chains, the essential components can operate as both enablers and blockers.

2.5 Inventory Management System

Inventory optimization and supply chain management's primary objective is to lower healthcare costs without compromising the quality of treatment, often by increasing system productivity or efficiency (Yung et al. 2021). According to Nawawi and Salin (2018), joint systems incorporate both continuous and periodic reviews of inventories. A certain condition must be met for the safety stock before the inventory levels are verified as part of the continuous review policy. The major reason a business maintains an inventory of ideal levels of inventory is to do maintenance to restore the system so that it can carry out its intended function. The demand, brought on by both corrective and preventive maintenance, for each inventory part determines the number of economic order quantities in stock.

To minimize stockouts, inventory management systems depend on the availability of stock. First-In-First-Out and inventory management are closely related and should both be taken into account at the same time when improving a company's operations (Eltantawy et al., 2015). Organizations focus on costs, downtime, service levels, and the appropriate inventory levels, or the minimal stock when optimizing the inventory systems. There are three main components to the inventory costs. It is necessary to factor in a holding cost. As opposed to when the money could be invested in other ventures, corporations that keep shares do not earn interest on the money that is blocked. This ordering fee is primarily a set sum that is added to each order. Whether or not an emergency order is placed could affect these order fees. It's common to classify the cost of buying parts as a maintenance expense, and occasionally as an inventory expense. When there is not enough stock in the warehouse to meet customer demand, shortage costs will be incurred. The inventory ordering systems have lead times that must be adhered to (Gurumurthy et al., 2021).

Fernando et al. (2020) state that inventory management systems centralize and streamline the process of regulating the flow and upkeep of inventory to guarantee that the appropriate quantity and quality of inventory is available at the appropriate time. A vast range of businesses, including manufacturing, utilities, healthcare, education, government, and more, heavily rely on inventory management systems. Materials management uses the ABC analysis, also known as selective inventory control, to categorize inventories. Three categories are created from an inventory using the ABC analysis. Items with the most minimal restrictions and the fewest records are all categorized as Types of Items, as are Items with the strictest controls and the most accurate

records, as well as Items with less strict controls and good records. The ABC analysis provides a way to identify items that will have a substantial impact on total inventory costs, in addition to a means for identifying distinct stock categories that will necessitate various management techniques and constraints (Karim et al., 2018).

First-In-First-Out (FIFO) stands for first-in, first-out, and, according to Gurumurthy et al. (2021), it does not always imply that the exact oldest physical item has been tracked and sold. Instead, it simply indicates that the oldest inventory items are recorded as sold first First-In-First-Out. In other words, the fee for the cost of the initial item(s) purchased. The cost of the most recent acquisitions is what is displayed on the balance sheet when inventory is valued using FIFO. Enterprise Resource Planning (ERP) is the term used to describe the integrated management of core company operations, which is typically carried out in real-time and is made possible by software and technology. Using shared databases controlled by a database management system, ERP offers a thorough and constantly updated picture of the most crucial company functions. ERP systems keep track of a company's cash, raw materials, production capacity, orders, purchase orders, and payroll, among other financial assets. A few of the departments that provide data to the system's applications are Manufacturing, buying goods, revenue, and accounting are all areas of expertise. ERP manages external stakeholder relationships and simplifies information flow across all corporate processes (Nawawi & Salin, 2018).

According to Kihara and Ngugi (2020), questionnaires were used to gather primary data, while secondary data was gathered from various sources. It discussed how inventory management systems affected Kenya's public hospitals' performance. To analyze the

qualitative data obtained from open-ended questionnaires, a qualitative data analysis method was used. According to the report, Just-in-time (JIT) benefits hospitals by enabling them to switch fast and easily, as needed, to new goods while maintaining short operational runs. Hospitals can avoid wasting money on sluggish-moving goods by using an effective inventory management approach.

2.6 Order Process Management

In a logistics system, order processing serves as the foundation for information flow by fulfilling a customer's order for goods or services (Yang et al., 2019). Its three main objectives were to generate a flow of information before, during, and after the production of the items (Mostafavi & Inman, 2016). In the past, the value of correct information for obtaining superior logistical performance had been undervalued. Even though knowledge of many different topics was essential for logistical operations, processing orders took precedence (Ye & Ma, 2017).

Its worth was not fully recognized due to a lack of comprehension of how operational faults and order processing distortion influence logistical operations (Sarder, 2021). The term "order processing" is used to describe all of the operations necessary to fulfill a customer's request for goods or services. The order processing system acts as the informational foundation of the healthcare facility to manage the links both inside and between logistics and other functional areas (Tavakkolimoghaddam et al., 2022).

The consumer must get the products and acknowledge that their purchases were delivered accurately and completely before the order processing procedure is considered complete.

Order processing began when the company accepted the customer's order. There are three main functions it fulfills for a medical establishment. It led to the development of an information flow that came before, was present with, and followed the commodities (Fernández, et al., 2020). Quick information transmission directly enhances workload balancing. According to Kumar and Jha (2019), a health facility trying to achieve quick delivery found that gathering orders at a local sales office for a week, mailing them to a regional office, processing the orders in a batch, assigning the orders to a distribution warehouse, and then shipping them via air was ineffective. Contrarily, faster and more dependable delivery systems were created at a lower overall cost by combining slower, less expensive transportation with direct Internet order transmission from the customer. The overall flow of commodities was improved via quick, precise processing. A healthcare facility should therefore always give efficient processing significant consideration. Utilizing metrics that tracked the dependability and adaptability of order handling, the capacity and effectiveness of order processing should have been assessed regularly (Dong et al., 2021).

Customer requirements were typically communicated through orders in supplier networks. The processing of these orders included initial order receiving, delivery, invoicing, and collection, among other facets of meeting client requirements. The faster an order was made, entered, and processed, the more time (lead time) management was required to arrange inventory and transportation tasks while upholding the critical levels of customer service. A health facility's logistical capabilities may be even better than its

order processing proficiency and even more so if they are managed well (Zivaljevic, 2015).

Wietholter et al. (2019) examined how Computerized Prescriber Order Entry (CPOE) affected the speed at which medicine orders were processed. The 761-bed tertiary care facility where this study was done. 2988 prescriptions were gathered, 1488 were analyzed before the installation of CPOE, and 1500 were analyzed subsequently. The data analysis included the times the order was placed by the doctor, when it was delivered to the pharmacy, and when it was completed by the pharmacist.

The results show that, from the time the prescriber was composed until the pharmacist verified the order, the average order processing time before the adoption of CPOE was 115 minutes. Following the implementation of CPOE, the mean order processing time was reduced to 3 minutes (p=0.0001) There was a reduction of 31 minutes (p 0.0001) from the time the pharmacy received an order and the time a pharmacist checked it following the implementation of CPOE. When CPOE was implemented, the time it took to process an order (from order composition to verification) was reduced by 97%. Additionally, the time needed to process pharmacy-specific orders, from the point at which they are received in the pharmacy until the pharmacist verifies them, was cut in half. By reducing the time it takes for orders to be processed, doctors can prescribe medications more quickly, which benefits patients. This decrease in order processing time may also provide pharmacists more time to consider options for improved clinical activities that will further benefit patients.

Inpatient medication overrides medicine first-dose turnaround time (TAT), and pharmacist assessment of the pharmaceutical orders handling procedure were the three performance metrics that Dow et al. (2020) looked at to determine the influence of computerized prescriber order entry (CPOE). The method for controlling medication use's three components was evaluated using a pre-post intervention trial design. Implementing CPOE was the intervention. The total number of Analogue-digital Converter (ADC) overrides and the availability of pertinent documentation for each override were the two outcomes that were assessed. Override data from the pre-CPOE and post-CPOE periods were examined in random samples of one week. The mean times between the prescriber's order input and the time of order verification and the mean periods between the prescriber's order entry and the time of drug administration were the pharmaceutical Turnaround Time (TAT) results that were examined. Those collected manually before CPOE and data collected electronically after CPOE were compared. The primary outcome measured was the pharmacist's evaluation of overall satisfaction with the management of pharmaceutical orders. Data from the pre- and post-CPOE periods were acquired via an online survey after CPOE was put into place.

The data showed that although there were 58 percent fewer prescriptions for medication overrides after the installation of CPOE, documentation got poorer by 73 percent. The average time to provide intravenous antibiotics was reduced by 31%, while the average time from order entry to order verification was reduced by 76%. Overall, there was a 23% improvement in pharmacist satisfaction with the drug order management process (Dow et al., 2020).

2.7 Information Flow Management System

In today's competitive environment, effective and timely responses to continually evolving client preferences and tastes have evolved into critical factors for successful corporate performance (Nawawi & Salin, 2018). The flow of information is beneficial for obtaining performance. Eltantawy et al. (2015) defined information flow as the transfer of data between various databases (departments) within an organization in several directions and with variable contents. Before now, logistics chains' ability to respond to accurate and real-time data depended on information flow (Gurumurthy et al., 2021). Health organizations at the time saw information flow as a resource because it was necessary for the movement of a reliable and efficient material (Nilsen et al., 2020). The timely and accurate flow of information in logistics is essential for the movement of materials, according to Alonso et al. (2017) , a key tool in the health facility's arsenal for boosting the bottom line is logistics, which was made possible by the information explosion (Fernando et al., 2018).

According to Karim et al. (2018), the positive outcome of logistics performance was primarily attributable to the exchange of information. Information flow has developed into a critical element that indicates cooperation between the logistics management and the performance of healthcare facilities. Sharing information on transfers, exchanging data on inventory levels and locations, anticipating sales data, tracking order statuses, manufacturing schedules, and delivery capacity, as well as sharing performance metrics for healthcare facilities, had all become necessary for all healthcare institutions (Mostafavi & Inman, 2016).

