

**INVENTORY MANAGEMENT PRACTICES AND
PERFORMANCE OF PUBLIC HOSPITALS IN KENYA**

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DECLARATION

This research project is my original work and has not been presented to any other University for an award of degree.

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DEDICATION

This project is dedicated to my family and especially my two lovely daughters, Rita and Joan, for their moral support and encouragement when I was writing this research project.

ABSTRACT

Public hospitals have a procurement department that is responsible for the provision of goods services to the hospitals with the aim of providing quality health care services in order to achieve customer satisfaction. The study sought to determine the inventory management practices used by Public hospitals in Kenya, establish the relationship between inventory management practices and performance of public hospitals in Kenya and to determine the challenges of implementing inventory management practices in public hospitals in Kenya. The study used a descriptive survey establishing the relationship between the variables. The study population comprised of the main public hospitals in Nairobi County and former Central Province Counties. The study considered 40 hospitals where inventory management was mostly carried out. The study used both primary data that was collected through a semi-structured questionnaire to collect information for quantitative and qualitative analysis. Out of the 40 questionnaires that were distributed 35 questionnaires were filled and returned successfully. This represents a response rate of 88 percent which was considered sufficient for making generalization of all the public hospitals in Kenya. Data was analyzed using descriptive statics and regression analysis. The study found that the most popular inventory management practices used by public hospitals in Nairobi and former central province counties are follows: ERP systems, ABC systems, e-procurement, simulation and EOQ. These practices were mainly used in level 5, level 6 and stand-alone which offers specialized services and operates under defined semi-autonomy which allows them to manage their own inventory. The study further concludes that the main challenges that hindered implementation of inventory management practices in public hospitals were: failure to invest in modern technologies, insufficient, insufficient funding, poor infrastructure, lack of top management commitment training and unreliable suppliers. The regression results concluded that inventory management practices were positively related to performance of public hospitals in Nairobi and former Central province. The major limitation of this study is that it was limited to district hospitals in Nairobi and former Central province Counties due to costs and time constraints. It would have been important for future researchers to consider investigating inventory management practices in public hospitals outside Nairobi County and former Central Province Counties to find out whether these findings will hold. The study recommends that government allocates more funds to public hospitals to be invested in modern information technologies because this will lead to increased information sharing, reduction of costs and improved quality of health services.

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ABBREVIATIONS AND ACRONYMS

EOQ	Economic Order Quantity
ERP	Enterprise Resource Planning
FIFO	First In First Out
FSN	First Slow Non-moving
HML	High Medium Low
IFMIS	Integrated Financial Management Information System
JIT	Just-In-Time
RFIDS	Radio Frequency Identification System
SCOR	Supply Chain Operations Reference model
SDE	Scarce Difficult Easy
SOPs	Standard Operating Procedures
SWOT	Strengths Weaknesses Opportunities Threats
VED	Vital Essential Desirable
VMI	Vendor Managed Inventory System

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

In the world today, every organization wants not only to mitigate the system wide cost, but also to maintain minimum inventories along the supply chain while maximizing the service level requirements of the customer (Sandeep, 2007). This however cannot be achieved without modern technologies. The advancement of technology and innovation has shortened the product life cycle and thus improved inventory management systems of firms. This has led to reduced costs, increased efficiency and thus boosted performance of firms. In some organizations it has led to demand variability and thus strengthened the need to maintain proper inventory for improved supply chain performance. Dryden and Brownell (2012) posit excess inventory in the supply chain blocks the cash flow and this might negatively affect organizational performance.

Managing customer and vendor relationships is a critical aspect of managing supply chains. In many cases, the collaborative relationship concept has been considered the essence of supply chain management. Bicheno (2011) indicates that a closer examination of supply chain relationships, particularly those involving product flows, reveals that the heart of these relationships is inventory movement and storage. Eckert (2012) argues that much of the activity involved in managing relationships is based on the purchase transfer, or management of inventory.

Brigham and Gapenski (2013) argue that inventory management is important because firms will ensure assets and stock are well managed and accurate demand forecasting is maintained to avoid unplanned procurement processes. This will assist the firm in executing successful procurement processes that match demand and supply forces.

Agus and Noor (2010) points out that demand forecasting helps the organization to minimize operational costs, increased efficiency and on time delivery of goods and services. This enables the organization to plan for the future demand by meeting the growing needs of customers. This highly contributes to improved customer satisfaction due to quality of goods and services offered.

1.1.1 Inventory Management Practices

Wisner and Leong (2011) define inventory management is the process of efficiently overseeing the constant flow of units into and out of an existing inventory. This process usually involves controlling the transfer in of units in order to prevent the inventory from becoming too high, or dwindling to levels that could put the operation of the company into jeopardy. Agus and Noor (2010) proper inventory management also seeks to control the costs associated with the inventory, both from the perspective of the total value of goods included and the tax burden generated by the cumulative value of the inventory.

Dryden et al. (2012) argue that inventory management involves keeping accurate records of finished goods that are ready for shipment. This often means posting the production of newly completed goods to the inventory totals as well as subtracting the most recent shipments of finished goods to buyers. The relevance of inventory management practices is that they make it possible to quickly convey information to sales personnel as to what is available and ready for shipment at any given time.

Brigham et al. (2013) posit that the firm should design and develop an inventory management system that balances the demand and supply. This is intended to reduce inventory costs, reduce the cycle time and improved sharing of information.

Therefore, the firm can effectively manage its inventory and coordinate its supply chain system leading to improved performance.

Inventory management practices are activities and functions used by organizations to manage stocks of finished products, semi-finished products and raw materials. Proper implementation of these activities enables the firm to minimize waste and costs and increase revenue (Zer and Wei, 2006). Some of the inventory management practices used discussed in this study includes; economic order quantity, radio frequency identification systems, vendor management inventory, enterprise resource planning, Just In Time, ABC Analysis and E-procurement.

1.1.2 Supply Chain Performance

Fawcett and Magnan (2008) define supply chain performance as the entire chain's ability to meet end-end customer needs through product availability and responsiveness with on-time delivery. Key performance indicators in public hospitals in Kenya, Financial Management Act (2006) and Treasury Instructions (TI)904 requires the department of Health to present annual indicators of effectiveness and efficiency to Parliament. The key effectiveness indicators report how well the department achieves its outcomes while efficiency indicators show accountability for funds spent on delivery of the services. According to the Millennium Development Goals (MDGs) (2000) the health sector key performance goals are MDG 1(eradication of extreme poverty and hunger), MDG 4 (reduction of child mortality rates), MDG 5 (improvement of maternal health) and MDG 6 (combat HIV, malaria and other diseases) Fawcett et al. (2008) maintain that the mechanism to achieve key performance indicator goals is referred as key performance indicators'

accomplishment. This connects planning and execution hence builds steps for realization of performance goals into routine daily work.

According to Stewart (2005) to measure supply chain performance, there are a set of variables that capture the impact of actual working of supply chains on revenues and costs of the whole system. These variables are drivers of supply chain performance and are always derived from supply chain management practices. Managers of an organization have to achieve an improvement in their supply chains. This is achieved through procurement planning, proper record keeping, implementation and monitoring performance. According to the results of the selected key performance indicators' accomplishment, managers may create current reports on key performance indicators to compare multiple plans of supply chain management. In this performance management cycle, there are many challenges, both in performance measurement and its improvement (Cai, Xiangdong and Zhihui, 2008).

There are two commonly used tools for measuring organizational performance namely: the Balance Score Card and SCOR models. The balanced scorecard is a strategic planning and management system that is used extensively in business to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organization performance against strategic goals. It was originated by Kaplan and Norton as a performance measurement framework that added strategic non-financial performance measures to traditional financial metrics to give managers and executives a more balanced view of organizational performance. The balanced scorecard suggests that we view the organization from four perspectives, and to develop metrics, collect data and analyze

it relative to each of these perspectives learning and growth, financial perspective, customer perspectives and business perspectives (Kaplan and Norton, 2001).

The Supply Chain Operations Reference Model (SCOR) is one of the supply chain frameworks, linking business processes, performance metrics, practices and people skills into a unified structure. Organizations employ the SCOR framework to achieve increased speed of system implementations, support organizational learning goals and improve inventory management (Watson, 2010). The SCOR model will be adopted for the purposes of this study because it is more relevant and effective in evaluating inventory management and supply chain performance.

1.1.3 Public Hospitals in Kenya

Vision 2030, Kenya's long term development blueprint posits health as one of the social pillars that play a key role in maintaining health and skilled manpower. To realise this goal, the health sector defined improved procurement and availability of essential health products and technologies as a priority reform besides digitization of records, equipping health facilities and infrastructure development.

The Kenya Health Policy (2014-2030) indicates that the government under the Ministry of Health works closely with public hospitals to ensure that goods and services are delivered on time in order to provide quality health care services to the citizens. According to the Kenya Constitution (2010) the Mandate of the Ministry of Health is to formulate policies, set standards, provide health services, create an enabling environment and regulate the provision of health service delivery. The County Government is responsible for County health services, pharmacies, and ambulance services, promotion of primary health care, licensing and control of undertakings that sell food to public, cemeteries, funeral parlors and waste disposal.

Kenya`s healthcare system is structured in a hierarchical as follows:

Community Health Services; Comprise community units (level 1) in the country that provide primary health care services at the sub-county level by facilitating individuals, households and communities to embrace appropriate healthy behaviors and recognizing signs and symptoms of conditions requiring referral.

Primary Care Services; Comprise of all dispensaries (Level 2) and health centers (Level 3) including those managed by non-state actors. They provide disease prevention and health care promotion services, linkages to community units, basic outpatient diagnostics, medical surgical and rehabilitative services, ambulatory services, in patient services for emergency clients awaiting referral.

County Referral Health Services; Comprise all Level 4 primary and Level 5 secondary facilities in the Counties (Districts) that provide comprehensive in patient diagnostic, medical, surgical, habilitative and rehabilitative care, specialized outpatient services as well as facilitate and manage both vertical and horizontal referrals.

National Referral Services; Comprise of all tertiary (Level 6) referral hospitals (stand-alone) such as national laboratories, government owned entities, blood transfusion services, research and training institutions of highly specialized services.

