THE IMPACT OF LOGISTICS MANAGEMENT ON LEAD TIME IN PUBLIC HEALTHCARE IN NAIROBI, KENYA

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DEDICATION

"All things so bright and beautiful, the Lord God created them all"

This research project is lovingly dedicated to my parents, wife and children who have been my constant source of inspiration. They have given me the drive and discipline to tackle any task with enthusiasm and determination. Without their love and support this project would not have been possible.

DECLARATION

I declare that this research project is my original work and has never been submitted to any other University for assessment or award of a degree.

Signature..... Date Nov. 7, 2012.....

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This project has been submitted with my authority as the university supervisor.

Signature..... Date 07/11/2012.....

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LIST OF ABBREVIATIONS

AIDS	-	Acquired Immunodeficiency Syndrome
EAI	-	Enterprise Application Integration
FDA	-	Food and Drugs Administration
FIFO	-	First In, First Out
HIV	-	Human Immunodeficiency Virus
IT	-	Information Technology
JIT	-	Just-In-Time
KEMSA	-	Kenya Medical Supplies Agency
KMO	-	Kaiser-Meyer-Olkin and Bartlett's test
MOH	-	Ministry of Health
MTTR	-	Mean Time to Repair
NGOs	-	Nongovernmental Organizations
SC	-	Supply Chain
SPSS	-	Statistical Packages for Social Sciences
USAID	-	United State Agency for International Development
3PLs	-	Third Party Logistics

ABSTRACT

This study establishes the factors that influence lead time and the impact logistics management have on lead time in public healthcare in Nairobi, Kenya. The researcher makes use of questionnaires to collect the primary data. The questionnaires consisted of two parts. The first part contained bio data of the respondent and the second part contained questions on the objectives of the study. Closed ended questions were used to collect the data. The questionnaire was administered through drop and pick later method. The respondents mainly constituted procurement officers and in some cases administrators who implemented procurement functions. The data was analyzed by the use of factor, regression and descriptive statistics.

The analysis indicated that logistics management is influence by 10 factors that impact on lead time among healthcare facilities in Nairobi. They included: Equipment failures; poor warehouse management; poor flow of information; poor order shipping, poor order listing; poor order sorting; ordering costs; bureaucracy in government; order packaging challenges and poor warehouse planning.

The analysis also revealed that the regression results indicated that the independent variables; demand variability, ordering costs, shortage costs, Changes in holding costs and Utilization rate explain 64.9% of the variance in lead time changes. This is an indication that 38.1% of the variance is explained by other variables outside the ones mentioned above.

The coefficient for x1 is 0.456 which have moderate direct relationship between demand variability and lead time. The coefficient for ordering costs is 0.671 which is a strong direct relationship hence very significant. The coefficient for shortage costs is -0.500 which is a moderate inverse relationship between lead time and shortage costs. It significance tend towards zero thus a sign that it is very important. Changes in holding costs have a strong inverse relationship of -0.697 and a significance of zero which is an indication of very high significance. Utilization rate has a weak direct relationship and a significance value of 0.26 which is a weak factor.

The factors and Variables which show strong relationships to demand variability and lead time can be taken seriously in reducing lead time in public healthcare. Healthcare providers in Nairobi, Kenya can place more emphasis in these areas so that patients and others medical facilities users can be served effectively and efficiently.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Logistics management deals with the planning and control of material flows and related information in organizations, both in the public and private sectors. Generally speaking, its mission is to get the right materials to the right place at the right time, while optimizing a given performance measure (e.g. minimizing total operating costs) and satisfying a given set of constraints (e.g. a budget constraint). Logistics is one of the most important activities in modern societies. It is constructed on subsystems which in turn contain a collection of interrelated components. The relationship between the subsystems and components takes the form of co-ordination and exchange of materials and information. The aim of the system is to supply customers efficiently with their required products. Each subsystem controls the size of the flow of materials through the system via storage, transportation and various stages of handling and value adding. The logistics systems do not only consist of flows of materials, components and products which are processed and distributed to customers, but also include supply chain flows of spare parts and return flows of defective and used products and packaging (P. Jonsson, 2008)

Supply chain management in public sector health systems has received increasing attention in recent years, as both a priority and a challenge for many countries since governments find themselves stressed with an increasing number of products, programs, and patients to manage. Due to major increases in funding and donor support for a multiplicity of health programs, supply chain managers may be responsible for a larger number and volume of products, but with limited additional resources to expand their capacity to manage, store, and distribute these products. Often, staff already working in this area receives extra pressure to build up internal capacity to meet the service delivery targets. However, many countries, faced with this type of challenge, recognize that these functions, that were once auxiliary to their primary function of service delivery to patients, could tie up a significant portion of their budgets should they scale up appropriately (USAID, 2010).