Ye and Ma (2017) determined that the following four elements were the primary motivators of the rising significance of accurate and timely information flow for the design and management of contemporary logistics systems: Customers believed that thorough customer service must include information on order progress, product availability, delivery date, shipment tracking, and billing. The flow of information improved flexibility in terms of how, when, and where resources may be deployed to create a strategic advantage; managers learned they could use the information to lessen the quantity of inventory and labor needed to reduce overall supply chain assets; The internet's improved information transport and exchange capabilities were altering the connections between buyers and sellers and reshaping the channel structures (Miguel et al., 2019).

However, the use of information technology in healthcare facilities must be emphasized for this information flow to be effective. Information technology allows consumers to examine personal data and watch the making of products in a system of collaboration where information is exchanged across the production chain (Tavakkolimoghaddam et al., 2022). It is commonly acknowledged, according to Porter and Millar (1985), that health institutions can with the proper IT setup, you may gain a competitive edge through cost savings or distinctiveness. According to Kumar and Jha (2019), Porter and Millar are correct that IT has made logistics possible, giving many healthcare institutions a competitive edge. The cost of stocks in the supply chain had decreased as a result of consumer information demands, as well as when data flowed, it took precedence over the flow of products and resources (Leech et al., 2022). Among the initial uses were systems for order input, order processing, Electronic Data Exchange (EDI), truck routing, and

scheduling. The managers needed to have access to cutting-edge information technologies to manage these activities and deal with continual product design and process modifications to meet the demands of the customers (Dong et al., 2021).

2.8 Availability of Medical Commodities

Eighty percent of medicines should be accessible in all sectors, according to the WHO's medium-term strategic plan (Brubakken et al., 2020). However studies carried out in the intervening years have shown that the availability of medicines is poor in Low- and Middle-Income Countries (LMICs). A study was conducted on the availability of 15 important medicines in 36 developing nations (Nartey et al., 2022). The availability of generic drugs was below average in both the private and public sectors (median availability: 38 and 64 percent, respectively) (Zhou et al., 2021).

However, there were noticeable discrepancies between the private and public sectors. The majority of essential medications for common ailments at the primary care level were widely available and cheaply priced for Kenyans, according to a health facility assessment of the country's public, religious, and private sectors. Stockouts of medications, even those that are important for meeting urgent medical demands, have, nonetheless, been widely reported at the hospital level (Obayelu et al., 2021). This was caused by a variety of things, such as irrational prescriptions, inadequate storage facilities, and a severe lack of skilled pharmacists to oversee the supply, dispensing, and usage of medications. The underutilization of public health services is significantly influenced by the most important

indicator of healthcare quality, which is usually cited by patients as being the availability of essential pharmaceuticals.

Kaupa and Naude (2021) found that health commodities are normally accessible for primary care services in the majority of health institutions. In comparison to the national average of 49 percent, Kajiado County has a 31 percent mean availability of general tracer medications. The lack of necessary medications for Non-Communicable Diseases, maternal health care, and children's health was notable and concerning. The paper advised decentralizing procurement to lower levels to boost coverage and access to services, as well as connecting the quantification of health items at healthcare institutions with disease load. Additionally, it suggested that to increase effectiveness, a pharmaceutical supply information management system must be put into action.

2.9 Literature Review Summary

The emphasis of the literature study conducted for this chapter was the influence of health logistics management information systems on the availability of medical commodities in public hospitals. The outcome of this investigation was to identify the influence of the demand forecasting system, inventory management system, order process management system, and information flow management system on the availability of medical commodities in public hospitals. The theoretical review discussed process theory and how it related to this study. This study’s independent and dependent variables have both been covered by literature, which has also been looked at for the conceptual framework

domains. The chapter also highlights a research gap to strengthen the case for the necessity of this investigation.

2.10 Research Gap

To determine how health logistics management information systems, influence the availability of medical commodities in public hospitals, this study evaluated pertinent literature. Numerous information gaps have been exposed by the review. For instance, it has demonstrated how little literature exists that is relevant to the area. The majority of the material that is currently available was produced in both emerging and industrialized nations. This is supported by studies like those done by Luo et al. (2022) in the US, Khoong et al. (2018) in California, Crema et al. (2016) in Italy, Le and Hsia in US public hospitals, Garcell et al. (2017) in Qatar, and Sarkies et al. (2017) in Australia, among others. To comprehend the effect of the health logistics management information system on the availability of medical commodities in public hospitals, research on the Kenyan setting is necessary. This study seeks to close a knowledge gap by looking at how health logistics management information systems influence the availability of medical commodities in public hospitals.

2.11 Theoretical Framework

2.11.1 Process Theory

Soh and Markus (1995) were the first to propose using process theory to analyze the relationship between information technology and business value. According to their

process theory model, an organization's investments in IT projects, applications, and skill sets result in the production of IT assets. Successful IT asset deployment results in revised procedures, greater judgment, and improved coordination. The model goes on to claim that, rather than having an immediate effect on the performance of the entire company, IT infrastructure may support vital operations that enhance company performance.

According to the process theory approach to IT return on Equity (ROI), businesses derive business value from intermediary operational and management processes. The authors contend that automation has a stronger influence on processes as IT continues to permeate the company and eventually the organization as a whole.

The results of Barua and Ravindran (1996), who presented a theory of corporate value complementarity, complemented the models of process theory. The authors contend that the benefit of having more of one element is increased by having more of a complementary factor using the process model. According to the authors, the organizational payoff can be increased when several variables related to IT, organizational structure, business processes, and incentives are altered in a coordinated manner in the proper directions by the right magnitude to progress toward an optimum design configuration.

Applying the process theory to the idea that IT indirectly influences the availability of medical commodities through process variables, the current study suggests that automation of supply chain practices complements organizational characteristics and processes and that the adoption of IT and business process optimization cannot be done in isolation. Because of this, even with automation, the health facilities' logistics

management systems can vary based on things like organizational structure and human resources, among other things. Because it describes how the systems management of transportation, inventories, order process management, and data flow administration contribute to expanding the availability of health commodities, the notion is significant and pertinent to this study.

2.11.2 Task Technology Fit (TTF)

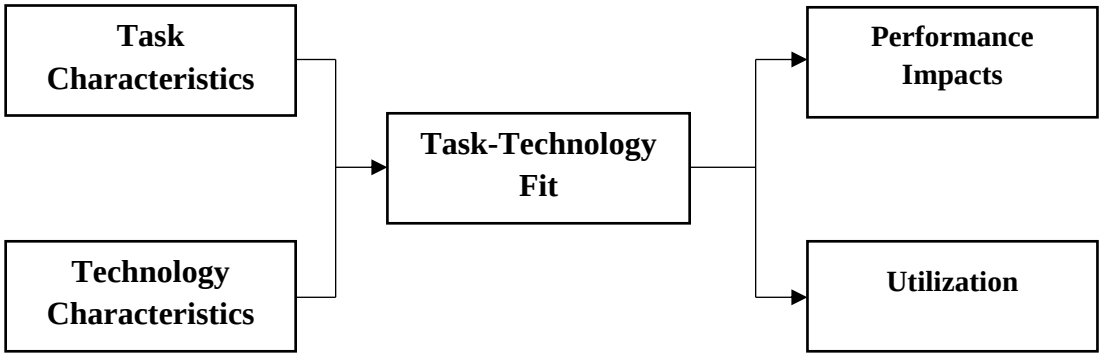
One of the most popular "models in Information System used to examine the connection between a system, the assignment requirements, and the needs of users is the Task Information System and Technology FIT (TTF). This model is predicated on the notion that high system use and user performance result from good integration between the features of user jobs and those of the information system. Interactions between TTF components, including information compatibility (compatibility), information meaning (understanding), and information accessibility (locatability), show how the demands of users, or what are known as the task requirements, and the Information system and Technology used to carry them out, are consistent.

Empirically, the findings demonstrate that TTF variables have a direct impact on performance. This is because greater performance derives from the system's characteristics being consistent with the needs of the user. In simpler terms, the system's ability to function can influence how useful it is regarded to be in enhancing how users interact with the system. In this instance, perceived utility, perceived simplicity of use,

and individual system usability are connected. For instance, a high-quality system responds to users more quickly, improving how helpful and efficient it is regarded to be.

Figure 2.1

Task Technology Fit (TTF)



