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EFFECT OF INVENTORY MANAGEMENT PRACTICES ON SUPPLY CHAIN PERFORMANCE OF GOVERNMENT HEALTH FACILITIES IN KISUMU COUNTY IN KENYA

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Abstract: In spite of the policy and institutional reforms undertaken in the Kenyan government health facilities and the support from non-governmental organizations, government health facilities in Kisumu County are still not able to effectively manage their inventory. The purpose of this study was to determine the effect of inventory management practices on supply chain performance of government health facilities in Kisumu County. The target population was the 12 government health facilities level 4 and 5 in Kisumu County since they operate under some defined level of semi-self-autonomy that allows them to manage their own inventory and supply chains; which formed the unit of analysis. The unit of observation was 84 comprising of Procurement officers, Stores clerks, Logistics officers and IT employees from those health facilities. The study was conducted in the year 2018. A census was conducted on all the 12 public health facilities. The study used both primary and secondary data where a semi-structured questionnaire was used to collect primary data while a secondary data sheet collected secondary data on procurement costs. The collected quantitative data was analysed using percentages, means, standard deviations and frequencies while inferential statistics used included regression and correlation analysis. Statistical analyses were carried out using SPSS version 21 and results presented in pie chart, table and graph. Regression analysis results revealed that lean inventory practices, inventory records accuracy and information technology had a significant effect on supply chain performance, while demand forecasting had an insignificant effect on supply chain performance. Based on the findings of the study, the study concluded that lean inventory practices, inventory records accuracy and information technology had the most significant effect on supply chain performance of government health facilities in Kisumu County.

Key Words: *Lean Inventory Practices, Inventory Records Accuracy, Information Technology, Demand Forecasting On Supply Chain Performance Of Government Health Facilities In Kisumu County*

Introduction

Inventory management refers to the process of efficiently overseeing the constant flow of units into and out of an existing inventory, (Wisner & Leong, 2011). Inventory management practices entails controlling the transfer in of units in order to prevent the inventory from becoming too high, or diminishing to levels that could put the operation of the company at risk. According to Agus and Noor (2010), appropriate inventory management practices aims to manage 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. Moreover, inventory management practices entails maintaining accurate records of finished goods that are ready for shipment. Normally, this implies posting the production of newly completed goods to the inventory totals as well as removing 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 (Dryden *et al,* 2012).

According to Brigham *et al* (2013), companies should design and build up 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. Healthcare organizations in the contemporary world are developing effective inventory management practices to ensure supply chain performance is sustained, (Kritchanchai, 2016). Too much inventory consumes physical space, creates a financial burden, and increases the possibility of damage, spoilage and loss. On the other hand, too little inventory often disrupts business operations, and increases the likelihood of poor customer service (Dimitrios, 2008). Rajeev (2008) argues there is increased need for business enterprises to embrace effective inventory management practices as a strategy to improve their competitiveness.

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 & Wei, 2006). Some of the inventory management practices used discussed in this study includes; 5's, ABC Analysis, radio frequency identification systems, vendor management inventory, enterprise resource planning, Just In Time, customer supplier involvement, cycle counting, electronic data interchange and simulation. Information technology has enabled health facilities to control their inventories better through storage, processing, distribution and exchange information both within companies and with customers and suppliers in the supply chain (Laudon & Laudon, 2016). Initiatives such as Vendor Managed Inventory (VMI) and Collaborative Planning, Forecasting and Replenishment (CPFR) are based on an increased level of automation in both the flow of physical materials and goods and the flow of information between companies to improve the efficiency in the entire supply chain (Laudon & Laudon, 2016). The use of internet-based system to carry out individual or all stages of procurement process has significantly redefined the inventory management in government health sector such as searching, sourcing, negotiation, ordering, receipt, and post purchase review, (Kaval Croom & Brandon, 2004).

Inventory records accuracy can be achieved through the following strategies proposed by Lee (2006); selection and installation of inventory tracking software, revision of layout to allow for optimal storage, creation of rack location codes and assigning unique identifying number, locking warehouse and storage areas to limit unauthor-

ized removal or movement of inventory. In addition, an organization may consolidate parts, so that the same items are kept in one place, assign unique part numbers to the parts, establish units of measure for the parts and embark on continuous and consistent inventory counting (Supply Chain Metric, 2016). In spite of the policy and institutional reforms undertaken in the Kenyan government health facilities and the support from non-governmental organizations (Wamai, 2008) the government health facilities in Kisumu County are still not able to effectively manage their inventory as evidenced by the data obtained from Kisumu County Health Management Information System (2016). For example, stock out for essential drugs, slow response to emergency, lack of equipment for theatre services and delays in food supplies for patients all pointing to an ineffective supply chain.

Despite the average distance of 5km to health facilities in Kisumu County, only 46% of women deliver their babies in health facility against a national average of 44%, this could be attributed to slow response to emergency and lack of equipment hence patient's preference for traditional midwives, who at times risks the lives of expectant mothers and their babies due to non-scientific medical procedures. Malaria remains the number one cause of morbidity and mortality at 44.7% and about 50% of the under-five sleep under treated nets (Kisumu County Integrated Development Plan (CIDP) 2013-2017. A child under-five in Nyanza is three times more likely to die than a child in Central Province (KDHS, 2008). This study will seek to determine the effect of inventory management practices on supply chain performance in the Kenyan government health facilities within Kisumu County.

Statement of the Problem

In spite of the policy and institutional reforms undertaken in the Kenyan government health institutions and the support from non-governmental organizations, government health facilities in Kisumu County are still not able to effectively manage their inventory, (Wamai, 2008). This is evidenced by the data obtained from Kisumu County Health Management Information System (2016) such as stock outs for essential drugs, slow response to emergency, lack of equipment for theatre services and delays in food supplies for patients all pointing to an ineffective supply chain. Kisumu County has one of the highest infant (95 per 1000), child (133 per 1000) and maternal mortality rates that are double the national average probably as a result of stock out for both essential drugs and insecticides for treating mosquito nets. Malaria remains the number one cause of morbidity and mortality at 44.7% and about 50% of the under-five sleep under treated nets (Kisumu County Integrated Development Plan (CIDP) 2013-2017. A child under-five in Nyanza is three times more likely to die than a child in Central Province (KDHS, 2008).