County and national referral public health centers (Level 4, 5 and 6) are targeted for this study because they offer specialized services and operate under some defined level of semi-self-autonomy that allows them to manage their own inventory and supply chains. The Health Policy provides that these public health centers maintain inventory management and supply chain systems subject to Public Procurement and Disposal ACT 2005 and Regulations 2006 in order to provide quality, accessible,

timely and affordable health care. This is based on an innovative, effective and efficient performance model, according to market prices and ability of creating extra value for its partners, service suppliers and customers (Silver, 2007).

1.2 Statement of the Problem

To continue serving the demand of customers most firms have realized the need to maintain proper inventory management. Proper management of inventory enables firms to mitigate inventory costs, reduce lead time and on-time delivery of goods and services. According to Wisner et al (2011) organizations that maintain proper inventory of raw materials are more likely to complete their production on time. Inventory management control is part of the inventory management: that helps to maintain continuity of production operations by maintaining a smooth flow of raw materials without shortages (Shapiro, 2009).

Public Procurement in the health sector is guided by the Public Procurement and Disposal Act 2005 and Regulations 2006. Mungu (2013) states that in hospitals, inventory management is set up to ensure an optimal stock level of medicine in general and essential medicine to enable satisfactory service that touches on human life unlike procurement in other sectors. Emergencies pose health threats that are of sudden onset in nature, are beyond the capacity of an individual/community to manage and are life threatening or will lead to irreversible damage to the health of individuals/community if not addressed. Thus inventory management is the heart of pharmaceutical system and poor management will lead to wastage of financial resources, shortages of essential medicines, average of others resulting in expiration and deadline in quality health care (USAID, 2012). Despite the threats, in most public hospitals patients are always turned away due to lack of essential drugs and

infrastructural facilities. Unfortunately in developing countries, most organizations in the health sector, supply chain is not accorded central role in overall strategy.

Public hospitals have a procurement department that is responsible for the provision of goods services to the hospitals with the aim of providing quality health care services in order to achieve customer satisfaction. They maintain inventory management system which is aimed at ensuring that facilities and equipment are supplied and delivered at the right time. The hospitals should consider implementing inventory management practices for reduced costs and improved supply chain performance. This has a positive impact on reduction of mortality rate to the patients especially in responding to emergency cases.

To undertake this critical role, the Health Policy orientation on health products and technologies, stressed the need for effective and reliable procurement systems that will enhance public and private investment to advance patients access to essential health products and technologies and ensure value for money across the system.

Studies have been done in relation to inventory management and supply chain performance. Akintonye (2014) found that inventory management led to improved performance of German Service firms. Mehra (2014) and Lapide (2010) also concluded that use of technology in inventory management improved efficiency of manufacturing firms and service firms.

Gakuru (2012) found that the major factor hindering the application of inventory model is frustrations by the ordering system. Lack of computers to keep track of inventory levels and lack of awareness on how best to implement the models were also cited as constraining factors. Kitheka (2012) indicated that inventory management automation affected the performance of the supermarkets. The findings

revealed that there was a positive linear relationship between inventory management automation and the performance of the supermarkets.

The above studies have dwelt on inventory models and inventory management automation. This study focused on inventory management practices and performance of public hospitals. This was achieved through seeking answers to the following research questions: what are the inventory management practices used by Public hospitals in Kenya? What is the relationship between inventory management practices and performance of Public hospitals in Kenya? What are the challenges of implementing inventory management practices in public hospitals of Kenya?

1.3 Objectives of the Study

- i. To establish the inventory management practices used by Public hospitals in Kenya
- ii. To determine the relationship between inventory management practices and performance of public hospitals in Kenya.
- iii. To determine the challenges of implementing inventory management practices in public hospitals in Kenya.

1.4 Value of the Study

The study hopes to provide adequate information to Public hospitals on better ways of managing their inventory to achieve efficiency in their supply system. Supply chain professionals and finance managers will find this study useful since it will educate them on ways of mitigating inventory costs and improving efficiency in the delivery of goods and services.

The findings of this study will be useful to the Ministry of Health since it will shed more light on the inventory management challenges faced by Public hospitals. This will enable the Ministry of Health and the County Governments to join hands in concerted efforts in allocating more resources and facilities to enhance supply chain performance and thus contribute to the achievement of quality health care services.

The study will be important since it will add knowledge in inventory management discipline of procurement and supply chain management. Academicians and scholars will also find this study useful in broadening their knowledge and skills in inventory management.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This section covers the inventory management models, inventory management practices, the relationship between inventory management practices and performance of public hospitals, challenges of implementing inventory management practices, the conceptual framework and the summary of the literature review.

2.2 Theories of Inventory Management

According to Croom and Jones (2010) deterministic inventory model is one of the fundamental techniques used by firms to develop inventory reserve estimates. Deterministic models of inventory control are used to determine the optimal inventory of a single item when demand is mostly largely obscure. Under this model inventory, inventory is built up at a constant rate to meet a determined or accepted demand. Dai and Kauffman (2001) argue that a deterministic circumstance is one in which the system parameters can be ascertained precisely. This is also known as a situation of sureness since it is realized that whatever is ascertained, things are sure to occur the same way.

Beamon et al (2006) argue that stochastic one-item models can be used for inventory control. Croom and Jones (2010) indicate that such models are used when demand is not known. Stochastic models are more realistic and thus more relevant. This is because they regard the cost of shortfalls, the cost of arranging and the cost of stacking away, and attempt to formulate an optimal inventory plan. According to Aberdeen Group (2004) the classical economic order quantity (EOQ) model seeks to find the balance between ordering cost and carrying cost with a view of obtaining the most economic quantity to procure by the distributor. Kotleba (2006)

contend that the economic order-quantity model considers the tradeoff between ordering cost and storage cost in choosing the quantity to use in replenishing inventories items. A larger order quantity reduces ordering frequency, and, hence ordering cost per month this helps in mitigating costs but requires holding a larger average inventory, which increases storage (holding) cost per month.

The relevance of this theory is that a smaller order-quantity reduces average inventory but requires more frequent ordering and higher ordering cost per month. This is most applicable to small firms that deal with perishable goods and services seeking to mitigate inventory management costs. Dai et al. (2001) explain that the cost of minimizing order-quantity is called the Economic Order Quantity (EOQ). Beamon et al (2006) posit that one of the advantages often explored to cushion the burden of net inventory cost and to enjoy substantial savings is the benefit from procuring large enough quantity that reduces the unit price of the item. This results to reduction of aggregate costs which enhances supply chain performance.

According to Palevich (2012) Radio frequency identification systems is used to minimize the level of inventory. This enables the distributor to maintain stock making the retailer secure. This improves delivery of goods and services to the final consumer while minimizing holding stock to the firm. A lean system provides the organization with a well-defined system to manage inventory effectively and efficiently. Fawcett et al. (2008) notes that firms that use lean inventory management systems benefit from improved productivity that allow employees to spend more time on value adding activities. Lysons (2006) posit that marginal analysis is a technique used to control the optimal levels of perishable goods whose value declines with time. Marginal analysis is used by firms to allocate their scarce resources to maximize on their

output. For instance organizations ensure that perishable goods are sold within their expiry period to prevent loss (Eckert, 2012). The periodic demand for the items is uncertain. Too much supplies results in wastage while too little leads to shortages.

2.3 Inventory Management Practices

According to Zhang (2005) inventory management process begins as soon as the organization has started production and ordered raw materials, semi-finished products or any other thing from a supplier. The inventory management practices that have been discussed in this study include: Economic Order Inventory, Radio Frequency Identification Systems, Vendor Management Inventory System, Enterprise Resource Planning, Just In Time, ABC Analysis and E-procurement. Other selective inventory control techniques have also been discussed.

Gonzalez and Gonzalez (2010) posit that the economic order quantity (EOQ) is the order quantity that minimizes total holding and ordering costs for the year. It gives a good indication of whether or not current order quantities are reasonable. According to Porteus (2008) the assumptions of inventory management model is that the firm knows with certainty how much items of particular inventories will be used or demanded for a specific period of time. Shapiro (2009) argues that the use of inventories or sales made by the firm remains constant or unchanged throughout the period. The model also assumes that the moment inventories reach zero level, the order of replenishment of inventory is placed without delay.

According to Blanchard (2010) radio frequency identification system (RFIDS) is de of identification where an item's identification is taken in which the reading and recoding of the data is executed using modern technology. This form of technology is useful in minimization of costs for companies since this process is efficient compared

to manual process. This enhances integration of supply chain systems through improved sharing of information leading to supply chain performance.

A vendor managed inventory system (VMIS) helps in minimizing the company's holding of stock and forces the distributor to maintain goods which in turn secures the level of service of the retailer. Zer and Wei (2006) argue that vendor inventory management can be described as supplier managed inventory or as continuous replenishment.

According to Beamon et al (2006) the system is an initiative of partnering that encourages co-operation and the sharing of information between partners in a business. Davila et al., (2009) explain that bar coding is a type identification employed by the technology of capturing information. Bar codes are used in tracking items such as stock in retail, records, people and machines. Some control systems used for inventories apply this technology in order to make stock tracking automatic this improves on efficiency and thus supply chain performance.

Lambert (2011) puts forth that enterprise resources planning (ERP) system is part of the integrated supply chain management system of an organization that integrates all the supply chain partners. Watson and Zhang (2005) argue that an enterprise resources planning package is a database allowing a company to develop data to be used in all the applications. Such data base together with equipment for developing and extracting can ensure effective information movement in the organization. This improves decision making process since the supply chain partners can share information. This minimizes communication costs in the supply chain leading to supply chain performance (Song and Zipkin, 2011).

Mehra and Inman (2000) define just-in-time (JIT) as an operating concept designed to eliminate waste (Krajewski and Ritzman, 1999). The goal for just in time is to produce goods and service without waste. This is achieved by testing each step in a process to determine if it adds value to the product or to the service. The implementation of a JIT system yields minimum inventories by having each part delivered when it is needed, where it is needed, and in the quantity needed to produce the product. A JIT system enables companies to operate efficiently with the least amount of resources, and thus, improves quality, reduces inventory levels, and provides maximum motivation to solve problems as soon as they occur.

ABC Analysis is an inventory control technique in which inventory items are classified into three groups according to their value. Group A: High value items. These are 15-20% of the items that account for 75% of the total inventory value. Items in this category should be monitored regularly. Group B: Medium value items. These are 30-40% of the items that account for approximately 15% of total value (Croom and Jones, 2010).