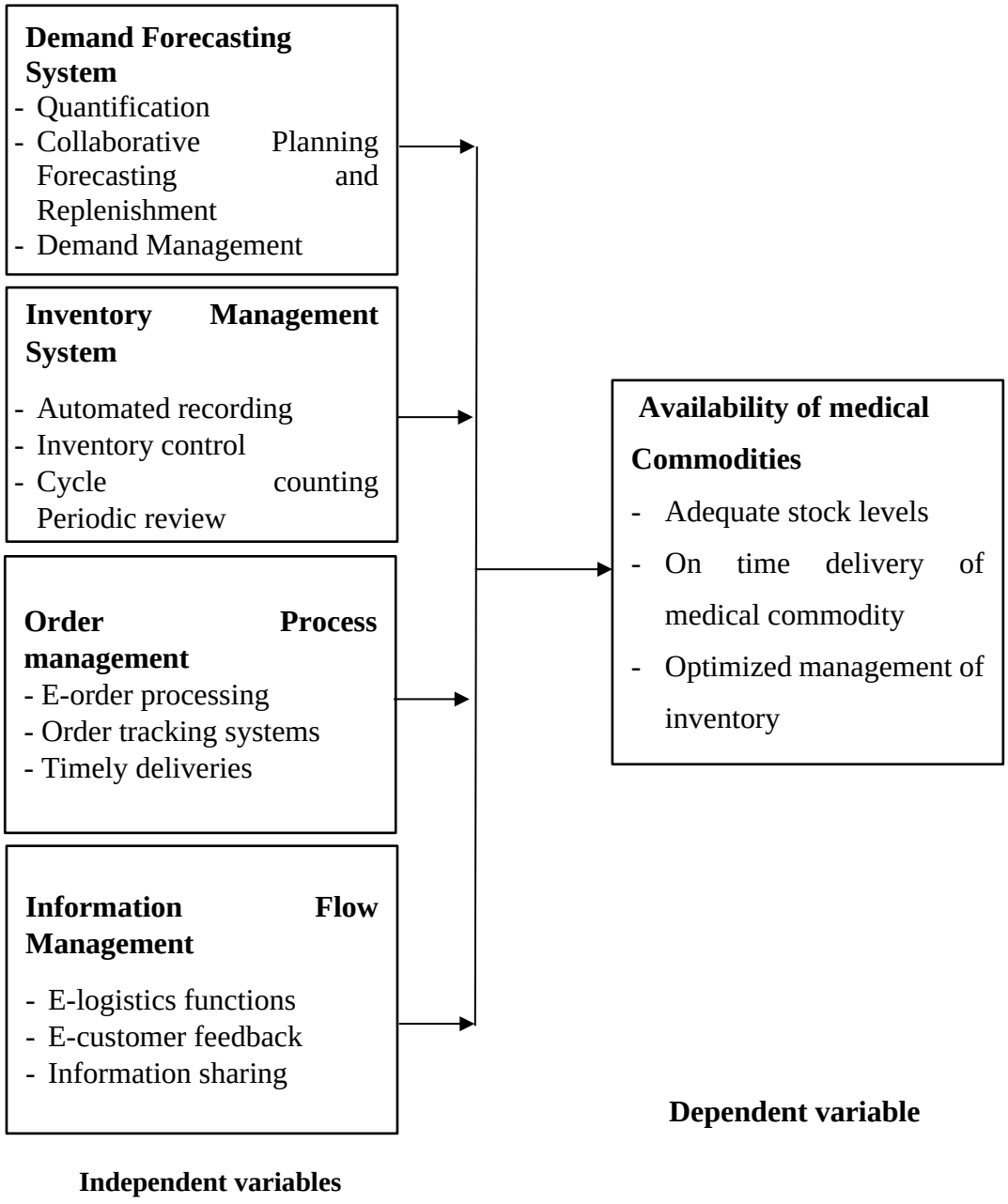
Source: Goodhue and Thompson (1995)

2.12 Conceptual Framework

The conceptual framework shows how the predictor variables and the outcome variable are related to and influence one another (Availability of medical commodities). The study's hypothesis states that the dependent variable will change as independent variables appear or change. The variables in this study are illustrated together with their relationships in the conceptual framework that follows.

Figure 2.2

Conceptual Framework



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The research plan which was used for the study is described in depth in this chapter. The research design includes the target population, sample size, data collecting instruments, and data analysis methods.

3.2 Research Design

Bryman and Bell (2015) stated that a research design is a strategy, outline, or scheme utilized to come up with solutions to research challenges. Research design, in the opinion of Babbie (2020), can be viewed as the framework of a study. This study embraced a descriptive cross-sectional survey as its research design. The way things are usually described and reported using this design. It is distinguished by the systematic gathering of information from members of the target demographic, primarily using questionnaires . For the following reasons, this design was chosen for this study: The design enables both quantitative and qualitative analytical methodologies, and it is excellent in describing the features of the targeted population.

3.3 Target Population

A population is the full set of research participants that meet the eligibility standards (Makrygiannakis & Jack, 2018). As illustrated in Table 3.1, the study's observational unit

included Kajiado County's public hospitals, while the unit of analysis comprised 397 healthcare professionals.

Table 3.1

Target Population

Category	**Kajiado referral hospital**	**Kitengela Sub-County Hospital**	**Ongata Rongai Sub County Hospital**	**Ngong Sub-County Hospital**	**Loitokitok Sub-County Hospital**	**Total**
Pharmacy store managers	1	1	1	1	1	5
Pharmacists	7	5	6	6	6	30
Pharm technologists	5	4	4	5	5	23
Procurement officers	13	12	13	12	12	62
Laboratory technicians	5	4	2	2	3	16
Pharmacy dispensing staff	13	9	11	11	11	55
Nurses	42	33	29	36	36	176
Medical doctors	7	5	6	6	6	30
Total	**93**	**73**	**72**	**79**	**80**	**397**

Source: Author (2023)

3.4 Sampling Techniques and Sample Size

3.4.1 Sampling Techniques

As per the County Ministry of Health report, 397 targeted healthcare professionals operate at the Kajiado County healthcare facilities that were the study respondents. The study used the Nassiuma formula , mentioned in Ogola et al., 2021) to obtain the necessary sample size from the target population.

$$n = \frac{Nc^2}{c^2 + (N-1)e^2}$$

Where n = size of the sample, N = size of the population, and e = error margin (= four (4) percent), c = coefficient of variation (= 50 percent) by replacing the formulae, thus, we obtain;

$$n = \frac{397 * 0.5^2}{0.5^2 + (397-1)0.04^2}$$

$$n = 112$$

3.4.2 Sample size

Since there are five target healthcare facilities, this research used stratified random sampling to choose health professionals from each of the five facilities. In addition to maintaining a manageable sample size, the characteristics of stratified random sampling give every healthcare professional an equal chance of inclusion (Boddy, 2016). The

respondents were chosen from the healthcare facility using a simple random sample method. To improve the generalization of the study's data, simple random sampling was performed (Helfrich et al., 2020). Following that, as stated in Table 3.2, the sample size was dispersed proportionally depending on the targeted population in the appropriate Subcounties.

Table 3.2

Sample Size

Sub-Counties	**Population**	**Ratio (r) = (112/397)**	**Sample size**
Kajiado referral hospital	93	0.2821	26
Kitengela Sub-County Hospital	73	0.2821	21
Ongata Rongai Sub County Hospital	72	0.2821	20
Ngong Sub-County Hospital	79	0.2821	22
Loitokitok Sub-County Hospital	80	0.2821	23
Total		0.2821	**112**

Source: Author (2023)

Where 112 = the calculated sample size, and 397 is the target population.

3.5 Instrumentation

To gather primary data, self-administered, structured questionnaires were employed Each component of the survey concentrated on one or more of the specific objectives of the study. According to Einola and Alvesson (2021) structured inquiries typically provide respondents with a list of all potential answers from which they choose the one that most accurately expresses their viewpoint. To target particular goals and offer a range of

potential answers, questions were created. The respondent's flexibility of answer is granted via unstructured questions, which enabled the researcher to better understand the respondent's emotions. The responses' attitudes and opinions were very clearly revealed by this kind of question (Einola & Alvesson, 2021).

On a five-point Likert scale, one denoted strongly disagree, two denoted disagree, three denoted indifferent, four denoted agreement, and five denoted strongly agreement, responses to statement-like questions will be given. The choice of the Likert-type format was made because it produces equal-interval data, which enables the testing of hypotheses with more potent statistics (Chege et al., 2020). Each respondent received a personalized questionnaire.

3.6 Methods of Data Collection

Health professionals working in the level 4 and level 5 public hospitals in Kajiado County were given self-administered questionnaires to complete. By personally delivering the research tools to the participants at their workplaces, the study used a drop-and-pick strategy to administer the surveys. If the respondents were not able to fill out the research tool right away, the researcher left the questionnaires with them and picked them up later. Data collection was completed in two months. This was carried out to provide the data collection process enough time.

3.7 Pre-Testing

A pre-test sample, according to Connelly (2008), should be 10% of the sample anticipated for the actual research. The simplest methods to utilize for choosing the sample size for the pilot research, according to Browne, are general guidelines for sample size. According to Morrison et al. (2016), "employ at least 30 participants or more to estimate a parameter," As a result, a pre-test was performed on a sample size of 30 participants who were randomly selected from the Embakasi East Sub-county hospital, which had similar characteristics to the targeted hospitals, to improve the data collection instrument.

A pre-test is required, following Cooper and Schindler (2022), mentioned in Chege et al. (2020) to identify design flaws and give proxy data for choosing a representative sample. The purpose of pre-testing questionnaires, according to Morrison et al. (2016), is to see how respondents responded and fix any unclear items.

3.7.1 Validity of Research Instruments

According to de Maia et al. (2018) a research's validity is assessed by how well the data analysis's findings represent the phenomenon that is the focus of the study. By including objective questions in the questionnaire and pre-testing the instrument, validity will be ensured. Any questions that are confusing, humiliating, or improper can then be found and edited. To completely confirm the instrument's validity, it was also handed to managers, coworkers, and other research professionals for content and face validity tests. This helped in figuring out how much of the requested data the instrument would capture. Based on feedback from the supervisors, colleagues, other researchers, and scholars, the instrument

was modified as necessary, for example by removing any confusing items, misspelled words, or other possible typographical problems.

3.7.2 Reliability of Research Instruments

The reliability of the instrument was assessed in this study using the Cronbach Alpha test technique. Reliability is sometimes referred to as data consistency, stability, or dependability. Cooper and Schindler (2022), referenced in Morrison et al. (2016), state that whenever an investigator measures a variable, they want to be certain that the measurement yields reliable and consistent data. The level of inaccuracy affects reliability in research. The threshold for reliability in this investigation was Cronbach Alpha coefficients above 0.7. The main goal of the test-retest research is to evaluate the questions' suitability and clarity in connection to the objects that were generated, the importance of the data, the language that was used, and the object content's accuracy in light of the supplied response.

3.8 Methods of Data Analysis

The collected data was assessed statistically with the Statistical Package for Social Sciences (SPSS) software version 26.0. Because the data was quantitative, inferential and descriptive statistics were employed. A Likert scale with a score of 5 was employed to assess the variables' responses, with One disagreeing strongly and Five being a strong agreement. The results were encoded into two categories: agree & disagree. This is because the data generated by Likert-type questions is ordinal. That is, they can identify where to rank replies (strongly agreeing was 'more' agreement than agree) despite the

distance that separates them (strongly agree is not twofold the amount of agree as agree). As a consequence, the responses strongly agree and agree were merged, as were the responses strongly disagree, neutral, and disagree.

