IMPACT OF INVENTORY MANAGEMENT TECHNIQUES ON THE PERFORMANCE OF PUBLIC HEALTH FACILITIES IN KISUMU COUNTY

BY

JOHN OMONDI ONYANGO

A Research Thesis Submitted to the School of Business and Economics of Jaramogi Oginga Odinga University of Science and Technology in Partial Fulfillment of the Requirements for the Award of the Degree of Master in Business Administration, Supply Chain Management.

2022

DECLARATION

The Student's Declaration;

This research project is my original work, and it has not been submitted to any other college or university for the award of a diploma or degree.

John Omondi Onyango Sign …… Date ……...……

B151/4144/2017

Approval by the research project supervisors;

As the university supervisors, we have given our approval to this research project.

Sign …… Date ……..……

Prof. Maria Onyango

Lecturer, School of Business and Economics

Jaramogi Oginga Odinga University of Science and Technology

Sign …… Date ……..……

Dr. Edwins Baraza

Lecturer, School of Business and Economics

Jaramogi Oginga Odinga University of Science and Technology

COPYRIGHT

DEDICATION

This research project is dedicated to my immediate family for love and support during my studies, my wife Mary and the boys Frank, Rubby, and John

ACKNOWLEDGMENT

I give thanks to Almighty God for giving me life and opportunities that have enabled me to come this far. Prof. Maria Onyango and Dr. Edwins Baraza, my project supervisors, deserve special thanks for their support, motivation, and wise advice in this project. Special thanks to the Ministry of Health management team and the entire Kisumu County workforce for their help and support in making my thesis a success. I thank everyone and I pray for God's blessings upon each and every one of you.

ABSTRACT

This quantitative study seeks to understand the impact of inventory management practices on the operational performance of public health facilities in Kisumu County, Kenya. The Objectives were to (1) determine the impact of the ABC system on the operation performance (cost management, waste management, and efficiency of service delivery) of public health facilities in Kisumu County; (2) examine the impact of the Economic Order Quantity system on the operation performance (cost management, waste management, and efficiency of service delivery) of public health facilities in Kisumu County; (3) investigate the impact of Just in Time on the operation performance (cost management, waste management, and efficiency of service delivery) of public health facilities in Kisumu County. Through stratified proportionate sampling, the study had a sample of 328 drawn from 1848 employees working in health facilities. From the findings, many respondents noted that the health facilities used the ABC system (84%), EOQ (96.4%), and JIT techniques (99.6%). The study found that the ABC system and operational performance of health facilities had correlation of (0.216); $p < 0.000$. Likewise, the EOQ technique and operational performance of health facilities had a correlation coefficient of (0.587); $p < 0.001$. JIT technique and operational performance of health facilities had a correlation of (0.439); $p < 0.008$. Lastly, the study established that the coefficients for the covariate (government policy) were not statistically significant ($p>.05$) indicating that government policy does not have a significant effect on the relationship between inventory management techniques and operational performance. This finding is not conclusive because the significance score was too high. Hence, the public health facilities in Kisumu County should continue improving their use of the techniques. Additional studies should be conducted.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

OPERATIONAL DEFINITION OF TERMS

When used in other contexts, the following terminologies may have different meanings, but their meanings in this study are as indicated.

ABC Analysis: This is an inventory categorization strategy that divides materials into three groups: class "A" items, class "B" items, and class "C" items.

Class “A” Inventories: These are inventories holding the highest dollar value but usually the least in numbers, also called the vital few

Class “B” Inventories: This class of inventories fall in between class A and class B in terms of dollar value and quantities, also called the moderate

Class “C” Inventories: These are the inventories with the least dollar value but usually the most in terms of quantities, also called the trivial many.

Cost Management: Cost management in public health facilities is the process of estimating, allocating and controlling costs in the public health facilities.

Economic Order Quantity: This is a predetermined order quantity that reduces overall keeping and ordering costs.

Efficiency of Service Delivery: Service delivery is the part of health system where patients receive the treatment and supplies that are entitled to them. The efficiency of service delivery indicates the level at which the provided services addresses patients’ needs in a timely and cost-effective manner is measured by service delivery efficiency.

Inventory Management Techniques: these are the different methods used in the stores to supervise inventories to avoid overstocking and understocking.

Inventory: is a quantity of products or stock kept for a specific purpose or use.

Just In Time: This is a production philosophy focused on scheduled stock reduction and continuous productivity development.

Management: Management entails administration activities within an organisation or facilities critical for achieving the goals of an organisation.

Management Staff: Refers to staff who are primarily involved in executive and management roles such as directing and implementing policies and practices.

Material Requirement Planning: This is a computerized product-oriented strategy for reducing inventory while preserving delivery schedules.

Operation Performance: The observable aspects of an organization's operations, such as inventory turns, customer satisfaction, and output cycle time, are referred to as operation efficiency.

Public Health Hospital: A non-profit making health institution owned and managed by the government that provides medical and nursing care for sick or injured people.

Support Staff: Non/semi-skilled employees who work in a company to keep it going and to help others who are interested in its main industry.

LIST OF ABBREVIATIONS AND ACRONYMS

AWP: Annual Work Plan

CHMT: County Health Management Team

DBR: Drum Buffer Rope

EOQ: Economic Order Quantity

GHX: Global Health Care Exchange

ICAP: International Centre for AIDS Care and Treatment Program

IFMIS: Integrated Financial Management Information System

IHIMS: Integrated Hospital Information Management System

DHIS: District Health Information Software

JIT: Just-In Time

KEMSA: Kenya Medical Supplies Agency

KRC: Knowledge Resource Centre

NHIF: National Hospital Insurance Fund

RFID: Radio Frequency Identification System

SPSS: Statistical Package for Social Science

TOC: Theory of Constraints

VMI: Vendor Managed Inventory

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

1.1.1 Inventory management

Inventor management entails the controlling of products as they are channeled from suppliers to distribution centers including retail points. According to Baron and Berman (2010), Inventory management involves supervising inventory products. Inventory is defined as the amount of materials or products that a company holds in warehouse or in another place at period (Baron & Berman, 2010). Management should establish the right amounts of inventory the company requires at a particular period to place orders or prevent losses. Many organizations require their management to have knowledge of the number of units of the organization's products that are available to satisfy customers' orders. To this end, Baron and Berman (2010) opine that different companies use inventory counts to provide answers. Thus, Tungo (2014) states that inventory management is a vital tool that is used to organize the supply of a company's products to its customers that includes consumables, sales items and spare parts. Hence, available inventory management strategies that are often employed include the ABC analysis, Economic Order Quantity (EOQ), and the Just in Time method.

Inventory management allows organizations to have materials at hand in the right quantity, enabling them to satisfy customers' requirements without incurring many expenses related to withholding too many inventories (Brigham & Ehrhard, 2005). Management of any organization must strive to get the optimum quantities needed by the organizations since having too much or too little inventories is a financial burden and

operational threat to the organizations (Lysons & Farrington, 2006). According to Muhayimana (2015), inventories of an organization are considered one of the fundamental resources, and it reflects the capital tied up until the time the article is either sold or used to produce the final product. Storage, insurance and tracking of materials have substantial cost implications, which can only be overlooked to the detriment of the organizations. It is, therefore, imperative that every organization must pay close attention to how they manage their inventories to cut down on unnecessary expenditure while at the same time ensuring smooth operations void of interruptions caused by stock-outs. This puts the organizations in a good position for profit maximization and enhanced growth. As Luthubua (2014) puts it, mismanagement of inventories leads to substantial financial burdens for organizations. This implies whether the mismanagement results in a surplus of inventories or a shortage of the same.

Bloomberg et al. (2012) highlight that the main reason that motivates organizations is economies of scale, meaning that when many stocks are purchased, quantity discounts are attracted. Transportation of large quantities also leads to significant cost savings through the optimal use of equipment. Specialization; instead of manufacturing various types of products, organizations may opt to specialize in a given product. This can be produced and shipped to the customers or sent for storage. Specialization allows each plant to achieve sufficient and competitive production by applying economies of scale.

Holding inventories helps an organization ensure smooth production flow when the supply of materials is cut off or when the demand increase and more shipment is required. In supply and demand balance, inventories can be kept constant throughout the

year by building up to cover peak seasons through manufacturing to stock and maintain production. Inventory can buffer key interfaces, saving time and space. Supplier and buying, purchasing and development, production and marketing, and intermediary and consumer are examples of these interfaces (Bloomberg et al., 2012).

1.1.2 Inventory management within the healthcare

Healthcare organizations require efficient use of available resources, enhancing productivity and reducing operating costs (Balkhi et al., 2022). However, Moons et al. (2019) asserted that the healthcare industry experiences many difficulties related to enhancing patient care while minimizing service delivery costs. Inventory consumes as a significant cost in health organizations. For instance, the cost of medical items like gloves has a significant budget allocation (Kelle et al. 2012). Thus, effective inventory management would save expenditures.

Kaswan, Rathi, and Singh (2019) noted that inventory management systems which were formerly developed in the manufacturing sector, found their way into the service industry. The service industry hence can enhance its operation by embracing techniques as well as tools used in the manufacturing sector. These inventory management practices allow the service sector to reconstruct its operations and become a leader in the market (Rathi et al., 2016). Presently, healthcare facilities continue adopting new technologies to cut costs, improve management, and increase operational efficiency to assure customer satisfaction (Chong et al., 2015). Healthcare is seeking to find innovations that will enhance efficient management of supply chain, enabling organizations to minimise operational costs while providing high standard care (Mathur et al., 2018). Moreover, a

comprehensive awareness with an education that considers all healthcare actors is needed to mitigate adverse situations. Health facilities continuously seek innovative solutions to contain costs while improving quality care. Many health facilities have heavily focused on containing and minimizing the acquisition price of supply with limited consideration of how to lower total delivered costs (Kaswan, Rathi, & Singh, 2019).

The health facilities plan, purchase, manage, and transport medicine, equipment, and other supplies. Equally, Balkhi et al., (2022) state that inventory management deals with improving efficiency, distributing supplies and controlling costs to assure quality service. Hence, inventory management systems ensure that healthcare institutions achieve precise recording of supplies by shielding them from financial and material losses (Dwivedi, Kumar, & Kothiyal, 2012). According to Brandon-Jones et al. (2014), the lack of appropriate inventory management might cause substantial losses to healthcare organizations, adversely impacting patient care. Notably, inappropriate management would cause overstocking, implying that surplus is retained, limiting a facility's cash flow and development (Moons et al., 2018). Health organizations have many and varied items, and the ability to store and distribute these items through the supply chain is essential in providing high-quality services (Moons et al., 2018). The lack of appropriate inventory management might cause inefficiency in healthcare and impact supply chain management, which might cause health institutions to reduce their operations costs (Balkhi et al., 2022).

Moreover, Balkhi et al. (2022) noted that just-in-time (JIT) methods were effective in pre-COVID, but the pandemic caused unfamiliar challenges. Chowdhury et al. (2021)

indicated that the pandemic disrupted the dispensation of vital health commodities like ventilators. The internal supply chain in health institutions is characterized by complexities, uniqueness and operational challenges like high-cost products and medical devices, which might sometimes have unpredictable demand.

Global spending on health constantly increases; for instance, in 2017, expenditure was USD 7.8 trillion (WHO, 2019). In 2019, USD 1.25 trillion was used on the pharmaceutical budget, indicating a significant healthcare budget. Again, the cost of logistics operations, such as moving and handling materials, has increased in recent years. Logistics expenses take 20% to about 45% of the health organizations operating budgets, and this occurs because of the waste within the supply processes of healthcare (Moons et al., 2018, World Health Organisation, 2010). According to Bhalki et al., (2022), advanced economies like the United States use more than a third of their health institutions funds on inventory-related activities like storage, and transportation.

Moreover, in developing economies, pharmaceutical expenditure is higher as it represents 40% of the health budget (Management Science for Health, 2012). Nguyen et al. (2015) also noted that developing economies are impacted by co-payments which constitute 76.8% of the total pharmaceutical spending affecting a person's capacity for buying essential items such as food when an individual has a severe illness. A large amount of medical costs in relation to income in developing countries brings the need for reducing non-value-added activities related to care delivery (Kaswan, Rathi, & Singh, 2019). The high cost of care represents the new disease patterns (Kaswan, Rathi, & Singh, 2019). In Kenya, radiotherapy costs USD5 to USD10 in public health institutions. This high cost is

unaffordable for Kenyans as they majorly live on USD 1 daily, and the cost of treating cancer is USD 5000 for one patient (Atieno et al., 2018).

Recently, Kenya has experienced challenges balancing the need for generating revenue at health institutions by imposing user fees to cater for medical expenses. However, these efforts have not translated to benefits because of the increased out-of-pocket healthcare expenditure, and many health institutions require adequate investment to employ workers and stock clinics with necessary inventories (Salari et al., 2019; Weiss et al., 2019). Moreover, Kenya represents a heterogeneous country based on geography, culture, and economy. For instance, healthcare needs vary according to the different geographical locations and disease patterns like malaria, including the access to healthcare which ranges from 30% to 100% across the counties (Weiss et al., 2019). To respond to this unique challenge, Kenya has a devolved healthcare system which allows the counties to manage the healthcare. Thus, the public financial management system is essential in collecting fees, reimbursing, and distributing funds. Nonetheless, the issues surrounding health institutions and their performance lack extensive evaluation (Moses et al., 2021).

In determining the stocking of medicines in Kenya, Health access international (2018) found that products from local manufacturing were more affordable and available, indicating that cost is one of the significant drivers of availability. Similarly, the Kenya ministry of medical services (2009) noted that two-thirds of public health institutions lacked skilled pharmaceutical staff which translated to stock-out and inappropriate stock-keeping records. Wangu and Osuga (2014) also asserted that stock out in health institutions might be attributed to the budget shortages and problems inherent in

bureaucracy (Muhia, Waithera, & Songole, 2017). Moreover, the lack of competent personnel resulted in the underestimation or overestimation of drugs which are needed (Muhia, Waithera, & Songole, 2017). Onkundi and Bachangi (2016) also noted that government facilities in Kisii County experienced over and understocking because of inadequate forecasting, including insufficient training. In Kisumu, the stock-out of essential medical supplies is related to a high infant mortality rate which double the national rate. Notably, Kisumu County Integrated Development Plan 2013-2017 indicated that malaria was a significant cause of mortality, where 50% of children below five years sleep under treated mosquito nets. Based on this background, the present study aims to assess the impact of inventory management techniques on the operational performance of public health facilities in Kisumu County.

Public health facilities in Kenya use a number of inventory management practices. Notably Kenyan public health facilities use different inventory management practice and the common being the ABC analysis technique, JIT technique and EOQ (Gatwiri, 2018). This research, hence, choose the most frequently applied methods in public health facilities.

1.2 Statement of the Problem

According to WHO (2017), the lack of access to vital health care affects half of the globe's population. The United Nations Sustainable Development Goals (UNSDG) (2015), through Universal health coverage (UHC), is aimed at addressing access to medication for every person. Nonetheless, the World Health Organization (2013) and Ewen et al. (2017) have noted that low and middle economies still lack adequate supply of medicines. Moreover, the lack of medicines relates to poor health outcomes for patients as they have treatment or experience delayed medical attention (Elbireer et al., 2011). The availability of medicine goes beyond impacting health; it is also associated with achieving other sustainable development goals like reducing poverty and social inequalities. Furthermore, health and well-being might affect an individual's ability to engage in economic activities (Tosun & Leininger, 2017).

Muhia, Waithera and Songole (2017) also noted that when patients were being prescribed medication, they were directed to proceed to the hospital pharmacy or receive an apology from practitioners regarding the lack of the availability of drugs in a health institution. This situation would force patients to ask for alternative medication, or they would need a source of funding before proceeding to buy and take the drug. The inadequate access to health services also impacts health practitioners' ability to treat patients, and consequently, patients have reduced trust in the health system (Nabbuye-Sekandi et al., 2011).

Inventory management is a critical aspect of the operation of public health facilities, as it helps to ensure the availability of the necessary products and materials needed to provide

high-quality care to patients. Public health facilities in Kisumu County face numerous challenges in effectively implementing inventory management techniques, which can lead to issues such as stock-outs, excess inventory, and poor utilization of resources (Gatwiri, 2018). These challenges can significantly negatively impact the performance of the facilities, including the disruption of vital health services, the waste of resources, and the decreased satisfaction of patients and staff.

One of the main reasons for the inadequate implementation of inventory practices in public health facilities in Kisumu County is the lack of adequate resources and trained personnel (Onyango, 2021). Many of these facilities are underfunded and understaffed, making implementing and maintaining inventory management systems challenging. In addition, staff may lack knowledge on significance of inventory management and ways for implementing these techniques. As Mbiriri et al. (2018) rightly observed, this can lead to a lack of compliance with established inventory management procedures and policies, which can further contribute to the challenges faced by the facilities.

There is a need to identify the specific challenges faced by public health facilities in Kisumu County in implementing inventory management techniques and to develop strategies to improve their effectiveness. By addressing these issues, it is possible to enhance the performance of these facilities and ultimately improve the health outcomes of the County's residents. This will require a combination of adequate resources and trained personnel, as well as education and training programs to ensure that staff understand the importance of inventory management and how to implement these techniques effectively.

1.3 General Objective

The study's general objective was to determine the impact of inventory management techniques on the operational performance of public health facilities in Kisumu County, Kenya.

1.3.1 Specific Objectives

The research objectives were as follows;

i. To establish the impact of the ABC system on the operation performance (cost management, waste management, and efficiency of service delivery) of public health facilities in Kisumu County.
ii. To examine the impact of the Economic Order Quantity system on the operation performance (cost management, waste management, and efficiency of service delivery) of public health facilities in Kisumu County.
iii. To investigate the impact of Just in Time on the operation performance (cost management, waste management, and efficiency of service delivery) of public health facilities in Kisumu County.

1.4 Research Questions

This section dealt with the formulation of research questions that helped to achieve the objectives of the study. They were;

i. What is the impact of the ABC system on the operation performance (cost management, waste management, and efficiency of service delivery) of public health facilities in Kisumu County?

ii. What is the impact of Economic Order Quantity on operation performance (cost, waste, and efficiency of service delivery) of public health facilities in Kisumu County?

iii. What is the impact of Just in Time on operation performance (cost management, waste management, and efficiency of service delivery) of public health facilities in Kisumu County?

1.5 Significance of the Study

This study is essential because they can provide a greater understanding of impact of inventory management strategies on the efficiency of Kisumu County's public health facilities. Healthcare facilities should have effective inventory management systems because, without sufficient stock, effective service delivery would translate to poor service delivery to patients (Parilla et al., 2022). To this end, it can be noted that inventory management plays critical in health service delivery. For instance, inventory management in health facilities might be evidenced by the scarcity of medicines which is demonstrated by the lengthy procurement process, an occasional decline of vital drugs in the market, inadequate investment, inadequate number of untrained personnel, and reluctance of suppliers (Parilla et al., 2022).

The health institutions generally focus on quality care operations without limited consideration of administration efficiency (Kua-Walker, 2010). The inefficiency is apparent in how the healthcare facility manages its inventory. Health institutions spend a significant amount on supplies. Moreover, a large amount of the expenditure goes to a very basic commodity, such as disposable gloves. Moons et al. (2018) also noted that

medical supply costs are the second largest expenditure after personnel costs. However, improper inventory management might lead to significant losses for health organizations as spoilage might render many supplies useless. Further, health institutions have unique features that directly affect patient care. The lack of materials might cause planning challenges or hazard towards patient health, while overstocking materials increases costs and hider the supply chain flow (de Vries, 2011). Moreover, de Vries (2011) has indicated that patients' influences continue to grow, and the need to deliver care efficiently requires health facilities to consider projects in the service quality, clinical pathways and patient logistics. Hence, health facilities should take inventory management measures to help address the health operations' uncertainty and dynamics. Nonetheless, for healthcare to be effective, it should have a strategy which can be applied at strategic levels of service which would help enhance the supply chain strategy critical in competitive strategy and good performance. Thus, this study aims to establish inventory practices within public health facilities in Kisumu County and assess their effectiveness.