Dai and Kauffman (2001) argues that Group B items should be given less attention. Group C: Low value items, the 40-50% of the items that account 10-15% of the annual inventory value. These items should receive least attention. Thus, ABC system facilitates inventory control, over-usage, selective control and enables companies to concentrate on the most cost-effective areas. In addition it eliminates unnecessary paperwork and reduces stock holding costs.

Lysons (2006) define e-procurement as use of internet to operate transaction aspects of requisitioning, authorizing orders, receiving and payment processes for goods and services .It is typically a focus of local business administrators(business-to- business)

network system by which organizations can be connected to suppliers for purposes of procuring goods and services at the lowest cost. In Kenya, the government has implemented e-procurement through the Integrated Financial Information System (IFMIS) a module configured to comply with the Public Procurement and Disposal Act (2005) and the Kenya Communication Amendment Act (2009). This system essentially replaces the offline version called tendering and will enhance order monitoring, processing time, transparency, inventory reduction hence lower operating costs.

Simulation is the process of imitating a real phenomenon with a set of mathematical formulas and advanced computer programs. Simulation models enable a priori managing and analyzing variety of possible results and implication of selected inventory policies. A well-designed inventory control simulation should include data based on the recommendations of front-line employees who know where losses occur that might otherwise go unnoticed. A simulation model is easier to explain to management personnel since it is a description of behavior of some system or process (Davila et al., 2009).

2.4 Other Inventory Management Practices

Beamon et al (2006) indicate that High-Medium-Low value approach is one of the inventory management models that check on costs of items. H-M-L this stands for high value, medium value and low value items on unit price of item. For instance a firm might decide to classify items that have a value of more than 5000 high, 1000-5000 medium and below 1000 low. SDE stand for Scarce Difficult Easy analysis. Under this model unit value is the basis of this analysis and not the annual consumption value. To keep vigil on availability, inventory should be kept in stock

keeping in mind difficulty of procurement and may follow forward buying (Kotleba, 2006).

Dai et al (2001) notes that the stores when subjected to analysis based on their criticality can be classified into Vital, Essential and Desirable stores. This analysis is termed as VED analysis. Vital items without which treatment comes to standstill that is non- availability cannot be tolerated. Under the essential items the organization looks at non availability which can be tolerated for 2-3 days, because similar or alternative items are available. In desirable items, non availability can be tolerated for a long period. Fast Slow and Non-moving (FSN) analysis is based on rate of consumption. Under this control model items can be classified into: fast moving, slow moving, non-moving, and obsolete. An understanding of the movement of items helps to keep proper levels of inventories by deciding a rational policy or reordering. This method is based on the fact that some stock items have a much higher annual usage value than others (Dai and Kauffman, 2001).

First-In, First-Out (FIFO) is one of the methods commonly used to calculate the value of inventory on hand at the end of an accounting period and the cost of goods sold during the period. This method assumes that inventory purchased first is sold first and newer inventory remains unsold. Thus cost of older inventory is assigned to cost of goods sold and that of newer inventory is assigned to ending inventory. The actual flow of inventory may not exactly match the first-in, first-out pattern (Watson and Zhang, 2005).

Silver (2007) indicate that stock-taking or inventory checking is the physical verification of the quantities and condition of items held in an inventory or warehouse. This may be done to provide an audit of existing stock valuation. It is also

the source of stock discrepancy information. Stock-taking may be performed as an intensive annual check or may be done continuously by means of a cycle count. The above is also referred to Periodic Count. Periodic counting is usually undertaken for regular, inexpensive items. The term periodic generally refers to annual stock count. However, periodic may also refer to half yearly, quarterly, monthly, bi-monthly or daily.

Refrigeration is an inventory management practice that involves all the activities that ensure maintenance of the refrigerator equipment by an organization. This activities include: updating of the equipment, storage information on items stored in the refrigerator by scanning radio frequency tags attached to the items whenever a door of the refrigerator is opened, transmitting the storage information to a mobile terminal, updating the storage information stored in the mobile terminal with the storage information transmitted from the refrigerator, and displaying, comparatively, the items of the updated storage information and items for the specific list set by a user or registering the items included in the specific list but not in the updated storage information as purchase information (Mehra and Inman, 2014).

Eckert (2012) argues that the standard operating procedures (SOPs) for inventory control consists of a step-by-step process that is easy follow and understand by the employees. These steps are inventory receiving, storage and product rotation and warehouse and inventory security. These steps also serve to hold employees accountable for adhering to inventory control policy expectations. Creating and following an SOP is essential to managing inventory and controlling inventory costs. Even small organizations should not underestimate the power of an inventory-control SOP.

2.5 Performance Measurements

Supply Chain Performance can be measured in the context of the following supply chain activities and processes: Plan, source, make and assemble, deliver and customer satisfaction. These activities are considered at various levels of management-strategic, tactical and operational levels. When seeking to improve organizational performance it is advisable to conduct regular assessments of the current performance of the organization. Assessments might be planned, systematic and explicit - these are often the best kind of assessments - or unplanned and implicit. Well done assessments typically use tools, such as comprehensive questionnaires, SWOT analyses and diagnostic models. The profitability of a company influences its value and the amount of income it generates for its owners (Kaplan and Norton, 2001).

2.6 Relationship between Inventory Management Practices and Performance

Proper management of inventory enables the organization to mitigate its inventory costs for example holding costs, stock out costs, lead time among others. Also, the organization is able to improve on its delivery time leading to quick delivery of goods and services. According to Water (2013) integration is one of the inventory management tools used to achieve efficiency. In an integrated system, the organization and the supplier can be able to share information. This helps the supplier to know when the organization is out of stock. This improves supply chain performance since the supplier is able to deliver goods and services on time.

To successfully manage inventory, top management and the employees should be actively involved in key decisions on supply of goods and services (Drurry, 2011). The organization should provide facilities and resources to manage inventory

management (Eckert, 2012). This will help the organization to improve on efficiency and thus improve on supply chain performance. Lapedis (2010) established that most organizations that invest in modern technologies for example: vendor managed inventory, just in time systems and integration were efficient in their operations. It was further revealed that there existed a positive relationship between integration and supply chain performance.

A study by Schonberger (2008) on 50 manufacturing firms in America: found that supplier partnering contributes to supply chain performance. This is because supplier partnering improves on efficiency and minimizes inventory costs. Also, it reduces the cycle time by reducing the lead time. Gonzalez and Gonzalez (2010) did an analysis of an economic order quantity and re-order point inventory control model for service firms. It was found that most organizations that had well managed inventory systems exhibited efficient supply chain systems. This was as a result of use of modern technologies and competent employees who had adequate skills and knowledge in inventory management.

Inventory management models have helped organizations to become more competitive in terms of how they manage their inventories. The availability of technologies has made it possible for firms to conduct businesses on a daily basis with fewer inventories (Akintonye, 2014). Increased competitiveness in transportation has led to greater opportunities for shippers to purchase high-quality as well as customized services, thus reducing the need to carry large inventories. Lapedis (2010) posit that Overall sensitivity to the incurring of excess and non-value added cost has motivated many firms to identify ways to reduce and even eliminate unnecessary levels of inventory leading to improved supply chain performance.

2.7 Challenges of Implementing Inventory Management Practices

Implementation of inventory management practices is coupled by a myriad of challenges especially by organizations in developing countries; Schonberger (2008) found that inadequate resources for implementing inventory management practices is major a problem to most firms. Companies fail to invest in inventory in technology and infrastructure lack effective inventory management systems. The firm should put proper infrastructure to maintain maximum and minimum levels of inventory. This enables the firm to save holding costs, stock out costs and lead time costs.

Song and Zipkin (2011) explains that lack of commitment by the top management of the organization is a major contributor to poor inventory management systems. In most cases the management fails to provide the required support to their subjects for effective implementation of inventory management practices for example the top management might fail to involve its supply chain partners in inventory management decisions. This brings about poor coordination, increased communication costs which negatively impact on the supply chain performance of the organization. Shapiro (2009) argues that if the management fails to provide facilities and resources required to effectively manage inventory in the organization.

According to Drurry (2011) some organizations especially in the developing economies the top management is reluctant to invest in modern technologies and equipment to facilitate inventory management this inhibits effective management of stocks. This prolongs the cycle time and delay delivery of goods and services to the final consumer and thus may negatively impact on supply chain performance. This causes lack of cooperation between the suppliers and the organization which eventually leads to delayed delivery of goods and services or no delivery in extreme

cases. To succeed in inventory management the organization should ensure that it has reliable suppliers to supply goods and services on time.

Storing excess inventory can cost a lot of money, and reducing the amount of inventory you keep on hand can reduce your carrying costs as well as the number of warehouses they maintain, or even allow them to eliminate those warehouses altogether. According to Dai and Kauffman (2001) lack of trained and competent professionals who understand the concept of inventory management is a major challenge to most organizations that seek to effectively manage their inventory systems.

2.8 Summary of the Literature Review and Knowledge Gaps

This section covers the summarized empirical review by scholars locally and globally, it consists of the title of the study, major findings and knowledge gaps as shown in Table 2.1.