Descriptive analysis produced metrics of central tendencies such as percentages and frequencies. Nevertheless, a Spearman rank correlation analysis was utilized to connect the predictors and the outcome variable in a combined connection to determine the influence of each predictive variable on the outcome variable.

When the outcome variable is categorical, logistic regression is utilized. The Likert-based items were transformed from a 5-point Likert scale to binary variables, to conduct a multivariate logistic regression analysis. The outcome variable, the availability of medical commodities drove this. It was anticipated that public hospitals would have medical commodities or that there would be no medical commodities available. Because it was considered that public hospitals may have medical commodities or that there was no availability of medical commodities, the three denoted neutral, two denoted disagree, and one denoted strongly disagree responses were changed to (zero) denoting no availability of medical commodities, whereas otherwise Responses of five-Strongly agree and four - Agree were encoded as (1), reflecting the availability of medicinal items. All of the independent variables were recorded in the same way.

The logistic model was written as follows:

$$f(z) = 1/(1 + e^{-z})$$

Where Z is a linear combination of the covariates expressed as:

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e$$

Where:

Z = Availability of medical commodities

B_0 = is the intercept

X_1 = Demand forecasting system

X_2 = Inventory management system

X_3 = Order process management system

X_4= Information flow management system

B1, 2, 2, and 4 _are log odds estimates of the outcome variable (availability of medicinal commodities) per unit rise in the outcome variables

Diagnostic test

Before doing logistic regression analysis, the research did a Multicolinearity test. Multicolinearity happens in statistics when two or more predictor variables in a multiple-regression model are significantly connected.The Gauss-Markov criterion only calls for that there should be no perfect relationship among variables before the model is determined. This indicates that the model is capable of estimating all of the coefficients and that the values of the coefficients will stay best linear and not biased estimates, with correct as well as effective standard errors .To assess multi-colinearity, the Variance Inflation Factor (VIF) was utilized.

3.9 Ethical Considerations in Research

According to the theory put forward by Geffner et al. (2018) and mentioned by Chege et al. (2020), ethics includes the study and implementation of ideas like right and wrong, good and evil, transparency, accountability, and responsibility. They continue by stating that all aspects of the study, including its design, data collection, analysis, distribution, and use of the findings, should comply with ethical standards for research. This research adhered to acknowledged standards for doing research. The postgraduate coordination office's clearance is necessary before entering the field to collect data. An official letter explaining the purpose of the study and the confidentiality of any data collected was given to the respondents along with consent forms. They also had the option to withdraw from the study if they believed that their privacy and confidentiality were in danger. Data were gathered, checked for consistency, and properly coded, analyzed, and reported following recognized research standards. The report adhered to academic study standards. The researcher also got approval from the National Commission for Science and Technology Innovation (NACOSTI).

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION, AND INTERPRETATION

4.0 Introduction

The statistical analysis, interpretation, and reporting of the data as they pertain to each research aim are included in this chapter. The purpose of the research was to figure out how demand forecasting systems, inventory management systems, order process management systems, and information flow management systems on the availability of medical commodities in public hospitals. The data was provided in portions that corresponded to the study topics. The research variables' descriptive statistics are provided first, then followed by inferential statistics.

4.1 Response Rate

The study was successful in reaching the healthcare staff. Table 4.1 provides the rate of response.

Table 4.1

Response Rate

Instrument type	Category	Sample size	Frequency	Percent
Questionnaire	Kajiado referral hospital	26	25	96.2
Questionnaire	Kitengela Sub-County Hospital	21	21	100.0
Questionnaire	Ongata Rongai Sub County Hospital	20	18	90.0
Questionnaire	Ngong Sub-County Hospital	22	21	95.5
Questionnaire	Loitokitok Sub-County Hospital	23	23	100.0
	Average response rate			**96.3**

Source: Research Findings (2023)

The study anticipated responses from 112 participants, the rate of response from diverse respondents is shown in Table 4.1 in various health facilities. The highest response rate was realized among participants in Kitengela Sub-County Hospital and Loitokitok Sub-County Hospital 100.0%, followed by Kajiado referral hospital (96.2%), Ngong Sub-County Hospital (95.5%), and lastly Ongata Rongai Sub County Hospital (90.0%). Overall, the study achieved a 96.3% response rate which was commendable. Kothari (2014) advocated that a response rate of 70% and above was suitable for health-related studies. A response rate of 100 percent was not reached since a number of the respondents were busy and did not have time to fill out the questionnaire.

4.2 Pretest Test Results

A pretest test evaluates particular questions, layout, question order, and instructions before they are used in the actual survey. Before beginning the actual data collection, validity and reliability tests were performed.

4.2.1 Test of Reliability

The reliability of the multiple variables is shown in Table 4.2. All of the variables have a Cronbach's alpha reliability value that is higher than 0.7. Demand Forecasting System had reliability of (α=0.785), Inventory Management System (α = 0.763), Order Process Management System (α= 0.713), Information Flow Management System (α= 0.766), and availability of medical commodities (α = 0.761). The research concluded that the instrument utilized was credible and may be used for further research.

Table 4.2

Reliability Results

Variable	Cronbach's Alpha	No. of items	Comments
Demand Forecasting System	0.785	8	Accepted
Inventory management system	0.763	8	Accepted
Order Process Management System	0.713	7	Accepted
Information Flow Management System	0.766	4	Accepted
Availability of medical commodities	0.761	9	Accepted

4.2.2 Test of Validity

The construct and content validity of the questionnaire were originally examined by the principal supervisor in this project. The questionnaire was further verified by talking with two selected random managers from the intended health institutions. To improve the content validity of the questionnaire, their opinions were reviewed and implemented by adding missing connections, eliminating ambiguous phrases, or replacing them with phrases that were readily understood.

4.3 Demographic Characteristics of the Respondents

Gender, age, degree of research, educational background, and job experience were among the demographics and general data judged helpful in this research. These variables were evaluated since they had a likelihood to influence the character of research respondents' replies. Table 4.3 contains descriptive data about the participants.

Table 4.3

Demographic Characteristics

Demographic	Classification	Frequency	Percent (%)
Gender	Male	72	66
	Female	37	34
Age	20-30 years	26	24
	31-40 years	42	39
	41-50 years	31	29
	>51 years	9	8
Education level	Certificate Level	15	14
	Higher Diploma	34	31
	Postgraduate degree	15	14
	Bachelor's Degree	45	41
Working experience	Less than 1 year	16	15
	1-5 years	39	36
	6 – 10 years	10	9
	Over 10 years	44	40

The research established that the bulk of respondents seventy-two percent were male, whereas females made up 37(34%), indicating an unbalanced gender distribution and hence gender bias in the data obtained. This conclusion is consistent with the findings of Karan et al. (2021), who discovered that male health employees outnumber female health workers.

According to the poll, the majority of respondents (42%) were between the ages of 31 and 40, which was followed by those around the ages of 41 and 50 (31%). The aforementioned ages are thought to have more job experience and hence would aid the research by

providing information regarding the systems used and the availability of medical commodities.

In terms of education, 45(41%) of the participants had an undergraduate degree, which was followed by those with a diploma education at 34 (31%), indicating that those who participated were competent and the responses they offered were centered on knowledge that was theoretical as well as practical. This suggested that participants were aware of and comprehended the research methods for gathering data in addition to the research's aims, which increased the relevancy of the replies.

The survey discovered that 44 (40%) of the participants had worked for more than ten years, which was followed by those who had worked for under five years at 39(36%), and those who had worked for less than a year at 16 (15%). The relatively high percentage of persons who have worked in their company for longer than five years suggests that the replies will be mainly based on the participants' experiences instead of a broad knowledge of the topic area. seen employees will give pertinent information based on what they have seen and seen in the facilities throughout the years.

4.4 Demand Forecasting System (DFS)

The first objective of this study was to establish the extent to which the demand forecasting system influences the availability of medical commodities in public hospitals. Data were obtained from 109 respondents with the help of questionnaires.

Participants were asked to indicate how much they agreed with assertions about the Demand Forecasting System. They scored comments about the Demand Forecasting System as strongly agreeing = 5, Agree = 4, Neutral = 3, Disagree = 2, or strongly disagree = 1 on a scale of 1-5. The results were divided into two categories: agree and disagree. This was by combining agree and strongly agree, to create the agreed category and combining disagree, strongly disagree, and neutral to create the "disagree" category. Table 4.4 summarizes the findings.

Table 4.4

Demand Forecasting System

	Agree **N (%)**	**Disagree** **N (%)**
I'm always able to determine the quantities of the health commodities needed.	71(64.6)	38(34.8)
I'm always able to determine the costs of the products required for a specific health program (or service)	16(15.2)	93(84.9)
I'm always able to determine the products that should be delivered to ensure an uninterrupted supply for the program	41(37.6)	67(61.8)
I'm always able to manage demand a key issue in supply chain operations	38(34.8)	70(64.6)
I'm always able to control the variety of essential goods in this facility	18(16.07)	91(83.7)
I'm always to able guide policy and advocacy efforts shaping future healthcare portfolios of essential products.	12(11.8)	97(88.2)
I can replenish based on my previous records	15(14.0)	94(85.9)

According to Table 4.4, 71(64.6%) agreed that they were always able to determine the quantities of the health commodities needed, and 16(15.2%) agreed that they were always able to determine the costs of the products required for a specific health program (or service). According to Ramani and Mavalankar (2016), a demand forecasting system should facilitate the continuous process of projecting which health commodity will be purchased, where, when, by whom, and in what quantities. This implies that public health hospitals should aim at improving their demand forecasting system to make it possible for the staff to always be able to determine the quantities of the health commodities needed.