The term Logistics in ancient times was frequently used in connection with the art of moving armies and supplies of food and armaments to the war front. Its use can be traced back to the seventeenth century in the French army. Logistics is defined as planning, implementing, and

controlling the physical flows of materials and finished goods from the point of origin to the point of use to meet customer's need at a profit Kotler, Philip. (2001). The logistics management activities typically include inbound, outbound transportation management, fleet management, warehousing, materials handling, order fulfillment, logistics network design, inventory management, supply demand planning and management of third party logistics service providers. The American Council of Logistics Management also defines logistics as the process of planning, implementing and controlling the efficient, cost effective flow and storage of raw materials, in-process inventory, finished goods and related information from point of origin to point of consumption for the purpose of conforming to customers' requirements.

Supply chain therefore involves movement of materials from suppliers to the final consumer of the product. Logistics has been viewed as an important part of supply chain management since it deals with the design and implementation of the movement of products and information in the supply chain. Drew and Smith (1995) argue that within a firm's supply chain management, logistics is the work required to move and geographically position inventory. As such, logistics is a subset of and occurs within the broader framework of a supply chain. Logistics is the process that creates value by timing and positioning inventory. Logistics is the combination of a firm's order management, inventory, transportation, warehousing, materials handling, and packaging as integrated throughout a facility network. Integrated logistics serves to link and synchronize the overall supply chain as a continuous process and is essential for effective supply chain connectivity. While the purpose of logistical work has remained essentially the same over the decades, the way the work is performed continues to radically change.

1.1.1 Lead Time

Customers around the globe are demanding products as they want them, when they want them, and at the best possible price. In today's highly competitive global marketplace they are placing greater value on quality and delivery time. Manufacturers similarly have begun to place more value on quality and delivery time and companies are trying to gain a competitive edge and improve profitability through cutting cost, increasing quality and improving delivery. However it is safe to say that the more competitive the industry, the more shortened lead times will help. In competitive industries, short lead time will differentiate a company from its competitors, leading to increase sales and effective service delivery.

Lead time is one of the main competitive factors among companies. The ability to deliver quickly influences export, sales and thereby revenue. The definition of lead-time can vary, depending on what part of the company is focused upon. Lead time begins with the first receipt of a customer order and ends with customer receipt of the product or service. Everything in between is the lead-time (elsmar.com, 2004). Lead-time refers to the time lag between placing an order and receiving it (Li, 2000). Lead time is therefore defined as the time it takes from getting order from a customer and receiving the delivered product by that customer (Azad, 2004). When the duration between the ordering period and the delivery varies from the expected time, then lead time variability occurs. Lead time variability therefore refers to the variations in lead time that can occur for purchased items and for those that are manufactured in-house (Heard and Plossl, 1984). A major factor related to these variations is quality problems. Typically, either safety stock or lead time is utilized to cushion the impact of this variability. In either case, larger variability requires increased inventories. Heard and Plossl (1984) portray high lead-time variability as a major reason for a plant's inability to achieve inventory goals and to incur longer average throughput.

The pressure to reduce inventory investments in supply chains has increased as competition expands and product variety grows. Managers are looking for areas they can improve to reduce inventories without hurting the level of service provided. Two areas that managers focus on are the reduction of the replenishment lead time from suppliers and the variability of this lead time. The normal approximation of lead time demand distribution indicates that both actions reduce inventories for cycle service levels above 50%. The normal approximation also indicates that reducing lead time variability tends to have a greater impact than reducing lead times, especially when lead time variability is large. There is a service-level threshold greater than 50% below which reorder points increase with a decrease in lead time variability. Thus, for a firm operating just below this threshold, reducing lead times decreases reorder points, whereas reducing lead time variability increases reorder points. For firms operating at these service levels, decreasing lead time is the right lever if they want to cut inventories, not reducing lead time variability.

1.1.2 Overview of Public Healthcare in Kenya

According to Bliss (2012), since achieving independence from Great Britain in 1963, Kenya has worked to improve the health of its nearly 40 million people, more than half of whom live in

rural areas. By the late 1980s Kenya had more than quadrupled the number of health facilities serving its growing population; extended life expectancy from 40 years to 62 years; and improved child survival rates. An economic downturn in the 1980s and the intensification of the HIV/AIDS pandemic in the 1990s exacerbated a number of health challenges for Kenya. where at least 45.9% of the population currently lives in poverty. These include the challenges of extending health services to impoverished and geographically dispersed populations; providing adequate financing to maintain and extend health infrastructure at the national, provincial and district levels: and ensuring the availability of health care providers where they are most needed. Beyond grappling with a persistent high burden of infectious disease, including malaria, HIV/AIDS, and tuberculosis, Kenya faces an emerging chronic diseases problem characterized by increasing rates of cardiovascular disease, cancers, and diabetes. Since the 1990s some of Kenya's early achievements in health have begun to reverse: Over the past two decades life expectancy has declined to 53 years, and mortality among children under the age of five has risen slightly.