Many health institutions in Kenya are adversely impacted by the poor selection of inventory management practices, including inadequate information regarding the type of inventory management practices to be applied. The results will assist in effective inventory management at all times, as they will direct practitioners especially those tasked with formulating strategies for coping with inventory issues in their decision-making. Techniques that positively impact performance by lowering costs, eliminating waste and increasing productivity can then be implemented. Finally, it is hoped that the study's results will act as an additional literature for future research in inventory management.

1.6 Limitations and Delimitations of the Study

1.6.1 Limitations of the Study

To reach all of the respondents, a significant amount of time and resources were required. This created a limitation for the study since time and resources were limited. The variables adopted by the research also limited the study. This research adopted inventory management and operational performance as the variables, with others excluded. It may be possible that some of the respondents may have had difficulty engaging with the instrument due to low literacy levels, as some of them are engaged without regard for academic considerations. On the other hand, the lack of willingness to provide the information required by the researcher also limited this research. To overcome these challenges, the limitations the study considered health facilities' employees with adequate knowledge on inventory management. Moreover, the study adequately conducted participants' invitations to the study.

1.6.2 Delimitations of the Study

Clients of Kisumu County's public health facilities were removed from the study. This is because they were unable to provide sufficient details on the impact of inventory management strategies on the health facility's operational performance. Furthermore, the study excluded private health facilities in Kisumu County. This is due to the research's concentration on the public agencies under investigation. The research aimed to assess the degree of significance between the study variables, so correlation analysis was not used.

1.7 Scope of the Study

In Kenya, the Ministry of Health (2014 and public health deliver care. Likewise, based on The Constitution of Kenya (2010), the county government cater for health services. The present study targets health facilities in Kisumu County. These facilities include all levels of health facilities, including levels 1 to 5. Level 1 is the community unit responsible for providing primary health care services at the sub-county level. The community unit plays an essential role in promoting healthy behaviour and identifying health conditions which require referral to the next level. The next levels, level 2 (dispensaries) and level 3 (Health centres) provide health promotion and prevention services. These levels also perform outpatient, medical-surgical and in-patient care for clients awaiting referrals. Level 4 and Level 5 services as county referral n health services, and they provide comprehensive care in terms of diagnosis, surgery, rehabilitation, and specialized outpatient care. Finally, Level 6 are at the tertiary level, indicating that they are the national n referral services. These facilities are referral hospitals and act as research and training centres for specialized care.

The different health facilities are selected in order to establish how the various inventory management practices are implemented across Kisumu County. The national health policy stipulates that public health facilities should maintain their inventory management. Thus, the health facilities have a specified semi-self-autonomy, allowing them to manage and supervise their inventories. Here are several reasons for lumping together health facilities of different levels in this study on the impact of inventory management techniques on the performance of public health facilities in Kisumu County.

First, as Gatwiri (2018) rightly noted, all health facilities, regardless of their level, play a crucial role in the provision of quality health care to the community. It is essential to understand the challenges and opportunities faced by hospitals of all levels in order to develop strategies that enhance the overall performance of the healthcare system in the County. Second, the challenges hospitals face in effectively implementing inventory management techniques may be similar across different levels of hospitals. For example, Kgokgwe et al. (2014) admit that all hospitals may face issues related to inadequate resources and trained personnel, as well as a lack of understanding among staff about the significance of inventory management. By lumping together hospitals of different levels, it is possible to identify common challenges and develop strategies that can be applied across the entire healthcare system. Finally, examining the performance of hospitals of different levels together allows for a more comprehensive understanding of the overall performance of the health care system in Kisumu County. As Kang'a et al. (2017) reiterate, this can provide valuable insights into areas where the system is performing well and areas where improvements are needed, which can inform the development of targeted interventions that improve the performance of the entire healthcare system.

The study covered all public health facilities in the entire Kisumu County. Kisumu County is located in the former Nyanza Province in Kenya's southwestern region. The study was carried out from the year 2018 to 2022. The study was confined to the 125 public health facilities in the entire Kisumu County. Staff from the selected public health facilities within Kisumu County were involved as the respondents. The study looked at how inventory management strategies influenced the efficiency of public health facilities in Kenya's Kisumu County.

1.8 Assumptions of the Study

The study assumed that serious changes in the composition of the target population that might have affected the effectiveness of the study sample were absent. The research also assumed that the respondents were honest, objective and cooperative in their responses to the research instruments used, allowing them to be available to respond to the research instruments in a timely manner.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews relevant literature from relevant studies and reports. It contains a critical analysis organized according to the study objectives. The study's related ideas are discussed, with supporters and opponents highlighted and how they can help the study. The conceptual structure and operationalization of the proposed study variables are also presented.

2.2 Theoretical Review

The theoretical and model review identifies and evaluates various existing theories explaining why the research problem exists.

2.2.1 Lean Model

Womack and Jones developed the lean model in 1991 (Wahab, Mukhtar, & Sulaiman, 2013). The lean theory is a development of Just in Time concepts. As a theory it reduces wastage in the manufacturing process by eliminating buffer stock. The leanness of an inventory positively impacts a company's performance and is the most effective inventory management method.

This theory was supported by Eroglu and Hofer (2011), who noted that a positive return on leanness was found in facilities that are leaner than the industry average. They endorsed the theory's assumption that more flexibility was achieved when producers made purchasing decisions, minimized inventory carrying costs and maximized on-hand inventory (Wahab, Mukhtar, & Sulaiman, 2013). Waller, Tangari and Williams (2008)

also supported the theory in their assertions. They found that that companies that applied lean supply chain practices to maximize inventory achieved high levels of asset utilization and customer satisfaction, which resulted in increased growth, profitability, and market share (Waller, Tangari and Williams, 2008).

In healthcare, lean philosophies and methods seek to maximize patient value through the reduction of waste and waiting. Notably, it aims to convert an organization's thoughts and values, which would translate to a change in culture and behaviour over time (Smith et al., 2012). The Toyota model indicates that lean aspects focus on the efficiency of resources and the values that a customer receives in the process (Campbell, 2009). Existing evidence has indicated that the healthcare industry has been successful in applying lean methods, as seen in the US, Canada, and Australia (Fine et al., 2009). Nonetheless, authors (Burgess et al., 2013) have noted that implementing lean methods is fragmented. On the other end, lean management within healthcare has been holistic through transforming its business approaches (Smith et al., 2012; Ulhassan et al., 2013).

The theory has received criticism because it can only be applied when there exists close and long-term cooperation and knowledge exchange between a company and its trading partners (Burgess & Radnor, 2013; Campbell, 2009). However, the theory was relevant to this study because it predicates that cost benefits are achieved when an organization uses an inventory management technique that embraces zero or minimal inventory levels. Thus, it serves as a significant theory in the study.

2.2.2 Theory of Constraints

The theory of constraints, first proposed by Goldratt in 1984, is a management philosophy that focuses on identifying and addressing the key factors that limit an organization's ability to achieve its goals (Rahman, 1998). These factors, referred to as "constraints," can be found at various points within a system and can take many forms, including specific resources, processes, or employees (Theory of Constraints Institute, 2019). By targeting these constraints, organizations can improve performance, increase on-time delivery to customers, reduce inventory and cycle times, and increase profitability (Noreen, Smith, & Mackey, 1995). The theory of constraints highlights the importance of identifying and addressing the key limitations that are holding an organization back, in order to drive continuous improvement and increase overall effectiveness.

The theory of constraints (TOC), introduced by Goldratt in 1984, has received both support and criticism from researchers. Cooper (2006) argued that TOC's focus on minimizing inventory makes it an effective tool for problem-solving and decision-making. However, others, such as Trietsch (2005) and Linhares (2009), have criticized TOC for its perceived limitations compared to other methodologies and its potential to yield suboptimal results. TOC has also been criticized for its lack of consideration of debt and its reliance on concepts from other management approaches, such as systems dynamics and statistical process control (Steyn, 2001). Despite these criticisms, TOC has been favorably compared to linear programming techniques and some of its key ideas have been recognized in management accounting literature for over a decade (Noreen, Smith, & Mackey, 1995).

TOC has been applied in healthcare, where it has demonstrated its effectiveness. For instance, TOC has accommodated the increasing expectations in a limited expenditure of UK hospitals, and it resulted in a significant reduction in wait time (Knight, 2003; Umble & Umble, 2006). Thus, this theory is also a significant theory in this research because it identifies inventory management techniques to be an important "constraints" that may affect the health facilities. The main aim of this study was to determine whether any of the three inventory management techniques being used in public health facilities in Kisumu County were causing operational issues. If such issues were found to exist, the study also sought to identify which specific technique was causing the problems.

2.2.3 Deterministic Inventory Model

Baker and Urban (1988) came up with the deterministic inventory model. The model assumes that all parameters and variables associated with an inventory stock are identified and that there exist no uncertainties associated with the demand and replenishment of inventory stock. According to Croom and Jones (2010), organizations develop inventory reserve estimates using the deterministic inventory model as one of the fundamental techniques.

In supporting the theory, Dai and Kauffman (2001) argue that a deterministic circumstance is one in which the system parameters can be ascertained precisely, which is also known as a situation of sureness. Since it is realized that whatever is ascertained, things are sure to occur the same way. According to Stopková, Stopka & Ľupták, (2019) the model is criticized because it assumes that all parameters and variables associated with an inventory stock are known and that there is no uncertainty associated with the

demand and replenishment of inventory stock. This may not be realistic as, in reality, there are uncertainties, and some variables associated with inventory may not be known. This makes the theory unrealistic. The theory also assumes that there are similar results for a particular set of inputs. This may not be the case, as other factors may influence the outputs at different times despite similar inputs (O'Neill & Sanni, 2018). This theory is relevant to the study in that it supports the ABC and EOQ inventory management techniques, which follow the deterministic model. Moreover, the deterministic model in healthcare is essential in estimating future resources (Navarro, Parker, & White, 1970).

2.2.4 Stochastic One-Item Models

Goyal and Satir applied the stochastic one-item model in inventory management for the first time in 1989. Beamon et al. (2006) argue that stochastic one-item models can be used for inventory control. According to Aberdeen Group (2004), the classical economic order quantity (EOQ) model aims to find the balance between the carrying cost and ordering cost with a view of obtaining the most economical quantity to procure by the distributor. On the other hand, Kotleba (2006) contend that the economic order-quantity model considers the tradeoff between ordering cost and storage cost in selecting the quantity to use in replenishing inventory items. A larger order quantity reduces the frequency of orders. At the same time, ordering cost per month helps mitigate costs but requires holding a larger average inventory, which increases storage (holding) costs per month.

Dai et al. (2001) found that the cost of minimizing order quantity aligns with stochastic models. Beamon et al. (2006) also support stochastic models, stating that procuring large

quantities at a reduced unit price can help mitigate the impact of net inventory cost and lead to significant savings. Croom and Jones (2010) mention that models based on the theory of constraints are often used when demand is uncertain. Stochastic models are therefore deemed to be more realistic and, thus, more relevant. This is because they count the cost of shortfalls, the costs of stacking away and the cost of arranging and attempt to find an effective inventory plan. The theory is criticized on the basis of assuming that the demand is unknown. Realistically, the production is based on assumed or actual demand, which creates a weakness in the theory (M'Hallah, Benkherouf & Al-Kandari, 2020). The theory is unrealistic and ignores the critical effect that the sequence of returns and volatility has on drawdown outcomes (Khalilpourazari & Pasandideh, 2020).

The theory is relevant to this research in that a smaller order quantity reduces average inventory but requires more frequent ordering and higher ordering costs per month. This is optimal for the application of smaller organizations that deal with perishable goods and services seeking to mitigate inventory management costs. As a result, there is a reduction of aggregate costs, which enhances supply chain performance. In healthcare, the stochastic model helps reduce shortages and wastes in hospitals, such as blood components (Gunpinar & Centeno, 2015).

2.3 The Concept of Inventory Management Techniques

Inventory levels should not be excessive nor insufficient; inventory management's goal is to evaluate and sustain an adequate level of inventory investment that aids in achieving the necessary goal. (Deveshwar & Modi, 2013). Beamom (1999) noted that Inventory turn, gross margin and benefit, average in-stock inventory, and ability to calculate

inventory were identified as supply chain activities by Singh & Kaur (2010), while inventory management, consumer loyalty, profitability, and customer base recognition were identified as four main primary constructs of competitive advantage by Singh and Kaur (2010). Gupta (2001) discovered that inventory management is shockingly low on the priority list as compared to customer care, order fulfilment, and efficiency. No matter how complicated a company's network, the best inventory management approach will result in drastic improvements in customer service and lower inventory. As a result, according to Nathan (2006), an organizations efficiency is enhanced when the activities in the supply chain management (SCM) have a greater effect on gaining competitive advantage.

2.3.1 The Concept of the ABC System

ABC analysis is a method for prioritizing resource management. A, B, and C inventories are the three types of inventories. The majority of management time and resources are spent on class-A products. Class C items receive the least attention, while class B items fall somewhere in the middle. Modern businesses stock a variety of products that include finished goods, spare parts, and raw materials (Van Kampen et al., 2012). Thousands of dollars are also involved. Managing these inventories entails doing this for each item one at a time, which is not reliable nor cost-effective, but requires the handling of inventories. They are often the most controllable manufacturing costs and account for a large portion of a company's assets. Typically, ABC analysis assumes that a small number of products (category A) account for the majority of the total dollar volume, while a large number of products (category C) contribute only a small portion. Category B products fall in between, in terms of both quantity and dollar value. Under this classification, category A

products are considered high-value and high-demand, while category C products are low-value and low-demand (Van Kampen et al., 2012).

Inventory objects are classified as A, B, or C items based on their annual use in the standard ABC classification system. Class A items receive more consideration from management than class B items, and class B items receive more attention than class C items (Beheshti et al., 2012). Since the revenue effect of stock outs of A and B items is greater than that of C items, the classification can also be used to ensure that classes A and B items are more accurately forecasted (Van Kampen et al., 2012).

Gatwiri (2018) noted that ABC analysis is extensively used in Kenyan public health facilities, where public health facilities in Kenya classify their inventories based on their value. Highly valuable inventories are given closer attention in management and control than less valuable inventories. The use of ABC technique helps in cost management by giving proper attention to the highly valuable inventories that would cost the organizations dearly if neglected. Gatwiri (2018) recommended that the ABC technique should be implemented to a larger extent in public health facilities as it can assist in improving the performance of these facilities through cost reduction.

2.3.2 The Concept of Economic Order Quantity Model (EOQ)

According to Sople (2010), the ordering quantity that minimizes the cost balance between inventory keeping costs and reorders costs is known as the EOQ. Sople went on to say that the following assumptions must be made in order to calculate a simple EOQ: demand is universal, constant, and continuous over time. The lead time is constant, order sizes are not limited by store capacity, the cost of placing an order is unaffected by order size, and

the cost of storing a unit of stock is unaffected by stock quantity. The derivation and graphical presentation of the EOQ formula are given. EOQ = 2CoD/ Cc … (1) Where Co, Cc and D represent the ordering costs, carrying cost and annual demand, respectively.

According to Ziukov (2016), the EOQ technique is very instrumental when determining an optimal ordering quantity that reduces the ordering and carrying costs to a bare minimum. The EOQ technique assumes that demand and annual quantity needed by the organizations are equal at all times (Milicevic et al., 2010). There exists a delicate trade off when the EOQ technique is used. This is the balance that exists between the storage and ordering costs. When large quantities are ordered, ordering frequency is automatically reduced, and this ultimately reduces the ordering cost but increases the storage cost and demands for a larger storage space (Schwarz, 2008). Some costs will reduce by having inventory at hand while at the same time holding cost increases, thus the total costs related to the inventories curve have a minimum point (Lwiki et al, 2013). Ordering costs are those expenses that the organizations incur when procuring inventories while carrying costs are those expenses that the organizations incur for inventory holding. EOQ is the point where the ordering cost curve intersects with the carrying cost curve. At this point of intersection, the two costs of ordering and carrying are equal (Kumar, 2016). The EOQ technique determines the optimal order quantity and minimizes total inventory cost. It is an important technique of inventory control which can be applied to all inventory stages, including raw materials, work in progress, and finished goods. It helps control the acquisition and storage of inventories to ensure an even flow of production while restricting unnecessary investment in inventories (Kumar, 2016).

2.3.3 The Concept of Just-In-Time (JIT)

Just in Time (JIT) inventory management is a method that aims to keep only the necessary amount of materials in the right place at the right time, in order to produce the right quantities of inventory (Carlson, 2002). This approach, which was developed by Japanese manufacturing companies, involves purchasing materials and components only when they are needed for production, with the goal of improving an organization's return on investment by reducing in-process inventory and associated costs (Schonsleben, 2000). According to the JIT definition, materials and components are only supplied to a company when they are needed for use (Franco et al., 2017). According to Franco et al. (2017), the use of JIT calls for a much more disciplined way and a change of culture of handling the inventories. It also necessitates the adoption of Japanese management characteristics such as collaborative decision-making, collective accountability, and holistic employee concern. The JIT concept originated in Japan, where it was known as Kanban. The United States of America later adopted JIT and called it Lean Manufacturing. JIT strives to eliminate waste and ensures that the process that does not add value is done away with. Over the years, JIT has been found to be very instrumental in reducing of expenses that appertains to inventories. This is because JIT ensures that the organizations require minimal inventories for immediate production are held. This significantly reduces costs that are associated with holding inventories (Kotanaee et al., 2013). The JIT methodology is based on three principles. These include waste reduction, continuous product or service quality enhancement, and staff engagement in policy formulation and implementation (Obori-Yeboah et al., 2015).

2.4 Empirical Literature Review

2.4.1 Impact of ABC system on the operational performance of public health facilities

Dwivedi, Kumar and Kothiyal (2011) indicated that cost analysis played an essential role in the management of pharmacy stores. Thus, in exploring the feasibility of ABC analysis in pharmacy stores, Dwivedi, Kumar, and Kothiyal (2011) noted that when applied to expensive drugs, the approach might translate to 20% savings for the pharmacy store budget. Dwivedi, Kumar and Kothiyal (2011) indicated that inventory management improves patient care and optimal resource usage. Continuous management translates value-added services to the patients. Notably, the main aim of inventory management is to ensure that institutions do not handle a large amount of stock.

Legese, Teshome, and Gedif (2022) also assessed a three-year inventory of health items, such as medicines and items, at Saint Paul Hospital Millennium Medical College in Ethiopia. The authors used ABC and VEN (Vital Essential and nonessential) for analyzing the data. The combination of ABC and VEN analysis groups health items into the following. The first category considers V and A items. The second category is comprised of E and B items. In comparison, the third category consists of inexpensive and nonessential items. Legese, Teshome and Gedif (2022) concluded that the hospital should prioritize and determine the quantity and frequency of ordering health items on the regular ABC-VEN results. Nonetheless, Legese, Teshome, and Gedif (2022) showed that class A medicines were about 20% of the total purchased medicines. The class A items are usually few but expensive, meaning they need close monitoring. When these medicines are not managed properly, their cost is likely to rise, thereby impacting the

provision of health services. With these considerations, priority should be given to improving the accuracy of forecasts, which reduces the time for ordering products. Likewise, Category one in the ABC-VEN analysis represented 84% of annual expenditure over three years. However, this study is impacted by the retrospective data. Moreover, few research papers have shown the actual consumption of medicine and medical supplies.

In studying pharmaceutical inventory management in Sudan, Ahmed, Kheder, and Awad (2019) also noted that ABC analysis showed that 66% of medicines were in class A, class B consisted of 19% and Class C consisted of 15% of the total volume of medicine. Moreover, Ahmed, Kheder and Awad (2019) noted that fresh graduates and university pharmacists had inadequate knowledge of inventory management, causing problems in purchasing drugs and optimizing costs. Similarly, Anand, Ingle, Kishore, and Kumar's (2013) study of ABC analysis and Vital essential and desirable (VED) in Delhi also noted that category 1, category II, and category III had 28.68%, 41.09%, 30.23% of the total volume of drugs respectively. Nonetheless, category I consumed 73% of the drug expenditure. Thus, Anand et al. (2013) concluded that inventory management is critical for the efficient management of pharmacy stores, which helps improve patient care and the effective use of resources.