Also, 41(37.6%) agreed that they are always able to determine the products that should be delivered to ensure an uninterrupted supply for the program, 38(34.8%) agreed that they were always able to manage demand a key issue in supply chain operations, 8(63.3%) agreed that they were always able to control the variety of essential goods in this facility. Further, 12(11.8%) of the respondents agreed that they were always able to guide policy and advocacy efforts shaping future healthcare portfolios of essential products. Lastly, 15(14.0%) agreed that they were able to replenish based on their previous records. The results are in line with Khorasani et al. (2018) suggestions that to ensure the availability of medical commodities, health facilities should have a team that has essential software database administration skills, that must be demonstrated to structure quantifying databases, enter predict and supply planning data and suppositions into a database, determine final drug amounts and expenses, and organize the necessary delivery amounts and timetables to fulfill the entire program or nation demands.

The current study therefore infers that to ensure there is availability of medical commodities in public hospitals, The ICT departments should improve their demand forecasting systems so that the health personnel's in charge of the supply chain are able to determine the quantities of the health commodities needed, establish the expenses of the products necessary for a certain health program (or service), establish the items that ought to be provided to maintain an unbroken availability for the program, monitor demand, and exercise authority over a range of important commodities in this facility.

4.5 Inventory Management System

The second objective of this study was to establish the extent to which the inventory Management System influenced the availability of medical commodities in public hospitals. Data were obtained from 109 respondents with the help of questionnaires. The findings were coded into recorded agree and disagree. This was by combining agree and strongly agree, to create the agree with category and combining disagree, strongly disagree, and neutral to create the "disagree" category. Table 4.5 summarizes the results.

Table 4.5

Inventory Management System

	Agree N (%)	Disagree N (%)
I'm always able to deal with the constant and often overwhelming influx of health commodity information	54(49.4)	55(50.5)
I'm always able to consistently follow records management procedures at the facility	44(40.4)	64(58.9)
I'm always able to back up important records to protect information in the event of a disaster	22(20.2)	87(79.8)
The system provides me with a central database and point of reference for all inventory.	18(16.9)	91(82.6)
The system always helps me ensure there are optimal stock levels to reduce stock-out costs	37(33.7)	72(66.3)
I am always able to capture and update procurement details to enable me to collate	13(11.8)	96(88.2)
I'm always able to confirm physical inventory counts match the inventory records	15(14.0)	94(85.9)
I'm always able to document stock levels	31(28.7)	78(71.3)

According to Table 4.5, 54(49.4%) agreed that they were able to deal with the constant and often overwhelming influx of health commodity information, 64(58.9%) agreed that they were able to consistently follow records management procedures at the facility, 22(20.2%) agreed that they were always able to back up important records to protect the information in the event of a disaster, 18(16.9%) agreed that the system provided them with a central database and point of reference for all inventory, 37(33.7%) agreed that the system always helped them ensure there were optimal stock levels to reduce stock out costs, 13(11.8%) of the respondents agreed that they were always able to capture and

update procurement details to enable them to collate. Further, 15(14.0%) agreed that they were always able to confirm physical inventory counts match the inventory records. Lastly, 31(28.7%) agreed that they were always able to document stock levels.

In every facility, an inventory management system is required to assist in ordering commodities, receiving and keeping an inventory, and registering and keeping track of inventories. As a result, the pharmacist in a hospital ought to be a medication expert because they give guidance on recommending, managing, and tracking, in addition to a supply chain manager who makes sure that drugs are readily accessible through purchasing, storage, distribution, control of inventory, as well as quality assurance. Mohammed and Workneh (2020) conducted a research in Ethiopia and discovered that utilizing a computer in inventory management can function through permitting real-time analysis of drug inventory data; delivering real-time data on product lot number, drug expiration, availability of critical healthcare, and inventory on hand. As a result, the pharmacy may operate more efficiently and quickly. The study found that by implementing a computerized system for medication inventory management, pharmacists and technicians used fewer hours on pharmaceutical inventory, were more effective in lowering inventory amount, and had a lower work load, resulting in lower inventory costs. As a result, health institutions should establish inventory management systems and guarantee that health personnel are able to utilize the systems to guarantee accurate inventory control and medication quantification.

4.6 Order Process Management System

The fourth objective of this study was to establish the extent to which the order process Management systems influenced the availability of medical commodities in public hospitals. Data was obtained from 109 respondents with the help of questionnaires. The findings are presented in Table 4.6.

Table 4.6

Order Process Management System

	Disagree n(%)	**Agree n(%)**
The facility uses electronic order processing	26(24.3)	83(75.7)
The system always supports me to make quality orders of products on the first order	39(36.1)	69(63.2)
The system always processes orders on time	47(42.0)	62(57.3)
I always have real-time data on orders	48(43.8)	61(55.6)
I use the order tracking system to ensure there is availability of health commodities at the facility.	22(20.2)	87(79.8)
The systems help me achieve timely delivery of health commodities	18(16.9)	91(82.6)
I'm always able to provide a notification to an employee working in a retrieval position and alert them to process the order	72(66.3)	37(33.7)

According to the results in Table 4.6, the majority 83(75.7%) disagreed that the facility uses electronic order processing while a few 26(24.3%) agreed, the majority 69(63.2%) disagreed that the system always supports me in making quality orders of products on the first order while a few 39(36.1%) agreed. Further, 62(57.3%) disagreed that the system

always processes orders on time while 47(42.0%) agreed, and lastly, 61(55.6%) agreed that they always have real-time data of orders while 48(43.8%) agreed.

Tavakkolimoghaddam et al. (2022) stated that an order processing management system, using a range of clear procedures, represents the basis of all logistics systems which makes it a key factor in logistics operations. The results show that OPMS allowed a few personnel to make quality orders of products on the first order, process orders on time, and have real-time data of orders, to ensure there was availability of health commodities at the facility. According to Barden and Bick (2021), using OPMS in a health institution saves the time required to offer the end client services or goods that improve the satisfaction of patients. As a result, health institutions must search for methods to strengthen their OPMS to increase the availability of health products. According to the present study, computerized order processing improves the accuracy and dependability of the processing system.

4.7 Information Flow Management System

The third objective of this study was to establish the extent to which the Order Process Management System influenced the availability of medical commodities in public hospitals. Data were obtained from 109 respondents with the help of questionnaires. The findings are presented in Table 4.7.

Table 4.7

Information Flow Management System

	Agree n(%)	**Disagree n(%)**
I always use ICT solutions in the facility's operations	54(49.4)	55(50.5)
The facility has invested in information-sharing systems	44(40.4)	64(58.9)
I always use the system as it ensures smooth information flow to all logistics functions	22 (20.2)	87(79.8)
The system allows practical internal information sharing	17 (15.7)	92 (84.2)

According to the results in Table 4.6, 54(49.4%) agreed that they always use ICT solutions in the facility's operations, also 44(40.4%) agreed the facility has invested in information-sharing systems. Further, 22 (20.2%) agreed they always use the system as it ensures smooth information flow to all logistics functions, lastly, 17 (15.7%) agreed the system allows practical internal information sharing.

The implementation of an information flow management system in a medical center's supply chain includes the ease of acceptance, accessibility to the system, assistance from management, a straightforward system, and the capacity of supply chain stakeholders to store memory (data) on information and communication technology as means of achieving efficiency in the pharmaceutical supply chain . According to the present research, the IFMS application enables actors to carry out each of their roles accurately, quickly, and with fewer individuals, allowing the medical facility to accomplish benefits associated

with ICT implementation which include patient fulfillment as well as cost reduction in its everyday activities.

4.8 Availability of Medical Commodities

Participants were asked to express how much they agreed with assertions on the availability of medical commodities. The findings are presented in Table 4.8.

Table 4.8

Availability of Medical Commodities

	Disagree n(%)	**Agree n(%)**
Commodities and drugs can be accessed at any time by the users from the facility's pharmacy, medical/surgical store	61(56.1)	48(43.3)
Clients always afford and access health commodities as per need/ prescriptions in the facility	61(55.7)	48(45.3)
Suppliers always deliver supplies on time	64(58.4)	45(41.6)
The facility does not often experience frequent stock-outs of essential medicines and vaccines	61(55.6)	48(43.8)
There is access to a regular supply of widely available essential health commodities from KEMSA	22 (20.2)	87(79.8)

According to the results in Table 4.8, 56.1% disagreed Commodities and drugs can be accessed at any time by the users from the facility's pharmacy, or medical/surgical store, while 45.3% agreed, 58.4% disagreed suppliers always delivered supplies on time while 41.6% agreed, 55.6 disagreed that the facilities did not often experience frequent stock-outs of essential medicines and vaccines while 43.8% agreed. Lastly, 63.5% disagreed that there was access to a regular supply of widely available essential health commodities

from KEMSA while 36.5% agreed. The study concludes that in some health facilities under study, commodities, and drugs were not accessed at any time by the users from the facility's pharmacy or medical/surgical store, some clients afforded and had access to health commodities as per need/ prescriptions in the facility and not all the suppliers delivered supplies in time and lastly there was no access to a regular supply of widely available essential health commodities from KEMSA in some of the facilities under study.

The WHO recommends that drugs be available in at least eighty percent of healthcare systems. Nonetheless, investigations have revealed that availability in poor countries is suboptimal. Research in 36 low-income countries on the availability of 15 medications, for example, found that generic drugs were not properly accessible in both the private and public sectors, with an average availability of 38 percent and 64 percent, respectively. In a similar vein, a thorough examination of WHO/HAI surveys on medication pricing and availability revealed variations in the availability of medicines for chronic and acute diseases among developing nations' both the private and public sectors for original and generic drug brands. The average availability of generic drugs in the public sector was minimal across both baskets (acute conditions = 52.1 percent and chronic conditions= 36.1 percent). The average availability of generic medications for every basket in the private sector was greater than in the governmental sector (66.21 percent for generics for acute illnesses and 54.6 percent for generic medications for chronic conditions), however, it remained low.