Table 2.1 Summary of the Literature Review and Knowledge Gaps

Scholars	Study	Major Findings	Knowledge Gaps
Lapide (2010)	Effectiveness of inventory management in service firms	The study confirmed that firms invested in inventory technology achieved reduced costs and improved efficiency	The study did not address inventory management practices
Onyango (2011)	Supply Chain Management Practices and Performance in Cement Industry in Kenya	supply chain management led to minimal inventory levels, improved partnerships and communication and demand forecasting	The study did not focus on inventor management practices.
Kitheka (2012)	Inventory management automation and the performance of supermarkets in western Kenya	There was a positive linear relationship between inventory management automation and the performance of supermarkets.	The study was limited to supermarkets only
Mungu (2013)	Supply Chain Management Practices and Stock Levels of Essential drugs in Public Facilities in Bungoma East Sub County	The study concluded that inventory management practices ensures optimal stock levels	The study was limited to stock levels of essential drugs in public hospitals
Mehra and Inman (2014)	Inventory management and efficiency of manufacturing firms	The study concluded that use of technology in inventory management improved efficiency	The study limited itself on manufacturing firms
Akintonye (2014)	The effect of inventory management on performance of German Service firms	The findings revealed that inventory management led to improved performance.	The study limited itself to service firms

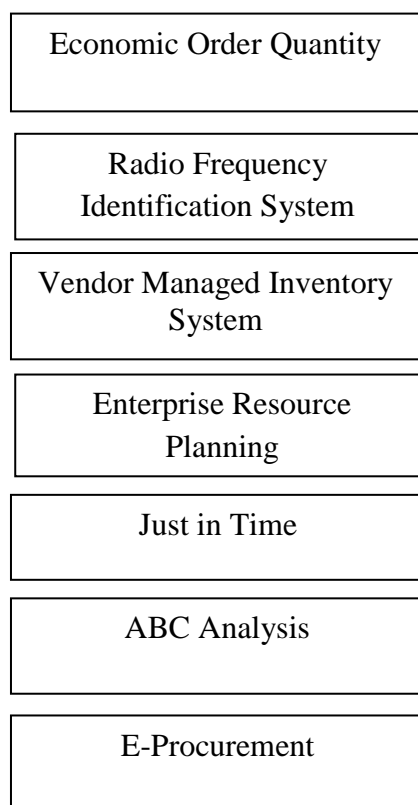
Source: Author (2015)

2.9 Conceptual Framework

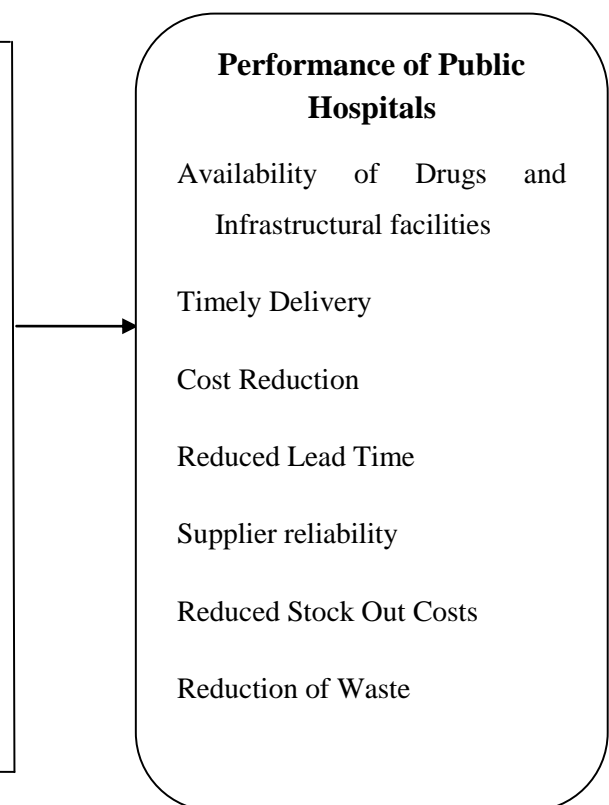
The conceptual framework adopted for this study shows that inventory management practices influences performance of public hospitals. These practices include: Economic order Quantity, Radio frequency identification system, vendor management inventory, enterprise resource planning, Just in Time, ABC analysis and E-procurement. The dependent variable is performance of public hospitals. Therefore, the conceptual framework shows that performance at public hospitals depends on inventory management practices used as presented in Figure 2.1

Figure 2.1 Independent and Dependent Variables

Independent Variables



Dependent Variable



Source: Author (2015)

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This section gives an outline of the research methodology that was used for the study. It comprises the research design, study population, data collection instruments, and data collection procedure and data analysis.

3.2 Research Design

The study used a descriptive survey. A descriptive survey is used in explaining the relationship between variables in a study. It was applied in laying more emphasis in determining the frequency with which the variables are implemented or the extent to which the variables co-vary (Kothari, 2004). Descriptive survey was used in establishing the relationship between inventory management practices and supply chain performance.

3.3 Study Population

The population for this study comprised of the main public hospitals (See Appendix II - E-Health Kenya Facilities, 2014). The study considered 40 hospitals where inventory management was mostly carried out. The study used a census survey of public hospitals (levels 4, 5 and 6) in Nairobi and former Central Province counties. These hospitals formed a representative sample.

3.4 Data Collection

The study used primary data that was collected through a semi-structured questionnaire to collect information for quantitative and qualitative analysis. The structured questionnaires had four sections. The first section covered questions about general information about the organization and the respondents. The second section had questions on the first objective of this study which is to establish inventory

management practices used by public hospitals. The third part contained questions on the second objective of the study which is to determine the relationship between inventory management practices and performance of public hospitals. The fourth part contained questions on the third objective of the study which is to determine the challenges of implementing inventory management practices by public hospitals. The respondents for the study were senior procurement officers or their equivalents. This group of respondents was selected because they have relevant experience in inventory management concept and how it impacts on performance of public hospitals. The semi-structured questionnaires were administered through a “drop and pick” later method at an agreed time with the researcher.

3.5 Data Analysis

Objective one which is to establish the inventory management practices used by public hospitals in was analyzed using descriptive statistics. Objective two of the study which is to determine the relationship between inventory management practices and performance of public hospitals was analyzed using regression analysis and objective three which is to determine the challenges faced by public hospitals in implementing inventory management practices were analyzed using descriptive statistics.

The regression model was used for determining the relationship between inventory management practices and performance of public hospitals. The regression model consisted of seven variables: The independent variables: inventory management practices (Economic Order Quantity, Radio Frequency Identification System, Vendor Management Inventory, Enterprise Resource Planning, Just In Time, ABC Analysis

and E-procurement) and the dependent variable (performance of public hospitals) as provided in the model below:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + b_6 X_6 + b_7 X_7 + e$$

Where:

Y = Supply Chain Performance

A = Y intercept when x is zero

b_1, b_2, b_3 and b_4 = Regression weights attached to the variables

$X_1 \dots X_n$ = Coefficients

X_1 = Economic Order Quantity

X_2 = Radio Frequency Identification System

X_3 = Vendor Management Inventory

X_4 = Enterprise Resource Planning

X_5 = Just In Time

X_6 = ABC Analysis

X_7 = E-procurement

e = Error

The table below gives a summary of how data collected was analyzed as per the objectives of the study.

Table 3.1 Summary of Data Collection and Analysis

Objectives	Questionnaire	Data Analysis
Objective 1	Section B	Descriptive Statistics
Objective 2	Section C	Regression Analysis
Objective 3	Section D	Descriptive Statistics

CHAPTER FOUR: DATA ANALYSIS, RESULTS AND INTERPRETATION

4.1 Introduction

This chapter consists of the analyzed data and the findings that were obtained from the primary data which was collected using a semi-structured questionnaire. Data analysis was done in line with the objectives of the study which were: to determine the inventory management practices used by public hospitals in Kenya, to establish the relationship between inventory management practices and performance of Public hospitals in Kenya and the challenges of implementing inventory management practices in Public hospitals in Kenya.

4.2 Response Rate

Out of the 40 questionnaires that were distributed 35 questionnaires were filled and returned successfully. This represents a response rate of 88 percent which was considered sufficient for making generalization of all the public hospitals in Kenya. This response is consistent with the response rate that was obtained by Waitthaka (2012) who concluded that a response rate of 87 percent of a sample is sufficient in making generalization for the whole population. According to Mugenda and Mugenda (1999) this represents response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent. Based on the assertion, the response rate was considered to be sufficient.

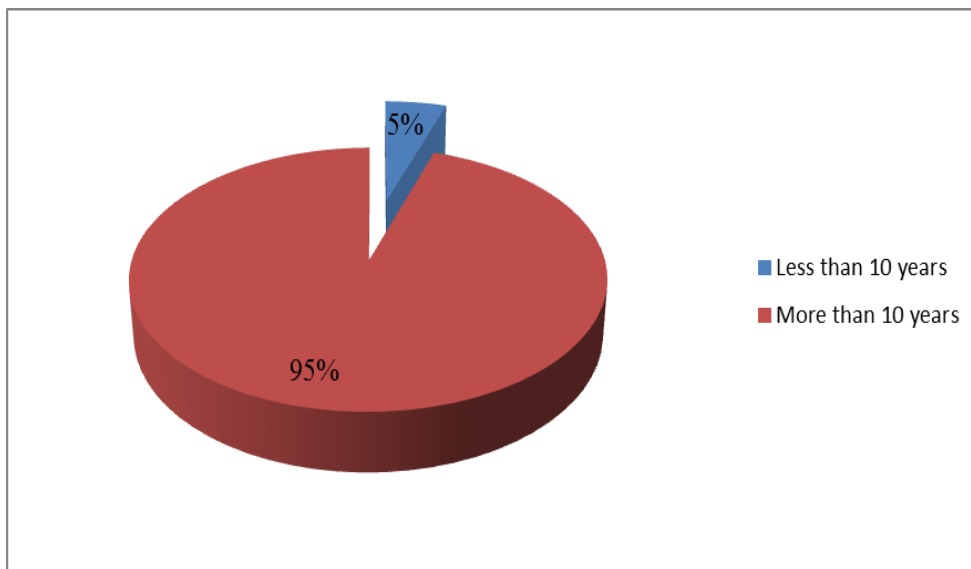
4.3 General Information

This section provides the demographic information of the respondents and the organization. This information is important in evaluating whether the respondents are qualified to give reliable information in line with the objectives of this study.

4.3.1 Duration of Operation of the Organization

The study sought to determine the duration which the organization had been in operation to find out whether it was long enough for the organization to have adequately used inventory management practices. The findings are presented in the figure 4.1 below:

Figure 4.1 Duration of Operation of the Organization



Source: Research Data (2015)

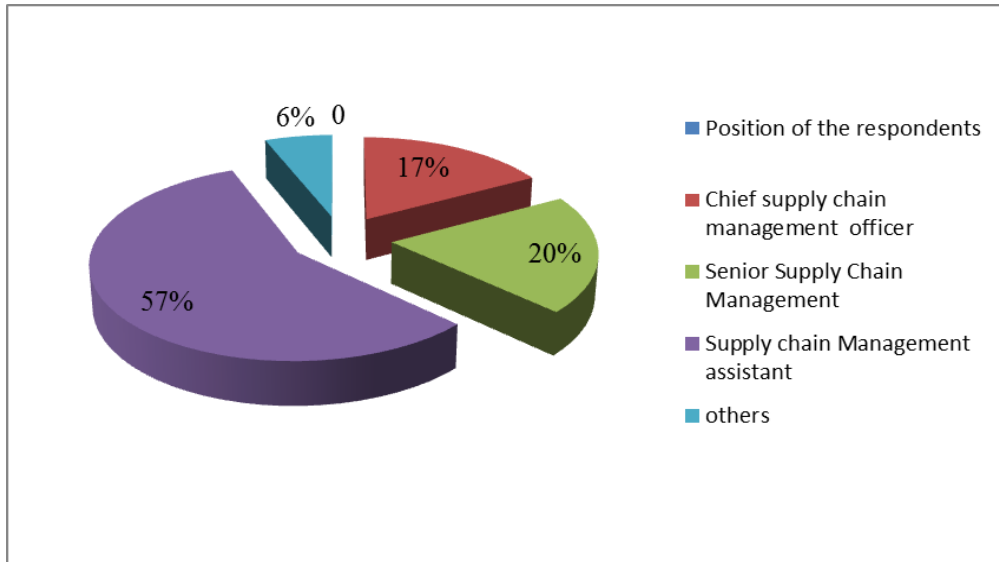
From the above findings in figure 4.1, 95% of the respondents indicated that most public hospitals had been in operation for a period of more than ten years. 5% of the respondents indicated that public hospitals had been in operation for less than 10 years. The findings therefore concluded that most public hospitals in Kenya had been in operation for a period of more than 10 years. This implies that most public hospitals used inventory management practices for a long period time.