Likewise, Jobira, Abuye, Jemal and Gudeta (2021) study evaluated the inventory management of some health institutions in west Arsi in Ethiopia. In this study, Jobira et al. (2021) noted that matrix analysis is a crucial tool critical in identifying items that require close monitoring. Particularly, the ABC-VEN analysis allows for combining

specific advantages like inventory cost, and functional importance is critical in enhancing inventory management. Nonetheless, Jobira et al. (2021) noted that controlling adequate stock level requires the use of FSN–XYZ (Fast, Slow, Non-moving–High, Medium, Low Value) matrix analysis. ABC-VEN are insufficient in controlling and stocking at appropriate level to reduce shortage and oversupply. In Kenya, Kivoto et al. (2018) also established that ABC-VEN categorization might help determine medicine, which would translate to cost savings. Manhas et al. (2012) also supported that ABC-VED analysis supports management in controlling cost and ensuring the availability of vital and essential items.

Muhindo and Rwakihembo (2021) conducted a study on the impact of inventory management on the financial performance of private hospitals in Western Uganda. Using a positivist approach and a cross-sectional research design, the study analyzed data from 32 private hospitals using a closed-ended questionnaire and simple linear regression. The results showed that inventory management has a significant effect on the financial performance of these hospitals. The study authors recommended that private hospitals in the region adopt inventory management techniques such as Just in Time (JIT) and ABC in order to optimize stock levels and minimize costs, in order to improve their financial performance.

Furthermore, Makori and Muturi (2018) conducted a study on the relationship between inventory management practices and procurement function performance in health institutions in Kenya. The study took place in five selected health institutions in western Kenya and was guided by the Just in Time, vendor management, and activity cost

analysis theories. The results indicated that ABC systems can coordinate inventory management practices and improve demand management, while also reducing the need for storage space. In a separate study, Oballah, Waiganjo, and Wachiuri (2015) also found a positive relationship between ABC inventory management systems and organizational performance in Kenyan public health institutions. These studies suggest that adopting ABC systems can be beneficial for improving the efficiency and effectiveness of inventory management in the healthcare sector in Kenya.

In another study, Odhiambo and Kihara (2018) investigated the effects of various inventory management practices on supply chain performance in government health facilities in Kisumu County, Kenya. The study focused on 12 facilities at levels 4 and 5, and analyzed data from 84 employees in procurement, stores, logistics, and IT roles at these facilities. Using regression analysis, the researchers found that the ABC inventory management system, accuracy of inventory records, and use of information technology had a statistically significant impact on supply chain performance, while demand forecasting was found to have no significant effect. These results suggest that implementing certain inventory management practices can improve supply chain performance in government health facilities in Kisumu County (Odhiambo & Kihara, 2018).

At Kenya Medical Supplies Agency, Sporta (2018) studied how inventory management strategies impact organizational efficiency (KEMSA). The researchers employed quantitative survey to identify actions, attitudes, attributes, and values to determine their success's impact on the organization's performance. Stratified random sampling was

employed to select study participants. According to the findings of the report, companies should use the ABC technique to improve their efficiency because it will help them monitor inventory levels while also allowing them to track their inventories. The study also found that organizations should use inventory management techniques that help in reducing operational costs, as this will give the organization a competitive advantage and improved performance (Sporta, 2018). The research further found out that the ABC technique is critical as far as efficiency is concerned, as it enables the classification of various inventories into various classes, which then helps to eliminate losses or damages which may be caused by confusion arising from poor classification. Accessing inventories from the storage facility is also made easier when the ABC technique is used (Sporta, 2018). The researcher recommended that organisations should use inventory techniques to assure cost containment and quality care to achieve optimum performance and competitive advantage. From the existing studies, the following hypothesis can be proposed: H1: ABC system positively impacts the operational performance of public health facilities in Kisumu County.

2.4.2 Impact of EOQ on the operational performance of public health facilities

Earlier studies by Kwak and Durbin, and Stanley (1991) established that the EOQ model was efficient in helping hospital administrators carry out management by reducing capital needs and space without compromising the service quality of hospitals. Thus, Nasution et al. (2022) contend that systematic drug management is vital in the overall management of a hospital. The process facilitates the availability of good quality drugs and ensures that they come in the right amount and the right type, are used rationally and assists delivery at the right time (Nasution et al., 2022). Further funds allocated for drug management can

be used sustainably to meet the interests of those seeking treatment. It is, therefore, essential to adopt pharmaceutical service standards as benchmarks in providing pharmaceutical services (Nasution et al., 2022).

Consequently, Dewi et al. (2020) opine that an efficient drug inventory planning system is vital for efficient procurement, budgeting and controlling drugs. Stagnant drugs can cause wastage, amounting to evidence of expired medications, which not only leads to losses but also jeopardize the service delivery of healthcare. In their research, Dewi et al. (2020) aimed to determine more efficient and effective management of drugs that were found to be stagnant and scarce by comparing three pharmacy logistic methods that, included the; economic order quantity (EOQ), the traditional consumption of drug inventory and minimum, maximum stock level (MMSL) at the RA Baseeni Hospital. This study noted that EOQ was one of the most effective methods in managing stagnant drugs, and it provides the most reduced opportunity cost for stagnant drugs, including shortages. Thus, Dewi et al. (2019) noted that EOQ was the most effective approach for managing drugs. EOQ is essential in determining the sufficient volume of normal drugs.

Further, research carried out by Agada and Ewuche (2017) applied a probabilistic EOQ model as opposed to a deterministic EOQ model because they found that real life inventory systems had a stochastic demand with a high coefficient variation of over 20%. The probabilistic EOQ model was preferred as it answered how much to order and when to order, which improved inventories at the Nigerian hospital (Agada & Ewuche, 2017). On the other hand, Hugo et al., (2018) carried out a systematic study to evaluate the inventory policies in South Africa's department of health between 2013 and 2018. The research revealed that policies that used EOQ formed shorter lead times and review

periods (in less than three days) but failed completely for longer periods. This was because the EOQ equation did not take into account the lead time or review period making the order quantity only scale with the current demand value, calculated within the last year. Thus, new demands did not affect the quantity of the order, which kept the EOQ value unchanged (Hugo et al., 2018).

Contrarily, Korir, Kaitany and Sang (2021) in their study sought to establish a relationship between the performance of 5 selected hospitals in the South Rift of Kenya and Economic Order quality control, targeting employees working in the supply chain and procurement departments. Their study found that the EOQ model positively correlated with performance in the hospitals selected (Korir, Koitany and Sang, 2021). Mahatme et al. (2012) also conducted studies comparing index costs, actual costs and forecast expenditure for future years in analyzing ABC-VED with EOQ. The results found that the annual expenditure of costs for the year analyzed accounted for a lower percentage of the annual budget for hospitals. ABC-VED collaborating with the EOQ model was found to optimize the cost of Medicare services. This improved health care quality by making money available to patients (Mahatme et al., 2012).

Notably, Jonrinaldi, Primadi and Hadiguna (2017) carried out a study on a pharmacy based in a Parimian Hospital, using the EOQ model under the condition of permissible delay in paying for multiple products in anticipation of stochastic demand. The study found that the system minimized the total inventory costs of the pharmaceutical department. These findings are echoed by Soraya, Surwanti and Sorbadi (2022), who researched inventory management at a hospital in Yogyakarta to establish a suitable

calculation method for management in hospitals. In applying the ABC-VEN analysis to the supply planning of the hospital pharmacy and EOQ to calculate the maximum number of orders, the study found that both methods increased the supply of medicines at the pharmacy and were suitable for managing supplies in hospitals. Similarly, Nopiana (2021) studied the implementation of cardiovascular drug inventory controls using ABC-EOQ-ROP-SS methods to minimize stock inventory while still maintaining services. The results indicated that all these methods could be implemented at the Islamic Jakarta Hospital to minimize stock inventory, increase efficiency and maintain the level of service for the patients. Njoroge (2015) also sought to investigate management practices by public hospitals in Kenya in establishing a relationship between their performance and inventory management practices. The study found that these hospitals' most popular inventory practices were ABC systems, EOQ model, simulation, e-procurement and ERP systems operating under their own semi-autonomy. However, the results indicated that the performance of public hospitals and the former central province were positively related to inventory management services. This promoted the implementation of inventory management in public hospitals.

On the other hand, Hermann (2008) noted that EOQ requires the responsible personnel to have information regarding the carrying cost and reorder cost in line with the purchase order. These attributes make EOQ to be difficult because few health institutions have made these calculations available, and they are usually calculated using industry benchmarks. Overall, Hermann's (2008) article provides a cautionary note on the use of inventory benchmarks in healthcare organizations. While they can be useful as a

reference point, they should be used with care and consideration in the context of an organization's specific needs and circumstances.

EOQ is a vital approach for health institutions seeking to balance the carrying cost of inventory and eliminate the shortage drugs, and minimizing the total cost of inventory (VanDerlinde, 1983, Murphy and Yemen, 1986). VanDerLinde (1983) highlights a case study on the use of the EOQ model in a small hospital setting. The author reports that implementing an EOQ system led to significant cost savings, improved operational efficiency, reduced inventory levels, and increased inventory accuracy. Murphy and Yemen (1986) also examined the use of the EOQ model in a hospital pharmacy in combination with ABC inventory analysis. The authors found that using the EOQ model helped optimize inventory levels and reduce costs while using ABC analysis allowed for more accurate forecasting and improved decision-making. Overall, both VanDerLinde (1983) and Murphy and Yemen (1986) present positive findings on the use of the EOQ model in hospital settings. Both studies demonstrate the potential for the EOQ model to improve operational efficiency and reduce costs through more effective inventory management. VanDerlinde (1983) noted that EOQ applies a computerization model with an online database, which effectively reduces inventory operation costs compared with EOQ lacking technology. Likewise, Murphy and Yemen (1986) demonstrated that EOQ translates into increased efficiency and cost saving. However, it is important to note that the EOQ model has certain limitations and may not be suitable for all types of organizations or inventory items. For example, the model is based on certain assumptions about demand and lead time that may not hold in all cases, and it may not adequately account for factors such as seasonality or changes in demand patterns. As such, it is

important for organizations to carefully consider the suitability of the EOQ model in their specific context.

Moreover, Gurumurthy, Nair, and Vinodh (2021) examine the use of a hybrid selective inventory control technique in a hospital setting. The authors describe the technique, combining elements of the economic order quantity (EOQ) model with selective inventory control to reduce inventory levels while ensuring sufficient stock is available to meet demand. The authors begin by providing an overview of the EOQ model, which is a commonly used tool for optimizing inventory levels in manufacturing and service organizations. The EOQ model helps determine the optimal order size and reorder point for inventory items based on demand, lead time, and carrying costs. Gurumurthy et al. (2021) then describe the application of the hybrid selective inventory control technique in a hospital setting, where it was used to optimize inventory levels for a range of medical supplies. The authors report that the technique successfully reduced inventory levels and improved inventory accuracy, leading to cost savings and improved operational efficiency. Overall, Gurumurthy et al. (2021) present a promising case study on the use of a hybrid selective inventory control technique in a hospital setting. The authors demonstrate the potential for this approach to reduce inventory levels and improve operational efficiency while still ensuring that sufficient stock is available to meet demand.

From the literature, the following hypothesis can be proposed: H2: EOQ positively impacts the operational performance of public health facilities in Kisumu County.

2.4.3 Impact of JIT technique on the operational performance of public health facilities

Karkowski et al. (2017), through a desk research approach, noted that the successful operation of JIT systems in health institutions requires close relations between the health organizations and suppliers. The health institutions and suppliers work jointly to deliver inventory on time. To limit excessive inventory, health institutions depend on their suppliers. The JIT requires significant work from suppliers indicating that having a reliable supplier is critical in building the relationship with health facilities and suppliers. The stock flow in hospitals is enhanced when health institutions have a better understanding of suppliers' capacity. On the other hand, the supplier should have adequate knowledge of health institutions' needs (Kua-Walker, 2010).

Balkhi et al. (2022) also indicated that JIT systems work effectively in a normal setting, and it gives solutions to many issues inherent in other inventory systems. Siddiqui's (2022) scoping review indicated that applying JIT systems translates to a stable work schedule and increased productivity. The JIT system assures quality and efficiency and enables health institutions to save resources. To this end, Balkhi et al. (2022) noted that the adoption of JIT among health institutions had been the widespread and essential benefit of JIT is cost reduction. Notably, Baum (2006) noted that JIT resulted in an annual saving of USD3-11 million in every health institution in the United States. In comparing hospitals in the United States and France, Aptel and Pourjalali (2001) established that the JIT system allowed the stock to be delivered when needed, which

reduced inventory costs by minimizing unused inventory. This process ensures that health institutions have money which might be used to enhance care. Baum's (2006) research also indicates that JIT allows a hospital to minimize warehouse space, reducing the holding cost. Kua-walker (2010) research also indicates that JIT assures productivity because employees can focus on other tasks, which improves patient care instead of the unnecessary inventory handling.

Furthermore, Balkhi et al. (2022) noted that JIT assures that inventory turnover ratios increase, which translates to a high efficiency level by preventing products from staying in the store for prolonged periods. Kaswan, Rathi, and Singh (2019), through conducting a survey of 20 hospitals in India to establish just-in-time elements in Indian health sector, also noted that JIT saves time as it considers a small volume of inventory and time spent on ordering becomes minimal which enhances productivity and service delivery. Likewise, the small number of items in the inventory enhances the monitoring and management of inventory. Moreover, the close management of smaller stocks also reduces the chance of wasting inventory items and non-adding value activities. Inventory management also tends to enhance operation and work flow which would help in enhancing service quality and customer satisfaction. Kaswan, Rathi, and Singh (2019) study indicated that the most important elements of JIT were teamwork, relationship between suppliers and health facilities, and management quality circles. Nonetheless, Kaswan, Rathi, and Singh (2019) focused on prioritizing the significant elements of JIT in health facilities in India. The applications of the JIT system vary from one country to another based on government initiatives and policies of the country. Thus, the current

study seeks to explore the generalized framework of JIT of public health facilities in Kenya.

Siddiqui (2022) researched the importance of the Just in Time (JIT) methodology and its advantages in managing health care by scoping 37 articles and websites that discussed the details of Just in Time methodology. The articles were selected from websites that only focused on health care using JIT, including PubMed and NIH. The research found that JIT could be used to save waste within organizations while still proving to be an effective saving avenue for organizations. The method was advantageous as it was convenient and sensible and had been used as a success in several big companies, including Toyota motors, McDonald and Apple (Siddiqui, 2022). Thus, as a prospective cost-saving strategy for hospitals, it provided added value to patients by ensuring lean management by removing non-value-adding and surplus activities.

Subsequently, Ragazzoni et al. (2020) also found that JIT training was an effective method that quickly equipped healthcare employees with new skills, knowledge and attitudes in emergencies like COVID-19. By conducting disaster training in the second largest tertiary hospital referral hospital in North West Piedmont Italy, they found that JIT provided the staff at the hospital with the competencies that were needed to work safely and effectively, which included understanding standard operating procedures, an understanding of working principles. In ensuring basic prevention and control, JIT training was able to avert a crisis in a health institutions of unparalleled scale (Ragazzoni et al., 2020). These observations are echoed by Gupta (2012), who states that training employees in JIT is crucial in the implementation of healthcare systems where hospital

staff are empowered to deal with flexibility and fluctuating demands to resolve operational weaknesses. Gupta (2012) highlights the importance of patient satisfaction, cost and quality as healthcare issues and states that Hospitals should continue to come up with innovative methods of containing and meeting patient costs without sacrificing quality, where JIT reduces costs and improves quality in service environments.

Consequently, in carrying out a cross-sectional survey of residents in the Emergency Department and supervising pediatric emergency medicine physicians, Thomas et al. (2016) aimed to observe JIT's impact on trainee self-perception of procedural competence and its effect on the need for supervisor interventions for physicians during procedures. The study found that the use of the JIT room improved the confidence of trainees, and there were fewer supervisor reports on procedural interventions (Thomas et al., 2016). The limitations of this research were that the survey instrument lacked the validity of evidence, and a convenience sample was used as a single institution study. However, despite incurring financial and time costs, an in situ JIT room was crucial for JIT training for procedural education in health (Thomas et al., 2016). Aradhye and Kallurkar's (2014) research also indicates that JIT gives several benefits, including operational efficiency, faster responses and waste reduction. Using a case study approach, they found that JIT focused on the process, not the product, which illustrated the benefits of reducing the waiting period when service companies employed JIT. Kaswan et al. (2021) also conducted studies to analyze, identify and prioritize JIT enablers in the healthcare sector. The was carried out using grey relational analysis (GRA) to rank the enablers where the ranks were validated further using a fuzzy technique of order preference by sensitivity analysis and similarity to the ideal solution (TOPSIS). The study establishes that JIT

improves productivity, gives high-quality patient care at a lower cost and reduces waste. The research recommends that healthcare organizations use JIT to provide better healthcare through optimized resources (Kaswan et al., 2021). Guris et al. (2020) focused on developing a number of simulation exercises that focused on critical care as a workflow design process in maintaining the coronavirus disease in 2019. The simulations were conducted at the Children's Hospital of Philadelphia in a PICU isolation room designated for COVID-19 patient care. These simulations involved increasing the complexity of the processes, intubations wearing personal protective equipment and activating the airway team for difficult airway emergencies. As a result, the simulations helped to identify and rework points of failure to generate guidance for optimal airway management where it was suspected or in positive children (Guris et al., 2020). The research concluded that JIT methods could be used to enhance planning, job aids, training and practical policies in addressing human factors, patient-provider safety, equipment choice and team communication in tackling the coronavirus disease in the pandemic era.

Mbiriri et al.'s (2018) study, which had 80 respondents, revealed that the inventory management systems employed by the hospital have a direct influence on service delivery which may be positive or negative. The study found that the use of VMI system, JIT system and RFID systems enhance the service delivery of public health facilities in the City. The study recommended the use of modern inventory management systems that utilize technology owing to their level of accuracy, as this ensures better service delivery (Mbiriri et al., 2018). The study also suggested using a Vendor Managed Inventory system, which was discovered to substantially affect service delivery. This analysis focused solely on service delivery, leaving out other factors that influence public hospital

results, such as cost control and waste management, which will be addressed in the researcher's study.

Besides having many benefits in health institutions, JIT approach might have challenges in health organizations based on the nature of the health sector. Balkhi et al. (2022) noted that one of the significant concerns with JIT system in the health sector is based on the uncertainty and unpredictability of the volume of hospital work which results in a serious risk to hospital operations in cases where demand would increase unexpectedly, and current inventory is insufficient. The situation might cause the hospital to have zero stock which might impact quality service (Baum, 2006). With these challenges, healthcare professionals might become hesitant to use JIT systems. Moreover, items from overseas might experience disruption during shipment. Balkhi et al. (2022) study particularly indicated that JIT might offer financial advantages. Nonetheless, care should be taken regarding specific conditions to minimise the adverse impact to the system, which might affect health institutions' competencies to deliver patient care. Balkhi et al. (2022) assert that JIT system is effective when an health institution has a precise estimation of demand, and when suppliers are dependable, particularly when suppliers are located locally. Health institutions should identify several supplies. Thus, further studies should seek to analyze JIT approach from diverse viewpoints, such as expenses, productivities, and advantages.

From the literature, the following hypothesis can be proposed: H3: JIT technique positively impacts the operational performance of public health facilities in Kisumu County.

2.4.4 Impact of government policy on the inventory management techniques and operational performance of public health facilities

In the healthcare sector, government policies play a crucial role in the inventory management of essential medicines and medical supplies. In developing countries, inadequate funding, weak logistics systems, and a lack of trained personnel are the main factors that affect the availability and accessibility of essential medicines and medical supplies in public health facilities (Kaswan, Rathi, & Singh, 2019; Salari et al., 2019; Weiss et al., 2019). For instance, UHC addresses access to medication for every person (UNSDG, 2015). Government policies that address these issues can positively impact inventory management in the healthcare sector.