4.9 Correlation Analysis Results

Spearman's coefficient of correlation was used to determine the relationship between health logistics management information systems and the availability of medical commodities as summarized in Table 4.9.

Table 4.9

Spearman Correlation Matrix for Independent and Dependent Variables

			IFMS	IMS	OPMS	DFS	AMC
Spearman's rho	**IFMS**	r	1.000				
		p-value	.				
		n	112				
	IMS	r	.437**	1.000			
		p-value	.000	.			
		n	112	112			
	OPMS	r	.579**	.445**	1.000		
		p-value	.000	.000	.		
		n	112	112	112		
	DFS	r	.227*	.014	.214*	1.000	
		p-value	.018	.884	.026	.	
		N	112	112	112	112	
	AMC	r	.737**	.733**	.397**	.303	1.000
		p-value	.000	.000	.000	.002	.
		n	112	112	112	112	112

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

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

Source: Research Findings (2023)

Keywords: DFS = Demand Forecasting System; **IMS** = Inventory Management System; **OPMS** = Order Process Management System; **IFMS** = Information Flow Management System; and **AMC** = Availability of Medical Commodities

The results in Table 4.12 show Spearman's coefficient of correlation which is a measure of the strength of the linear association between two variables. The results indicate that the relationship between the demand forecasting system and the availability of medical commodities was significant and positively correlated r = 0.303, p=0.002. This means that any positive change in the demand forecasting system leads to increased availability of medical commodities. The results agree with those of (Asiamah et al., 2017; Meegahapola & Prabodanie, 2018).

The results indicate that the relationship between the inventory management system and the availability of medical commodities was significant and positively correlated r = 0.733, p=0.000. This means that any positive change in the availability of medical commodities leads to increased availability of medical commodities. The results agree with those of (Pferzinger & Rammerstorfer, 2017; Roland et al., 2017)

The results indicate that the relationship between the Order Process Management System and the availability of medical commodities was significant and positively correlated r = -0.397, p=0.000. This means that any positive change in the Order Process Management System leads to increased availability of medical commodities. The results agree with those of (Short et al., 2020; Were & Moturi, 2017).

The results indicate that the relationship between the information flow management system and the availability of medical commodities was significant and positively correlated r = 0.737, p=0.000. This means that any positive change in the information flow

management system leads to increased availability of medical commodities. The results agree with those of (Kosny & Allen, 2016; Okyere et al., 2022).

4.10 Logistic Regression for Independent and Dependent Variables

The study employed binary logistic regression analysis to examine the linear statistical association between the predictors and the outcome variables of the current study.

4.10.1 Checking for Multicollinearity

The findings of this analysis are shown in Table 4.10.

Table 4.10

Checking for Multi-collinearity

Independent variables	Tolerance	VIF
Demand Forecasting System	0.766	2.152
Quality improvement guidelines	0.882	2.274
Order Process Management System	0.750	1.245
Information Flow Management System	0.669	1.891

Table 4.10 displays the tolerance and VIF data, which reveal that there is no multi-colinearity among the predictors since no variable had a value of the VIF above ten and no tolerance value was less than 0.1, as stated by Hamilton (2019). This confirmed absence of multicollinearity.

4.10.2 Binary logistic regression analysis

The health logistics management information system influencing the availability of medical commodities was predicted using binary logistic regression analysis.

Table 4.11

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	27.557a	0.349	0.471

The Nagelkerke Square outcome in Table 4.11 indicates that the four predictors being explored describe 47.1 percent of the chance of the availability of medical commodities occurring; demand forecasting system, inventory management system, order process management system, and information flow management system. Also, the results indicate that 52.9% of the variation in the availability of medical commodities is a result of other factors not captured in the model.

Logistic regression was done to establish the influence of the demand forecasting system, inventory management systems, order process management systems, and information flow management systems on the likelihood of the availability of medical commodities. The results of a chi-square goodness of fit test are shown in Table 4.12.

Table 4.12

Omnibus Tests of Model Coefficients

		Chi-Square	Df	Sig
	Step	12.826	5	0.023
	Block	12.826	5	0.023
Step 1	Model	12.826	5	0.023

The Ho stated that all intercepts and the coefficients were equal to zero. The Ho was rejected by $\chi 2(5) = 12.826$, $p < 05$. The model was then found to suit the data satisfactorily. As a result, the study went on to construct the entire regression model. To address the study's questions, the influence of the predictor variable on the outcome variable was examined. Because the outcome variable in the present investigation is a Logit, the extent of each predictor variable's effect is represented by the odds ratio obtained from its Exp (B). The odds ratio is calculated by dividing the likelihood of success by the probability of failure .

Table 4.13

Relationship of Individual Independent Variable to Dependent Variable

Parameters	B	S.E.	Wald	df	Sig.	Exp(B)
Demand Forecasting System	2.016	0.581	12.025	1	0.001	7.509
Inventory management system	1.567	2.298	0.465	1	0.005	4.794
Order Process Management System	0.742	0.363	4.173	1	0.041	0.476
Information Flow Management System	3.491	1.312	7.086	1	0.008	1.030
Constant	1.057	1.067	.981	1	.322	.348

a. Variable(s) entered on step 1

The results for the coefficients of the predictor variables forming the systems were established and presented in Table 4.13 to suit the logistic regression equation.

The Regression Function

The logistic regression model for the current study has been developed as follows:

Logit (p) = β0 + β1DFS + β2IMS + β3OPMS + β4IFMS + ε.

Where: p is the probability of selecting a given system.

β0 = 1.057 = the coefficient of constant

β1 = 2.016 = the coefficient of the Demand Forecasting System [DFS]

β2 = 1.567 = the coefficient of the Inventory Management System [IMS]

β3 = 0.742 = the coefficient of Order Process Management System [OPMS]

β4 = 3.491 = the coefficient of Information Flow Management System [IFMS]

And, ε = is the error term.

The analysis of the logistic regression model for this study was done and the B coefficients for the four independent variables were fitted and expressed in terms of the variables used in this study. The results showed the logistic regression equation is;

Y = 1.057 + 2.016*DFS + 1.567*IMS + 0.742*OPMS + 3.491*IFMS…

a) Influence of Demand Forecasting System on the availability of medical commodities

In Table 4.13, the demand forecasting system was a significant predictor (β = 2.016, S.E. = 0.581, P value < 0.05) indicating that the demand forecasting system was likely to improve the availability of health commodities in public hospitals. The odds ratio of 7.509 indicates that for every unit increase in the demand forecasting system, the odds of improving the availability of health commodities changed by a factor of 7.509.

b). Influence of Inventory Management System on the availability of medical commodities

The inventory management system was a significant predictor (β = 1.567, S.E. = 2.298, P value < 0.05) indicating that the inventory management system was likely to improve the availability of health commodities in public hospitals. The odds ratio of 4.794 indicates that for every unit increase in the inventory management system, the odds of improving the availability of health commodities changed by a factor of 4.794.

c). Influence of Order Process Management System on the availability of medical commodities

Order process management system was a significant predictor (β = 0.742, S.E. = 0.363, P value < 0.05) indicating that the order process management system was likely to improve the availability of health commodities in public hospitals. The odds ratio of 0.476 indicates

that for every unit increase in the order process management system, the odds of improving the availability of health commodities changed by a factor of 0.476.

d) Influence of Information Flow Management System on the Availability of medical commodities

Information flow management system was a significant predictor ($\beta = 3.491$, S.E. = 1.312, P value < 0.05) indicating that the information flow management system was likely to improve the availability of health commodities in public hospitals. The odds ratio of 1.030 indicates that for every unit increase in the information flow management system, the odds of improving the availability of health commodities changed by a factor of 1.030.

The reason for addressing the relationship of each predictor variable with the outcome variable was that the overall goal of this study was to establish the systems that improved the availability of medical commodities in public health facilities. The findings that are detailed in Table 4.13 confirm that the systems under investigation have a statistically significant influence on the availability of medical commodities in public health facilities in Kajiado County as indicated by the direction and magnitude of regression coefficients.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This study sought to determine how the health logistics management information system influenced the availability of medical commodities at public hospitals in Kajiado County. This chapter summarizes the findings of the study and presents the conclusions and recommendations made based on the study. It also presents suggestions for further study.

5.2 Summary of the Study

The purpose of the study was to determine the health logistics management information system that influences the availability of medical commodities in public health facilities in Kajiado County. Specifically, the study sought to investigate the extent to which the demand forecasting system influences the availability of medical commodities in public hospitals, to determine the extent to which the inventory management system improves the availability of medical commodities in public hospitals, to establish the extent to which order process management system improves the availability of medical commodities in public hospitals and lastly to determine the extent to which Information flow management system improve the availability of medical commodities in public hospitals.

5.2.1 Demand Forecasting System and availability of medical commodities in public hospitals, in Kajiado County

The descroitpive analysis results showed that in some hospitals, the staff were not always able to determine the quantities of the health commodities needed, were not able to always determine the costs of the products required for a specific health program (or service), or determine the products that should be delivered to ensure an uninterrupted supply for the program, or manage demand a key issue in supply chain operations, or control the variety of essential goods in this facility or guide policy and advocacy efforts shaping future healthcare portfolios of essential products or replenish based on their previous records.

The correlation analysis results indicated that the demand forecasting system and availability of medical commodities in public hospitals, in Kajiado County were positively correlated ($r = 0.303$; P-value < 0.05). Logistic regression analysis results indicated that the Demand Forecasting System improved the availability of medical commodities in public hospitals. From the analysis, the value of Exp (B) was 7.509 which implies that a one-unit increase in the order process management system increased the odds by 7.509 times that the health availability of medical commodities is influenced by the demand forecasting system.