Some studies have been conducted in the Kenyan Government Health Sector on inventory management and its relationship with organisational performance. Onkundi and Bachangi (2016) investigated the factors influencing inventory management in government hospital in Kisii County, their findings revealed that overstocking and under stocking of inventory in the Government Health Sector in Kisii County was due to inadequate forecasting of requirements, Scheduled time for deliveries, insufficient staff, Scheduled time for receiving, issuing and unorganized storage facilities which affected information sharing between the customer and supplier thus affecting supply chain performance.

Similarly, Oballa *et al* (2015) study revealed that inventory investment and inventory records accuracy have a positive influence on organizational performance while inventory shrinkage have a negative effect on organizational performance. Moreover, a study by Wagura (2015) assessed the impact of inventory management systems on supply chain performance in government hospitals in Nairobi, his finding indicated lack of proper inventory management systems to control cost. Studies by Onkundi and Bachangi (2016), Oballa *et al* (2015) and Wagura (2015) demonstrate that some research has been conducted in this area, however these studies have failed to address the effect of lean inventory practices, inventory records accuracy, Information technology, demand forecasting on supply chain performance of government health facilities in Kisumu County. This study therefore proceeded to address the research and knowledge gap in regard to the effect of the above inventory management practices on supply chain performance of government health facilities in Kisumu County.

Objectives of the Study

i. To determine the effect of lean inventory practices on supply chain performance of government health facilities in Kisumu County in Kenya.
ii. To analyze the effect of inventory records accuracy on supply chain performance of government health facilities in Kisumu County in Kenya.
iii. To assess the effect of information technology on supply chain performance of government health facilities in Kisumu County in Kenya.
iv. To examine the effect of demand forecasting on supply chain performance of government health facilities in Kisumu County in Kenya.

Literature Review

Theoretical Review

Lean Theory

Lean Theory was first coined by John Krafcik in his 1988 article. Lean is the set of "tools" that assist in the identification and steady elimination of waste. As waste is eliminated, production time and cost are reduced while quality improves (Krafcik , 1988). Kros *et al* (2016), further define lean as an extension of ideas of just in time, elaborating just in time as a pull-based system designed to align the production and business processes throughout the supply chain. Green and Inman (2005) assessed the impact of lean theory on financial performance. They suggested that lean theory may eliminate buffer stock and minimize waste in production process. Eroglu and Hofer (2011) found that leanness positively affects profitability of a business firm; they argued that inventory leanness is the best inventory control tool. The lean theory elaborates on how manufacturers gain flexibility in their ordering decisions, reduce the stocks of inventory held on site and eliminate inventory carrying costs. At the aggregate level, the empirical strength of the lean explanation lies both in the timing and the magnitude of the adoption. Therefore, this theory is important in providing an understanding on the effect of lean inventory practices on the supply chain performance.

Transaction Cost Economics Theory (TCE)

Transaction cost theory was first posited by John R Commons (1931). According to the transaction cost economic theory the determinants of transactions are; frequency, specificity, uncertainty, limited rationality and opportunistic behavior. The Transaction Cost Economics (TCE) theory argues that the use of ICT will lead to reduced transaction costs associated with the management of transactions (Coase, 1937; Alchian & Demsetz, 1972; Williamson, 1975) and by efficient coordination. Explicitly recognizing the costs of coordination among

economic entities in markets, TCE stresses that a firm's central task is to coordinate transactions efficiently (Williamson, 1989). Information technologies can lower coordination costs, and in supply chain contexts, digitally enabled integration capability can substantially improve transactional efficiencies through increased information sharing and communications capabilities, resulting in improved supply chain performance (Zhu & Kraemer, 2005). Furthermore, as argued by (Lopez, 2013), ICT resources impact on communication improvement; this includes internal and external communication and coordination of activities and this enables a faster and more efficient use of information both within the firm and with external agents, such as customers and suppliers. TCE sheds light on the role of the digitally enabled supply chain management in competitive environments. Thus this theory is relevant to the study as it links the independent variable of information technology to the study.

Application Control Theory

The proponent of the theory was Ortega and Lin in 2004. The proponent of the theory aimed to reduce inventory variation, reduce demand amplification and optimize ordering rules (Sourirajan & Ramachandran, 2008). In a flexible demand environment, other organizations have doubts on inventory control, but Bijulal, Venkateswaran and Hemachandra (2011) point out that application control theory plays a vast role to deal with uncertainties of demand. The theory help suggests guidelines on reordering processes such as when and how much to reorder in the situation of uncertainty demand. It is clear that uncertainty of demand is subjected into intervals and can result in great effort placed upon procurement because there is no specific lead time in between of the demand and the extent to reorder. Satisfying customers in this situation may also require strong management support and advanced procurement strategies that derive theory into practice (Minner & Transchel, 2010). Hence, the theory is important in understanding the effect of lean inventory practices on the supply chain performance.

Deterministic Inventory Theory

Deterministic Inventory theory was first posited by Buzacott, (1975). Deterministic models of inventory control are used to determine the optimal inventory of a single item when demand is mostly largely obscure. According to Croom and Jones (2010), deterministic inventory theory 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. Deterministic inventory model helps to understand the challenges of Irregular large orders and frequent small orders. Large orders increase the amount of inventory available, which is costly, but may benefit from volume discounts. Suppliers 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. Frequent orders are costly to process, and the resulting small inventory levels may increase the probability of stock outs, leading to loss of customers. This theory is relevant to the study as it provides a link with the independent variable of demand forecasting to the study. This is most applicable to health facilities as it deals with perishable goods and services seeking to mitigate inventory management costs.