Uthayakumar and Priyan (2013) asserted that pharmaceutical management is related to a country's capacity to address its public health challenges. Managing supply chain in a health institution requires cooperation among producers, purchasers, and providers. Likewise, the process should have an effective policy. Awad et al. (2016) study on the causes of the inadequate supply of medicine in Jordan indicated that regulatory challenges as one of the variables. Moreover, the policy on approved medicine and the political situation impacted the supply and demand imbalances (Awad et al., 2016). George and Elrashid (2023) concluded that the health system requires a working inventory management policy to ensure the availability of drugs. According to Kebede and Tilahun's (2021) study, drugs are given based on the budgeted drugs. The government usually procure drugs based on a budget that is allocated once. Likewise, Kebede and Tilahun (2021) noted that lack of skilled workforces, such as pharmacy professionals, as many nurses are responsible for managing clinics at dispensaries and

stores. The assigned store management is also impacted by the shortage of professionals, which affects the full utilisation of their competencies. For instance, assigned store managers are usually busy as one worker is given a task while another is generally off duty. The workload also impacts the ability to update bin cards. More compounding to the challenge is the inadequate computer infrastructure, which translates to manual record keeping.

Thus, Government policy can play a significant role as a mediating variable in inventory management practices in the healthcare sector. Government regulations and reimbursement policies can affect the demand for certain medical products and the reimbursement rates for procedures, which can impact how much inventory healthcare providers and suppliers maintain. For example, changes in reimbursement policies for a particular procedure may increase or decrease demand for the necessary medical supplies, and healthcare providers may need to adjust their inventory levels accordingly. Additionally, government regulations regarding the storage and transportation of certain medical products can also affect how they are managed in inventory.

From the literature, the following hypothesis can be proposed: H4: Government policy has a mediating role on the relationship between inventory management technique and performance.

Summary

From the existing literature, it is apparent that scant literature addresses and explains the impacts of inventory management practices across the different health facilities. Moreover, challenges exist in referring findings in the different regions to the Kisumu county context. Likewise, this study questions the soundness of the viewpoints within retail inventory management when applied in a setting such as the health sector. Notably, inventory approaches emerged in past years, consequently improving inventory replenishment approaches across retails (Van Donselaar et al., 2010). These improvements have led to improved store executions and assortments (Xue et al., 2017). Using the retail supply chain approaches in health institutions with diverse factors indicates the significant aspects of models are difficult to establish (Escamilla, Fransoo & Tang, 2020; Karamshetty et al., 2021). Nonetheless, the existing literature has indicated that inventory management techniques positively impact the operational performance of health institutions. Thus, this study seeks to add literature by considering different healthcare contexts, particularly the different public healthcare institutions in Kisumu County**.** Below is the conceptual framework of this study.

2.5 Conceptual Framework Of Inventory Management and Performance

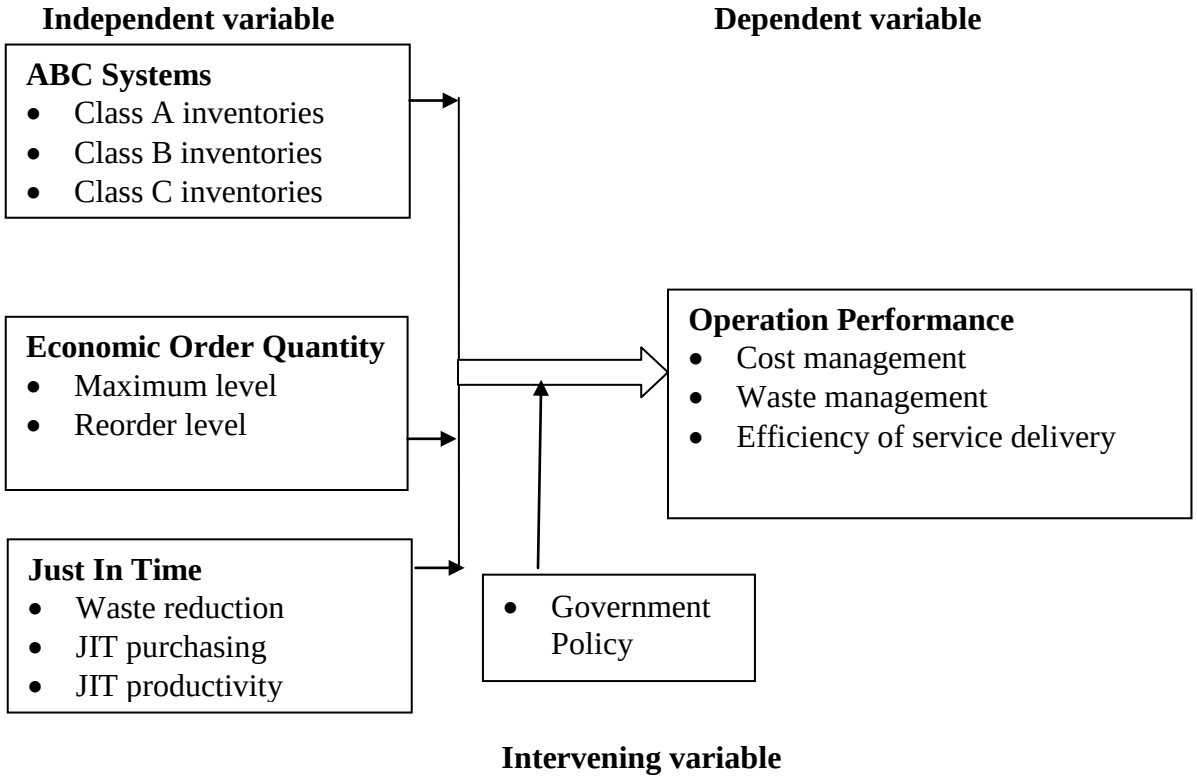


Figure 2.1: *Conceptual Framework*

Source: Researcher (2022)

The study's conceptual structure is depicted in Figure 2.1. The independent variables were the ABC systems, Economic Order Quantity, and Just in Time systems. On the other hand, the dependent variable was operational performance measured through cost management, waste management and efficiency in service delivery.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter elucidates the methodological approaches used to collect, analyze and present the information of the study. This includes the research design, the study's population, the instruments used to collect data, and the methods used to collect data. Further, it also explains how the data was collected, the sample size and sampling techniques, the validity and reliability of data, how the data was analyzed, and the study's ethical issues.

3.2 Research Design

This research adopted a descriptive survey research design to investigate and define the relationship between the study's variables (Mugenda & Mugenda, 2003). This design granted the researcher room to discover the relationship between inventory management techniques and public health facilities' operational performance in Kisumu County, Kenya. The descriptive survey design allows a researcher to collect data using a questionnaire issued to the sampled population. Notably, this study adopted a descriptive survey because it clearly defined the problem (Orodho, 2003).

3.3 Target Population

A population is a group of people, cases, or artifacts with specific, measurable characteristics (Mugenda & Mugenda, 2003). Purposive sampling was applied in selecting the target population. The target population of this study was healthcare workers in the public health facilities of Kisumu County. The study population was 1,848

employees of the 125 public health institutions in the entire Kisumu County. (Kisumu County Integrated Development Plan II, 2018-2022). The employees within the public health facilities in Kisumu County were involved as the respondents for the study. These employees included management, clinical, supply chain, and support staff.

Table 3. 1: *Target Population*

Facility type	Number	Percentage	Employees
Hospital	21	16.8	311
Health Centers	35	28	517
Dispensaries	69	55.2	1020
Total	125	100	1848

Source: Odhiambo (2021)

3.4 Sample Size and Sampling Techniques

A sample is a selected subset of the available population from which the researcher collects data. Mugenda and Mugenda (2003) define a sampling technique as a method for choosing the number of people needed in a sample where the people chosen reflect the wider population from which they were selected. The researcher used a proportionate stratified sampling methodology where the total number of people sampled was 328. The sample size was calculated using the Yamane (1967) formula, with a margin of error of 0.05. Thus, the sample size was 328.

$n = N / (1 + Ne^2)$
Where:
n= sample size, N = population size, and e = Margin of error (5%).
$n=1848/ [1+1848(0.05)^2]$
n= 1848/5.62
n=328

As a result, the study's sample size was 328 people. This represents 17.7% of the target population. Assuming the same proportion, the study will sample 22 public health facilities in Kisumu County as indicated in Table 3.2. From the population of 125 public health facilities, the study covered 17.7%. The facilities were chosen using proportionate stratified sampling method and census methods. The study population was divided into three strata: hospitals, health centers, and dispensaries.

Table 3. 2: *Sample of employees*

Facility	**Number of health facilities**	**Sample of health facilities**	**Target population**	**Sample of employees**
Hospital	21	4	311	55
Health Centers	35	6	517	92
Dispensaries	69	12	1020	181
Total	**125**	22	**1848**	**328**

Source: Author (2022)

From the 22 public health facilities, the researcher drawn the sample size and this sample was spread across the different health institutions. The sample size was drawn from 1848 healthcare workers which was the target population of study. Thus, the sample size was 328 respondents. The sample size is summarized in Table 3.2. Sample size for each cadre is calculated as below:

Hospitals =328(311/1848) =55 respondents

Health Centers =328(517/1848) =92 respondents

Dispensaries =328(1020/1848) =181 respondents

Because the health facilities were classified based on the level of care, the stratified sampling approach was employed. This study considered distinct categories like hospitals, health centres, and dispensaries. From this classification or the independent sub population, random sampling was employed to select individual units. The individual units represented the category of health facilities.

3.5 Data Collection Instruments

In the selected public health facilities, primary data was obtained from respondents using questionnaires. The survey had closed-ended questions that collected quantitative data. Moreover, A Likert scale was used to guide respondents so that precise empirical answers can be obtained (Mwangangi et al, 2015). The Likert Scale used in this study ranged from 1 which means 'Strongly disagree' or 'very small extent' to 5 which means 'Strongly disagree' or 'Very large extend'. Thus, range of the Likert scale was 1 to 5.

The questionnaire as a data collection instrument was selected because it has minimum intervention bias required by the researcher, and it further saved on resources since the physical presence of the researcher is not mandatory (Zikmund, 2003; Powney & Watts, 2018). The three parts of the questionnaire were A, B, and C where; Section A was created to collect demographic variables as well as the respondents' basic background information. Section B was used to collect multidimensional variables that were used to evaluate inventory management activities, while section C was used to evaluate organization performance. The questions in the questionnaire were developed from the existing literature that captured topics such as cost, waste, and efficiency of service

delivery (Balkhi et al., 2022; Moon et al., 2019; Teshome & Gedif, 2022; Awad, 2019; Siddiqui, 2022; Kaswan, Rathi & Singh, 2019: Kothiyal, 2011; Mahatme et al., 2012).

3.6 Validity and Reliability of Instrument

3.6.1 Validity

The degree to which findings obtained from data analysis actually reflect the phenomenon under investigation, according to Mugenda (2003), is the validity of a research instrument. The researcher aimed for content validity in this study by developing the questionnaire to cover a broad range of related questions about inventory management strategies and their effect on public hospital efficiency in Kisumu. The questionnaire was examined by two research supervisors and two sector practitioners, who scored the significance of each question item before computing the material validity index (CVI) to determine the instrument's validity. CVI=Relevant Items/Total Number of Items. Fisher (2004), indicates that for a research instrument to be valid, the CVI should be more than or equal to 0.7 (70%). The CVI calculated was 0.85 (85%).

3.6.2 Reliability

The term "reliability" refers to a person's ability to be dependable or consistent. It implies that the same thing happens over and over again in the same or very similar circumstances (Neuman and Robson, 2009). Notably Mugenda and Mugenda (2003) opine that reliability is a measure of a research instrument's ability to produce reliable results over time. To ensure the test instruments' reliability, the researcher planned to conduct a pilot study in two health facilities that would not be included in the survey.

The pilot study included 14 participants, or 4% of the total sample size. The researcher undertook a pilot study in two health facilities in the neighboring Siaya County. According to Mugenda and Mugenda (2003), the pre-test sample should be between 1% and 10% of the total sample size. A test re-test method was then used to test for reliability. The instruments were re-administered to the same respondents after 4weeks (Mugenda & Mugenda, 2003), a reliability coefficient was then computed. In a majority of social science research situations, a reliability coefficient of 0.70 or higher is deemed "rational" (Frankel and Wallen, 2006). With a reliability coefficient of 0.85 (85%) the study was deemed reliable.

3.7 Data Collection Procedures

The university through the board of post graduate gave an introduction letter for data collection and the ethics review office also gave an approval letter for conducting the study. These were then attached together with the proposal for a research permit by NACOSTI and were presented to the Kisumu County Ministry of Health. The health facilities were identified, and the authorization letters were given to the in-charges of the institutions, who assisted in the identification of the respondents. The intention of the study was clarified and their informed consent sought once the respondents were identified in their respective facility.

Each respondent was given a questionnaire, which was collected after 5 working days. The questionnaires were tested for completeness and accuracy after they are picked up. Secondary data was collected from the different facilities' existing records. The researcher sought permission of the facility in charge for him to collect data. With due

permission, the researcher visited the hospital record's office. The data was filled in the sheet based on the variables.

3.8 Data Analysis

Statistical Package for Social Sciences (SPSS) version 20 was used to generate the statistics. In this case, the data was cleaned for analysis. After that the data was coded and entered into the analysis software. Then the researcher generated the statistics for interpretation. The information gathered was analyzed through descriptive and inferential statistics. Percentage, frequency, and mean was used in descriptive statistics. on the other hand, the study used regression equation:

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \epsilon$$

Where;

Y = performance of public health facilities

β0 = constant (coefficient of intercept)

β_1, β_2, β_3 = regression coefficients of the three variables (ABC system, EOQ technique and JIT technique)

x_1 = ABC system
x_2 = EOQ technique
x_3 = JIT technique
ε = error term

Tables were used to show the data results in order to provide a clear illustration of the study findings. After conducting a regression analysis, the analysis entailed adding intervening variables as a covariate to the regression equation by including it as an additional predictor variable. Thus, the researcher re-run the regression analysis with the added covariate. Finally, the researcher compared the results with the initial analysis to

note the relationship between the independent variable and dependent variable changes after controlling for the intervening variables. The study also interpret results of coefficients and p-values for the independent variable and intervening variables.

3.9 Ethical Issues

The researcher pledged that the entire process did not violate or breach any ethical standards, and took appropriate steps to do so. The researcher had obtained authorization from the hospital management before administration of questionnaires. Thereafter consent of the respondents was sought. The respondents were allowed to give their free consent without any coercion or being compromised in any unethical manner. The respondents were administered with informed/voluntary consent forms which assured them of the requisite ethical requirements in regards to the study. Once the questionnaires were collected from the field, the researcher ensured that they are not doctored in any way and the findings were presented as given by the respondents even if they seem contrary to the researcher's expectations.

The researcher assured the respondents and the facility administration of utmost confidentiality regarding any classified information that may be received in the course of the study and this was then strictly observed. In framing the questions in the questionnaire, care was taken to ensure that the questions posed was not embarrassed or intimidated the respondents in anyway. The study was strictly objective; focusing only on the purpose of the research as the researcher did not attempt to influence the outcome of the study in any way.

CHAPTER FOUR

FINDINGS AND DISCUSSIONS

4.1 Introduction

This section presents the findings of the research based on the objectives and the variables of the study. The study sought to determine the influence of inventory management techniques on the operational performance of public health facilities in Kisumu County, Kenya. The study used descriptive and regression statistics for analysis.

4.1.1 Response Rate

The research sampled 328 respondents. The 328 interviewees were issued with questionnaires to fill. However, out of the 328 questionnaires, 250 were dully filled and returned. This gave a response rate of 76.2% which was excellent according to Mugenda and Mugenda (2012).

4.2 General Information

4.2.1 Education level of the respondents

Table 4. 1: *Education level of the respondents*

	Frequency	**Percent**	**Cumulative Percent**
Certificate and below	11	4.4	4.4
Diploma	123	49.2	53.6
Bachelors	79	31.6	85.2
Postgraduate degree	37	14.8	100.0
Total	250	100.0	

Source: Author (2022)

The research aimed to know the educational level of the respondents. In this case, the respondents were tasked to indicated their highest level of education. From the findings, 53.6% of the respondents had diploma education while 31.6% had bachelors. However, 14.8% indicated that they had postgraduate degree. This showed that the majority of the respondents had a diploma indicating that they could answer the questionnaire with ease and from a point of knowledge. This a vital finding as Ahmed, Kheder, and Awad (2019) found that fresh graduands and pharmacists from universities had a little understanding of inventory management which negatively impacted the purchase of drugs and optimising of cost.

4.2.2 Respondents' period of work in years

The research aimed to establish the period of time worked in health facilities in Kisumu County. To address this, the respondents were asked to indicate how long they had worked in their facility.

Table 4. 2: *Respondents' period of work in years*

	Frequency	**Percent**	**Cumulative Percent**
below 1 year	24	9.6	9.6
1 year - 5 years	45	18.0	27.6
6 years – 10 years	152	60.8	88.4
Over 10 years	29	11.6	100.0
Total	250	100.0	

Source: Author (2022)

From the findings, the study found that 60.8% of the respondents indicated that they had worked in their current facilities for 6 to 10 years. Further, 18% indicated 1-5years,

11.6% indicated over 10 years while 9.6% indicated below 1 year. This indicates that most of the respondents had worked in their current facilities for more than 5 years. That means they had enough knowledge about their organization. Moreover, experience enhances the understanding of inventory management practices (Ahmed, Kheder, & Awad, 2019).

4.3 Impact of the ABC system on the operational performance of public health facilities

The first objective of the research aimed to establish the influence of ABC system on the performance of public health facilities in Kisumu County. To answer this objective, the study used descriptive statistics of frequencies, percentage, and mean.

4.3.1 Use ABC System in the facilities

Table 4. 3: *Use of the ABC system for Inventory Management in the facilities*

	Frequency	Percent	Cumulative Percent
Yes	210	84.0	84.0
No	29	11.6	95.6
Don't know	11	4.4	100.0
Total	250	100.0	

Source: Author (2022)

The research sought to know whether the organization that they worked in used ABC system as an inventory management technique. From the findings 84% indicated that their organizations used ABC system as an inventory management technique while 11.6% indicated that their organizations had not used ABC system as an inventory management technique. However, 4.4% indicated that they did not know whether their organizations used ABC system as an inventory management technique. This indicates

that majority of the hospital facilities in Kisumu County use ABC systems for inventory management. This findings agree with Dwivedi, Kumar, and Kothival (2011), Ahmed, Kheder, and Awad (2019), and Jobira et al. (2021) who showed that ABC systems are some of the significant inventory management employed in health institutions.

4.3.2 Extent of Use the ABC System as an Inventory Management Technique

Table 4. 4: *Extent of Use the ABC System as an Inventory Management Technique*

	Frequency	Percent	Cumulative Percent
Very small extent	1	.4	.4
small extent	35	14	14.4
moderate extent	33	13.2	27.2
Large extent	145	58	85.6
Very large extent	36	14.4	100
Total	250	100.0	

Source: Author (2022)

The research aimed to establish the extent to which public health facilities in Kisumu County used the ABC system as an inventory management technique. To establish this, the study asked the respondents to indicate the extent to which their organizations used the ABC system as an inventory management technique. From the findings, 58% of the organizations used the system in large extent. On the other hand, 14% indicated to a small extent, while 13.2% indicated to a moderate extent while 0.4% indicated to a very small extent. This implies that majority of the public health facilities in Kisumu adopt ABC systems to a great extent. The existing studies have established the importance of ABC system in inventory management in healthcare institutions and the studies have demonstrated that ABC is usually combined with VEN analysis (Legese, Teshome, & Gedif, 2022). Moreover, Dwivedi, Kumar, and Kothiyal (2011) noted that healthcare

institutions uses inventory management practices to enhance handling of stock. Thus, this study findings concur with the existing literature.

4.3.3 Period of ABC Implementation

Table 4. 5: *Period of Implemented ABC systems*

	Frequency	**Percent**	**Cumulative Percent**
1-3 years	27	10.8	10.8
4-6 years	138	55.2	66.0
7-9 years	60	24.0	90.0
over 9 years	25	10.0	100.0
Total	**250**	**100.0**	

Source: Author (2022)

The study aimed to know how long public health facilities in Kisumu had implemented ABC systems. To establish this, the researcher requested the respondents to indicate how long their organizations had implemented ABC systems. From the findings 55.2% had implemented for 4 and 6 years. However, 24% indicated 7 to 9 years, 10.8% indicated 1 to 3 years while 10% indicated 9 years and above. This means many of the public health facilities in Kisumu had implemented the ABC system for less than seven years. The existing literature (Anand et al., 2013; Legese, Theshome, Gedif, 2022; Dwivedi, Kumar & Kothiyal, 2011) does not provide precise information on the period for the implementation of ABC systems.