The health facilities in Kenya can be grouped as either public or private. Public health care facilities are owned and operated by the government while private are owned and operated by Nongovernmental organizations (NGOs), religious institutions (churches and mosques), private individuals and commercial enterprise. Muga,Kizito, Mbayah, Gakuruh, (2004) indicate that public hospitals exist at different levels. The dispensaries are at the lowest level of the public health system and are the first point of contact with patients. They are staffed by enrolled nurses, public health technicians, and dressers (medical assistants). The enrolled nurses provide antenatal care and treatment for simple medical problems during pregnancy such as anemia. and occasionally conduct normal deliveries. Enrolled nurses also provide basic outpatient curative care. Health centers are staffed by midwives or nurses, clinical officers, and occasionally by doctors. They provide a wider range of services, such as basic curative and preventive services for adults and children, as well as reproductive health services. They also provide minor surgical services such as incision and drainage. They augment their service coverage with outreach services, and refer severe and complicated conditions to the appropriate level, such as the district hospital.

District hospitals are the facilities for clinical care at the district level. They are the first referral hospital and form an integral part of the district health system. Provincial hospitals form a secondary level of health care for their location. They provide services to a geographically well-defined area. Provincial hospitals are an integral part of the provincial health system. They provide specialized care, involving skills and competence not available at district hospitals, which makes them the next level of referral after district hospitals. Their personnel include medical professionals, such as general surgeons, general medical physicians, pediatricians, general and specialized nurses. midwives. and public health staff. Moi Referral and Teaching Hospital and Kenyatta National Hospital are the referral and teaching hospitals in Kenya. They are centers of excellence and provide complex health care requiring more complex technology and highly skilled personnel. They have a high concentration of resources and are relatively expensive to run. They also support the training of health workers at both pre-service and in-service levels Muga *et al*, (2004).

1.2 Statement of the problem

The healthcare system in Kenya faces a number of challenges that makes it difficult for its supply chain to operate efficiently and effectively. Logistics plays a very important role in ensuring that drugs and medical equipment are sourced and delivered within reasonable time in order to serve their purpose. The Kenya medical supplies Agency (KEMSA) is given the responsibility of procuring and delivering drugs to various public hospitals in Kenya. There are cases where health facilities run short of drugs and it takes long durations before replenishment is done. Part of this delay may be caused by poor logistics that leads to high lead time. Infrastructure may also affect the efficiency with which a healthcare logistics network operates. When the logistics network is inefficient, healthcare facilities will experience longer lead times as well as stock out (Muga *et al* 2004).

In the contemporary world whether public or private sector, companies focus mainly on customer satisfaction (Gaither, 1994). For instance, to perform in a global market, short lead times are essential to provide customer satisfaction. Organizations that have focused on cycle time as a productivity measure can reduce delivery time and improve quality,

thereby creating more satisfaction to customer. Cycle time or lead time is from the time a customer release an order until the time they receive the finished product (Gaither 1994).

Bosire, Kongere, Ombati, and Nyaoga (2011) conducted a study on the impact of outsourcing on lead time and customer services in supermarkets in Nairobi. The study indicates that supermarkets outsource several services such as; marketing and advertising, maintenance, fleet operation etc. The study also reviled the impact of outsourcing on lead time. It established that there is a positive correlation between outsourcing and lead time and those supermarkets that implement the variables manifest customer service management as a strategy to retain customers and remain competitive. The public healthcare sector in Kenya faces a number of challenges that impact on the level of services that are delivered. For instance there are occasions when there is lack of drugs in public health facilities, a situation that affects the efficient delivery of health services. Logistics plays an important role in the distribution of healthcare products. Lead time is very essential in the management of logistics.

A number of studies have been conducted on the effects of lead time uncertainty on safety stocks. Chopra, Reinhardt, and Dada. (2004) established that for cycle service levels above 50%, reducing lead time variability reduces the reorder point and safety stock. It was also established that for cycle service levels above 50%, reducing lead time variability is more effective than reducing lead times because it decreases the safety stock by a larger amount.

Rad (2008) also carried out a study on reduction of lead time. The purpose of the study was to reduce lead time by focusing both on ordering and production times. It was established that identification and elimination of waste makes it easier to focus on value adding activities and to become more cost efficient. Nordas, Pinali and M. Geloso Grosso (2006). (2006) conducted a study on the logistics and time as trade barriers. The study concluded that logistics management is an essential ingredient in the reduction of lead time. In another study by Rad (2008) on lead time reduction, efficient logistics system was established as a major factor.

Arovovich, Dana, Gelfeld and Steve Kinzett (2001), conduct a study on Kenya: Assessment of the health commodity supply chain and the role of KEMSA. The study found that supply chain for each of the different health commodities varied in coverage, availability of information and

commodities and logistics system performance. The finding demonstrated that family planning, commodities, tuberculosis and leprosy drugs and vaccines were generally maintained in full supply with relatively good supervision and information system. However, some issues were identified within the vertical programs. such as poor inventory controls at the service delivery point level, poor reporting for reproductive health commodities and high wastage rate for vaccines. In addition HIV test kits where in short supply and a number found in the central cold store had expired before use.