Conceptual Framework

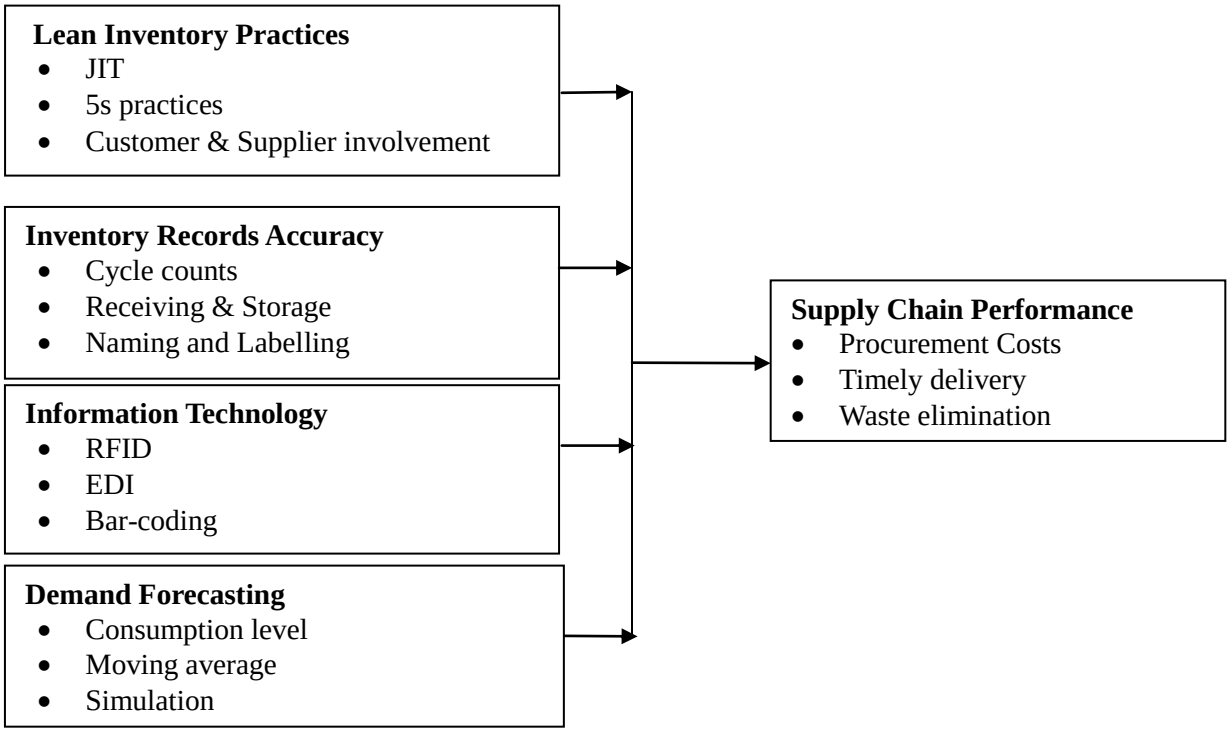

Figure 1: Conceptual Framework

Empirical Review

Nawanir *et al* (2013) investigated the impact of lean practices on operations performance and business performance from the Indonesian manufacturing companies and established that lean practices had a positive and significant impact on both Operations performance namely; quality of product, inventory minimization, on time delivery, cost reduction and Business performance namely; profitability, sales, customer satisfaction. Chituri *et al* (2016) investigated the linkage between the determinants of inventory management and customer satisfaction within supermarkets in Nigeria and established that inventory management system had the most significant positive impact on customer satisfaction. Further, the results indicated that maintaining an efficient inventory management system is important in enhancing supermarkets patronage. It would be of value to test the same hypothesis in the government health facilities in Kenya specifically the health facilities in Kisumu County. Mukopi and Iravo (2015) examined the effects of inventory management on procurement performance function of the sugar manufacturing companies in the western sugar belt namely; Mumias Sugar Company, West Kenya Sugar Company, Nzoia Sugar Company and Butali Sugar Mills and revealed a strong positive relationship between lean inventory systems and procurement performance.

A study conducted by Onchoke and Wanyoike (2016) on influence of inventory control practices on procurement performance of agrochemicals distributors in Nakuru Central Sub-County revealed that computerized inventory control system has significant positive influence on records accuracy and procurement performance. On the other hand, Ruankaew and Williams (2013) investigated the impact of inventory inaccuracy in the food manufacturing industry in Pennsylvania, United States and established that inventory inaccuracy impacts an organization's resources and performance in terms of time, cost, and risk. Oballah *et al* (2015) in their study investigated the effect of inventory management practices on organization performance in the Government Health facility in Kenyatta National Hospital and established that inventory shrinkage have a negative effect with could be reduced by inventory accuracy. Kithinji (2015) sought to examine the impact of information technology on inventory management in supermarkets in Nairobi City County and indicated that Supermarkets should invest more in modern technologies for example information communication technology in order to achieve integration, minimize communication costs, enhance efficiency and increase sharing of information which will eventually lead to improved performance. Do Rego and de Mesquita (2015) conducted a simulation study on automotive spare parts to determine the effect of demand forecasting on inventory control. The results of the study indicated that demand forecasting had a positive and significant effect on inventory control. Leung *et al,* 2016) sought to determine the impact of inventory management on stock-outs of essential drugs in Sub-Saharan Africa using simulation. The study revealed that simulation experiments closely reproduced these results and linked them to the use of average past monthly issues and failure to capture lead-time variability in current inventory control policies.

Research Methodology

This study employed a descriptive research design. A descriptive research describes a situation or condition at hand; it examines aspects such as opinion, abilities, behaviour, knowledge and beliefs of individuals, groups or situation (Kothari, 2005). The target population was level 4 and 5 government health facilities in Kisumu County which are 12 in number as per the year 2018. The unit of observation was the Procurement officers, Stores clerks, Logistics officers and IT employees who were 84 in total. The study conducted a census on the entire target population without adopting a sampling methodology. Both primary and secondary data was adopted for analysis. A semi-structured questionnaire and secondary data sheet were used for data collection. Before data collection, a pilot to establish reliability of the instrument was conducted on 8 respondents randomly sampled from 3 public health facilities in Siaya County. Content validity was established through expert opinion of the supervisor and a procurement expert. The data collection tool for analysis of quantitative data was statistical software for social sciences version 21 which produced both descriptive and inferential statistics. On the other hand, the study analyzed qualitative data through content analysis. A multivariate regression model was used in determining of coefficients of the independent in relation to the dependent variable. The multivariate model was as follows;

$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon}$**, where** Y = Supply Chain Performance**,** X_1= Lean Inventory Practices**,** X_2= Inventory Records Accuracy**,** X_3= Information Technology**,** X_4= Demand Forecasting **,** $\boldsymbol{\beta_0}$ = the constant term while the coefficient $\boldsymbol{\beta_i}$ = 1….4 were used to measure the sensitivity of the dependent variable (Y) to unit change in the predictor variables X_1, X_2, X_3 and X_4 and ε is the error term, which captures the unexplained variations in the model.