4.3.4 Agreement on statements relating to ABC Systems

Table 4. 6: *Agreement on statements relating to ABC Systems*

	N	Minimum	Maximum	Mean	Std Dev. Deviation
Using ABC method leads to efficient resource management	250	2.00	5.00	3.6600	.79177
Using ABC method reduces on holding costs	250	2.00	5.00	3.5640	.82985
Using ABC eliminates wastes associated with obsolescence and expiry of supplies	250	2.00	5.00	3.6280	.77720
Using ABC leads to increased number of clients served	250	2.00	5.00	3.7200	.71810

Source: Author (2022)

Further the research aimed to know the extent to which the respondents agreed on statements relating to ABC systems. The respondents agreed that use of ABC method led to efficient resource management as shown by mean of 3.6600 and Std Dev. of 0.79177. Also, the respondents agreed to a great extent that use of ABC method reduced holding costs as shown by mean of 3.5640 and Std Dev. of 0. 82985. In addition, they further concurred that that use of ABC eliminated wastes associated with obsolescence and expiry of supplies as shown by mean of 3.6280 and Std Dev. of 0.77720; and that use of ABC led to increased number of clients as shown by mean of 3.7200 and Std Dev. of 0.71810. This indicates that ABC systems is crucial to the performance of public facilities in Kisumu County. These findings concur with other research works (Ahmed,

Kheder, & Awad, 2019; Anand et al., 2013; Dwivedi, Kumar & Kothiyal, 2011; Jobira et al., 2021; Legese, Teshome & Gedif, 2022; Manhas et al., 2021; Kivoto et al., 2018) which indicated that ABC analysis translated to improved patient care, resource usage, efficient management of pharmacy, and reduced oversupply.

4.4 Impact of EOQ on the operational performance of public health facilities

The second objective of the research aimed to examine the influence of Economic Order Quantity system on the performance of public health facilities in Kisumu County. To establish this, the researcher asked whether their organizations had adopted EOQ and the extent to which they had adopted EOQ inventory management techniques. The researcher also asked the respondents to indicate the extent to which they agreed on statements relating to EOQ technique.

4.4.1 Whether Organizations Used Economic Order Quantity

Table 4. 7: *Whether Organizations Used Economic Order Quantity*

	Frequency	Percent	Cumulative Percent
Yes	241	96.4	96.4
No	5	2.0	98.4
Don't know	4	1.6	100.0
Total	250	100.0	

Source: Author (2022)

The study sought to establish whether public health facilities in Kisumu used Economic Order Quantity as an inventory management technique. The respondents were asked to indicate whether their organizations used Economic Order Quantity as an inventory management technique. Based on the findings, 96.4% indicated that their organizations used Economic Order Quantity as an inventory management technique. However, 2%

indicated otherwise. On the other hand, 1.6% indicated that they did not that they did not know whether their organizations used Economic Order Quantity as an inventory management technique. This implies that public health facilities in Kisumu use Economic Order Quantity as an inventory management technique. The existing literature has indicated the use of EOQ in healthcare institutions (Kwak, Durbin, & Stanley, 1991; Nasution et al., 2022; Dewi et al., 2020).

4.4.2 Extent of Use of Economic Order Quantity

Table 4. 8: *Extent of Use of Economic Order Quantity*

	Frequency	**Valid Percent**	**Cumulative Percent**
Very small extent	3	1.2	1.2
Small extent	184	73.6	74.8
moderate extent	17	6.8	81.6
large extent	44	17.6	99.2
Very large extent	2	0.8	100
Total	250	100.0	

Source: Author (2022)

This research was also carried out with the aim of knowing the extent to which public health facilities in Kisumu used the economic order quantity as an inventory management technique. The respondents were asked to indicate the extent to which organizations used the economic order quantity as an inventory management technique. From the findings, 73.6% indicated that their organizations used EOQ to a little extent. However, 17.6% indicated to a large extent while 6.8% indicated to a moderate extent. This indicates that majority of the public health facilities in Kisumu County use EOQ to a little extent. These findings are also echoed in the existing studies (Agada & Ewuche, 2017; Hugo et al.,

2018; Hermann, 2008) and there are handful of research focusing on EOQ in the context of Kenya (Korir, Kaitany, & Sang, 2021). Hermann (2008) asserted that EOQ requires a responsible staff and have information related to the carrying cost and reorder cost. These factors makes EOQ difficult to use.

4.4.3 Implementation period of EOQ as an inventory management technique

Table 4. 9: *Implementation period of EOQ as an inventory management technique*

	Frequency	Valid Percent	Cumulative Percent
1-3 years	45	18.0	18.0
4-6 years	38	15.2	33.2
7-9 years	146	58.4	91.6
over 9 years	21	8.4	100.0
Total	**250**	**100.0**	

Source: Author (2022)

The research also aimed at establishing the period that the public health facilities in Kisumu had implemented EOQ technique as an inventory management technique. The respondents were requested to stipulate the length of time their organizations had implemented EOQ technique as an inventory management technique. From the findings, 58.4% indicated that they had implemented EOQ for 7 to 9 years. However, 18% indicated between 1 and 3 years, 15.2% indicated 4 to 6 years while 8.4% had implemented for over 9 years. This shows that public health facilities in Kisumu had implemented EOQ for less than 9 years. Authors (Dewi et al., 2020; Kwar, Durbin, & Stanley, 1991; Njoroge, 2015) have demonstrated the use of EOQ within the healthcare. The literature has been published in different years. Nonetheless, the literature does not indicate period of which EOQ has been used in a particular health institutions.

4.4.4 Agreement On Statements Relating to EOQ

Table 4. 10: *Agreement on Statements Relating to Economic Order quantity*

	Mean	Std Dev. Deviation
The use of EOQ ensures uninterrupted operations	3.6960	.92031
The use of EOQ leads to obsolescence and expiry of items	2.1800	.87560
The use of EOQ eliminates stock outs	3.9680	.62654
EOQ leads to increased number of clients served	3.9320	.73316
EOQ eliminates wastes associated with obsolescence and expiry of supplies	3.9920	.68835
EOQ method reduces on holding costs	4.0240	.71657
EOQ method leads to efficient resource management	4.0480	.65068

Source: Author (2022)

Consequently, the research also aimed to establish the extent to which the respondents agreed other following statements relating to EOQ. From the research, the respondents agreed that the use of EOQ ensured uninterrupted operations as shown by mean of 3.6960 and std of 0.92031. They further agreed that the use of EOQ eliminated stock outs as shown by mean of 3.9320 and std of 0.73316; EOQ eliminated wastes associated with obsolescence and expiry of supplies as shown by mean of 3.9920 and std of 0.68835.; and that EOQ method reduced on holding costs as shown by mean of 4.0240 and std of 0.71657. They also agreed that EOQ method led to efficient resource management as shown by mean of 4.0480 and Std Dev. of 0.65068. However, they disagreed that the use of EOQ led to obsolescence and expiry of items as shown by mean of 2.1800 and Std Dev. of 0.87560. This indicates that EOQ influence performance of public health

organizations in Kisumu County. This study findings concurs with other studies. Dewi et al. (2020) noted that EOQ is associated with the control of stocks, budgeting, and procurement as it maximise the stock level. EOQ indicates the quantity desired to order and when to order items in a hospital (Agada & Ewuche, 2017). VanDerLinde (1983) noted that EOQ system translated to cost saving and improved operational efficiency.

4.5 Impact of JIT on the operational performance of public health facilities

In the third and final objective, the researcher aimed to analyze the impact of Just in Time on the performance of public health facilities in Kisumu County. This was done by checking whether the organizations used JIT for inventory management, period and to which extent. The researcher also checked on the agreement on statements relating to JIT.

4.5.1 Whether Just In Time is used in inventory management

Table 4. 11: *Whether Just In Time is used in inventory management*

	Frequency	**Valid Percent**	**Cumulative Percent**
Yes	249	99.6	99.6
No	1	.4	100.0
Total	**250**	**100.0**	

Source: Author (2022)

The research sought to establish whether public health organizations in Kisumu County use Just In Time as an inventory management technique. To establish this, the respondents were asked to indicate whether their organizations used Just In Time for inventory management. From the findings, 99.6% indicated that their organizations used Just In Time for inventory management while 0.4% indicated otherwise. This indicates that majority public health organizations in Kisumu County use Just In Time as an inventory management technique. Based on the existing literature, it is apparent that

hospitals and other health facilities (Aptel & Pourjalali, 2001; Karkowski et al., 2017; Kua-Walker, 2010; Balkhi et al., 2022; Baum, 2006; Kaswan, Rathi, & Singh, 2019).

4.5.2 Extent of Adoption of Just In Time technique

Table 4. 12: *Extent of Adoption of Just In Time*

	Frequency	Percent	Cumulative Percent
Very small extent	5	2.0	2.0
small extent	24	9.6	11.6
moderate extent	35	14.1	25.7
Large extent	184	73.5	99.2
very large extent	2	.8	100.0
Total	250	100.0	

Source: Author (2022)

The study sought to establish the extent to which public health organizations in Kisumu County use just in time as an inventory management technique. The respondents were asked to indicate the degree to which their organizations used Just In Time as an inventory management technique. From the findings 73.5% of the respondents said that they used JIT in large extent, 14.1% said that they used in moderate extent, while 9.6% said that they used in small extent. However, 2% said that they used in very small extent and 0.8% said they used in very large extent. That means JIT was greatly used in public health organizations in Kisumu County. Studies such as Ragazzoni et al. (2020) noted that JIT was effective in rapidly equipping workers with new skills, knowledge, and attitudes. Moreover, Balkhi et al. (2022) noted that JIT system is effective in normal setting.

4.5.3 Period of Use of Just In Time technique

Table 4. 13: *Period of Use of Just In Time technique*

	Frequency	Percent	Cumulative Percent
1-3 years	23	9.2	9.2
4-6 years	29	11.6	20.9
7-9 years	63	25.2	46
over 9 years	135	54	100.0
Total	**250**	**100.0**	

Source: Author (2022)

The research sought to know how long public health organizations in Kisumu County have implemented JIT technique. The respondents were requested to indicate how long their organizations had implemented JIT technique. From the results, 54% said they had implemented JIT for over 9 years. On the other hand, 25.2% indicated 7 to 9 years, 11.6% indicated 4 to 6 years while 9.2% indicated 1 to 3 years. This indicates that public health organizations in Kisumu County have implemented JIT technique for more than 7 years. These findings align with findings from previous studies conducted (Balkhi et al., 2022; Ragazzoni et al., 2020). Balkhi et al. (2022) noted that noted that JIT is effective in a normal setting.

4.5.4 Agreement on Statements Relating To Just In Time technique

Table 4. 14: *Agreement on statements relating to Just in Time*

	Mean	Std Dev. Deviation
The use of JIT eliminates wastes associated with obsolescence and expiry of supplies	4.0600	.71164
Using JIT method disrupts operations due to stock outs	2.0240	.69379
JIT method improves the delivery time of supplies	3.8240	.58857
Use of JIT method reduces some costs such as storage and handling costs	4.0960	.68751
JIT method leads to efficient resource management	3.9720	.70797
JIT method leads to effective resource management	3.8560	.83790
reduces some costs such as storage and handling costs	3.9480	.62197
Reduces lead time of supplies delivery	4.1240	.60505
Improves efficiency in resource management	3.8280	.66346
Better waste management	3.7880	.80601
Improves efficiency of service delivery	3.7760	.77991
Increases the number of clients served	3.7680	.73508
Better service delivery	3.8840	.66355

Source: Author (2022)

The research aimed to establish the degree to which the respondents agreed on following statements relating to JIT. From the findings, the respondents agreed that the use of JIT eliminated wastes associated with obsolescence and expiry of supplies as shown by mean of 4.0600 and Std Dev. of 0.71164. They also agreed that JIT improved the delivery time of supplies as shown by mean of 3.8240 and Std Dev. of 0. 58857; reduced some costs such as storage and handling costs as shown by mean of 4.0960 and Std Dev. of 0.68751; reduced lead time of supplies delivery as shown by mean of 4.1240 and Std Dev. of 0.60505; and improved efficiency in resource management as shown by mean of 3.7880 and std of 0.80601. The respondents further agreed that JIT led to better waste

management as shown by mean of 3.7880 and Std Dev. of 0.80601; improved efficiency of service delivery as shown by mean of 3.7760 and Std Dev. of 0.77991; increased the number of clients served as shown by mean of 3.7680 and Std Dev. of 0. 73508; and led to better service delivery as shown by mean of 3.8840 and Std Dev. of 0.66355. These findings concur with the existing evidence which showed that JIT translated to increased productivity (Siddiqui, 2022), cost reduction (Aptel & Balkhi et al., 2022; Baum, 2006), and service delivery (Kaswan, Rathi, & Singh, 2019). Siddiqui (2022) also noted that JIT created stable work schedule and minimized unused inventory (Aptel & Pourjalali. 2001).

4.6 Operation Performance

The study sought to establish the performance of public health facilities in Kisumu County, Kenya. To establish this, the researcher asked the respondents to indicate the extent to which they agreed on statements relating to the operational performance of their organizations.

Table 4. 15: *Operational Performance*

My organization has experienced	Mean	Std. Deviation
reduced costs such as storage and handling costs	2.0520	.62197
Reduce lead time of supplies delivery	1.8760	.60505
Improved efficiency in resource management	2.1720	.66346
Better waste management	3.7880	.80601
Improved efficiency of service delivery	2.2240	.77991
Increased number of clients served	3.6520	.81828
Improved service delivery	2.1160	.66355

Source: Author (2022)

From the findings, the respondents agreed that their organizations had experienced better waste management as shown by mean of 3.7880 and Std Dev. of 0.80601; and increased number of clients served as shown by mean of 3.6520 and Std Dev. of 0.81828. However, they disagreed that their organizations had experienced reduced costs such as storage and handling costs as shown by mean of 2.0520 and Std Dev. of 0.62197. The respondents also disagreed that their organizations experienced reduced lead time of supplies delivery as shown by mean of 1.8760 and Std Dev. of 0.60505; improved efficiency in resource management as shown by mean of 2.1720 and Std Dev. of 0.66346; improved efficiency of service delivery as shown by mean of 2.2240 and std. dev. of 0.77991; and improved service delivery of 2.1160 and Std Dev. of 0.66355. This shows that public health facilities in Kisumu have experienced poor performance in the recent years.

4.7 Regression Analysis

Regression analysis was done to find out the effect of inventory management techniques on the performance of public health facilities in Kisumu County, Kenya.

Table 4. 16: *Model Summary*

Model	R	R Square	Adjusted R Square	Std Dev. Error of the Estimate
1	.902[a]	.814	.658	2.07800

a. Predictors: (Constant), EOQ technique, JIT technique, ABC system

From the model summary, the correlation coefficient (R) was 0.902. This indicates that the predictor variables had a strong relationship with the performance of public health facilities in Kisumu County, Kenya. The model summary showed an R^2 of 0. 814. This indicates that ABC system, EOQ technique and JIT technique contributes 81.4% of the

change performance of public health facilities in Kisumu County, Kenya. Other factors contributed 18.6% of the change in performance of public health facilities in Kisumu County. This indicates that ABC system, EOQ technique and JIT technique are the major factors influencing performance of public health facilities in Kisumu County.

Table 4. 17: ***ANOVA***[a]

Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	17.386	3	5.795	8.787	.000[b]
	Residual	162.250	246	.660		
	Total	179.636	249			

a. Dependent Variable: performance

b. Predictors: (Constant), EOQ technique, JIT technique, ABC system

From the ANOVA table, the model showed an F-value of 8.787 which was significant with a significance value of 0.000. The significance value was less than 0.05 indicating that the regression model fits the data and is the best model to use in the research.

Table 4. 18*: Coefficients*[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std Dev. Error	Beta		
1	(Constant)	24.697	2.495		9.899	.000
	ABC system	.216	.084	.239	2.529	.012
	EOQ technique	.587	.168	.521	3.491	.001
	JIT technique	.439	.164	.406	2.669	.008

a. Dependent Variable: performance

The study aimed at assessing the impact of inventory management techniques on the operational performance of public health facilities in Kisumu County, Kenya. The regression model showed a constant value of 24.697 indicating that inventory management techniques remain constant, the value of performance of public health facilities would be 24.697. A unit increase in ABC system would cause an increase in performance of public health facilities in Kisumu County by having a Beta Coefficient β (0.216); $p < 0.000$. This shows that ABC system had a positive effect in performance of public health facilities in Kisumu County. This finding proves H1: ABC system positively impacts operational performance of public health facilities in Kisumu County. This similar to other studies findings (Dwivedi, Kumar, & Kothiyal, 2011; Legese, Teshome & Gedif, 2022).

A unit increase in EOQ technique would cause an increase operational performance of public health facilities in Kisumu County by having Beta coefficient β (0.587). ; $p < 0.001$. This shows that the EOQ technique have a positive effect on performance of public health facilities in Kisumu County. A unit increase in EOQ technique would cause an increase in performance of public health facilities by 0.168. This shows that the EOQ technique have a positive effect performance of public health facilities. The effect of the EOQ technique systems was significance as the significance values were below 0.05. Thus, the study proves that H2: EOQ technique systems positively impact operational performance of public health facilities in Kisumu County. Thus the finding is supported by the existing studies (Nasution et al., 2022; Dewi et al., 2020; Agada & Ewuche, 2017). A unit increase in JIT technique would cause an increase in performance of public health facilities by Beta coefficient β (0.439); $p < 0.008$. This shows that JIT system had a

positive effect in performance of public health facilities in Kisumu County. The effect of the JIT technique was significance as the significance values were below 0.05. The analysis shows that inventory management techniques have a positive effect on the performance of public health facilities in Kisumu County. Thus the study proves H3: JIT system has a positive impact on public health facilities in Kisumu County. These findings concurs with existing evidence (Ragazzoni et al., 2020; Siddiqui, 2022; Kaswan, Rathi, & Singh, 2019).

From the regression analysis above, the general model for the study can now be given. Notably, as shown in chapter 3, the general model formula is given as

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \epsilon$$

Where;

Y = performance of public health facilities

β0 = constant (coefficient of intercept)

β_1, β_2, β_3 = regression coefficients of the three variables (ABC system, EOQ technique and JIT technique)

x_1 = ABC system

x_2 = EOQ technique

x_3 = JIT technique

ε = error term

Replacing the β1, β2, and β3, with the actual regression coefficients gives the following general model:

$$Y = \beta_0 + .239x_1 + .521x_2 + .406x_3 + \epsilon$$

4.8 The ordinal regression analysis with government policy as a covariate

The research aimed at exploring the mediating role of government policy on the impact of inventory management techniques on operational performance of the public health facilities. The summary of the results for the ordinal regression analysis with government policy as a covariate, based on the output provided, is as follows:

Table 4. 19: *Model Fitting Information*

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1039.385			
Final	1011.043	28.342	30	.552

Link function: Logit.

Source: Author (2022)

The model fitting information in Table 4.19 shows the -2 Log Likelihood, Chi-Square, degrees of freedom (df) and significance (Sig.) for the intercept-only model and the final model. The difference between the -2 Log Likelihood of the two models gives an idea of how well the model fits the data. The Chi-Square, df and Sig. are used to test the overall goodness-of-fit of the model. The final model has a -2 Log Likelihood of 1011.043, which is a slightly better fit than the intercept-only model (1039.385). The Chi-Square test of overall model fit is not significant (p=.552).

Table 4. 20: *Goodness-of-Fit*

	Chi-Square	Df	Sig.
Pearson	2964.603	2730	.001
Deviance	988.051	2730	1.000

Link function: Logit.

Source: Author (2022)

The Goodness-of-Fit Table 4.20 shows the Chi-Square, df, and Sig. for the Pearson, Deviance, and Link function used in the analysis. The Chi-Square test of goodness-of-fit is significant (p=.001) indicating that the model is not a good fit for the data. The deviance test is not significant (p=1.000) which means that the model is a good fit for the data.