4.3.2 Position of the Respondents

The respondents were asked to indicate the position that they served to find out if they were qualified to give information with regard to the inventory management practices

and performance of Public Hospitals. The findings are presented in the figure 4.2 below:

Figure 4.2 Positions of the Respondents



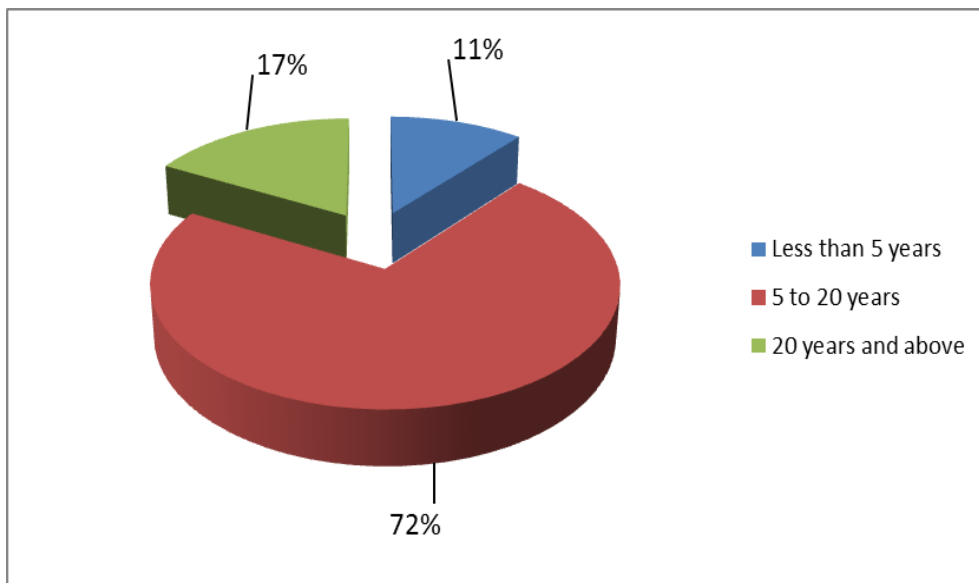
Source: Research Data (2015)

From the above findings in figure 4.2 above, 57% of the respondents indicated that they served as supply chain management assistant, 20% of the respondents served as senior supply chain management while 17% of the respondents served as Chief supply chain management officer. Only 6% of the respondents indicated that they served as health administrative officers and accountants. The findings therefore conclude that most of the respondents working for public hospitals had a relevant experience.

4.3.3 Length of Service

The respondents were asked to indicate the period that they had served in the organization. This was intended to determine whether the respondents had a relevant working experience in the field of inventory management practices. The findings are presented in the figure 4.3 below:

Figure 4.3 Length of Service



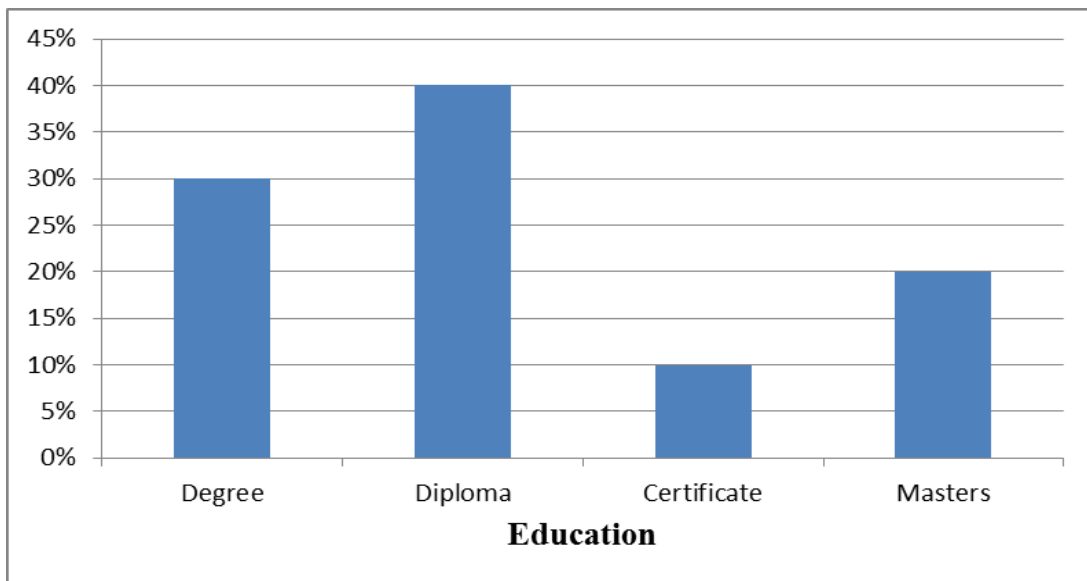
Source: Research Data (2015)

From the above findings in the figure 4.3 above, it was found that 72% of the respondents worked for a period between 5-20 years, 17% of the respondents worked for a period above 20 years while 11% of the respondents worked for a period of less than 5 years. It was concluded that most of the respondents who responded had a relevant experience in inventory management practices in public hospitals in Kenya.

4.3.4 Level of Education

The respondents were asked to indicate their level of education to determine whether they understood inventory management practices and how these practices contributed to performance of Public Hospitals. The findings are presented in the figure 4.4 below:

Figure 4.4 Level of Education



Source: Research Data (2015)

From the findings in figure 4.4, 40% of the respondents had diplomas, 30% of the respondents were holders of first degree, 15% of the respondents attained masters degrees while 10% of the respondents had certificates. This is an indication that most of the respondents understood inventory management practices and performance in public hospitals in Kenya.

4.4 Inventory Management practices

The study sought to determine the first objective of this study which was to determine the inventory management practices implemented in public hospitals in Kenya. The findings are presented in the table 4.4 below:

4.4.1 Economic Order Quantity

The respondents were asked to indicate the extent to which EOQ was used in public hospitals in Kenya. The findings are presented in the table 4.1 below:

Table 4.1 Economic Order Quantity

	N	Mean	Std. Deviation
Use of EOQ model minimizes operational cost	35	3.71	.926
Use of marginal analysis techniques helps control optimal stock levels of perishable goods	35	3.46	.501
Use of EOQ minimizes lead time	35	3.32	.421
Use of EOQ enables hospital to meet demand	35	3.29	.451
Valid N (listwise)	35		

Source: Research Data (2015)

From the above results in table 4.1, it was revealed that public hospitals minimized operational costs; they also maintained optimal stock levels and minimized lead time. Their mean scores are as follows: 3.71, 3.46, 3.32 and 3.29 respectively. Their standard deviations are as follows: .926, .501, .451 and .421 respectively. This is an indication that EOQ was used to a large extent in most public hospitals in Kenya.

4.4.2 Radio Frequency Identification System

The study sought to determine whether public hospitals adopted RFIDS and to what extent. Below are the results of the findings in table 4.2.

Table 4.2 Radio Frequency Identification System

	N	Mean	Std. Deviation
Radio Frequency Identification System	35	1.92	.285
The hospital uses RFID for efficient management of records	35	1.29	.406
Use of RFID improves effectiveness in stock management	35	1.21	.347
Use of RFID reduces theft	35	1.17	.710
Valid N (listwise)	35		

Source: Research Data (2015)

From the above results in table 4.2, the findings revealed that few of the public hospitals used RFID systems for efficient management of records, effectiveness and

to minimize theft. Their mean scores were as follows: 1.92, 1.29, 1.21 and 1.17 respectively. Their standard deviations were as follows: .285, .406, .347 and .710 respectively. This is an indication that most public hospitals implement RFID systems to a very small extent in managing their inventory.

4.4.3 Vendor Managed Inventory System

The study sought to determine whether public hospitals adopted VMIS and to what extent. Below are the results of the findings in table 4.3

Table 4.3 Vendor Managed Inventory System

	N	Mean	Std. Deviation
The hospital uses VMIS for reduction of stock out costs	35	2.46	.532
The hospital uses VMIS for improved speed to tracking stock items	35	2.43	.502
Use of VMIS reduces stock holding costs	35	2.42	.621
Use of VMIS has reduced the risk of defective and obsolescence of items	35	2.42	.505
Use of VMIS has enhanced supplier relations partnership	35	2.29	.458
Valid N (listwise)	35		

Source: Research Data (2015)

From the above findings in table 4.3, few public hospitals adopted VMIS for stock reduction, improved speed of tracking stock items, reduction of holding stock and reduction of defective and obsolescence items and enhanced supplier relations partnership. Their mean values are as follows: 2.46, 2.43, 2.42, 2.42 and 2.29 respectively. Their standard deviations are as follows: .532, .502, .621, .505 and .458 respectively. This is an indication that most public hospitals used VMIS to a very small extent in their inventory management.

4.4.4 Enterprise Resource Planning

The study sought to determine whether public hospitals adopted ERP and to what extent. Below are the results of the findings in table 4.4

Table 4.4 Enterprise Resource Planning

	N	Mean	Std. Deviation
The hospital uses Enterprise Resource Planning system	35	4.10	.832
The hospital has an integrated information sharing system	35	3.63	.512
The hospital maintains a database for all its suppliers	35	3.52	.611
Valid N (listwise)	35		

Source: Research Data (2015)

From the above results in table 4.4, the study found that most public hospitals used ERP systems; they also practiced integration and maintained a database for their suppliers. The mean scores are as follows: 4.10, 3.63 and 3.52 respectively. Their standard deviations are as follows: .832, .512 and .611 respectively. This implies that most public hospitals in Nairobi County and former Central Province Counties used ERP systems to a large extent in their inventory management.