Results

A total of 84 questionnaires were administered out of which 58 questionnaires were dully filled and returned. This presented a response rate of 70% which was considered good for reporting and interpretation. This is based on the assertion of Bailey, (2010) that a response rate of 50% is adequate, 60% is considered good, and response greater than 70% is considered very good.

Demographic Characteristics

Table 1 Respondent Demographic Information

Demographic Characteristic	Category	Percentage
Respondent level of education	Certificate	9.5%
	Diploma	63.1%
	Bachelor's Degree	23.8%
	Post Graduate	3.6%
Work Experience	Less than 2 years	19%
	Between 2- 5 years	44%
	Between 5-10 years	19%
	Above 10 years	17.9%

Descriptive Results

This section contains descriptive statistics for all the variables used in this study. The study's independent variables included Lean inventory practices, inventory record accuracy, information technology and demand forecasting. The study also presented the descriptive results on the dependent variables. In this section the study used percentages, mean and standard deviation.

Lean Inventory Practices

The first objective of this study was to determine the effect of lean inventory practices on supply chain performance of government health facilities in Kisumu County. In this section the study basically sought to determine if lean inventory practices were carried out in government health facilities. The lean inventory practices the study focused on included JIT, 5s practices and Customer & Supplier involvement. Table 2 presents the descriptive results. The study sought to establish whether government health facilities obtained medical and non-medical supplies from suppliers just when they are needed which reduced inventory holding cost, the findings showed that 42.9% and 27.4% of the respondents agreed and strongly agreed. The results further revealed that the statement had a mean of 4 confirming majority of the respondents agreed and a standard deviation of 1.15 implying variation in the responses.

On whether, the health facility had arrangement with suppliers to deliver specified medical and non-medical supplies just when they are need to reduce inventory carrying cost, the findings revealed that 45.2% and 17.9% of the respondents agreed and strongly agreed respectively. Similarly, the findings revealed a mean of 4 and standard deviation of 1.16 which confirmed majority respondents agreed and the response slightly varied from the mean. The study further sought to establish whether organizing, standardizing and maintaining medical and non-medical supplies in health facility stores eliminates waste of time, effort and expiry, the findings showed that 27.7% and 62.7% of the respondents agreed and strongly agreed. Those who disagreed and very much disagreed were 4.8% and 1.2% respectively.

The mean of 4 further confirmed that majority of the respondents agreed while the standard deviation of 0.87 confirmed that the response slightly varied from the mean response. On whether the health facilities had reliable suppliers who can supply medical supplies just when they are needed, the response varied as shown by the mean of 3. Some of the respondents agreed and very much agreed (38.1% and 15.5%) while who disagreed (21.4%) and very much disagreed (7.1%). The findings implied that some health facilities had reliable suppliers who can supply medical supplies just when they are needed while other lacked such suppliers.

The study finally sought to establish whether the customer and supplier involvement while purchasing medical and non-medical supplies reduces waste, the findings of this study revealed that 45.2% and 40.5% of the respondent agreed and very much agreed. The statement had a mean response of 4 which further confirmed that majority of the respondents were in agreement with the statement. The standard deviation of 0.86 also revealed that the response varied slightly from the mean. The overall implication of these study findings was that majority of the government health facilities in Kisumu County practiced lean inventory to boost their supply chain performance. Studies on lean inventory practices established a positive relationship between lean inventory and supply chain performance. For instance, Nawanir *et al* (2013) revealed that lean practices had a positive and significant impact on both Operations performance namely; quality of product, inventory minimization, on time delivery, cost reduction and Business performance namely; profitability, sales, customer satisfaction. Chituri *et al* (2016) results also indicated that maintaining an efficient inventory management system is important in enhancing supermarkets patronage.

Table 2 Descriptive Results on Lean Inventory Practices

Statements	Very Much Disagree	Dis agree	Not Sure	Agree	Very Much Agree	Mean	Std Dev
Obtaining medical and non-medical supplies from suppliers just when they are needed reduces inventory holding cost	3.6%	17.8%	8.3%	42.9%	27.4%	4	1.15
The health facility has arrangement with suppliers to deliver specified medical and non-medical supplies just when they are need to reduce inventory carrying cost	7.10%	14.0%	15.5%	45.2%	17.9%	4	1.16
Organizing, standardizing and maintaining medical and non-medical supplies in health facility stores eliminates waste of time, effort and expiry	1.20%	4.8%	3.6%	27.7%	62.7%	4	0.87
The health facility has reliable suppliers who can supply medical supplies just when they are needed	7.1%	21.4%	17.9%	38.1%	15.5%	3	1.19
The customer and supplier involvement while purchasing medical and non-medical supplies reduces waste	0.00	7.10	7.10	45.3%	40.5 %	4	0.86
Overall						**3.8**	**1.05**

Inventory Record Accuracy

The second objective of the study was to analyse the effect of inventory record accuracy on supply chain performance of government health facilities in Kisumu County. This section presents the findings on descriptive analysis which provide insight on the extent of adoption of inventory record accuracy among the government health facilities. The study sought to determine whether the health facilities frequently conduct count of a number of medical and non-medical supplies in different parts of facility without having to count the entire inventory, the findings presented in Table 3 revealed that 21.4% and 25.0% very much disagreed and disagreed respectively. Those who agreed and very much agreed were 27.4% and 8.3% respectively. The mean response for this statement was 3 which indicated that the responses varied across various respondents which were also confirmed by the standard deviation of 1.30. The study also sought to establish whether frequent counting of a number of medical supplies in different parts of the facility without having to count the entire inventory has improved accuracy of medical and non-medical supplies, similarly, the research findings showed that 40.5% and 13.1% disagreed and very much disagreed. Those who agreed and very much agreed were 21.4% and 15.5% respectively. The mean of 3 also confirmed that the statement had varying responses.