Table 4. 21: *Pseudo R-Square*

Cox and Snell	.107
Nagelkerke	.109
McFadden	.027

Link function: Logit.

Source: Author (2022)

The Pseudo R-Square Table 4.21 shows the values of the different coefficients used to measure goodness-of-fit of the model like Cox and Snell, Nagelkerke and McFadden. The pseudo R-square values for Cox and Snell, Nagelkerke, and McFadden are .107, .109 and .027 respectively. These are low values which indicate that the model does not fit the data well.

Table 4. 22: *Parameter estimates*

		Estimate	Std. Error	Wald	Df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[Y = 20.00]	-3.299	3.461	.909	1	.340	-10.083	3.484
	[Y = 21.00]	-2.603	3.410	.583	1	.445	-9.286	4.081
	[Y = 22.00]	-1.355	3.409	.158	1	.691	-8.037	5.327
	[Y = 23.00]	-.430	3.421	.016	1	.900	-7.135	6.274
	[Y = 24.00]	.385	3.427	.013	1	.911	-6.331	7.101
	[Y = 25.00]	1.154	3.429	.113	1	.737	-5.567	7.874
	[Y = 26.00]	2.066	3.429	.363	1	.547	-4.655	8.788
	[Y = 27.00]	2.980	3.429	.756	1	.385	-3.739	9.700
	[Y = 28.00]	3.837	3.428	1.253	1	.263	-2.882	10.556
	[Y = 29.00]	4.873	3.429	2.019	1	.155	-1.848	11.595
	[Y = 30.00]	6.111	3.440	3.157	1	.076	-.630	12.853
	[Y = 31.00]	6.946	3.459	4.031	1	.045	.166	13.726
Location	GovtPolicy	-.424	.362	1.367	1	.242	-1.134	.287
	[X1=8.00]	4.225	2.684	2.478	1	.115	-1.036	9.487
	[X1=10.00]	1.861	2.255	.682	1	.409	-2.557	6.280
	[X1=11.00]	2.463	2.155	1.306	1	.253	-1.761	6.687
	[X1=12.00]	4.212	2.035	4.286	1	.038	.225	8.200
	[X1=13.00]	3.204	2.016	2.526	1	.112	-.747	7.156
	[X1=14.00]	3.671	2.009	3.341	1	.068	-.265	7.608
	[X1=15.00]	3.382	2.021	2.800	1	.094	-.579	7.344
	[X1=16.00]	3.535	2.003	3.112	1	.078	-.392	7.461
	[X1=17.00]	3.266	2.055	2.525	1	.112	-.763	7.295
	[X1=20.00]	0[a]	.	.	0	.	.	.

[X3=17.00]	1.027	1.593	.416	1	.519	-2.096	4.150
[X3=18.00]	1.288	1.562	.680	1	.409	-1.773	4.350
[X3=19.00]	.614	1.379	.198	1	.656	-2.089	3.318
[X3=20.00]	.937	1.336	.491	1	.483	-1.682	3.556
[X3=21.00]	1.207	1.330	.823	1	.364	-1.400	3.814
[X3=22.00]	.977	1.321	.547	1	.460	-1.613	3.566
[X3=23.00]	.774	1.306	.351	1	.553	-1.786	3.334
[X3=24.00]	1.627	1.328	1.499	1	.221	-.977	4.230
[X3=25.00]	1.709	1.545	1.222	1	.269	-1.321	4.738
[X3=26.00]	0[a]	.	.	0	.	.	.
[X2=18.00]	-1.493	2.572	.337	1	.561	-6.535	3.548
[X2=21.00]	-.088	2.055	.002	1	.966	-4.116	3.940
[X2=22.00]	-.540	1.961	.076	1	.783	-4.383	3.304
[X2=23.00]	-.208	1.835	.013	1	.910	-3.805	3.389
[X2=24.00]	.046	1.822	.001	1	.980	-3.525	3.616
[X2=25.00]	-.321	1.818	.031	1	.860	-3.885	3.242
[X2=26.00]	.104	1.808	.003	1	.954	-3.440	3.648
[X2=27.00]	-.099	1.806	.003	1	.956	-3.638	3.440
[X2=28.00]	-.390	1.827	.046	1	.831	-3.971	3.191
[X2=29.00]	.411	1.874	.048	1	.827	-3.263	4.084
[X2=30.00]	-1.191	1.946	.374	1	.541	-5.004	2.623
[X2=31.00]	0[a]	.	.	0	.	.	.

Link function: Logit.

a. This parameter is set to zero because it is redundant.

Source: Author (2022)

The Parameter Estimates Table 4.22 shows the estimates, standard errors, Wald statistics, df, Sig., and 95% Confidence Interval for the Thresholds and the Location variable. The thresholds represent the different categories of the dependent variable and the location

variable represents the independent variable (inventory management techniques) and the covariate (government policy). The coefficients for the independent variable (inventory management techniques) are statistically significant ($p<.05$) for some levels, indicating that inventory management techniques have an effect on performance. The coefficients for the covariate (government policy) are not statistically significant ($p>.05$) indicating that government policy does not have a significant effect on the relationship between inventory management techniques and performance. The existing literature demonstrated that government policy was a mediating variable in the relationship between inventory management techniques and operational performance of public health facilities. The literature demonstrate that government policy plays a key role in influencing budgeting, staffing, and supply of drugs (Kobede & Tilahun, 2021; Awad et al., 2016; George & Elrashid, 2023). Thus, the current finding contradicts the existing literature but the finding of this study is not conclusive because the significance score was too high.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This section outlines the summary of the study, conclusions, recommendations and suggestions for further research. The chapter is based on the objectives of the study, where the research sought to determine the impact of inventory management techniques on the operational performance of public health facilities in Kisumu County, Kenya.

5.2 Summary of findings

The research was aimed at establishing the operational performance of public health facilities in Kisumu County, Kenya. On the extent to which the respondents agreed on statements relating to the operational performance of their organizations, they agreed that their organizations had experienced better waste management; and increased service delivery. However, they disagreed that their organizations had experienced reduced costs such as storage and handling costs; reduced lead time of supplies delivery; improved efficiency in resource management; improved efficiency of service delivery; and improved service deliver. From the model summary, ABC, EOQ and JIT showed a strong relationship (90.2%) with the performance of public health facilities in Kisumu County, Kenya. They contributed 81.4% to performance of public health facilities in Kisumu County indicating that they inventory management techniques are the major factors influencing performance of the public health facilities in Kisumu County. Particularly, A unit increase in ABC system would cause an increase in performance of public health facilities in Kisumu County by having a correlation coefficient of (0.216); $p < 0.000$. Likewise, a unit increase in EOQ technique would cause an increase operational

performance of public health facilities in Kisumu County by having correlation coefficient of (0.587); $p < 0.001$. Further, a unit increase in JIT technique would cause an increase in performance of public health facilities by having a correlation coefficient of (0.439); $p < 0.008$. Furthermore, the study established that the coefficients for the covariate (government policy) were not statistically significant ($p>.05$) indicating that government policy does not have a significant effect on the relationship between inventory management techniques and performance.

5.2.1 Impact of ABC system on operational performance of public health facilities

Primarily the first objective of the research was aimed at establishing the influence of ABC system on the performance of public health facilities in Kisumu County. To address the objective, research sought to know whether the organizations used ABC system as an inventory management technique. The findings indicated that majority of the organizations used ABC system as an inventory management technique. The findings further showed that majority had adopted ABC systems to a large extent (58%) with a substantial number adopting it to a little extent. On the time that the facilities had implemented the ABC technique, the findings showed that more than half of respondents (55.2%) had implemented it for less than 7 years.

On the extent to which the respondents agreed on statements relating to ABC systems, they agreed that use of ABC method led to efficient resource management. They also agreed that use of ABC method reduced holding costs; eliminated wastes associated with obsolescence and expiry of supplies; and increased number of clients. This indicates that ABC systems is crucial to the performance of public facilities in Kisumu County. The

regression analysis findings showed that an increase in ABC systems would cause an increase in operation performance of public health facilities. Particularly, the findings demonstrated a significant positive relationship of correlation of (0.216); $p < 0.000$.

5.2.2 Impact of Economic Order Quantity on operational performance of public health facilities

The second objective aimed to examine the influence of Economic Order Quantity on the performance of public health facilities in Kisumu County. On whether public health facilities in Kisumu used Economic Order Quantity as an inventory management technique, majority of the respondents indicated that their organizations used Economic Order Quantity as an inventory management technique (96.4%). On the extent to which public health facilities in Kisumu used the economic order quantity as an inventory management technique, majority of the respondents (73.6%) indicated that their organizations used EOQ to a little extent with a small percentage of the organizations adopting it to a large extent.

On the period that the public health facilities in Kisumu had implemented EOQ technique as an inventory management technique, majority (58.4 %) of the respondents indicated that their facilities had implemented EOQ for 7-9 years. On the extent to which the respondents agreed on statements relating to EOQ, the respondents agreed that the use of EOQ ensured uninterrupted operations. They further agreed that the use of EOQ eliminated stock outs; eliminated wastes associated with obsolescence and expiry of supplies and reduced holding costs. They also agreed that EOQ method led to efficient resource management; and obsolescence and expiry of items. From the regression

analysis, an increase in EOQ technique would cause a significant increase in performance of public health facilities. The findings illustrated that a significant positive relationship of correlation coefficient of **(**0.587); $p < 0.001$**.**

5.2.3 Impact of Just in Time on operation performance of public health facilities

Further in carrying out the third objective, the researcher sought to scrutinize the influence of Just in Time on the performance of public health facilities in Kisumu County. On whether public health organizations in Kisumu County use Just In Time as an inventory management technique, the majority of the respondents (99.6%) indicated that their facilities used Just In Time for inventory management. Majority (73.5%) indicated that their organizations used JIT to a large extent. Majority of the respondents (53.8%) further indicated that their organizations had used JIT for over 9 years. On the extent to which the respondents agreed on statements relating to JIT, the respondents agreed that the use of JIT eliminated wastes associated with obsolescence and expiry of supplies; improved the delivery time of supplies; reduced some costs such as storage and handling costs; reduced lead time of supplies delivery; and improved efficiency in resource management. They further agreed that JIT led to better waste management; improved efficiency of service delivery; increased the number of clients served; and led to better service delivery. However, the respondents disagreed that Using JIT method disrupted operations due to stock outs. From the regression analysis, increase in JIT technique would cause an increase in performance of public health facilities significantly. This shows that a JIT had a positive influence on operational performance by having correlation coefficient of **(0.439); $p < 0.008$.**

5.2.4 Impact of government policy on the inventory management techniques and operational performance of public health facilities

The study established that the coefficients for the covariate (government policy) were not statistically significant ($p>.05$) indicating that government policy does not have a significant effect on the relationship between inventory management techniques and performance. The finding of this study is not conclusive because the significance score was too high.

5.3 Conclusions

The findings showed that the selected public health facilities had experienced better waste management; and increased number of clients served. This leads to the conclusion that public health facilities in Kisumu County have experienced improved waste management; as well as an increase in the number of clients. This may be accrued to the reduced GDP per capita which has reduced the capacity of the residents of Kisumu to pay for private health care. However, the facilities had experienced increased costs such as storage and handling costs; increased lead time of supplies delivery; poor efficiency in resource management; reduced efficiency of service delivery; and reduced service delivery. This leads to the conclusion that public health facilities in Kisumu County have poor service delivery and high costs of operations. This indicates that the public health facilities in Kisumu County are performing poorly.

From the model summary, ABC, EOQ and JIT showed a strong relationship (90.2%) with the performance. This study, hence, concludes that inventory management techniques have a strong relationship with performance of public health facilities in Kisumu County.

The findings further showed that ABC, EOQ and JIT contributed 81.4% to performance of public health facilities in Kisumu County. This leads to the conclusion that inventory management techniques (ABC, EOQ and JIT) are the major factors influencing performance of the public health facilities in Kisumu County. Overall, inventory management practices significantly positively impact operational performance in public health facilities.

5.3.1 Impact of ABC systems on operational performance of public health facilities

From the findings, the research concludes that majority of the public health facilities in Kisumu County use ABC systems for inventory management to a great extent. The study also concludes that majority of the public health facilities in Kisumu have implemented the ABC system for less than seven years. The study also concludes that ABC method has increased efficiency in resource management among public health facilities in Kisumu County. The study also concludes that ABC systems are important to public health facilities in Kisumu County in that it enables them reduce holding costs; eliminate wastes; and increase the number of patients visiting the facilities.

The regression analysis showed that ABC had a positive and significant regression coefficient against performance. This leads to the conclusion that ABC system has a positive effect on the performance of public health facilities in Kisumu County. This means that when the public health facilities increase the use of ABC, they experience improved performance.

5.3.2 Impact of Economic Order Quantity on operational performance of public health facilities

In the second objective, the research aimed at examining the influence of Economic Order Quantity on the performance of public health facilities in Kisumu County. From the findings, the study concludes that public health facilities in Kisumu County use Economic Order Quantity as an inventory management technique to a little extent. The study further concludes that public health facilities in Kisumu have implemented EOQ technique as an inventory management technique for less than 9 years. Further, the study concludes that adoption of EOQ has ensured uninterrupted operations among public health facilities in Kisumu County.

The study also concludes that EOQ eliminates stock outs and wastes associated with obsolescence and expiry of supplies within public health facilities in Kisumu County. The study also concludes that EOQ reduces holding costs, and increases efficiency in resource management. The regression analysis showed that EOQ had a positive and significant regression coefficient with performance. This leads to the conclusion that EOQ technique has a positive effect on the performance of public health facilities in Kisumu County.

5.3.3 Impact of Just in Time Technique on operational performance of public health facilities

In the third objective, the researcher sought to investigate the influence of Just in Time on the performance of public health facilities in Kisumu County. The study concludes that majority public health organizations in Kisumu County use Just in Time as an inventory

management technique to a great extent. Public health organizations in Kisumu County have used JIT technique for less than 9 years. From the descriptive statistics, the study concludes that the use of JIT among public health organizations in Kisumu County eliminates wastes associated with obsolescence and expiry of supplies. The study further concludes that JIT improves the delivery time of supplies; reduces storage and handling costs; reduces lead time of supplies delivery; and improved efficiency in resource management.

The study concludes that JIT leads to improved waste management; improved efficiency of service delivery; increased the number of clients; and improved service delivery while avoiding disrupted operations through stock outs among public health organizations in Kisumu County. Regression analysis showed that JIT had a positive and significant regression coefficient against performance. This study, hence, concludes that JIT has a positive effect on the performance of public health organizations in Kisumu County. This means that increased adoption of JIT among public health organizations in Kisumu County would lead to improved operational performance.

5.2.4 Impact of government policy on the inventory management techniques and operational performance of public health facilities

The study established that the coefficients for the covariate (government policy) were not statistically significant ($p>.05$) indicating that government policy does not have a significant effect on the relationship between inventory management techniques and performance. The finding of this study is not conclusive because the significance score was too high indicating the need for further studies.

5.4 Recommendations

The study found that ABC technique was adopted by majority of the public health facilities in Kisumu County. However, a substantial number of the facilities have implemented the ABC technique in their inventory management to a little extent. From the descriptive statistics, the research indicates that ABC is effective in inventory management among firms. This study recommends that public health facilities in Kisumu County ensure that they implement the ABC technique fully for them to reap the benefits of the system.

The study deduces that adoption of EOQ has ensured uninterrupted operations among public health facilities in Kisumu County. The study concludes that EOQ has a positive influence on performance of public health organizations in Kisumu County. Hence, this study recommends that public health facilities in Kisumu County increase the usage of EOQ in inventory management. This would in turn reduce costs, improve service delivery and enhance resource management hence improved performance.

The study concludes that JIT has a positive influence on performance of public health organizations in Kisumu County. This study recommends that public health organizations in Kisumu County increase the usage of JIT for inventory management. This would reduce inventory costs and lead time which would improve their performance. The adoption of JIT would also enhance resource management and increase efficiency in the organizational operations. Finally, the public health facilities in Kisumu County should enhance their use of inventory management practices to improve operational performance.

5.5 Suggestions for Future Studies

The study found that inventory management techniques contributed 81.4% on the performance of public health facilities in Kisumu County. This study recommends a similar study based on other factors that contributed to 18.6% of the change in performance of public health facilities in Kisumu County. The study was based on public health facilities. Similar research is recommended based on private health facilities within Kisumu County. The study was based in in Kisumu County. A similar study is recommended based in other counties like Wajir for comparison of results.

REFERENCES

Agada, P. O., & Ogwuche, E. H. (2017). A probabilistic economic order quantity (EOQ) model for inventory management of drugs and hospital consumables. *FUW Trends in Science and Technology Journal*, *2*(2), 737-742.

Ahmed, H. A., Kheder, S. I., & Awad, M. M. (2019). Pharmaceutical inventory control in Sudan central and hospital stores using ABC-VEN analysis. *Glob Drugs Therap*, *4*, 1-4.

Anand, T., Ingle, G. K., Kishore, J., & Kumar, R. (2013). ABC-VED Analysis of a Drug Store in the Department of Community Medicine of a Medical College in Delhi. *Indian journal of pharmaceutical sciences*, *75*(1), 113–117. https://doi.org/10.4103/0250-474X.113543

Aradhye, A. S., & Kallurkar, S. P. (2014). A case study of just-in-time system in service industry. Procedia Engineering, 97, 2232-2237.

Atieno, O. M., Opanga, S., Martin, A., Kurdi, A., and Godman, B. (2018). Pilot study assessing the direct medical cost of treating patients with cancer in Kenya; findings and implications for the future. *J. Med. Econ.* 21, 878–887. doi: 10.1080/13696998.2018.1484372

Awad, H., Al-Zu'bi, Z. M., & Abdallah, A. B. (2016). A quantitative analysis of the causes of drug shortages in Jordan: A supply chain perspective. International Business Research, 9(6), 53–53.

Baheshti, H., (2012). A Decision Support System for Improving Performance of Inventory Management in Supply Chain Network: *International Journal of Productivity and Performance Management 59, 452-461*

Balkhi, B., Alshahrani, A., & Khan, A. (2022). Just-in-time approach in healthcare inventory management: Does it really work? *Saudi Pharmaceutical Journal*. https://doi.org/10.1016/j.jsps.2022.10.013

Baron, O.,Berman, O., & Perry, D., (2010). Shelf space management when demand depends on the inventory level production and operations management. *Production and operations management society, 1, (1) 1 – 13.*

Beamon, B. & Kotleba, S, (1999) Inventory Modelling for Complex Emergencies In Humanitarian Relief Operations: *International Journal Of Logistics: Research And Applications, 9, 1-18*

Becerril-Montekiou, Reyes. J. D. D, & Manuel A. (2011). The Health System of Chile. *Salud Publica Mex*, 53(2)

Berry K. & Whybark, D. (1992) Inventory Management: Is There a Knock-On-Effects. *International Journal of Production-Economics, 43, 94,129-138.*

Bloomberg, G., Lemay M., & Hanne J. (2012). Logistics Supper Saddle River: Prentice Hall

Brigham, E & Enhard G. (2005). International Financial Management. New York: Dryden Press

Bryman & Bell (2011). *Business Research Methods*. (3rd edition).

Burgess N, & Radnor Z. (2013). Evaluating Lean in healthcare. *Int J Health Care Qual Assur.* 26 (3), 220–235. http//doi: 10.1108/09526861311311418.

Burgess, N., & Radnor, Z. (2013). Evaluating Lean in healthcare. *International journal of health care quality assurance*, *26*(3), 220–235. https://doi.org/10.1108/09526861311311418

Campbell, R. J. (2009). Thinking lean in healthcare. *Journal of AHIMA*, *80*(6), 40-43.

Chen, H., Frank, M. Z., & Wu, O. Q. (2005). What actually happened to the inventories of American companies between 1981 and 2000?. *Management science*, *51*(7), 1015-1031.

Chong, A.Y.L., Liu, M.J., Luo, J. & Keng-Boon, O. (2015). Predicting RFID adoption in healthcare supply chain from the perspectives of users, *International Journal of Production Economics*, 159(1), 66-75.

Cooper, D.R & Schindler,P.S.,(2006) Business Research Methods. (9th Edition). Tata McGraw New Delhi India.