Essential drugs, such as anti malaria drugs were consistently undersupplied for those in high demand and oversupplied for those in low demand. The information system was non-operational because of chronic stock outs, poor supervision and monitoring and the absence of regular reporting of stock level and consumption trends. In generally, lack of transportation and communication were among the levels of the system supervision and monitoring of stock levels and consumption difficult.

Al-Qatawneh and Hafeez (2011) conducted a study on healthcare logistics cost optimization using a multi-criteria inventory classification. The study concluded that assigning a different percentage service level to items according to their criticality, usage, and value not only can reduce inventory cost, but can ensure the availability of items that are critical for human life saving. Nachtmann and Pohl (2009) also conducted a study on the state of healthcare logistics. The study established that most healthcare supply chains are immature and are at their infancy. They recommend that Healthcare supply chain managers should focus on fundamental improvements in order to increase the maturity of their supply chain.

From the above studies, it is clear that there have been several researches conducted on lead time and logistics management. However, most of the studies focus on other countries. In Kenya there is no study that has been conducted on the impact of logistics management on lead time in public healthcare in Nairobi, Kenya. This is the gap that the study seeks to address. The study examined the following questions; what are the logistics factors that impact on lead time in public healthcare in Nairobi, Kenya? And how does logistics management impact on lead time within the public health care in Nairobi Kenya?

1.3 Objectives of the Study

i. To determine the logistics factors that impact on lead time in Kenyan public healthcare in Nairobi.

ii To establish the impact of logistics management on lead time in Kenyan public healthcare in Nairobi.

1.4 Hypotheses of the Study

H_{o1} The impact of logistics management on lead time in public health care in Nairobi, Kenya is not statistically significant

H_{o2} Logistics management has a significant impact on lead time in public health care in Nairobi, Kenya.

1.5 Value of the Study

The public healthcare sector in Kenya is usually faced with a number of challenges that lead to inefficiencies. Logistics management is one of these challenges. This study can help the players in the public healthcare in Nairobi, Kenya to understand the various factors that impact on lead time. The study can also enable the public healthcare institutions to better understand how they can make use of logistics management to reduce their lead times thus improving the efficiency of their supply chains.

The government of Kenya may also find this study beneficial. The findings can enable the government to understand better on how to improve the public healthcare institutions through proper and efficient logistics management.

The academic fraternity can also benefit from the findings of this study. Logistics management is becoming an important concept both in corporate and academic aspects. Future researchers in the area of logistics management and lead time can find reference materials for their studies. Practitioners in the field of logistics management can also get new information that may be more beneficial in their day to day management of logistics activities.

This study can also be a benchmarking tool for the Government of Liberia and healthcare providers who are challenged by poor logistics management in moving medical supplies to various health facilities across the country to serves patients.

CHAPTER TWO: LITERATURE REVIEW

2.1 Overview of Logistics

Today managers are experiencing what can be termed as a supply chain revolution and a related logistical renaissance. These two massive shifts in expectation and practice concerning best-practice performance of business operations are highly interrelated. However, they are significantly different aspects of contemporary strategic thinking. Supply chain management consists of firms collaborating to leverage strategic positioning and to improve operating efficiency. For each firm involved, the supply chain relationship reflects a strategic choice. A supply chain strategy is a channel and business organizational arrangement based on acknowledged dependency and collaboration. Supply chain operations require managerial processes that span functional areas within individual firms and link suppliers, trading partners, and customers across organizational boundaries (Tyndall, 1988).

Arovovich, Dana, Gelfeld and Steve Kinzett (2001), conduct a study on Kenya: Assessment of the health commodity supply chain and the role of KEMSA. The study found that supply chain for each of the different health commodities varied in coverage, availability of information and commodities and logistics system performance. The finding demonstrated that family planning, commodities, tuberculosis and leprosy drugs and vaccines were generally maintained in full supply with relatively good supervision and information system. However, some issues were identified within the vertical programs, such as poor inventory controls at the service delivery point level, poor reporting for reproductive health commodities and high wastage rate for vaccines. In addition HIV test kits where in short supply and a number found in the central cold store had expired before use.

Essential drugs, such as anti malaria drugs were consistently undersupplied for those in high demand and oversupplied for those in low demand. The information system was non-operational because of chronic stock outs, poor supervision and monitoring and the absence of regular reporting of stock level and consumption trends. In generally, lack of transportation and communication were among the levels of the system supervision and monitoring of stock levels and consumption difficult.