The study further sought to establish whether health facilities had specialized storage facilities for types of inventory, the research findings revealed that 44.0% and 32.1% of the respondents agreed and very much agreed with the statement. The statement had a mean response of 4 which confirmed that majority of the respondents agreed. Similarly, the standard deviation of 1.08 showed that the response varied slightly from the mean. On whether health facilities had a process for counter checking all inventory on receipt, the results showed that 44.0% and 42.9% of the respondents agreed and very much agreed with the statement. The statement had a mean of 4 and standard deviation of 0.93 that confirmed that majority of the respondents agreed. The study finally sought to establish whether inventory in government health facility was properly labelled and kept in the right labelled bin for easy tracking, the findings revealed that 40.5% and 48.8% of the findings agreed and very much agreed with the statements. Those who disagreed and very much disagreed were 3.5% and 1.2% respectively. The statement had a mean response of 4 which also confirmed that majority of the respondents agreed with the statements.

The overall implications of the study findings were that majority of the government health facilities had adopted inventory records accuracy practices in managing their inventory. Such practices are highly linked to high supply chain performance. For instance, Onchoke and Wanyoike (2016) study revealed that computerized inventory control system have significant positive influence on records accuracy and procurement performance, Similarly, Ruankaew and Williams (2013) revealed that the causes of inventory inaccuracy can occur at various stages during the processes such as receiving, the material usage recording process, and cycle counting. As a result, inventory inaccuracy impacts on organization's resources and performance in terms of time, cost, and risk.

Table 3 Descriptive Results on Inventory Records Accuracy

Statements	Very Much Disagree	Dis Agree	Not Sure	Agree	Very Much Agree	Mean	Std Dev
The health facility frequently conduct count of a number of medical and non-medical supplies in different parts of facility without having to count the entire inventory	21.4%	25.0%	17.9%	27.4%	8.3%	3	1.3
Frequent counting of a number of medical supplies in different parts of the facility without having to count the entire inventory has improved accuracy of medical and non-medical supplies	13.1%	40.5%	9.5%	21.4%	15.5%	3	1.33
The health facility has specialized storage facilities for types of inventory	1.2%	16.7%	6.0%	44.0%	32.1%	4	1.08
Our health facility has a process for counter checking all the inventory on receipt	2.3%	4.8%	6.0%	44.0%	42.9%	4	0.93
The inventory in our health facility is properly labeled and kept in the right labeled bin for easy tracking	1.2%	3.5%	6.0%	40.5%	48.8%	4	0.84
Overall						**3.6**	**1.09**

Information Technology

The third objective of the study was to assess the effect of information technology on supply chain performance of government health facilities in Kisumu County. This section presented the descriptive results on the level of adoption of information technology in managing inventory among the government health facilities. The study sought to establish whether government health facilities uses electromagnetic fields to automatically identify and track tags attached to specified medical inventory, the finding showed that 46.4% and 10.7% of the respondents agreed and very much agreed respectively. The statement had a mean response of 3 and standard deviation of 0.66 implying majority of the respondents were not sure. The study also sought to establish whether use of computer based system that allows exchange of business documents for example, purchase orders and invoices electronically reduces supply chains cost, the research findings revealed that 22.6% very much disagreed and 23.8% disagreed.

On the other hand, 23.8% and 14.3% of the respondents very much agreed and agreed respectively. The mean of 3 showed that the response varied across various respondents as indicated by the standard deviation of 1.41. The study similarly sought to establish whether government health facilities has computer system that exchanges business documents electronically with suppliers, 39.3% and 11.9% of the respondents agreed and very much agreed respectively.

The statement had a mean response of 3 which further confirmed that majority of the respondents had varying opinion which implied some health facilities had computers while other lacked such systems. On whether government health facilities uses Bar-coding in inventory management, the findings showed that 28.0% and 19.5% of the respondents agreed and very much agreed respectively. The statement had a mean response of 3 which further confirmed that majority of the respondents had varying opinion which implied some health facilities had Bar-coding in inventory management while other lacked. The standard deviation of 1.21 indicated variation in the response. Finally, the study sought to establish whether the use of IT reduces loss of inventory in government health facilities in Kisumu County. The research findings revealed that 23.8% and 21.4% of the respondents agreed and very much agreed respectively. Those who very much disagreed and disagreed were 13.1% and 23.8% respectively. The statement had a mean response of 3 which further confirmed that the respondents had varying opinions on this particular statement.

The research findings in this section generally implied that some government health facilities had adopted information technology in inventory management while other facilities did not use information technology in inventory management. The findings revealed that majority of the respondent had varying opinion on the use of information technology in inventory management. Onchoke and Wanyoike (2016) finding of the study revealed that Computerized Inventory Control had significant positive influence on supply chain performance. Mathias and Owuor (2015) revealed that inventory management system is positively related and is significant for the realization of organizational performance in Grain Bulk handlers Ltd.

Table 4 Descriptive Results on Information Technology

Statement	Very Much Disagree	Disagree	Not Sure	Agree	Very Much Agree	Mean	Std Dev
Our health facility uses electromagnetic fields to automatically identify and track tags attached to specified medical inventory	0.0%	0.0%	42.9%	46.4%	10.7%	3	0.66
The use of computer based system that allows exchange of business documents for example, purchase orders and invoices electronically reduces supply chains cost	22.6%	23.8%	15.5%	14.3%	23.8%	3	1.41
Our health facility has computer system that exchanges business documents electronically with suppliers	11.9%	8.3%	28.6%	39.3%	11.9%	3	1.24
Our health facility uses Bar-coding in inventory management	14.7%	4.9%	32.9%	28.0%	19.5%	3	1.21
The use of IT reduces loss of inventory in our health facility	13.1%	23.8%	17.9%	23.8%	21.4%	3	1.51
Overall						**3**	**1.21**

Demand Forecasting

The final objective of this study was to examine the effect of demand forecasting on supply chain performance of government health facilities in Kisumu County. This section presents the results on descriptive analysis on the use of demand forecasting in inventory management in government health facilities in Kisumu. The study sought to establish whether use the use mathematical formula, equation and model in demand forecasting enhances decision making by experimenting, testing intervention scenarios and consequences over time, the research findings revealed that 34.5% and 19.0% of the respondents agreed and very much agreed with the statements. The statement had a mean 4 of which confirmed that majority of the respondents agreed. The statement had a standard deviation of 1.07 that implied respondents opinions slightly varied from the mean. On whether, the health facility uses mathematical formulas , equations and models to determine the right level of current and future inventory needs, the research findings revealed that 33.3% and 13.1% agreed and very much agreed respectively. However, a significant percentage (32.1%) indicated they were not sure. The statement had a mean of 3 which confirmed that majority of the respondents had varying opinions on this statements.