Coyle, J., Bardi, E., & Langley, J. L.(2003). The Management Of Business Logistics: A Supply Chain Perspective. Canada. Thomsom South-West.

Croom, S. & Jones, A. (2010). E-procurement: Key Issues in inventory control implementation and operation in the Public Sector.

De Vries, J. (2011). The shaping of inventory systems in health services: A stakeholder analysis. *International Journal of Production Economics*, *133*(1), 60-69. https://doi.org/10.1016/j.ijpe.2009.10.029

Dewi, E. K., Dahlui, M., Chalidyanto, D., & Rochmah, T. N. (2020). Achieving cost-efficient management of drug supply via economic order quantity and minimum-maximum stock level. *Expert Review of pharmacoeconomics & outcomes research*, *20*(3), 289-294.

Dewi, E. K., Dahlui, M., Chalidyanto, D., & Rochmah, T. N. (2019). Achieving cost-efficient management of drug supply via economic order quantity and minimum-maximum stock level. *Expert Review of Pharmacoeconomics & Outcomes Research*, *20*(3), 289-294. https://doi.org/10.1080/14737167.2019.1633308

Dwivedi, S., Kumar, A. & Kothiyal, P. (2012). Inventory management: A tool of identifying items that need greater attention for control. *The Pharma Innovation*, *1*(), 125.

Elbireer, S., Guwatudde, D., Mudiope, P., Nabbuye-Sekandi, J., & Manabe, Y. C. (2011). Tuberculosis treatment default among HIV-TB Co-infected patients in urban Uganda. *Tropical Medicine & International Health*, *16*(8), 981-987. https://doi.org/10.1111/j.1365-3156.2011.02800.x

Eruglu, C. (2011). Consumer Driven Retail Operations. The Moderating Effect of Consumer Demand and Case Pack Quantity. *International Journal of Physical Distribution and Logistics Management, 41 (5), 420-434*

Escamilla, R., Fransoo, J. C., & Tang, C. S. (2020). Improving agility, adaptability, alignment, accessibility, and affordability in Nanostore supply chains. *Production and Operations Management*, *30*(3), 676-688. https://doi.org/10.1111/poms.13309

Fine, B. A., Golden, B., Hannam, R., & Morra, D. (2009). Leading Lean: a Canadian healthcare leader's guide. *Healthcare quarterly (Toronto, Ont.)*, *12*(3), 32–41. https://doi.org/10.12927/hcq.2013.20877

Franco, E.,& Rubha, S., (2017) an Overview about JIT (Just-In-Time)-Inventory Management System; *International Journal of Research* 5 (4).

Frankel, J. R, & Wallen, N.E. (2006). *How to design and evaluate research in education,* New York, McGraw- Hill.

Gatwiri, K.R. (2018). Inventory Management Practices and Operational Performance of Government Hospitals in Kenya. Unpublished Research Project Submitted in Partial Fulfilment of the Requirement For Award Of The Degree Of Master Of Business Administration, School Of Business, University of Nairobi, Kenya.

George, S., & Elrashid, S. (2023). Inventory management and pharmaceutical supply chain performance of hospital pharmacies in Bahrain: A structural equation modeling approach. *SAGE Open*, *13*(1), 215824402211497. https://doi.org/10.1177/21582440221149717

Gunpinar, S., & Centeno, G. (2015). Stochastic integer programming models for reducing wastages and shortages of blood products at hospitals. *Computers & Operations Research*, *54*, 129-141. https://doi.org/10.1016/j.cor.2014.08.017

Gupta, A. K. (2012). JIT in healthcare: an integrated approach. *International Journal of Advances in Management and Economics*, *1*(1), 20-27.

Gupta,S, (2001) Effective Inventory Visibility: Its Impact On Profitability: *International Indexed And Referred Research Journal 4,(39) 59-60*

Guris, R. J. D., Doshi, A., Boyer, D. L., Good, G., Gurnaney, H. G., Rosenblatt, S., ... & Wolfe, H. A. (2020). Just-in-time simulation to guide workflow design for coronavirus disease 2019 difficult airway management. *Pediatric Critical Care Medicine*, *21*(8), e485.

Gurumurthy, A., Nair, V. K., & Vinodh, S. (2021). Application of a hybrid selective inventory control technique in a hospital: a precursor for inventory reduction through lean thinking. *Tqm Journal*, *33*(3), 568–595. https://doi.org/10.1108/TQM-06-2020-0123

Health Access International. (2018). Prices & availability of locally produced & imported medicines in Kenya. Technical report, Health Access International, Amsterdam. http://scholar.google.com/scholar?hl=en&q=+Health+Access+International.+2018.+Prices+%26+availability+of+locally+produced+%26+imported+medicines+in+Kenya.+Technical+report%2C+Health+Access+International%2C+Amsterdam.

Health Sector Performance Report. (2017). *Annual Operational Plan 4*

Hermann, D. (2008). Are inventory benchmarks really useful? *Healthcare Purchasing News*, *32*(11), 66–66.

Higgo, M. R., Grobbelaar, S. S., & Van Eeden, J. (2018). Hospital inventory management: a systematic review of the literature.

Jobira, T., Abuye, H., Jemal, A., & Gudeta, T. (2021). Evaluation of pharmaceuticals inventory management in selected health facilities of West Arsi Zone, Oromia, Ethiopia. *Integrated pharmacy research & practice*, *10*, 1. https://doi.org/10.2147%2FIPRP.S298660

Jonrinaldi, Primadi, M. Y., & Hadiguna, R. A. (2017). A joint inventory policy under permissible delay in payment and stochastic demand (Case study: Pharmacy Department of Pariaman Hospital). In *AIP Conference Proceedings* 1902(1), 020002. AIP Publishing LLC.

Kang'a, S., Puttkammer, N., Wanyee, S., Kimanga, D., Madrano, J., Muthee, V., ... & Lober, W. B. (2017). A national standards-based assessment on functionality of electronic medical records systems used in Kenyan Public-Sector health facilities. *International journal of medical informatics*, *97*, 68-75.

Karamshetty, V., De Vries, H., Van Wassenhove, L. N., Dewilde, S., Minnaard, W., Ongarora, D., Abuga, K., & Yadav, P. (2021). Inventory management practices in private healthcare facilities in Nairobi County. *Production and Operations Management*, *31*(2), 828-846. https://doi.org/10.1111/poms.13445

Kaswan, M. S., Rathi, R., Singh, M., Garza-Reyes, J. A., & Antony, J. (2021). Exploration and prioritization of just in time enablers for sustainable health care: An integrated GRA-fuzzy TOPSIS application. *World Journal of Engineering*, *19*(3), 402-417. https://doi.org/10.1108/wje-09-2020-0414

Kebede, O., & Tilahun, G. (2021). Inventory management performance for family planning, maternal and child health medicines in public health facilities of West Wollega zone, Ethiopia. *Journal of pharmaceutical policy and practice*, *14*(1), 20. https://doi.org/10.1186/s40545-021-00304-z

Kenyan Healthcare Sector Report. (2016). Opportunities for the Dutch Life Science and Health Sector.

Khalilpourazari, S., & Pasandideh, S. H. R. (2020). Multi-objective optimization of multi-item EOQ model with partial backordering and defective batches and stochastic constraints using MOWCA and MOGWO. *Operational Research*, *20*(3), 1729-1761.

Kinyua, D, M. (2016). *Inventory Management Practices and Performance of Consumer Goods Manufacturing Organizations In Nairobi, Kenya.* Unpublished Master of Business Administration Project, University of Nairobi, School of Business.

Kisumu County Integrated Development Plan 2013-2017. (2013). Kisumu County. Devolution Hub. Retrieved from https://www.devolutionhub.or.ke/resource/kisumu-county-integrated-development-plan-2013-2017

Kisumu County Integrated Development Plan II, 2018-2022. (2018). https://www.kisumu.go.ke/wp-content/uploads/2018/11/Kisumu-County-CIDP-II-2018-2022.pdf

Kivoto, P. M., Mulaku, M., Ouma, C., Ferrario, A., Kurdi, A., Godman, B., & Oluka, M. (2018). Clinical and financial implications of medicine consumption patterns at a leading referral hospital in Kenya to guide future planning of care. *Frontiers in Pharmacology*, *9*. https://doi.org/10.3389/fphar.2018.01348

Knight A. (2003). *Making TOC the main way of managing the health system*. TOCICO Upgrade Conference, Cambridge. Retrieved on October 25, 2022 from https://scholar.google.com/scholar_lookup?title=Making+TOC+the+main+way+of+managing+the+health+system&author=A.+Knight&publication_year=2003&

Kootanaee, A.J., Nagendre,B. & Hamidreza,F.T. (2013) Just In Time Manufacturing System: Fun Introduction to implementation. *International Journal of Economics, Business & Finance*,1 (2), 07-24

Korir, K. G., Kaitany, P., & Sang, H. (2021). Economic Order Quantity Stock Control Technique and Performance of Selected Level Five Hospitals: An Evidence of Kenya. *International Journal of Business Marketing and Management*. 6(6), 8(13)

Kumar R. (2016) Economic Order Quantity Model. *Global Journal of Finance and Economic Management*, 5 (1), 1 – 5.

Kwak, N. K., Durbin, E., & Stanley, D. (1991). An inventory model for optimizing purchasing of intravenous fluids for hospitals: A case study. *Journal of medical systems*, *15*(2), 171-181.

Legese, N., Teshome, D., & Gedif, T. (2022). Inventory Management of Health Commodities in a Tertiary Teaching Hospital in Ethiopia. *Frontiers in pharmacology*, *13*, 763909. https://doi.org/10.3389/fphar.2022.763909

Linhares, A. (2009). Theory of constraints and the combinatorial complexity of the product-mix decision. *International Journal of Production Economics*, *121*(1), 121-129.

Luthubua, D,M. (2014). Supplier Base Rationalization Practices and Supply Chain Performance of Large Manufacturing Organizations in Nairobi, Kenya. Unpublished Dissertation, University of Nairobi

Lwiki T., Ojera, P.B., Mugenda,N.G. & Wachira, V.K. (2013) The impact of Inventory management practices on financial performance of sugar manufacturing organizations in Kenya. *International Journal of Business, Humanities and Technology*, 3 (5), 75 -85

Lyson, K. & Farrington,B (2006). *Purchasing and Supply Chain Management (7th Ed.).* New Jersey: Prentice Hall. London.

M'Hallah, R., Benkherouf, L., & Al-Kandari, A. (2020). Optimal inventory policies for a two-dimensional stochastic inventory model: A numerical investigation. *Computers & Operations Research*, *119*, 104939.

Mahatme, M. S., Hiware, S. K., Shinde, A. T., Salve, A. M., & Dakhale, G. N. (2012). Medical store management: An integrated economic analysis of a Tertiary Care Hospital in Central India. *Journal of Young Pharmacists*, *4*(2), 114-118.

Makafuli R.A. (2015). Assessing the impact of efficient inventory management in an organization. *International journal of advanced research in computer science and software engineering* 5 (8), 86-103.

Makori, J. K., & Muturi, W. (2018). Influence of Inventory Management Practices on Performance of Procurement Function in Health Institutions in Kenya. A Survey of Selected Public Health Institutions in Western Kenya. *International Journal of Social Sciences and Information Technology*, *4*(10).

Management Sciences for Health (2012). *Managing Medicines Selection. In Managing Access to Medicines and Health Technologies*. 6. 1–16.15. https://scholar.google.com/scholar_lookup?title=Managing+Medicines+Selection.+In+Managing+Access+to+Medicines+and+Health+Technologies&publication_year=2012&

Manhas Anil, K., Aubid, M., Haroon, R., Sheikh Mushtaq, A., & Syed, A. T. (2012). Analysis of inventory of drug and pharmacy department of a tertiary care hospital. *Analysis*, *25*(3), 183.

Mbiriri, E. & Moronge, M. (2018). Influence of Inventory Management Systems on Service Delivery in Public health facilities in Nairobi City County, Kenya. *The strategic journal of Business and Change Management*, 5(2),1885-1907

Milicevic, N., Davidovic, M. & Stefanovic M. (2012) Financial Effectson Inventory Management in Trading Companies– EOQ Model. *Economic and Organization, 9 (4), 507 – 519.*

Ministry of Health Kenya. (2014). *Kenya health policy 2014-2030*, Ministry of Health, Nairobi

Moses, M. W., Korir, J., Zeng, W., Musiega, A., Oyasi, J., Lu, R., Chuma, J., & Di Giorgio, L. (2021). Performance assessment of the county healthcare systems in Kenya: a mixed-methods analysis. *BMJ global health*, *6*(6), e004707. https://doi.org/10.1136/bmjgh-2020-004707

Mugenda, O. & Mugenda A., (2003). *Research Methods: Quantitative and Qualitative Approach*. ACTS Press, Nairobi, Kenya.

Muhanyimana, V., (2015) Inventory Management Techniques and Its Contribution on Better Management on Manufacturing Companies in Rwanda: A Case Study of Sulfo Rwanda Ltd. *European Journal of Academic Essays, 2 (6), 49-58.*

Muhia, J., Waithera, L., & Songole, R. (2017). Factors affecting the procurement of pharmaceutical drugs: A case study of Narok County referral hospital, Kenya. *Medical & Clinical Reviews*, *03*(04). https://doi.org/10.21767/2471-299x.1000061

Muhindo, C., & Rwakihembo, J. (2021). Inventory management and financial performance of private hospitals: A positivist evidence from Western Uganda. *International Journal of Business Strategies*, *6*(1), 24-34.

Muiruri, C. (2017). *Factors influencing availability of essential medicines in public health facilities in Kenya: A case of Embu County* (Doctoral dissertation, University of Nairobi). http://hdl.handle.net/11295/101916

Murphy J, Yemen S. (1986). Computer-assisted inventory control utilizing ABC inventory analysis and EOQ in a hospital pharmacy. *Can J Hosp Pharm*. 39, 159–163.

Mwangangi, P.W., Guyo,W., & Erasa, R., (2015) influence of inventory management on performance of manufacturing organizations in Kenya. *International journal of logistics and management, 2 (1), 23-44*

Nabbuye-Sekandi J., Makumbi F. E., Kasangaki A., Kizza I. B., Tugumisirize J., Nshimye E. (2011). Patient Satisfaction with Services in Outpatient Clinics at Mulago Hospital, Uganda. *Int. J. Qual. Health Care* 23 (5), 516–523. 10.1093/intqhc/mzr040

Nasution, S. L. R., Asthariq, M., & Girsang, E. (2022). Analysis of the Implementation of Drug Inventory Control with the Always Better Control-Economic Order Quantity-Reorder Point-Safety Stock Method. *Open Access Macedonian Journal of Medical Sciences*, *10*(A), 1397-1401.

Navarro, V., Parker, R., & White, K. L. (1970). A stochastic and deterministic model of medical care utilization. *Health services research*, *5*(4), 342–357.

Nguyen, T. A., Knight, R., Roughead, E. E., Brooks, G., and Mant, A. (2015). Policy options for pharmaceutical pricing and purchasing: issues for low- and middle-income countries. *Health Policy Plan* 30, 267–280. doi: 10.1093/heapol/czt105

Njoroge, M. W. (2015). Inventory management practices and performance of public hospitals in Kenya (Doctoral dissertation, University of Nairobi).

Nopiana, A. N. (2021). Analysis of Cardiovascular Drugs Inventory Control Using ABC-EOQ-ROP-SS Method at Jakarta Islamic Hospital. *Journal: JMMR (Jurnal Medicoeticolegal dan Manajemen Rumah Sakit)*, *9*(3), 237-247.

Noreen, E., Smith, D., & Mackey, J. T. (1995). *Theory of constraints and its implications for management accounting: A report on the actual implementation of the theory of constraints*. North River Press, Incorporated.

Oballa, D., Waiganjo, E. and Wachiuri, (2015) Effects of Inventory Management Practices on Organizational Performance In Public Health Institutions In Kenya: A Case Study Of Kenyatta National Hospital. *International Journal of Education and Research,* 13 (3), 704 – 714.

Odhiambo, M. O., & Kihara, A. N. (2018). Effect of inventory management practices on supply chain performance of government health facilities in Kisumu county in Kenya. *Journal of International Business, Innovation and Strategic Management, 2*(2), 145-166.

Office of the Auditor General, (2012) Performance Audit Report of the Auditor General Specialized Health Care Delivery at Kenyatta National Hospital

O'Neill, B., & Sanni, S. (2018). Profit optimisation for deterministic inventory systems with linear cost. *Computers & Industrial Engineering*, *122*, 303-317.

Onkundi, E. H. & Bichanga, W., O. (2016). Factors influencing inventory management performance in government health sector in Kisii County. European journal of business and management , *8(2), 89-123*

Onyango, J. O. (2021). Influence of inventory management techniques on the performance of public health hospitals in Kisumu County, Kenya. *International Journal of Research in Social Science*. 11(05) 117-126

Parilla, E., Evangelista, J., Aurelio, R., & Bullalayao, C. (2022). Inventory management practices and service delivery of healthcare facilities in Ilocos Norte Philippines. *Logistic and Operation Management Research (LOMR), 1*(1), 16-33. https://doi.org/10.31098/lomr.v1i1.919

Powney, J., & Watts, M. (2018). *Interviewing in educational research.* Routledge.

Public Procurement Oversight Authority (2012,2015) (Public Procurement and Disposal Mannual).

Uthayakumar, R., & Priyan, S. (2013). Pharmaceutical supply chain and inventory management strategies: Optimisation for a pharmaceutical company and a

hospital. *Operations Research for Health Care*, *2*(3), 52-64. https://doi.org/10.1016/j.orhc.2013.08.001

Ragazzoni, L., Barco, A., Echeverri, L., Conti, A., Linty, M., Caviglia, M., Merlo, F., Martini, D., Pirisi, A., Weinstein, E., Barone-Adesi, F., & Della Corte, F. (2021). Just-in-Time training in a tertiary referral hospital during the COVID-19 pandemic in Italy. *Academic Medicine*, *96*(3), 336-339. https://doi.org/10.1097/acm.0000000000003575

Rahman, S. U. (1998). Theory of constraints: a review of the philosophy and its applications. *International journal of operations & production management*. 18 (4), 336–355

Rathi,R., Khanduja, D., & Sharma, S.K. (2016), Afuzzy MADMapproach forproject selection: a six sigma case study, *Decision Science Letters*, 5(2), 255-268.

Salari, P., Di Giorgio, L., Ilinca, S., & Chuma, J. (2019). The catastrophic and impoverishing effects of out-of-pocket healthcare payments in Kenya, 2018. *BMJ global health*, *4*(6), e001809.

Sanders,M., Lewis, P., & Thornbill, A., (2009). *Research methods for Business Students.* (5th edition). England; Prentice Hall.

Schwarz L.B. (2008). *The Economic Order Quantity (EOQ) Model.* Purde University. Selected Flour Mill Companies In Nigeria. Unpublished Thesis Dissertation Submitted in Partial Fulfilment of the Requirement For Award Of The Degree Of Doctorate OfPhilosophy, School Of Management Sciences, Babcock University, Nigeria

Sharma, J, K. (2009). *Operations Research: Theory of Applications.* (4th Edition). India. Macmillan Publishers.

Siddiqui, A. A. (2022). The importance of just in time (JIT) methodology and its advantages in health care quality management business – A scoping review. *Biomedical Journal of Scientific & Technical Research*, *42*(1). https://doi.org/10.26717/bjstr.2022.42.006701

Singh, R. & Kaur, G., (2010). Strategy Development for Competitiveness; A Study on Indian Auto Company Sector: I*nternational Journal Productivity and Performance Management, 56 (4), 285 - 304*

Smith, G., Poteat-Godwin, A., Harrison, L. M., & Randolph, G. D. (2012). Applying Lean principles and Kaizen rapid improvement events in public health practice. *Journal of public health management and practice: JPHMP*, *18*(1), 52–54. https://doi.org/10.1097/PHH.0b013e31823f57c0

Sople, V., (2010). *Logistics Management*. (2nd Edition). New Delhi: Dorling Kindersley

Soraya, C., Surwanti, A., & Pribadi, F. (2022). Drug Inventory Management Using ABC-VEN and EOQ Analysis for Improving Hospital Efficiency. *Jurnal Aisyah: Jurnal Ilmu Kesehatan*, *7*(1), 373-382.