Tyndall (1988) further argues that within a firm's supply chain management, logistics is the work required to move and geographically position inventory. As such, logistics is a subset of and occurs within the broader framework of a supply chain. Logistics is the process that creates value by timing and positioning inventory. Logistics is the combination of a firm's order management, inventory, transportation, warehousing, materials handling, and packaging as integrated throughout a facility network. Integrated logistics serves to link and synchronize the overall supply chain as a continuous process and is essential for effective supply chain connectivity. While the purpose of logistical work has remained essentially the same over the decades, the way the work is performed continues to radically change.

Logistics can indeed be a true core competence, strategically positioning the organization for market success and a source of long-run competitive advantage (Gunn, 1993). Integrated logistics management and changing customer needs lead naturally to effective business process redesign, elimination of traditional barriers and a total supply chain viewpoint. However, new approaches to logistics management are best built on a strong and flexible foundation. No redesign should be launched without proper prior attention to both the organizational and technical contexts. Logistics management is too frequently considered only as an afterthought to top level strategy formation. Many criticisms have been made of traditional planning and its inability to ensure that important functions such as logistics acquire a strategic focus. For instance, Hamel and Prahalad (1994) report that senior management spend less than 3 per cent of their time concentrating on building a corporate perspective of the future. Without such creative Organizational foresight, flexible and successful enterprise-wide logistical management may be serendipitous or merely wishful thinking. The same authors also emphasize that building business foresight is not so much about visioning as about exploring and learning. New and imaginative directions must build on well-developed knowledge and understanding of forces driving technological, demographic, regulatory, life-style and market change. Techniques such as "supply chain visioning" (Copacino, 1994) are steps in the right direction but, in our opinion, may not be sufficient to help managers address the complexities in which most businesses operate.

According to Bowersox, Closs, and Cooper, (2007), logistics is a broad function which consists of a series of related activities. Procurement or purchasing which is the flow of materials into an organization is usually initiated by a purchase order sent to a supplier. To prepare this a purchasing or procurement department finds suitable suppliers, negotiates terms and conditions, organizes delivery, arranges insurance and payment, and does everything needed to get materials into the organization. Inward transport or traffic moves materials from suppliers to an organization's receiving area. For this, managers have to choose the type of transport (road, rail, air, etc). Receiving makes sure that materials delivered match an order, acknowledges receipt, unloads delivery vehicles, inspects materials for damage, and sorts them. Warehousing or stores moves materials from the receiving area into storage and makes sure that they are available when needed. Stock control sets the policies for inventory. It considers the materials to store, overall investment, customer service, stock levels, order sizes and order timing. Material handling is the general term for moving materials within an organization. Order picking finds and removes materials from stores.

Packaging wraps materials to make sure that they are properly protected during movements so that damage is kept to a minimum. Outward transport takes materials from the departure area and delivers them to customers. Physical distribution is a general term for the activities that deliver finished goods to customers, including outward transport. Even when products have been delivered to customers, the work of logistics may not be finished. Sometimes there are problems with delivered materials and they have to be collected and brought back (perhaps because they were faulty, or too many were delivered, or they were the wrong type). Sometimes associated materials such as pallets, delivery boxes, cable reels and containers are returned to suppliers for reuse. Activities that return materials back to an organization are called reverse logistics alongside the physical flow of materials are the associated flow of information. This links all parts of the supply chain, passing information about products, customer demand, materials, movements, schedules, stock levels, availability, problems, costs, service levels, and so on. Coordinating the flow of information is always difficult, and logistics managers often describe themselves as processing information rather than moving goods (Christopher, 1996).

2.2 Lead Time

Nordas *et al.* (2006) indicate that Lead time is the amount of time between the placement of an order and the receipts of the goods ordered. It depends on the nature of the product e.g. whether it is made to order or if it is a from the shelf product. Lead time also depends on planning and supply chain management, logistics services and of course distance to customers and suppliers. Long lead time does not need to be a problem if delivery is predictable and demand is stable. However, if there is uncertainty about future demand, long lead time is costly even when the customer knows exactly when the merchandise will arrive. If future demand has been underestimated, running out of stock has costs in terms of foregone sales and the possibility of losing customers. If future demand has been overestimated, excess supply must be sold at a discount. Furthermore, the longer the lead time and the more varieties of the product in question are on the market, the larger stocks are needed. It is also important to notice that competitiveness on lead time is not a static concept. When some firms are able to shorten lead time, others must follow in order to avoid punishment in terms of discounted prices or at worst exclusion from the bidding process. The latter can happen when a critical mass of suppliers is able to deliver just-in-time and the customer finds it safe to reduce inbound inventories to a couple of days or in some cases even a couple of hours.

Bosire et al. (2011) conducted a study on the impact of outsourcing on lead time and customer services in supermarkets in Nairobi. The study indicates that supermarkets outsource several services such as; marketing and advertising, maintenance, fleet operation etc. The study also reviled the impact of outsourcing on lead time. It established that there is a positive correlation between outsourcing and lead time and those supermarkets that implement the variables manifest customer service management as a strategy to retain customers and remain competitive.