5.2.2 Inventory Management System and the Availability of Medical Commodities

The descroitpive analysis results showed that in some hospitals the staff were not always able to deal with the constant and often overwhelming influx of health commodity information or consistently follow records management procedures at the facility, or back

up important records to protect information in the event of a disaster, The systems did not always provide the respondents with a central database and point of reference for all inventory, did not always help them ensure there were optimal stock levels to reduce stock-out costs. The staff were not always able to capture and update procurement details to enable them to collate, or confirm physical inventory counts match the inventory records.

Further, the correlation analysis results indicated that the inventory management system and availability of medical commodities in public hospitals, in Kajiado County were positively correlated ($r = 0.733$; P-value < 0.05). Laslty, the logistic regression analysis results indicated that the Inventory Management System improved the availability of medical commodities in public hospitals. From the analysis, the value of Exp (B) was 4.794 which implies that a one-unit increase in the inventory management system increased the odds by 4.794 times that the health availability of medical commodities is influenced by the demand forecasting system.

5.2.3 Order Process Management System and the Availability of Medical Commodities

The descriptive analysis showed that some facilities were not using electronic order processing, the system were not always supporting the staff to make quality orders of products on the first order, or processes orders on time or have real-time data on orders, or help achieve timely delivery of health commodities. Further, the correlation analysis results indicated that the Order Process Management System and availability of medical

commodities in public hospitals, in Kajiado County were positively correlated (r = 0.397; P-value < 0.05). Laslty the logisitic regression analysis showed order process management System affected the availability of medical commodities. The value of Exp (B) was 0.476 which implies that a one-unit increase in the order process management system increased the odds by 0.476 times that the health availability of medical commodities is influenced by the order process management system.

5.2.4 Information Flow Management system and the Availability of medical commodities

The descriptive analysis results showed that some staff were not always using the ICT solutions in the facility's operations, the facility had not invested in information-sharing systems, some staff were not always using the system to ensure smooth information flow to all logistics functions and neither did the system allow practical internal information sharing. Further, the correlation analysis results indicated that the information flow management system and availability of medical commodities in public hospitals, in Kajiado County, were positively correlated (r = 0.737; P-value < 0.05). This indicated that the information flow management system influenced the health availability of medical commodities. Regarding the logistic regression analysis results, The value of Exp (B) was 1.030 which implies that a one-unit increase in the information flow management system increased the odds by 1.030 times that the health availability of medical commodities is influenced by the information flow management system.

5.3 Conclusion

In conclusion, this study provided a unique perspective on health logistics management information systems that influence the availability of medical commodities' concepts by looking at the aspects of the demand forecasting system, quality improvement guidelines, order process management system, and information flow management system. The study filled the contextual and conceptual gaps that were identified in Chapter One Section 1.3. The study was founded on the process theory of needs and provided a solid ground for developing a conceptual model to explain how and why the health logistics management information system improved the availability of medical commodities in public hospitals, in Kajiado County.

The study concludes that at the bivariate level demand forecasting system, order process management systems, inventory management systems, and information flow management systems all have a positive relationship with the availability of medical commodities in public hospitals under study.

At a combined setup including all the variables, it was established that the demand forecasting system, order process management system, and information flow management system influenced the health availability of medical commodities. However, the inventory management system was found not to bring any improvement in the availability of medical commodities in public hospitals. In addition, at a combined set-up, the Information flow management system was found to be the most important health system, followed by the demand forecasting system.

5.4 Recommendations for Policy and Practice

Based on the gaps identified above, this study recommends the following interventions aimed at improving the availability of medical commodities at public hospitals: To ensure there is the availability of medical commodities, the management at public hospitals should train their staff to equip them with the necessary knowledge that will improve their ability to use the demand forecasting system to enable them to determine the quantities of the health commodities needed, the expenses of the items necessary for a given health scheme (or service), as well as the products that have to be provided to assure the program's ongoing delivery, thus making it possible for the staff to manage demand a key issue in supply chain operations, to control the variety of essential goods in the facilities, and lastly, to guide policy and advocacy efforts shaping future healthcare portfolios of essential products.

To ensure there is the availability of medical commodities, the management should train their staff on the application of the inventory management system so that they can deal with the constant and often overwhelming influx of health commodity information, consistently follow records management procedures at the facility, back up important records to protect the information in the event of a disaster. This is because the system will provide the staff with a central database and point of reference for all inventory, the system would help in ensuring there are optimal stock levels to reduce stock-out costs, enable easy capturing and updating of procurement details, and also make it possible to confirm physical inventory counts match the inventory records.

To ensure there is the availability of medical commodities, the management should ensure there is a smooth flow of information by ensuring the staff are familiar with the information flow management system at the facilities. This can therefore enhance the use of ICT solutions in the facility's operations, also The management should invest more in information-sharing systems to ensure an easy flow of information to all logistics functions and also allow practical internal information sharing.

To improve the availability of medical commodities at the facilities, the management should improve and implement electronic order processing in their operations, ensure that the system supports the staff in making quality orders of products on the first order, and ensure orders are processed on time. The order tracking system would ensure there is the availability of health commodities at the facilities and help in achieving timely delivery of health commodities.

The central government should therefore encourage the adoption of health logistics management information systems in all public hospitals to improve the availability of medical commodities, promote population health, and achieve healthcare outcomes and goals. For the general public's use, essential medications should be offered in health facilities in sufficient quantities, in the proper dose forms, with guaranteed quality, and at reasonable costs.

5.5 Areas for Further Research

While this study successfully establishes the health logistics management information system that influences the availability of medical commodities in public health facilities

in Kajiado County, it, however, presents gaps that should be filled in future studies. Further studies can be done on the health logistics management information system that influences the availability of medical commodities in both private and public health facilities in Kajiado County, in other counties, and also in East Africa and beyond and see whether the results will be replicated. Lastly, there is a need for another study to determine why the Inventory Management System negatively affected the availability of medical commodities in Kajiado County.

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APPENDICES

Appendix I: Informed Consent

Kenya Methodist University

P. 0 Box 267-60200

MERU, Kenya

SUBJECT: INFORMED CONSENT

Dear Respondent,

My name is Julius Habakkuk Bunyali, I am an MSc student from Kenya Methodist University. I am conducting a study titled: **INFLUENCE OF HEALTH LOGISTICS MANAGEMENT INFORMATION SYSTEM ON THE AVAILABILITY OF MEDICAL COMMODITIES IN PUBLIC HOSPITALS IN KENYA: A CASE OF PUBLIC HOSPITALS IN KAJIADO COUNTY.** The health system will be strengthened by the findings of this study, especially at the county level. This will intern benefit the community, the neighboring counties, and the country at large. The proposal will bring out new insight to the researcher and will help those making decisions on health systems. All the decisions made will be relevant to county and national government.

Procedure to be followed

This study will require that I gather some of the important information from you as the participant that will help in enforcing the health system pillar. I will require your approval to record some of the information that you will give for academic purposes only.

You as the participant can either accept or reject the pleasure of participating in this academic study. No one will judge you for your decision to partake in this study. And whatever you decide will not be used against you by any party present or absent.

It is on your own will that you are allowed to participate in this study. Any questions that are study-related are accepted at any time. You may or may not answer questions that you

feel not to answer at any time. You may also leave an interview room or area at any time you wish to. All the decisions you make will be accepted positively by the researcher.

Discomforts and risks.

Some of the many questions that you might experience in the session may not be as you wish and might be at an intimate level. If this is so, you may answer if you wish or refuse and you will not be questioned by anyone. A whole interview may take more than 40 min, if you will feel uncomfortable in the middle of the session you may leave at your wish.

Benefits

By your participation in this academic study, you may be of big help to improving county and national healthcare systems. As a result not only does your county or country benefit from it but also the entire continent of Africa will get new insight on strengthening healthcare systems. This will greatly help both scholars and government entities on healthcare systems and how to improve them.

Rewards

This study is fully academic; therefore no rewards will be given or received for undertaking this critical study.

Confidentiality

The study will be confidential from any outside partner and it will be undertaken in a private room in the hospital to ensure every party is comfortable. No name or any personal detail will be recorded in either of the questionnaires. After all is done the documents will be kept safely in the University.

Contact Information

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

Below are the main contact persons that you may call if there are any questions you wish to put across.

1. Dr. Keziah Njoroge Head of the Department of Health Systems Management of Kenya Methodist University, Nairobi campus.

Participant's Statement

The above statements are well-read and understood by myself. There are chances given to me to ask any kind of questions as per the study at hand and am satisfied with the answers I will get. I have volunteered entirely to participate in this study. Any records that come from this study I believe will be kept with utmost care and privacy. I understand that I can leave the study session at any time that I wish without questions asked. I understand that I will not be victimized at any place may it be at work or home.

Name of Participant…… Date……..

Signature…….

Investigator's Statement

I, the researcher have read to my participants all the required instructions on this study in the easiest language that he/she may understand and I have sighed with all the agreements done to this study.

Name of Interviewer……...Date…….
Interviewer Signature……

Appendix II: Questionnaire

Kindly fill in the questions in the spaces provided to the best of your ability. Be assured that the information you provide here will only be used for academic purposes.

SECTION A: BACKGROUND OF THE STUDY

1. What is your gender?

   Female [ ] Male [ ]

2. Kindly tick in the bracket in which your age falls under

   20 years and below [ ] 21-25 years [ ] 26-30 years [ ]

   31-35 years [ ] 36-40 years [ ] 41-45 years [ ]

   Above 45 years [ ]

3. In your education, what is the highest level attained?

   Certificate [ ] Diploma [ ] Degree [ ]

   Postgraduate Degree [ ]

4. What is the duration of your service in this hospital?

   0- 5 years [ ] 6- 10 years [ ] 11- 15 [ ]

   Above 15 years [ ]

SECTION B: HEALTH LOGISTICS MANAGEMENT INFORMATION SYSTEM (DFS)

Part A: Demand Forecasting System (DFS)

5. To what extent do you agree with the following statements on demand forecasting systems? Tick as appropriate against SA = Strongly Agree A Agree N = Neutral, 4 Disagree, S = Strongly Disagree (please put a tick as appropriate).