4.4.5 Just in Time

The study sought to determine whether public hospitals adopted just in time and to what extent. Below are the results of the findings in table 4.5

Table 4.5 Just in Time

	N	Mean	Std. Deviation
The hospital uses JIT stock control system	35	2.38	.432
The hospital uses the JIT system to eliminate waste	35	2.19	.512
Valid N (listwise)	35		

Source: Research Data (2015)

From the above results in table 4.5, the study found that most public hospitals in Nairobi County and former Central Province Counties did not implement JIT stock control systems. Further, it was found that few public hospitals used JIT systems to eliminate their waste. The mean scores are as follows: 2.38 and 2.19 respectively. Their standard deviations are as follows: .432 and .512 respectively. This is an indication that most public hospitals in Nairobi County and former Central Province Counties used JIT to a very small extent in inventory management.

4.4.6 ABC Analysis

The study sought to determine whether public hospitals adopted ABC Analysis and to what extent. Below are the results of the findings in table 4.6:

Table 4.6 ABC Analysis

	N	Mean	Std. Deviation
The hospital uses ABC analysis to classify items according to their stock value	35	4.05	.852
The hospital uses ABC Analysis to reduce stock holding cost	35	3.96	.642
Valid N (listwise)	35		

Source: Research Data (2015)

From the above results in table 4.6, the study found that most public hospitals in Nairobi County and former Central Province Counties used ABC analysis to classify their items according to their stock value as well as reducing their stock holding costs. The mean scores are as follows: 4.05 and 3.96 respectively. Their standard deviations are as follows: .852 and .642 respectively. This is an indication that most public hospitals in Nairobi County and former Central Province Counties used ABC analysis to a large extent in inventory management.

4.4.7 E-procurement

The study sought to determine whether public hospitals adopted e-procurement and to what extent. Below are the results of the findings in table 4.7:

Table 4.7 E-procurement

	N	Mean	Std. Deviation
The hospital comply with e-procurement systems (IFMIS module)	35	3.76	.595
There is improved connectivity with a wide range of suppliers	35	3.68	.698
Valid N (listwise)	35		

Source: Research Data (2015)

From the above analysis in table 4.7, it was found that public hospitals complied with e-procurement systems to a moderate extent. Further, public hospitals used e-procurement for improved connectivity with their suppliers. Their mean scores are as follows: 3.76 and 3.68 respectively. Their standard deviations are as follows: .595 and .698 respectively. This is an indication that most public hospitals in Nairobi County and former Central Province Counties used e-procurement to a moderate extent in managing their inventory.

4.4.8 Simulation

The study sought to determine whether public hospitals adopted simulation and to what extent. Below are the results of the findings in table 4.8:

Table 4.8 Simulation

	N	Mean	Std. Deviation
The hospital adapts simulation module	35	3.65	.695
The hospital uses simulated values of services and stocks	35	3.24	.489
Valid N (listwise)	35		

Source: Research Data (2015)

From the above analysis in table 4.8, it was found that public hospitals used simulation model to a moderate extent. A good number of public hospitals used simulated values of services and stocks. Their mean scores are as follows: 3.65 and 3.24 respectively. Their standard deviations are as follows: .695 and .489 respectively. This is an indication that most public hospitals in Nairobi County and former Central Province Counties implemented simulation to a moderate extent in inventory management.

4.4.8 Summary of Inventory Management Practices used by Public Hospitals in Nairobi County and former Central Province Counties

This section gives a summary of the various rankings of inventory management practices based on their implementation by Public Hospitals in Nairobi County and former Central Province Counties. Below are the results of the findings in table 4.9.

Table 4.9 Summary of Inventory Management Practices used by Public Hospitals in Nairobi County and former Central Province Counties

Ranking	Inventory management Practices	Mean
1	ERP systems	3.75
2	ABC	3.72
3	E-procurement	3.69
4	Simulation	3.55
5	EOQ	3.48
6	VMIS	2.34
6	JIT systems	2.21
7	RFID	1.62

Source: Research Data (2015)

From the results in table 4.9, it was revealed that the most popular inventory management practices used by public hospitals in Nairobi County and former Central Province Counties are as follows: ERP systems, ABC systems, e-procurement and simulation. These inventory practices were implemented to a moderate extent. Their average scores are as follows: 3.75, 3.72, 3.69 and 3.55 respectively. These findings

are consistent with Onyango (2011) who pointed out that ERP and e-procurement systems were largely used in most cement manufacturing firms in Kenya.

Further, Akintonye (2014) indicated that e-procurement was highly implemented in German services firms. VMIS, JIT systems and RFID systems were least implemented in public hospitals in Nairobi County and former Central Province Counties. The average scores are as follows: 2.34, 2.12 and 1.62. These findings are in line with a study by Kitheka (2012) who indicated that RFID and JIT systems were least implemented in public hospitals in Nairobi County.

4.5 Inventory Management Practices and Performance of Public Hospitals in Kenya

To achieve the second objective of the study which was to establish the relationship between inventory management practices and performance of public hospitals in Kenya, a regression analysis was conducted. Below are the results presented in the tables.

4.5.1 Model Coefficients

The table below summarizes the results of the regression equation. The values in column B represent the extent to which the value of independent variables contributes to the value of the dependent variable. The other column shows the level of significance of the study variables. Below are the results in the table 4.10 below:

Table 4.10 Model Coefficients

Model		Coefficients ^a				
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.701	.490		1.323	.134
	EOQ (X ₁)	.133	.277	-.161	-.429	.621
	RFID (X ₂)	-.562	.187	.762	4.471	.000
	VMIS (X ₃)	.152	.049	-.617	-3.154	.001
	ERP (X ₄)	.035	.089	.043	.310	.771
	JIT(X ₅)	-.105	.050	-.061	-.082	.825
	ABC(X ₆)	.101	.054	.206	1.792	.043
	E-procurement(X ₇)	-.420	.059	-.041	-.371	.714

Source: Research Data (2015)

a. Dependent Variable: Cost reduction

The regression model obtained for this study is as follows;

$$Y = .701 + .133X_1 - .562X_2 + .152X_3 + .035X_4 - .105X_5 + .101X_6 - .420X_7$$

The model was subjected to statistical significant tests to establish the reliability or adequacy of the model for estimation purposes.

The regression model obtained shows that there is a positive relationship between EOQ, VMIS, ERP and ABC with supply chain performance of public hospitals in Nairobi County. This implies that holding all other factors constant a unit increase in one of the variables obtained in the regression model results into a corresponding increase in supply chain performance of public hospitals in Nairobi County.

RFID, JIT and E-procurement show a negative relationship with supply chain performance. This contradicts the hypothesis of this study which predicts a positive relationship between inventory management practices and performance of public hospitals in Nairobi County and former Central Province Counties

Significance Testing

The above analysis was conducted at 5% significance level. The criteria for comparing whether the predictor variables were significant in the model was done by comparing the corresponding probability value obtained; $\alpha=0.05$. If the probability value is less than α , then the predictor variable is significant. The regression results observe that RFID, VMIS and ABC are statistically not significant since their probability values obtained from the regression model above are below 0.05 (5%), $P=0.000$, $p=0.001$, $P=.043$ respectively. On the other hand, EOQ, ERP, JIT and E-procurement are statistically insignificant since their p-values are more than 5%, $p=.621$, $p=.771$, $p=.825$ and $p=.714$ respectively. These results are consistent with high t values for significant variables and low t values for variables which are not significant.

4.5.2 Coefficient of Determination R^2

The model summary illustrates the variation in the value of the dependent variable which is explained by the regression model. The results are provided in the table 4.11 below:

Table 4.11 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.765 ^a	.585	.352	1.4212

Source: Research data, (2015)

From this table $R^2 = 0.585$ i.e. 58.5 % variation in the performance of public hospitals is explained by predictors in the model. However 41.5% variation in performance of public hospitals is due to other factors not in the regression model. From this test result, the model is satisfactory and can be used for estimation purposes.

4.5.3 F-Test for the Full Model

The study conducted analysis of variance (ANOVA) to determine the significance of the relationship among the variables in the regression model. The results are provided in table 4.12.

Table 4.12 Analysis of Variance

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	3.544	7	.506	3.329	.000 ^b
Residual	4.415	29	.152		
Total	7.959	34			

Source: Research data, (2015)

The numerator for $\alpha = 5\%$ whose degrees of freedom (df) =7, denominator df =29 and critical F value is 2.045. The above findings show computed F value is 3.329. From these findings, the regression model is significant since the computed F-value exceeds the critical value that is $3.329 > 2.045$. This is collaborated by the P value = 0.000 which is less than 5%. This implies that all the independent variables considered together provide a significant level of explanation of the relationship between inventory management practices and performance of Public hospitals in Nairobi County and former Central Province Counties. This implies that 95% chance that the relationship among the variables is not due to chance. These findings are consistent with a study by Kitheka (2012) whose regression results concluded that there was a statistically significant relationship between inventory management automation and performance of supermarkets in Kenya.

4.5.4 Challenges of Inventory Management Practices

As a final objective, the researcher sought to determine the challenges faced by public hospitals in the implementation of inventory management practices. The results are presented in the table 4.13 below:

Table 4.13 Challenges of Implementing Inventory Management Practices

	N	Mean	Std. Deviation
Failure to invest in modern technologies.	35	4.42	.615
Insufficient funding by government	35	4.34	.781
Poor infrastructure	35	3.76	.668
Lack of proper training	35	3.50	.631
Incompetent staff	35	3.35	.542
Unreliable suppliers	35	3.41	.548
Lack of commitment by top management	35	3.31	.642
Lack of proper training	35	2.86	.744

Source: Research data, (2015)

From the above findings in table 4.13, the respondents indicated that the main challenges facing public hospitals in the implementation of inventory management practices were as follows: lack of adequate finances to invest in modern technologies, insufficient funding by the government, poor infrastructure, lack of proper training and incompetent staff. The mean scores are as follows: 4.4.2, 4.34, 3.76 and 3.50 respectively. Their standard deviations are as follows: .615, .781, .668 and .631 respectively. These findings are line with Schonberger (2008) who indicated inadequate resources for implementing inventory management practices is major a problem to most firms. Companies fail to invest in inventory in technology and infrastructure lack effective inventory management systems.