According to Hetzel (1988), forecast errors cause expediting to meet unexpected demand, and the disruption adds to queuing and missed deliveries. The entire supply chain becomes asynchronous with high lead time variability and rising safety stock needs. The cycle time grows even longer, thus forcing a longer forecast horizon and even less forecast accuracy. This type of feedback cycle can grow throughout the organization without a focused effort toward cycle time reduction. Gross and Soriano (1969) demonstrate that lead-time variation has a major impact on lot size and inventory costs. Furthermore, they indicate that an inventory system is more

sensitive to lead-time variation than to demand variation. Variations in lead time can occur for purchased items and for those that are manufactured in-house. A major factor related to these variations is quality problems. Typically, either safety stock or safety lead time is utilized to cushion the impact of this variability. In either case, larger variability requires increased inventories. High lead-time variability is a major reason for a plant's inability to achieve inventory goals and to incur longer average throughput.

2.2.1 Factors Influencing Lead Time

According to Spitter, de Kok, and Dellaert (2003) the production dynamics and cost of inventory may play an important role in lead time variability. Spitter further indicates that waiting time is also a factor that can determine lead time variability. Waiting times are the times which elapse while jobs are queuing in front of machines. Zong (2008) also argues that in manufacturing systems there are many factors contributed to long production lead-times. Machine failure is one of those significant factors. When a machine breaks down, longer mean time to repair (MTTR) will cause lower machine availability. Thus, it will result in longer production lead-times.

Lead-time variability depends on all the operations that take place in a facility which intern depend on the equipment used and the decisions made. Variation of orders is also a factor that leads to lead time variability. Since all orders do not arrive at the same time, pickers may remain idle for some time. This decreases the utilization of order picking and affects the efficiency of the warehouse. Hence, while reducing the lead-time, the efficiency of the warehouse will not be 100%. Piroird and Dale (1998) identified that planning in a warehouse is one of the most important factors affecting lead-time variability. The other factors that affect lead-time are listing orders, order picking, sorting, packing and shipping.

The waiting time plays an important role in lead time variability. In this case it is important to consider the expected waiting time for a single server queue when using queuing theory where the service time and the inter-arrival time between the orders have a general distribution. When an order arrives and the server is busy, the order waits in a queue. When all earlier arrived orders are finished, the order is produced. In this case the first in, first out (FIFO) system is used. This therefore leads to variability in lead time (Kingman, 1962).

According to Spitter *et al.* (2003) the length of the optimal planned lead time of an item is dependent on the variation of the demand, the utilization rate of the resource the item is produced on, and the difference in the holding costs between this item and the end item it is used in. For the variation in the demand and the difference in holding costs it holds that if the value of one or both parameters increases, the optimal planned lead time becomes longer. For the utilization rate this characteristic only holds if the difference in holding cost between the item produced on the capacitated resource and the end items is large enough. The holding cost structure plays the leading role in the determination of the optimal planned lead time. Safety stocks can decrease by longer planned lead times if the variation in demand and/or the utilization rate is high, but this is only advantageous if the work-in-process costs do not increase too fast by long planned lead times.

2.3 Role of Logistics on Lead Time

In face of the challenges of global competition, organizations are concentrating more on the needs of customers and seeking ways to reduce costs, lead time, improve quality and meet the ever-rising expectation of their customers. To these ends, many of them have identified logistics as an area to build cost and service advantages. On the other hand, the Just-in-Time (JIT) management approach, which has long been proven effective in the manufacturing sector in increasing quality, productivity and efficiency, improving communication and decreasing costs, reducing lead times and waste, might enhance the chances of firms to achieve cost, lead time and service advantages through logistics. However, the potential of JIT has not been widely recognized in logistics as compared to in manufacturing. Similar to manufacturing, logistics employs processes that add value to the basic inputs used to create the end product. As the focus of JIT is on business processes, not products, the management principles of JIT can be replicated and applied in logistics. This sets out to explore the possibilities of employing JIT to manage logistics activities, and provide an introduction to the application of JIT in the major areas of business logistics Stank *et al.* (2003).

The value chain concept of Porter (1985) provides further insights on how logistics can contribute to the cost and service advantage of firms. The value chain depicts the activities that a firm must perform in order to provide benefits to customers. Primary activities in the value chain include those involved in the ongoing production, marketing, delivery and servicing of the

product or service. There is support activities including such primary tasks as purchase inputs, technology, human resources and overall infrastructure needed to support the primary activities. It is important to note that two of the five primary activities are related to logistics: supplying raw materials, component parts and related services into the production line (inbound logistics), and managing the flow of finished goods from the end of the production line to the customer (outbound logistics).