	Statements	**SA**	**A**	**N**	**D**	**SD**
	Quantification					
DFS1	The facility has a quantification committee					

DFS2	The health committee can calculate the quantities of the health commodities required in the facility					
DFS3	We are always able to project when the products should be delivered to ensure an uninterrupted supply of health services					
	Product selection					
DFS4	There is a product selection committee is available in the facility					
DFS5	User departments are involved in product selection					
DFS6	A National Essential Medicine List (NEML) is used to guide product selection					
DFS7	We only select health products registered for use in the country					
DFS8	We conduct health product need assessment as per the local disease pattern					
DFS9	Product availability is KEMSA and other suppliers guide the product selection					
DFS10	Quantification of health products is done annually					
DFS11	Quantification of health products is done quarterly					
DFS12	Quantification of health products is done monthly					
	Product costs					
DFS13	We are guided by the set budget to select health products					
DFS14	A budget is always prepared and approved by the set committee for health product procurement					
DFS15	We ensure that health products ordered are affordable to the patients and clients					
DFS16	Products to be ordered are prioritized as per the approved budget					

Part B: Inventory Management System (IMS)

6. To what extent do you agree with the following statements on inventory management systems? Tick as appropriate against SA = Strongly Agree A Agree N = Neutral, 4 Disagree, S = Strongly Disagree (please put a tick as appropriate).

	Statements	**SA**	**A**	**N**	**D**	**SD**
	Inventory practices					

IMS1	Inventory tools are available, accessible, and regularly updated (stock/ bin cards, control cards)					
IMS2	The facility has guidelines, policies, and rules on storage of health products					
IMS3	First In First Out (FIFO) practice is well used in inventory control					
IMS4	First Expiry First Out (FEFO) is well used in inventory control					
IMS5	Inventory performance monitoring is always conducted to ensure records are up to date					
	Product tagging					
IMS6	All products are tagged for easy accounting					
IMS7	I can track products for usage					
	Real-Time Tracking					
IMS8	The stock levels are updated daily					
IMS9	I receive notifications of items ordered					
IMS10	I am always able to track orders					
IMS11	The system provides me with a central database and point of reference for all inventory					
IMS12	I have adequate information in the system which helps me make informed decisions					
IMS13	I can back up information on time in case of a system crush					
IMS14	The system timely updates me on commodities expiry dates					
IMS15	I am always alerted on product stock exhaustion					
IMS16	I am always alerted of any attempt to overstock					
IMS17	I can access information for future decision-making					

	Stock maintenance					
IMS18	I am always updated by the system of the product conditions for maintenance					
IMS19	I schedule the maintenance of health equipment on time					
IMS20	I can conduct a physical check on the health products on time					

Part C: Order Process Management System (OPMS)

7. To what extent do you agree with the following statements on the order process management system? Tick as appropriate against SA = Strongly Agree; N = Neutral; 4= Disagree; S = Strongly Disagree (please put a tick as appropriate).

	Statements	**SA**	**A**	**N**	**D**	**SD**
	order processing					
OPMS1	The facility uses electronic order processing					
OPMS2	There exists a clear procedure for ordering health commodities from suppliers					
OPMS3	All the orders from different departments are received in the systems					
OPMS4	The system always processes orders on time					
	There exists an annual procurement plan in the facility					
OPMS5	Annual procurement plans are strictly followed					
OPMS6	Suppliers are selected after a competitive bidding					

OPMS7	The facility uses a competitive process where tenders are published publicly					
OPMS8	The tender evaluation process is BOTH competitive and transparent					
OPMS9	There exists a tender opening and an evaluation committee					
OPMS10	The facility receives and assesses samples and specifications given, before making orders					
OPMS11	e-procurement tool from KEMSA is always updated for requisitions					
	Timely deliveries					
OPMS12	Strict procurement timelines are always set for timely delivery within the lead time					
OPMS13	I'm always able to notify an employee working in a retrieval position and alert them to process the order					
OPMS14	There is a continuous monitoring process to ensure timely delivery of quality products by the supplier contracted					
OPMS15	Strict delivery schedules are always agreed upon and followed by the suppliers					
OPMS16	The facility has an inspection and acceptance committee					
OPMS17	The inspection and acceptance team confirms orders against the delivery notes upon deliveries					

Part D: Information Flow Management System (IFMS)

8. To what extent do you agree with the following statements on information flow management systemss? Tick as appropriate against SA = Strongly Agree; A = Agree N = Neutral; 4= Disagree; SD = Strongly Disagree (please put a tick as appropriate).

	Statements	**SA**	**A**	**N**	**D**	**SD**
	Information technology infrastructure					
IFMS1	The facility has sufficient software components to run the management of health commodities					
IFMS2	We have enough computers in the facility to run the management of health products					
IFMS3	Internet connectivity is always good in the health facility					
IFMS4	We have a functional backup generator in the health facility					
IFMS5	We never lack electricity since there is an automated backup of electricity from the generator					
	Integration					
IFMS6	The facility has an information system that connects all the departments					
IFMS7	Orders from different departments are automatically picked by the procurement team in the system					
IFMS8	I can tell what medication a given patient has been prescribed by the doctor before they arrive at the pharmacy					

SECTION C: AVAILABILITY OF MEDICAL COMMODITIES (AMC)

9. To what extent do you agree with the following statements on the availability of medical commodities? Tick as appropriate against SA = Strongly Agree; A= Agree N = Neutral, 4= Disagree, S = Strongly Disagree (please put a tick as appropriate).

	Statements	**SA**	**A**	**N**	**D**	**SD**
AHC1	Commodities and drugs can be accessed at any time by the users from the facility's pharmacy, medical/surgical store					
AHC2	Clients always afford and access health commodities as per need/ prescriptions in the facility					
AHC3	Suppliers always deliver supplies on time					
AHC4	The facility does not often experience frequent stock-outs of essential medicines and vaccines					
AHC5	The facility always has adequate stock levels					
AHC6	The facility always has positive customer feedback on commodities					
AHC7	I am always able to order goods timely from KEMSA					
AHC8	The facility has a procurement policy that governs the procurement activities					
AHC9	There is access to a regular supply of widely available essential health commodities from KEMSA					

10. In your opinion, what do you think should be improved to facilitate the availability of medical commodities in public hospitals in Kajiado County, Kenya?

……

……

……
……

-Thank you for participating-

Appendix III: KeMU SERC Approval

KENYA METHODIST UNIVERSITY
P. O. Box 267 Meru - 60200, Kenya
Tel: 254-064-30301/31229/30367/31171
Fax: 254-64-30162
Email: deanrd@kemu.ac.ke

DIRECTORATE OF POSTGRADUATE STUDIES

August 3, 2022

Commission Secretary,
National Commission for Science, Technology and Innovations,
P.O. Box 30623-00100
NAIROBI.

Dear Sir/Madam,

RE: JULIUS HABAKKUK BUNYALI – (REG. NO. HSM-3-0539-1/2018)

This is to confirm that the above named is a bona fide student of Kenya Methodist University, in the School of Medicine and Health Sciences, Department of Health System Management undertaking a Masters' Degree in Health System Management . He is conducting research on; **"Influence of Health Logistics Management Information System on Availability of Medical Commodities in Public Hospitals in Kajiado County, Kenya".**

We confirm that his research proposal has been presented and approved by the University.

In this regard, we are requesting your office to issue a research license to enable him collect data.

Any assistance accorded to him will be appreciated.

KENYA METHODIST UNIVERSITY P.O. BOX 267-60200 MERU KEMU SERC 03 AUG 2022

Thank you.

Dr. John Muchiri, Ph.D.
Director, Postgraduate Studies

Cc: Dean SMHS
CoD, HSM
Postgraduate Co-ordinator-HSM
Supervisors

Appendix IV: NACOSTI Research Authorization

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **235511**

Date of Issue: **17/August/2022**

RESEARCH LICENSE

This is to Certify that Mr.. Julius Habakkuk Bunyali of Kenya Methodist University, has been licensed to conduct research in Kajiado on the topic: INFLUENCE OF HEALTH LOGISTICS MANAGEMENT INFORMATION SYSTEM ON AVAILABILITY OF MEDICAL COMMODITIES IN PUBLIC HOSPITALS IN KAJIADO COUNTY, KENYA for the period ending : 17/August/2023.

License No: **NACOSTI/P/22/19755**

235511

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix V: Kajiado County Approval

COUNTY GOVERNMENT OF KAJIADO
DEPARTMENT OF MEDICAL, PUBLIC HEALTH AND SANITATION SERVICES

Ref: 101/20/2022 **Date: 30th September 2022**

Julius Habakkuk Bunyali
Kenya Methodist University
Nairobi

Dear Julius

RE: Research Authorization

This is to inform you that having reviewed your research proposal document on the study topic " Influence of health logistics manangment informantions systems on availability of health commodities in public hospitals in Kajiado County.

We wish to confirm that you have been authorised to undertake the study in Kajiado county and collect your data from the facilities of choice.
You are required to adhere to the facility guidelines at all times.

On completion of the study you are required to submit one hard copy script with your findings and recomendations to enhance decision making for health commodites available to our people.

KAJIADO EAST SUB - COUNTY
MEDICAL OFFICER OF HEALTH
(MOH)
30 SEP 2022
P. O. Box 581, KAJIADO
Sign:.....

Yours Sincerely,e

Julius Sazia
Medical Officer Of Health