The study further sought to establish whether the health facility uses past records on inventory consumption to aid accurate budgeting and procurement plan, the study results showed that 49.4% and 31.3% of the respondents agreed and very much agreed with the statements. The statements had a mean of 4 which confirmed that majority of the respondents agreed. The statements had a standard deviation of 0.89 which showed that the response varied slightly from the mean. On whether, the government health facilities uses moving average method in determining the correct trend of inventory level over a period of time, the findings showed that 34.9% and 25.3% of the respondents agreed and very much agreed respectively. Similarly, the research findings revealed a mean of 4 that confirmed that majority of the respondents agreed with the statement. The study finally sought to determine whether effective demand forecasting has helped the health facility in maintaining the right of inventory level, the findings showed that 48.8% and 27.4% agreed and very much agreed with statement. The statements also had a mean of 4 confirming that majority of the respondents agreed and very much agreed with the statement. The research findings in this section implied that government health facilities in Kisumu County adopted the use of demand forecasting in their inventory management to enhance the supply chain performance. The descriptive results revealed that majority of the respondents agreed and very much agreed with the statements measuring use of demand forecasting. The study finding concurred with those of Do Rego and de Mesquita (2015) results of the study that indicated that demand forecasting had a positive and significant effect on inventory control.

Table 5 Descriptive Results on Demand Forecasting

Statements	Very Much Disagree	Dis agree	Not Sure	Agree	Very Much Agree	Mean	Std Dev
The use mathematical formula equation and model in demand forecasting enhances decision making by experimenting, testing intervention scenarios and consequences over time.	3.6%	14.3%	28.6%	34.5%	19.0%	4	1.07
The health facility uses mathematical formulas , equations and models to determine the right level of current and future inventory needs	8.4%	13.1%	32.1%	33.3%	13.1%	3	1.12
The health facility uses past records on inventory consumption to aid accurate budgeting and procurement plan	1.3%	6.0%	12.0%	49.4%	31.3%	4	0.89
The health facility uses moving average method in determining the correct trend of inventory level over a period of time	2.4%	14.5%	22.9%	34.9%	25.3%	4	1.09
Effective demand forecasting has helped the health facility in maintaining the right of inventory level	1.2%	8.3%	14.3%	48.8%	27.4%	4	0.93
Overall						**3.8**	**1.02**

Supply Chain Performance

Table 6 presented the findings on the supply chain performance among the government health facilities in Kisumu County. The measurements of the supply chain performance adopted included procurement cost, waste elimination and extent of customer satisfaction. The research findings presented in Table 6 revealed that 46.4% and 11.9% of the respondents indicated better and much better there was an improvement in the Time of delivery of medical and non-medical supplies in the health facility, 21.5% indicated about the same while 13.1% and 7.1% worse and much worse with the statement. The statements had a mean of 3 confirming that the respondents had varying opinions. On whether, there is a reduction in inventory carrying cost of medical and non-medical supplies in the health facility, the findings showed that 47.6% and 9.5% indicated better and much better respectively. The statement had a mean response of 4 confirming that majority of the respondents agreed and very much agreed that there is a reduction in inventory carrying cost of medical and non-medical supplies in the health facility.

The study further sought to establish whether cases of equipment and medical supplies shortage has reduced in the health facility, 29.8% and 13.1% of the respondents indicated better and much better while 15.5% and 15.5% indicated worse and much worse respectively. The statement had a mean of 3 which further confirmed that majority of the respondents had varying opinion. The findings also showed that 51.2% and19.0% of the re-

spondents indicated better and much better on whether there is more customer satisfaction in the health facility. The statement had a mean of 4 and standard deviation of 0.84 which implied that majority of the respondents agreed and the response varied slightly from the mean. The study further sought to establish whether there is an increase in waste elimination in the health facility, the research findings of the study revealed that 34.5% and 16.7% of the respondents indicated better and much better on the statements respectively. The mean of 3 indicated that respondents opinion varied as further confirmed by the standard deviation of 1.11. The findings in this section implied that supply chain performance varied among government health facilities. Some of the government health facilities had better supply chain performance as shown by those who agreed while other had poor supply chain performance as shown by those who disagreed. However, the findings revealed that on average the supply chain performance was below average. According Ng'ang'a (2013) a delay in procurement and frequent stock outs of inventory affects the performance of the health facilities in Kenya.

Table 6 Descriptive Results on Supply Chain Performance

Statements	Much Worse	Worse	About the Same	Better	Much Better	Mean	Std Dev
There is an improvement in the Time of delivery of medical and non-medical supplies in the health facility	7.1%	13.1%	21.5%	46.4%	11.9%	3	1.09
There is a reduction in Inventory Carrying cost of medical and non-medical supplies in the health facility	0.0%	10.8%	32.1%	47.6%	9.5%	4	0.81
Cases of equipment and medical supplies shortage has reduced in the health facility	15.5%	15.5%	26.1%	29.8%	13.1%	3	1.27
There is more customer satisfaction in the health facility	1.2%	4.8%	23.8%	51.2%	19.0%	4	0.84
There is an increase in waste elimination in the health facility	6.0%	14.2%	28.6%	34.5%	16.7%	3	1.11
Overall						**3.4**	**1.02**

Figure 2 presents the findings on procurement costs for the last four financial years in the level 4 government health facilities in Kisumu County. The findings showed that procurement costs have been increasing in majority of the government health facilities in Kisumu Counties. The increase could however be attributed to a number of reasons such as increase in the carrying capacity of the facilities on one hand and lack of proper inventory management on the other hand. Similarly, according Ng'ang'a (2013) a delay in procurement and frequent stock outs of inventory affects the performance of the health facilities in Kenya.