Other challenges included unreliable suppliers, lack of commitment by the top management and lack of proper training. Their mean scores are as follows: 3.41, 3.31

and 2.86 respectively. Their standard deviation scores are as follows: .548, .642 and .744. These findings collaborate with a study by Song and Zipkin (2011) who explains that lack of commitment by the top management of the organization is a major contributor to poor inventory management systems.

4.6 Chapter Summary and Discussion

The most popular inventory management practices used by public hospitals in Nairobi County are as follows: ERP systems, ABC systems, e-procurement and simulation. These inventory practices were implemented to a moderate extent. These findings are consistent with Onyango (2011) who pointed out that ERP and e-procurement systems were largely used in most cement manufacturing firms in Kenya. Further, Akintonye (2014) indicated that e-procurement was highly implemented in German services firms. VMIS, JIT systems and RFID systems were least implemented in public hospitals in Nairobi County and former Central Province Counties. These findings are in line with a study by Kitheka (2012) who indicated that RFID and JIT systems were least implemented in public hospitals in Nairobi County and former Central Province Counties.

The regression results indicated that RFID, VMIS and ABC are statistically significant since their probability values obtained from the regression model above are below 0.05 (5%). On the contrary, EOQ, ERP, ABC, JIT and E-procurement are statistically insignificant since their p-values are more than 5%. These findings are consistent with Kitheka (2012) who indicated that RFID systems were statistically significant in explaining the relationship between inventory management and performance of supermarkets in Kenya. The regression model is statistically significant since $.000 < 5\%$ this implies that all the independent variables considered

together provide a good level of explanation of the relationship between inventory management practices and performance of Public hospitals in Nairobi County and former Central Province Counties. These findings are consistent with a study by Kitheka (2012) whose regression results concluded that there was a statistically significant relationship between inventory management automation and performance of supermarkets in Kenya.

The main challenges facing public hospitals in the implementation of inventory management practices were as follows: lack of adequate finances to invest in modern technologies, insufficient funding by the government, poor infrastructure, lack of proper training and incompetent staff. These findings are line with Schonberger (2008) who indicated inadequate resources for implementing inventory management practices is major a problem to most firms. Companies fail to invest in inventory in technology and infrastructure lack effective inventory management systems. Other challenges included unreliable suppliers, lack of commitment by the top management and lack of proper training. Their mean scores are as follows: 3.41, 3.31 and 2.86 respectively. Their standard deviation scores are as follows: .548, .642 and .744. These findings collaborate with a study by Song and Zipkin (2011) who explains that lack of commitment by the top management of the organization is a major contributor to poor inventory management systems.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter covers a comprehensive review of the major findings that were drawn from chapter four. These findings were intended to answer the following questions: what are the inventory management practices used by public hospitals in Kenya, what is the relationship between inventory management practices and performance of Public hospitals in Kenya and what are the challenges of implementing inventory management practices in Public hospitals in Kenya. The chapter is structured as follows: Summary, conclusion, recommendations, limitations of the study and suggestions for further research.

5.2 Summary

The most popular inventory management practices used by public hospitals in Nairobi County and former Central Province Counties are as follows: ERP systems, ABC systems, e-procurement and simulation. These inventory practices were implemented to a moderate extent. Their average scores are as follows: 3.75, 3.72, 3.69 and 3.55 respectively. VMIS, JIT systems and RFID systems were least implemented in public hospitals in Nairobi County. The average scores are as follows: 2.34, 2.12 and 1.62.

The findings further revealed that 58.5 % variation in the performance of public hospitals was explained by predictors in the model. The regression model was found to be statistically significant since $.000 < .005$ which implied that all the independent variables adequately explained the relationship between inventory management practices and performance of Public hospitals in Nairobi County. Further, it was observed that RFID, VMIS and ABC were statistically significant since their probability values

obtained from the regression model were below 0.05 (5%). $P=0.000$, $p=0.001$, $P=.043$ respectively. On the other hand, EOQ, ERP, ABC, JIT and E-procurement were statistically insignificant since their p-values are more than 5%, $p=.621$, $p=.771$, $p=.825$, $p=.053$ and $p=.714$ respectively.

The main challenges facing public hospitals in the implementation of inventory management practices were as follows: lack of adequate finances to invest in modern technologies, insufficient funding by the government, poor infrastructure, lack of proper training and incompetent staff. The mean scores were as follows: 4.4.2, 4.34, 3.76 and 3.50 respectively. Their standard deviations were as follows: .615, .781, .668 and .631 respectively. These findings are line with Schonberger (2008) who indicated inadequate resources for implementing inventory management practices is major a problem to most firms. Companies fail to invest in inventory in technology and infrastructure lack effective inventory management systems.

5.3 Conclusion

The study concludes that the most popular inventory management practices used by public hospitals in Nairobi and former central province counties are follows: ERP systems, ABC systems, e-procurement, simulation and EOQ. These practices were mainly used in level 5, level 6 and stand-alone which offers specialized services and operates under defined semi-autonomy which allows them to manage their own inventory. The study further concludes that RFID, VMIS and JIT were used to a very small extent in sub-district hospitals like level 4 at the location and divisional level. This is because of poor infrastructure to support modern technologies.

Further, the study concludes that the main challenges that hindered implementation of inventory management practices in public hospitals were: failure to invest in modern

technologies, insufficient funding, poor infrastructure, lack of top management commitment training and unreliable suppliers. Other challenges faced by the procurement officers were lengthy bureaucratic processes in the procurement system, interference of supply chain process from other professionals and finally poor relation between the national and county governments. These challenges are as result of poor implementation of government policies and failure to allocate adequate funds.

5.4 Recommendations from this Study

The study recommends that Government of Kenya allocates more funds to public hospitals to invest in modern information technologies such as enterprise resource planning systems that will provide an integrated organization wide health information system in a bid to increase information sharing, reduce costs and ultimately improve the delivery of quality of health care services. Through regular audits in all its public hospitals, the Government of Kenya can ensure that all the health facilities increase their capacity and access to health care services. On the other hand, the government should also train procurement officers and suppliers on procurement services inorder to eradicate corruption.

The Ministry of Health should ensure that all public hospitals are in good condition through regular and structured maintenance and servicing. This will ensure that the hospitals and their facilities are in a good working condition which will ultimately improve the quality of health care services they offer. The Government of Kenya should invest more on the infrastructure that is the road and the communication network in remote locations to enhance access and prompt health care services which will minimize referrals and deaths.

Finally, the study recommends that the Government of Kenya builds the capacity of existing supply chain staff and or hire a team of competent supply chain management staff who are to effectively manage hospital inventory systems. This will cut costs, reduce wastage and ultimately improve the effectiveness of public hospitals in Kenya.

5.5 Limitations of the Study

The government is known to work under strict confidentiality to prevent unauthorized access to information by third parties. It was challenging to convince the respondents to give information even after presenting the letter of authorization to collect data from the University of Nairobi. Most of the respondents agreed to fill the questionnaires on condition that that information would not be disclosed to third parties rather it would be used for academic purposes only.

The study was limited to district hospitals in Nairobi and former Central province Counties due to costs and time constraints. It would have been important for future researchers to consider investigating inventory management practices in public hospitals outside Nairobi County to find out whether these findings will hold. The researcher did not have any control over the filling process of the questionnaires. Some of the respondents refused to fill the questionnaires while others did not complete filling the questionnaires even after making follow-ups. This negatively affected the accuracy and completeness of the findings that have been in this study.

The other challenge that was faced by the researcher was that some of the respondents especially the head of supply chain delegated filling and completion of the questionnaires to their juniors who do not have similar experience and qualifications as compared to their managers. This might have affected the accuracy and findings thereof obtained in this study. The facilities from which data was collected were far

apart so the researcher had to cover long distances, poor infrastructure notwithstanding, which was not easy especially where numerous follow ups were required. The researcher had to create additional time to work on the project, perfect on her APA skills and data analysis. This was not easy given the strict deadline for the defense and final project submission as per the schedule followed by the University of Nairobi.

5.6 Suggestions for Further Research

A similar study should be conducted in the other 45 counties across the country other than Nairobi and former Central Province Counties to know the extent of implementation of inventory management practices and their influence in performance of public hospitals. This will create a platform to make a comparison on the findings upon which reliable conclusion can be made based on solid facts.

Moreover, it would be interesting to investigate the extent to which private hospitals implement inventory management practices and what public hospitals can learn, if anything, from them in relation to quality health care service delivery leveraged on efficient and effective supply chains. This will provide insights into areas for improvement for the health sector as a whole.

A comparative study should be conducted within the East African region in a middle class country that is similar in size for purposes of benchmarking. This will allow comparison, borrowing and adoption and implementing of some of the best inventory management practices that are competitive and compatible with the health policies.

The researcher also suggests a comprehensive review of health facilities compliance with Public Procurement and Oversight Authority regulations and health policy on supply chain management in the sector. This will ensure compliance of public health policies to ensure that they meet international standards.

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APPENDICES

APPENDIX I: RESEARCH QUESTIONNAIRE

INTRODUCTION

This questionnaire has been designed for the sole purpose of collecting data on the effect of inventory management practices and performance of public hospitals in Kenya. The data collected will be treated with a very high degree of confidentiality and it is meant for academic purpose only.

SECTION A: GENERAL INFORMATION

Name of Hospital

1. Duration that the hospital has been in operation

(i) Less than 10 years []

(ii) More than 10 years []

2. What is your position in this hospital?

a) Chief Supply Chain Management Officer []

b) Senior Supply Chain Management Officer []

c) Supply Chain Management Assistant []

d) Other (specify).....