On the other hand, past research has indicated that logistics influences a manufacturer's ability to satisfy customers through reduction of lead time and overall performance Tracey (1998). It is important for firms to develop logistics capabilities to attain cost and service advantages (Lai 2004). Similarly, another study has found that logistics service performance engenders customer satisfaction, which has links with customer loyalty and market share (Stank et al. 2003).It is important to understand that poor logistics management can result in higher logistics costs and longer lead times. Examples include inventory, transportation, and order processing, whereby firms handling the processes will suffer from the higher logistical costs, and consequently lower profitability and reduced competitiveness. Viewed from this perspective, logistics management is not only a 'good-to-have' business strategy but a 'must' to sustain the growth of a firm or even a supply chain in the long run.

2.4 The Healthcare Industry

According to Beeny (2010), with over $4.5 trillion in expenditure, the global medical industry is one of the world's largest and fastest growing industries, comprising various sectors: medical equipment and supplies, pharmaceutical, healthcare services, biotechnology, and alternative medicine sectors. Undoubtedly, the management and delivery of these vital goods throughout the healthcare supply chain are proportionally as complex and important as its size and velocity. Overall, the process of manufacturing and distributing pharmaceutical products is similar to that of other industries. Companies purchase raw materials for bulk combination of active and inactive ingredients. Dosages are formulated and packaged. These Products flow through manufacturing warehouses, wholesale distributors, third Part logistics providers, retail pharmacies, medical institutions and finally to the patient. Some products make their way back to their manufacturers due to recalls and returns.

Today, the healthcare industry is characterized by a number of drivers affecting its supply chain, including: Globalization, competition and margin compression increased regulatory oversight. the rise in information technology (IT) budgets at healthcare institutions, growth in usage of medication. increased cost of drug development, production and distribution of major retailers driving packaging and labeling requirements Manufacturers' desire to control the customer and take margins away from wholesalers, and new outsourcing models in the "patent to patient" supply chain process .To meet these while improving cost, reducing inventory and maintaining high fill rates is a significant challenge to any supply chain. It is an even greater challenge in pharmaceuticals because of the compliance and regulatory requirements. Visibility in healthcare is certainly vital! Not knowing the route by which pharmaceutical products make their way to the consumer can lead to risk in counterfeits. In addition, with food and drugs administration (FDA) regulations, life science companies need to trace drug and product information such as historical locations; time spent at each location, record of ownership, transaction history, packaging configurations, and environmental storage conditions to efficiently and safely manage the full lifecycle of such products in the supply chain Raja, Wilbur, and Blackburn, (2000).

For years, healthcare organizations have had fragmented IT environments with multiple applications and silos of data that cannot be quickly and easily accessed resulting in operational inefficiencies, increased costs decreased service levels and risks to patients. Certainly, visibility tools should be at the forefront of healthcare technology adoption. However, the high cost, time required and internal political struggles are often the biggest barriers to integrate disparate systems of healthcare IT. Healthcare organizations have primarily two choices: Adopt Enterprise Application Integration (EAI) suite to tie together and capture all relevant data in disparate applications or outsource to 3PLs. 3PLs provide an asset and services platform for the management and visibility of healthcare supply chains. It is a distribution and IT infrastructure typically built and maintained with a focus on standards, regulatory compliance and best-practice distribution, business intelligence and track and trace technology Beeny, (2010).

2.5 Empirical Review

Raja *et al* (2000) did a survey of the Uganda Logistics Systems for Public Health Commodities. The study focused on family planning commodities logistics. The report came up with numerous findings that were used to give recommendations. It was established that Public health

commodities reach the customer through several separate logistics systems. Some aspects of the logistics system in the MOH are integrated while others are managed separately. Systematic integration of the supply chains could result in cost and time-savings and improve product availability and efficiency at the service delivery level.

Chopra *et al* (2004) also conducted a study on The Effect of Lead Time Uncertainty on Safety Stocks. The intention of the study was to show the existence of a service-level threshold greater than 50% below which reorder points increase with a decrease in lead time variability. They argued that the normal approximation of lead time demand distribution indicates that both actions reduce inventories for cycle service levels above 50%. The normal approximation also indicates that reducing lead time variability tends to have a greater impact than reducing lead times, especially when lead time variability is large. The study concluded that for a firm operating just below this threshold, reducing lead times decreases reorder points, whereas reducing lead time variability increases reorder points. For firms operating at these service levels, decreasing lead time is the right lever if they want to cut inventories, not reducing lead time variability.