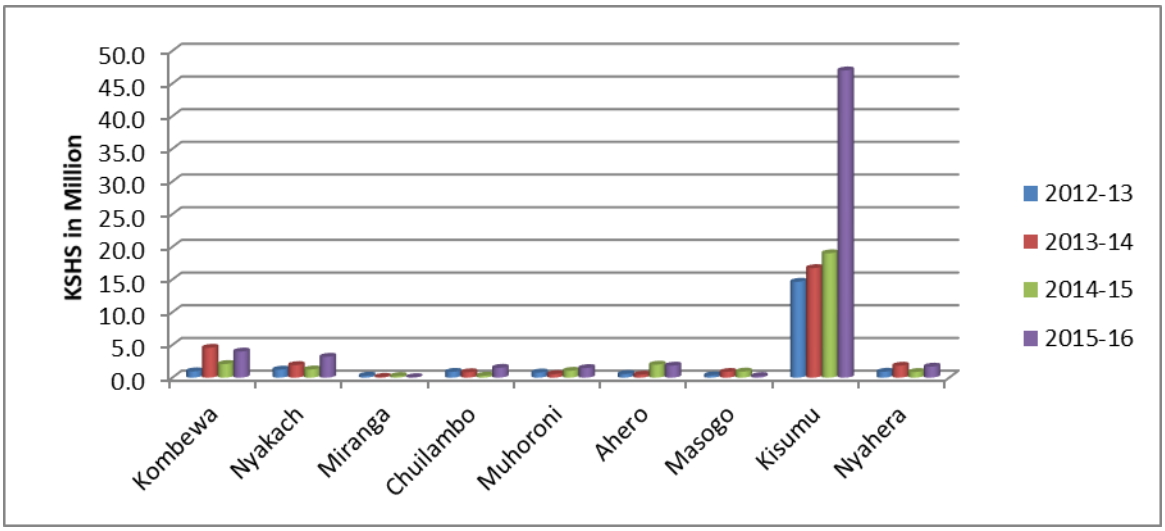

Figure 2 Procurement Cost in level 4 & 5 Government Health Facilities in Kisumu

Figure 3 presents the trends in Total procurement cost in level 4 government health facilities in Kisumu County that participated in the study for last four financial years. The findings revealed that procurement costs increased over the study period, however, the increase was huge between 2014/15 and 2015/16 financial years as shown in Figure 4.5. Sudden increase could be attributed to poor inventory management practices among the health facilities as suggested by Ng'ang'a (2013).

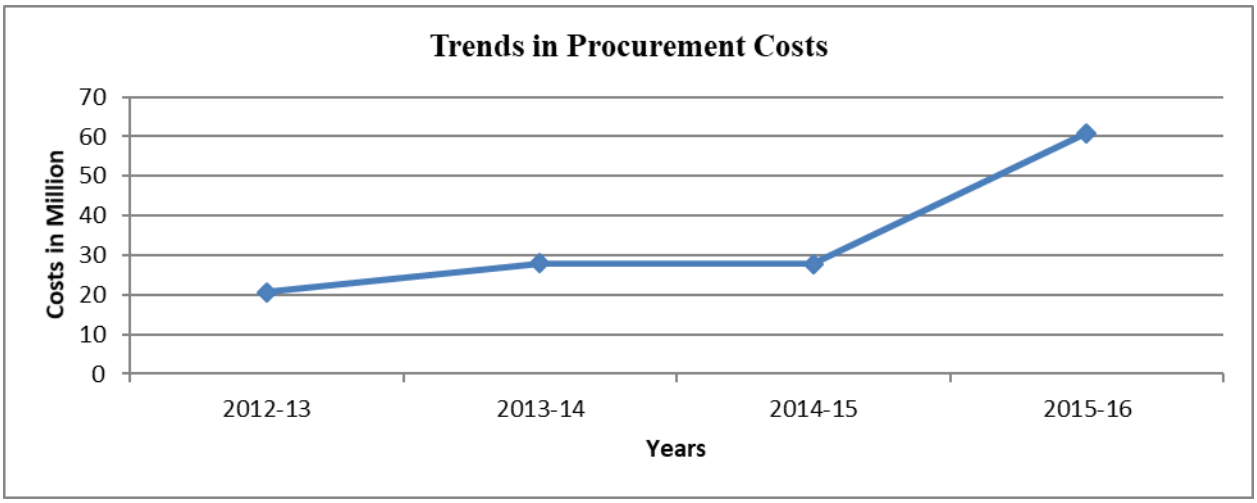

Figure 3 Trend in Procurement Cost of level 4 & 5 Government Health Facilities

Correlation Results

The Pearson Correlation of lean inventory practices versus supply chain performance was computed and established as 0.418 (p-value=0.000) which is a significant and positive relationship between the two variables. These findings implied that positive lean inventory practices results to positive supply chain performance. Study findings concur with Mukopi and Iravo (2015) who revealed a strong positive relationship between lean inventory systems and procurement performance. Similarly, Chituri *et al* (2016) the results indicated that maintaining an efficient inventory management system is important in enhancing supermarkets patronage. The correlation results of this study further revealed that there was significant, weak, and positive association between inventory records accuracy and supply chain performance. The Pearson correlation established was 0.394 (p=0.000). The finding implied improving inventory records accuracy led to a significant change on supply chain performance. The study findings concurs with those of Ruankaew and Williams (2013) who established that inventory inaccuracy impacts an organization's resources and performance in terms of time, cost, and risk.

The Pearson Correlation of information technology versus supply chain performance was computed and established as 0.407 (p-value=0.004) which is significant, weak, and positive association between the two variables. These findings implied that adoption of information technology results to positive supply chain performance. Research findings agreed with those of Onchoke and Wanyoike (2016) who revealed that Computerized Inventory Control had significant positive influence on supply chain performance. Mathias and Owuor (2015) also revealed that inventory management system is positively related and is significant for the realization of organizational performance in Grain Bulk handlers Ltd. The Pearson Correlation of demand forecasting versus supply chain performance was computed and established as 0.493 (p-value=0.007) which is a weak, significant and positive association between the two variables. These findings implied that adoption of demand forecasting practices results to positive supply chain performance. The study finding concurred with those of Do Rego and de Mesquita (2015) results of the study that indicated that demand forecasting had a positive and significant effect on inventory control.