3. How long have you been in this position?

a) Less than 5 years []

b) 5 to 20 years []

c) 20 years and above []

4. What is your highest professional qualification in supply chain management?

a) Degree []

b) Diploma []

c) Certificate []

d) Other (specify)

SECTION B: INVENTORY MANAGEMENT PRACTICES IN PUBLIC HOSPITALS IN KENYA

Please indicate the extent to which you agree with the following statements on the inventory management practices used by public hospitals. The scale below will be applicable: 1=very small extent, 2= small extent, 3= moderate extent, 4= Large extent, 5= to a very large extent

No	Statement	1	2	3	4	5
	Economic Order Quantity					
1	The hospital adopts a classical economic order quantity model.					
2.	The hospital observes periodical replenishment of stocks					
3	The hospital maintain a minimum stock levels					
	Radio Frequency Identification System					
1	The hospital uses Radio Frequency Identification System of technology in reading and collecting data					
2	The hospital uses manual system of information					
	Vendor Managed Inventory System					
1	The hospital practices vender managed inventory systems.					
2	The hospital collaborates with its suppliers in system upgrade					
3	The hospital uses automatic stock tracking					
	Enterprise Resource Planning					
1	The hospital uses Enterprise Resource Planning system					
2	The hospital has an integrated information sharing system					
3	The hospital maintains a database for all its suppliers					
	Just In Time					
1.	The hospital uses JIT stock control system					
2.	The hospital uses the JIT system to eliminate waste					
	ABC Analysis					
1	The hospital uses ABC analysis to classify items according to their stock value					
2.	The hospital uses ABC Analysis to reduce stock holding cost					
	E-Procurement					
1	The hospital comply with e-procurement systems (IFMIS module)					
2	There is improved connectivity with a wide range of suppliers					
	Simulation					
1	The hospital uses simulation inventory models technique					
2	The hospital uses simulation to generate reports that help in decision making.					

Any other (please specify)

.....

SECTION C: INVENTORY MANAGEMENT PRACTICES AND SUPPLY CHAIN PERFORMANCE

Please indicate the extent to which you agree with the following statements in regard to the relationship that exists between inventory management practices and performance of public hospitals . Use the following rating; 5 = to a very large extent, 4 = Large extent, 3 = Moderate extent, 2 = Small extent, 1 = Very small extent.

No	Statement	1	2	3	4	5
	Economic Order Quantity					
1.	Use of EOQ model minimizes operational cost					
2.	Use of EOQ minimizes lead time					
3.	Use of EOQ enables hospital to meet demand					
4.	Use of marginal analysis techniques helps control optimal stock levels of perishable goods					
	Radio Frequency Identification System					
1.	The hospital uses RFID for efficient management of records					
2.	Use of RFID improves effectiveness in stock management					
3.	Use of RFID reduces theft					
4.	Use of barcodes in tracking stock items has enhanced availability of items					
	Vendor Management Inventory System					
1.	The hospital uses VMI for reduction of stock out costs					
2.	The hospital uses VMI for improved speed to tracking stock items					
3.	Use of VMI reduces stock holding costs					
4.	Use of VMI has reduced the risk of defective and obsolescence of items					
5.	Use of VMI has enhanced supplier relations partnership					
	Enterprise Resource Planning					
1.	Use of ERP improves planning for inventory					
2.	Use of ERP has improved connectivity with a wide range of suppliers					
3.	Use of ERP enhances integration of all supply chain partners					
4.	Use of ERP has led to improved inventory accuracy					
	Just In Time					
1.	Use of JIT improves quality					

No	Statement	1	2	3	4	5
2	Use of JIT improves reliability of suppliers					
3.	The hospital uses the JIT system to improve customer service					
4.	Use of JIT improves timely delivery of goods and services					
ABC Analysis						
1.	Use of ABC leads to efficient management of resources					
2.	Use of ABC enables the hospital to concentrate on the most cost-effective areas					
3.	ABC reduces stock holding costs					
E-Procurement						
1.	Use e-procurement increases improved connectivity with suppliers					
2.	Use of e-procurement minimizes operational costs					
3.	Use of e-procurement leads to real time processing of data					
4.	The hospital has formally improved transparency in all its tendering processes					
5	Use of e-procurement improves customer satisfaction					
Simulation						
1	The hospital adapts simulation module					
2	The hospital uses simulated values of services and stocks					

Others (please specify)

.....
.....
.....

SECTION D: CHALLENGES OF INVENTORY MANAGEMENT PRACTICES

Please indicate the challenges faced by your organization in implementation of inventory management practices in public hospitals in selected counties. Please tick in the appropriate box using the following rating; 5 = Strongly agree, 4 = Agree, 3 = Neither agree nor disagree, 2 = Disagree, 1 = Strongly disagree

		5	4	3	2	1
1.	Lack of commitment by top management					
2.	Failure to invest in modern technologies					
3.	Insufficient funding by government					
4.	Incompetent staff					
5.	Unreliable suppliers					
6.	Poor record keeping					
7.	Poor infrastructure					
8.	Lack of proper training					

List any other areas for improvement in supply chain management

.....

.....

.....

THANK YOU

**APPENDIX II: List of Public Hospitals in Nairobi County and Former Central Province Counties in Kenya
(Levels 4, 5, 6 & stand alone)**

Nairobi Referral Hospitals

SN	FACILITY NAME	DISTRICT	COUNTY	DIVISION	TYPE OF FACILITY	OWNER
1.	Kenyatta National Hospital	Nairobi	Nairobi	Kibra	National Referral Hospital	Ministry of Health
2.	National Spinal Injury Hospital	Nairobi	Nairobi	Dagoretti North	National Referral Hospital	Ministry of Health

Nairobi District Hospitals

SN	FACILITY NAME	DISTRICT	COUNTY	DIVISION	TYPE OF FACILITY	OWNER
3.	Mathari Hospital	Nairobi	Nairobi	Mathare	District Hospital	Ministry of Health
4.	Mama Lucy Kibaki Hospital – Embakasi	Nairobi	Nairobi	Embakasi West	District Hospital	Ministry of Health
5.	Mbagathi District Hospital	Nairobi	Nairobi	Kibra	District Hospital	Ministry of Health

Nairobi Stand Alone Hospitals

SN	FACILITY NAME	DISTRICT	COUNTY	DIVISION	TYPE OF FACILITY	OWNER
6.	TB central Reference Lab	Nairobi	Nairobi	Kibra	Laboratory (Stand-alone)	Ministry of Health
7.	National Blood Transfusion Services	Nairobi	Nairobi	Kibra	Laboratory (Stand-alone)	Ministry of Health
8.	National HIV Reference Lab	Nairobi	Nairobi	Kibra	Laboratory (Stand-alone)	Ministry of Health
9.	National Public Health Laboratories	Nairobi	Nairobi	Kibra	Laboratory (Stand-alone)	Ministry of Health
10.	Microbiology Reference Lab	Nairobi	Nairobi	Kibra	Laboratory (Stand-alone)	Ministry of Health

Nairobi Medical Clinic

SN	FACILITY NAME	DISTRICT	COUNTY	DIVISION	TYPE OF FACILITY	OWNER
11.	Kari health Clinic	Nairobi	Nairobi	Westlands	Medical Clinic	Ministry of Health
12.	Kamiti Maximum Clinic	Nairobi	Nairobi	Roysambu	Medical Clinic	Ministry of Health
13.	Westlands District Health Management	Nairobi	Nairobi	Westlands	Medical Clinic	Ministry of Health

Central District Hospitals

SN	FACILITY NAME	DISTRICT	COUNTY	DIVISION	TYPE OF FACILITY	OWNER
14.	Kiambu District Hospital	Central	Kiambu	Kiambu	District Hospital	Ministry of Health
15.	Thika District Hospital	Central	Kiambu	Thika	District Hospital	Ministry of Health
16.	Gatundu District Hospital	Central	Kiambu	Gatundu	District Hospital	Ministry of Health
17.	Tigoni District Hospital	Central	Kiambu	Limuru	District Hospital	Ministry of Health
18.	Kerugoya District Hospital	Central	Kirinyaga	Kirinyaga Central	District Hospital	Ministry of Health
19.	Maragua District Hospital	Central	Murang'a	Murang'a South	District Hospital	Ministry of Health
20.	Murang'a District Hospital	Central	Murang'a	Kiharu	District Hospital	Ministry of Health
21.	Nyeri Provincial General Hospital	Central	Nyeri	Nyeri Municipality	District Hospital	Ministry of Health
22.	Karatina District Hospital	Central	Nyeri	Mathira East	District Hospital	Ministry of Health
23.	Mukurweini District Hospital	Central	Nyeri	Mukurweini	District Hospital	Ministry of Health
24.	Engineer District Hospital	Central	Nyandarua	Nyandarua South	District Hospital	Ministry of Health

Central Sub-District Hospitals

SN	FACILITY NAME	DISTRICT	COUNTY	DIVISION	TYPE OF FACILITY	OWNER
25.	Kihara Sub-District Hospital	Central	Kiambu	Kiambu	Sub - District Hospital	Ministry of Health
26.	Igegania Sub-District Hospital	Central	Kiambu	Gatundu North	Sub - District Hospital	Ministry of Health
27.	Nyathuna Sub-District Hospital	Central	Kiambu	Kikuyu	Sub - District Hospital	Ministry of Health
28.	Ruiru Sub-District Hospital	Central	Kiambu	Ruiru	Sub - District Hospital	Ministry of Health
29.	Kimbimbi Sub-District Hospital	Central	Kirinyaga	Kirinyaga South	Sub - District Hospital	Ministry of Health
30.	Kianyaga Sub-District Hospital	Central	Kirinyaga	Kirinyaga East	Sub - District Hospital	Ministry of Health
31.	Sagana Sub-District Hospital	Central	Kirinyaga	Kirinyaga West	Sub - District Hospital	Ministry of Health
32.	Kirwara Sub-District Hospital	Central	Murang'a	Gatanga	Sub - District Hospital	Ministry of Health
33.	Kigumo Sub-District Hospital	Central	Murang'a	Kigumo	Sub - District Hospital	Ministry of Health
34.	Kandara Sub-District Hospital	Central	Murang'a	Kandara	Sub - District Hospital	Ministry of Health
35.	Kangema Sub-District Hospital	Central	Murang'a	Kiharu	Sub - District Hospital	Ministry of Health
36.	Muriranjias Sub-District Hospital	Central	Murang'a	Kahuro	Sub - District Hospital	Ministry of Health
37.	Oi Kalou Sub-District Hospital	Central	Nyandarua	Nyandarua Central	Sub - District Hospital	Ministry of Health
38.	Mt. Kenya Sub-District Hospital	Central	Nyeri	Nyeri	Sub - District Hospital	Ministry of Health
39.	Othaya Sub-District Hospital	Central	Nyeri	Nyeri	Sub - District Hospital	Ministry of Health

Central Medical Clinic

SN	FACILITY NAME	DISTRICT	COUNTY	DIVISION	TYPE OF FACILITY	OWNER
40.	Amazing Grace Medical Clinic	Central	Nyandarua	Oljoro-orok	Medical Clinic	Ministry of Health

Source: Kenya Health Policy 2014-2015