Sporta, F., (2018). Effects of Inventory Control Techniques on Organization's Performance: A Case Study at Kenya Medical Supplies Agency: *International Journal of Business and Management 6, (3): 62*

Steyn, H. (2001). An investigation into the fundamentals of critical chain project scheduling. *International journal of project management*, *19*(6), 363-369.

Stopková, M., Stopka, O., & Ľupták, V. (2019). Inventory model design by implementing new parameters into the deterministic model objective function to streamline effectiveness indicators of the inventory management. *Sustainability*, *11*(15), 4175.

Tersine, R., (1982) *Principle of Inventory and Material Management.* (2nd Edition). North Holland: McGraw.

The Constitution of Kenya. (2010). Kenya Law. Retrieved on October 25, 2022 from http://kenyalaw.org/kl/index.php?id=398

Theory of Constraints Institute. (2019). Theory of ConstraintInstitute. https://www.tocinstitute.org/theory-of-constraints_A_Literature_Review

Thomas, A. A., Uspal, N. G., Oron, A. P., & Klein, E. J. (2016). Perceptions on the impact of a just-in-time room on trainees and supervising physicians in a pediatric emergency department. *Journal of graduate medical education*, *8*(5), 754-758.

Tosun, J., & Leininger, J. (2017). Governing the Interlinkages between the sustainable development goals: Approaches to attain policy integration. *Global Challenges*, *1*(9), 1700036. https://doi.org/10.1002/gch2.201700036

Trietsch, D. (2005). From Management by Constraints (MBC) to Management By Criticalities (MBC II). *Human Systems Management*, 24(1), 105–115.

Tungo, E,M. (2014) .The Influence Of Inventory Management Practices On Organizational Financial Performance: Case Study of National Microfinance Bank Headquarters Dar Es Salaam. *Unpublished Thesis Dissertation Submitted in Partial Fulfilment of The Requirement For Award Of The Degree of Master of Science In Procurement And Supply Chain Management, Mzumble University, Dar Es Salaam.*

Ulhassan, W., Sandahl, C., Westerlund, H., Henriksson, P., Bennermo, M., von Thiele Schwarz, U., & Thor, J. (2013). Antecedents and characteristics of lean thinking implementation in a Swedish hospital: a case study. *Quality management in health care*, *22*(1), 48–61. https://doi.org/10.1097/QMH.0b013e31827dec5a

Umble M., & Umble E. J. (2006). Utilizing buffer management to improve performance in a healthcare environment. *European Journal of Operational Research*, 174, 1060–1075. http://doi:10.1016/j.ejor.2005.02.059

Van Donselaar, K. H., Gaur, V., Van Woensel, T., Broekmeulen, R. A., & Fransoo, J. C. (2010). Ordering behavior in retail stores and implications for automated replenishment. *Management Science*, *56*(5), 766-784. https://doi.org/10.1287/mnsc.1090.1141

VanDerLinde L. P. (1983). System to maximize inventory performance in a small hospital. *Am J Health Syst Pharm*. 40, 70–73.

Wacker, J. & Sprague, L. Macroeconomics Analyses of Inventories: Leading From Practice: *International Journal of Production Economics.* 45 (3).

Wahab, A. N. A., Mukhtar, M., & Sulaiman, R. (2013). A conceptual model of lean manufacturing dimensions. *Procedia Technology*, *11*, 1292-1298.

Wangu, M. M., Osuga. B. O. (2014). Availability of essential medicines in public hospitals: A study of selected public hospitals in Nakuru County, Kenya. *African Journal of Pharmacy and Pharmacology*, *8*(17), 438-442. https://doi.org/10.5897/ajpp2014.4000

Weiss, D. J., Lucas, T. C., Nguyen, M., Nandi, A. K., Bisanzio, D., Battle, K. E., Cameron, E., Twohig, K. A., Pfeffer, D. A., Rozier, J. A., Gibson, H. S., Rao, P. C., Casey, D., Bertozzi-Villa, A., Collins, E. L., Dalrymple, U., Gray, N., Harris, J. R., Howes, R. E., … Gething, P. W. (2019). Mapping the global

prevalence, incidence, and mortality of plasmodium falciparum, 2000–17: A spatial and temporal modelling study. *The Lancet, 394*(10195), 322-331. https://doi.org/10.1016/s0140-6736(19)31097-9

Weller, M. & Tangari, D., (2008) Vendor Managed Inventory in the Retail SupplyChain, *Journal of Business and Logistics, 20 (1)*

World Health Organisation. (2013). *Global action plan for the prevention and control of noncommunicable diseases 2013–2020*. Retrieved on October, 25, 2022 http://scholar.google.com/scholar?hl=en&q=+WHO.+2013.+Global+action+plan+for+the+prevention+and+control+of+noncommunicable+diseases+2013%E2%80%932020.

World Health Organization. (2010). *Health systems financing: the path to universal coverage*.

World Health Organization. (2017). *World Bank and WHO: Half the World Lacks Access to Essential Health Services, 100 Million Still Pushed into Extreme Poverty Because of Health Expenses*. Retrieved from October 25, 2022 from https://www.who.int/news/item/13-12-2017-world-bank-and-who-half-the-world-lacks-access-to-essential-health-services-100-million-still-pushed-into-extreme-poverty-because-of-health-expenses .

World Health Organization. (2019). *Global Spending on Health: A World in Transition 2019*. Available from: https://creativecommons.org/licenses/by-nc-sa/3.0/igo.

Xue, W., Caliskan Demirag, O., Chen, F. Y., & Yang, Y. (2017). Managing retail shelf and backroom inventories when demand depends on the shelf-stock level. *Production and Operations Management, 26*(9), 1685-1704. https://doi.org/10.1111/poms.12713

Yamane, T. (1967). *Statistics, An Introductory Analysis.* (2nd Ed.). New York: Harper and Row.

Yin, R. K., (2003). Case Study Research: Design and Methodology. (3rd edition). Thousands Oaks: Sage Publications.

Zikmund, W.G. (2003). *Business Research Methods.* USA: Thomson South – Western.

Ziukov, S. (2016) A literature review on models of inventory management under uncertainty. *Business System and Economics, 5 (1), 26 - 35*

APPENDICES

Appendix I: Introductory Letter

John Omondi Onyango,

P.O.Box 23248-00100,

Nairobi.

Phone: 0724-716098,

Email: omondijohn66@yahoo.com

16th April 2022.

Dear Sir/Madam,

RE: DATA COLLECTION FOR MASTERS THESIS

The above subject matter refers.

I am a student at Jaramogi Oginga Odinga University of Science and Technology, school of Business and Economics pursuing a master degree program in Business Administration (MBA) in Supply Chain Management. As part of course requirement, I am presently undertaking a research project entitled **"Influence of Inventory Management Techniques on the Performance of Public health facilities in Kisumu County, Kenya."** Kindly be informed that you have been selected to provide information beneficial to this study.

For any correspondence, please feel free to contact me on the address provided above. Kindly looking forward to your cooperation.

Yours faithfully,

John Omondi Onyango.

Appendix 2: Participant Consent Form

Dear respondent,

I am **John Omondi Onyango**, undertaking a **Master In Business Administration (Supply Chain Management),** from **Jaramogi Oginga Odinga University Of Science And Technology**. I am doing research on "**The Influence Of Inventory Management Techniques On The Performance Of Public Health Facilities In Kisumu County"**.

Kindly answer all questions without consulting others. There is no right or wrong answers and your honesty is of great value to the researcher. Your participation is completely voluntary and you have the right of withdrawal from participation at any level of filling the questionnaire.

Do not write any personal identification on the questionnaire. The responses you give will remain confidential and anonymous. All respondents' forms are coded and your response will not be used to identify you. The information provided even if published will not be used to identify you in any way and hence anonymity is assured.

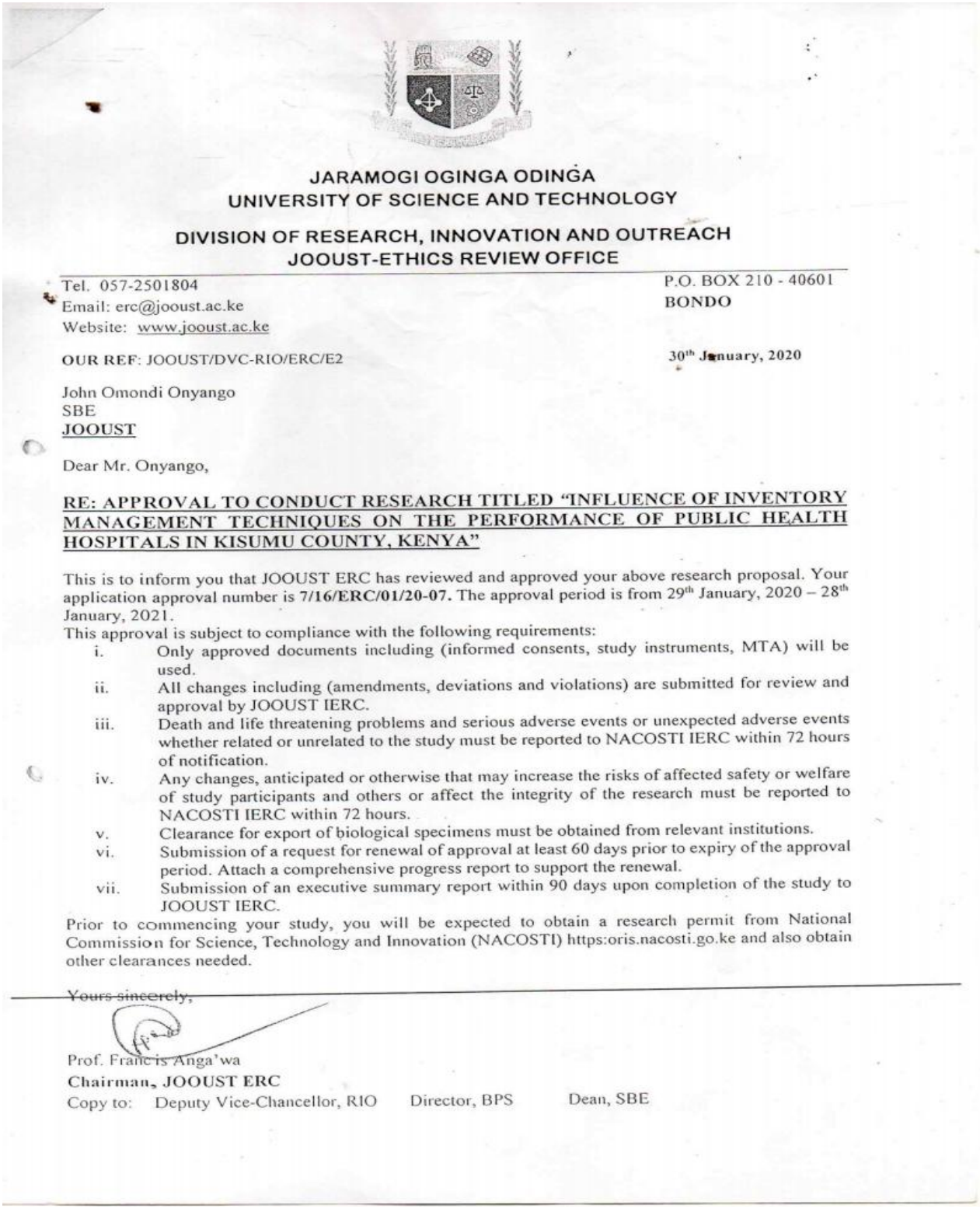
CONSENT

I have read and I understand the provided information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I voluntarily agree to take part in this study.

Participant's Signature _____Date _____

Researcher's Signature _____Date _____

Appendix 3: Research Approval By Ethics Review Office



JARAMOGI OGINGA ODINGA
UNIVERSITY OF SCIENCE AND TECHNOLOGY

DIVISION OF RESEARCH, INNOVATION AND OUTREACH
JOOUST-ETHICS REVIEW OFFICE

Tel. 057-2501804
Email: erc@jooust.ac.ke
Website: www.jooust.ac.ke

P.O. BOX 210 - 40601
BONDO

OUR REF: JOOUST/DVC-RIO/ERC/E2

30th January, 2020

John Omondi Onyango
SBE
JOOUST

Dear Mr. Onyango,

RE: APPROVAL TO CONDUCT RESEARCH TITLED "INFLUENCE OF INVENTORY MANAGEMENT TECHNIQUES ON THE PERFORMANCE OF PUBLIC HEALTH HOSPITALS IN KISUMU COUNTY, KENYA"

This is to inform you that JOOUST ERC has reviewed and approved your above research proposal. Your application approval number is **7/16/ERC/01/20-07.** The approval period is from 29th January, 2020 – 28th January, 2021.

This approval is subject to compliance with the following requirements:

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

Prior to commencing your study, you will be expected to obtain a research permit from National Commission for Science, Technology and Innovation (NACOSTI) https:oris.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

Prof. Francis Anga'wa
Chairman, JOOUST ERC
Copy to: Deputy Vice-Chancellor, RIO Director, BPS Dean, SBE

Appendix 4: Authorization letter from the Board of Post Graduate

JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE & TECHNOLOGY

BOARD OF POSTGRADUATE STUDIES

Office of the Director

Tel. 057-2501804
Email: bps@jooust.ac.ke

P.O. BOX 210 - 40601
BONDO

Our Ref: B151/4144/2017

Date: 6th December 2019

TO WHOM IT MAY CONCERN

RE: JOHN OMONDI ONYANGO – B151/4144/2017

The above person is a bona fide postgraduate student of Jaramogi Oginga Odinga University of Science and Technology in the School of Business and Economics pursuing Master of Business Administration. He has been authorized by the University to undertake research on the topic: **"Influence of Inventory Management Techniques on the Performance of Public Health Hospitals in Kisumu County, Kenya."**

Any assistance accorded to his shall be appreciated.

Thank you.

Prof. Dennis Ochuodho
DIRECTOR, BOARD OF POSTGRADUATE STUDIES

Appendix 5: Research Permit-NACOSTI

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **221471**

Date of Issue: **20/July/2020**

RESEARCH LICENSE

This is to Certify that Mr.. john omondi onyango of Jaramogi Oginga Odinga University of Science and Technology, has been licensed to conduct research in Kisumu on the topic: influence of inventory management techniques on performance of public hospitals in kisumu -kenya for the period ending : 20/July/2021.

License No: **NACOSTI/P/20/4707**

221471

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 6: Research Questionnaire

SECTION A: DEMOGRAPHIC INFORMATION.

Please tick as appropriate

1. What is your age?

24 years and below [ ]

25-39 years [ ]

40-55 years [ ]

Above 55 years [ ]

2. What is your education level?

Certificate and below [ ]

Diploma [ ]

Bachelors [ ]

Postgraduate degree [ ]

3. How long have you worked in the hospital?

Below 1 year [ ]

1 year - 5 years [ ]

6 years – 10 years [ ]

Over 10 years [ ]

SECTION B: INVENTORY MANAGEMENT TECHNIQUES.

(A) ABC SYSTEM

4. Does this organization use ABC system as an inventory management technique??

Yes [ ]

No [ ]

Don't know [ ]

5. If your answer is YES, to what extent does your organization use the ABC system as an inventory management technique?

Very small extent [ ]

Small extent [ ]

Moderate extent [ ]

Large extent [ ]

Very large extent [ ]

6. How long has your organization implemented ABC systems?

1-3 years [ ]

4-6 years [ ]

7-9 years [ ]

over 9 years [ ]

7. Please indicate the extent of your agreement/disagreement with the statements regarding **ABC systems** and performance at your health facility.

Likert scale: 1. Strongly Disagree; 2. Disagree; 3. Neutral; 4 Agree; 5. Strongly Agree

Sno.	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	Using ABC method leads to efficient resource management					
2	Using ABC method reduces on holding costs					
3	Using ABC eliminates wastes associated with obsolescence and expiry of supplies					
4	Using ABC leads to increased number of clients served					

(B) ECONOMIC ORDER QUANTITY (EOQ) TECHNIQUE

8. Does this organization use Economic Order Quantity as an inventory management technique?

Yes [ ]

No [ ]

Don't know [ ]

9. If your answer is YES, to what extent does your organization use the economic order quantity as an inventory management technique?

Very small extent [ ]

Small extent [ ]

Moderate extent [ ]

Large extent [ ]

Very large extent [ ]

10. How long has your organization implemented EOQ technique as an inventory management technique?

1-3 years [ ]

4-6 years [ ]

7-9 years [ ]

over 9 years [ ]

11. Please indicate the extent of your agreement/disagreement with the statements regarding **Economic Order Quantity (EOQ)** technique and performance at your health facility. **Likert scale:** 1. Strongly Disagree; 2. Disagree; 3. Neutral ; 4 Agree ; 5. Strongly Agree

Sno.	**Statement**	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
1	The use of EOQ ensures uninterrupted operations					
2	The use of EOQ leads to obsolescence and expiry of items					
3	The use of EOQ eliminates stock outs					
4	EOQ leads to increased number of clients served					
5	EOQ eliminates wastes associated with obsolescence and expiry of supplies					
6	EOQ method reduces on holding costs					
7	EOQ method leads to efficient resource management					

(C) JUST IN TIME (JIT) TECHNIQUE

12. Does this organization use Just In Time as an inventory management technique?

Yes [ ]

No [ ]

Don’t know [ ]

13. If your answer is YES, to what extent does your organization use the Just In Time as an inventory management technique?

Very small extent [ ]

Small extent [ ]

Moderate extent [ ]

Large extent [ ]

Very large extent [ ]

14. How long has your organization implemented JIT technique?

1-3 years [ ]

4-6 years [ ]

7-9 years [ ]

over 9 years [ ]

15. Please indicate the extent of your agreement/disagreement with the statements regarding **Just In Time (JIT) technique** and performance at your health facility.

Likert scale: 1. Strongly Disagree; 2. Disagree; 3. Neutral; 4 Agree; 5. Strongly Agree

Sno.	**Statement**	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
s1	The use of JIT eliminates wastes associated with obsolescence and expiry of supplies					
2	Using JIT method disrupts operations due to stock outs					
3	JIT method improves the delivery time of supplies					
4	Use of JIT method reduces some costs such as storage and handling costs					
5	JIT method leads to efficient resource management					
6	JIT method leads to effective resource management					

SECTION C: PERFORMANCE OF PUBLIC HEALTH FACILITIES IN KISUMU COUNTY.

16. In a scale of 1 to 5, where 1 is strongly disagree, and 5 strongly agree, indicate your level of agreement or disagreement on the statements on performance of Public health facilities in Kisumu County, Kenya.

Likert scale: 1. Strongly Disagree; 2. Disagree; 3. Neutral; 4 Agree; 5. Strongly Agree

Sno.	**Statement**	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
1	reduces some costs such as storage and handling costs					
2	Reduces lead time of supplies delivery					
3	Improves efficiency in resource management					
4	Better waste management					
5	Improves efficiency of service delivery					
6	Increases the number of clients served					
7	Better service delivery					

SECTION D: Role of government policy

17. In a scale of 1 to 5, where 1 is strongly disagree, and 5 strongly agree, indicate your level of agreement or disagreement on the questions pertaining to the significance and effectiveness of government policy on performance of Public health facilities in Kisumu County, Kenya.

Likert scale: 1. Strongly Disagree; 2. Disagree; 3. Neutral; 4 Agree; 5. Strongly Agree

Sno.	**Questions**	**Strongly disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
1	How would you rate your agreement or disagreement on the overall effectiveness of the government policies related to inventory management in public health facilities?					
2	To what extent do you agree or disagree that government funding levels have an impact on the ability of your facility to effectively manage inventory?					

3	Do you agree or disagree that government regulations for inventory management have affected the performance of your facility?					
4	How would you rate the level of your agreement and disagreement on the support and guidance provided by government agencies in the implementation of inventory management techniques at your facility?					
5	How do you feel that changes in government policy have affected the ability of your facility to					

	meet performance targets related to patient satisfaction, wait times, and medication errors?					
6	To what extent do you agree or disagree that the current government policies related to inventory management in public health facilities are effective in addressing the needs of your facility?					

Thank You For Your Cooperation

Appendix 7: Map of Kisumu County