Table 7 Correlation Matrix

		Lean Inventory	Inventory Record Accuracy	Information Technology	Demand Forecasting	Supply Chain Performance
Lean Inventory	Pearson Correlation	1				
Inventory Record Accuracy	Pearson Correlation	0.382	1			
Information Technology	Pearson Correlation	0.319	0.112	1		
Demand Forecasting	Pearson Correlation	0.372	0.318	0.347	1	
Supply Chain Performance	Pearson Correlation	0.418	0.394	0.407	0.493	1
	Sig. (2-tailed)	0.000	0.000	0.004	0.007	

Regression Analysis Results

Regression is the determination of a statistical relationship between two or more variables (Kothari, 2014). This section presented the regression analysis between lean inventory practices, inventory record accuracy, information technology, demand forecasting and supply chain performance. The results are presented in Tables 8 to 4.10. The regression analysis shows a relationship R=0.764 and R^2=0.584. These findings meant that 58.4% of variation in the supply chain performance can be explained by a unit change in lean inventory practices, inventory record accuracy, information technology and demand forecasting. The remaining percentage of 41.6% is explained by other variables that were not included in this model.

Table 8 Model Summary Results

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.764	0.584	0.563	0.43276

The results of ANOVA in table 9 indicate that lean inventory practices, inventory record accuracy, information technology and demand forecasting were significant predictor variables of supply chain performance of government health facilities in Kisumu County. This was indicated by the F-statistics results (F = 27.753, p = 0.000) indicating that the model used to link the independent variables and dependent variable was statistically significant. The study further confirmed the findings by comparison of the F calculated and F critical results. F critical ($F_{4, 53, (0.05)}$) was obtained from the f distribution table using a numerator degrees of freedom of 4 and denominator degrees of freedom of 53 at 5% level of significance. The value of f critical was 2.546 which is less than F calculated value of 27.753 implying that the model linking inventory management to supply chain performance was significant.

Table 9 ANOVA Regression Results

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	20.791	4	5.198	27.753	0.000
Residual	14.795	53	.187		
Total	35.586	57			

The regression results revealed that lean inventory practices had a positive and significant (β = 0.321, p = 0.001) effect on supply chain performance of government health facilities. These findings implied that increase in lean inventory practices increased the supply chain performance of government health facilities in Kisumu. Study findings concur with Mukopi and Iravo (2015) who revealed a strong positive relationship between lean inventory systems and procurement performance. On the relationship between inventory records accuracy and supply chain performance, the study established a positive and significant relationship (β = 0.359, p = 0.000) between inventory records accuracy and supply chain performance in government health facilities. The findings implied that the inventory record accuracy practices adopted by government health facilities positively and significantly affected the performance of supply chain in those facilities. The study findings agrees with Ruankaew and Williams (2013) who revealed that inventory inaccuracy impacts an organization's resources and performance in terms of time, cost, and risk.

The regression results further revealed that information technology had a positive but significant (β = 0.196, p = 0.004) effect on supply chain performance of government health facilities. These findings implied that adoption of information technology significantly increased the supply chain performance of government health facilities. The findings agreed with Mathias and Owuor (2015) who revealed that inventory management system is positively related and is significant for the realization of organizational performance. Finally, regression analysis results revealed that demand forecasting had a positive but insignificant (β = 0.001, p = 0.990) effect on supply chain performance of government health facilities. The findings implied that despite the facts that increase in adoption of demand forecasting practices led to positive increase in supply chain performance, the change was not statistically significant for government health facilities. These findings disagrees with those of Do Rego and de Mesquita (2015) results of the study that indicated that demand forecasting had a positive and significant effect on inventory control.

Table 10 Regression Coefficients Results

Predictors	B	Std. Error	Beta	t	Sig.
(Constant)	0.428	0.314		1.362	0.177
Lean Inventory Practices	0.321	0.093	0.334	3.446	0.001
Inventory Record Accuracy	0.359	0.091	0.35	3.951	0.000
Information Technology	0.196	0.066	0.261	2.958	0.004
Demand Forecasting	0.001	0.078	0.001	0.012	0.990

Conclusion

It was also concluded that an improvement in the inventory records accuracy practices can enhance supply chain performance of public health facilities in Kenya. It can be argued that when the public health facilities enhance cycle counts, put in place better receiving and storage practices as well develop effective naming and labeling practices, then they are likely to record higher supply chain performance score. The findings also led to the conclusion that adoption of information technology in inventory management leads to a significant improvement in the supply chain performance of public health facilities in Kenya. It was concluded that information technology practices such as RFID, EDI and adoption of bar coding can significantly enhance supply chain performance of public health facilities in Kenya. Lastly, the study concluded that demand forecasting can have a positive influence on supply chain performance of public health facilities in Kenya. However, the influence is small because demand forecasting is not common among the public health facilities. Specifically, demand forecasting practices can be used to establish the consumption level, as well as using moving average and simulation to predict demand, then the supply chain performance of public health facilities can improve.

Recommendations

The study established that lean inventory practices had the highest effect on supply chain performance in government health facilities; the study therefore recommended that government health facilities that have not adopted the use of lean inventory practices should adopt to enhance the performance of the supply chain. The adoption should be done in line with the existing legislation to avoid legal conflicts. The study established that averagely there was an increase in procurement costs among majority of the level 4 government health facilities in Kisumu, based on these findings the study recommended that county assembly should legislate against sudden increase in procurement costs by providing progressive policies that will provide a road map on supply chain management in government health facilities. Since supply chain performance in government sector is subject to procurement act and legislation, county governments in Kenya should harmonize county procurement policies in such that they don't negatively impacts on supply chain performance. The study further recommended that management of government health facilities should frequently conduct count of a number of medical and non-medical supplies in different parts of facility to reduce loss of inventory. The study further recommended that the department of supply chain should create policies and procedures that will enable frequent counting of a number of medical supplies in different parts of the facility without having to count the entire inventory which will improve accuracy of medical and non-medical supplies.

The study established that some of the government health facilities do not use electromagnetic fields to automatically identify and track tags attached to specified medical inventory, also some health facilities lacked computer system that exchanges business documents electronically with suppliers and similarly some of health facilities did not use Bar-coding in inventory management. The study recommended that management of these government health facilities should advocate for adoption of such information technology to enhance inventory management. The study established that majority of health facility did not use mathematical formulas, equations and models to determine the right level of current and future inventory needs. The study further recommended that government health facility should adopt latest demand forecasting tools to generate reports that help in decision making on inventory levels to avoid unnecessary increase in procurement costs.

Conflict of Interest

No potential confict of interest was reported by the authors

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