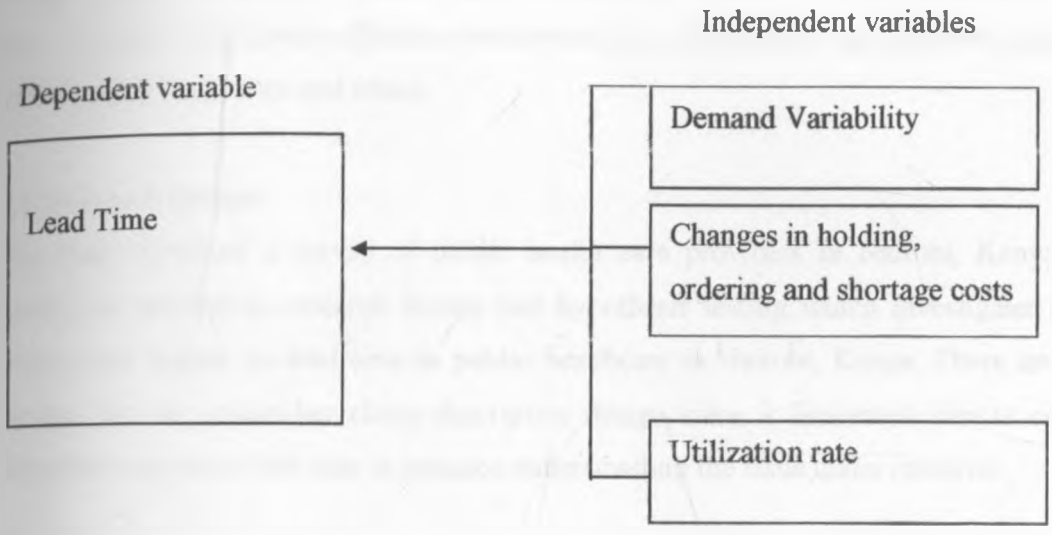
Hetzel (1988) conducted a study on Cycle Time Reduction and Strategic Inventory Placement across a Multistage Process. The study focused on cycle time and inventory reduction, which are central thrusts of Eastman Kodak's corporate strategy. The findings indicate that these reduction efforts cannot be addressed in isolation. Instead, they represent the outcome that results from improving the fundamental manufacturing processes across the supply chain. Form the reviewed of the literature, no study had being done on the impact of logistics management on lead time variability in public healthcare in Nairobi, Kenya. Therefore there is a need to address this knowledge slit that have existed for so long.

2.6 Conceptual Framework

Conceptual framework helps make simpler the proposed relationships between the variables in the study and show the diagrammatically (Mugenda & Mugenda, 2003). The conceptual framework of this study is based on four independent variables specifically; demand variability, changes in holding, ordering and shortage costs and utilization rate. The dependent variable in

this study is lead time. The diagram below shows how the various independent variables influence the dependent variable under study.

Figure 2.1 Conceptual Framework



Lead time is determined by three main factors: demand variability, changes in holding costs and utilization rate. When the demand of a product or service varies from the forecasted or projected demand, it may lead to shortages or accumulation of inventory. This situation is bound to cause variations in lead time. Changes in holding, ordering and shortage costs will also determine how much the lead time will vary. For instance, if it is expensive to hold inventory a firm may opt to hold products for the shortest time possible. This is likely to translate to shorter lead times. The reverse may also occur if holding costs are lowered. The rate at which a product or service is utilized will also cause lead time. If a product is utilized quickly and there is stock out, it is likely to cause lead time.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

In this section the researcher indicates how information was gathered from respondents. This section covers the research design, target population, sample design and procedures that were used. It also covers data collection instruments and procedures, data analysis and presentation and research limitations and ethics.

3.2 Research Design

The study involved a survey of public health care providers in Nairobi, Kenya. The study adopted a descriptive research design and hypothesis testing which investigated the logistics factors that impact on lead time in public healthcare in Nairobi, Kenya. There are many other designs but the researcher chose descriptive design since it facilitated him to come up with descriptive statistics that help in enhance understanding the issue under research.

3.3 Population of the Study

The target population for this study involves all the public health facilities in Nairobi, Kenya. There are approximately 127 facilities they includes, National referral hospitals with two, District hospitals three, Dispensaries sixty six, Health centers twenty eight, Medical clinics ten, other Hospitals six and twelve VCT Centers that are run by the government of Kenya in Nairobi *(E- Health Kenya Facility 2011, Ministry of Health, Kenya)*. These 127 facilities were used as the population of this study. From this population, the researcher was able to obtain the sample from the subgroup.

3.4 Sample Design and Procedures

In this study stratified sampling was used so that all existing sub groups in the population were represented. The sample size obtained was by using the following formula by Yamane (1967):

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

Where n is the sample size, N is the target population and e is the level of precision. This study assumes a confidence level of 95% and hence precision of .05.

Applying the above formula therefore we get the following results:

$$n = \frac{N}{1+N(0.05)^2} = \frac{127}{1+127(0.0025)} = 96.39$$

The above calculation resulted to 96.39 respondents. Therefore 97 respondents was selected using stratified sampling after rounding up as shown in the table below:

From each facility the researcher selected respondents from the supply chain or administrative departments of the facility since they understand the logistics and lead time issues that affect the facilities. The researcher calculated the percentage each facility represent among the total number of facilities and use the same percentage to calculate the number of respondents for that facility using regression analysis.

Table 3.1: sample size

Description	**Facilities**	**Percentage (%)**	**Number selected**	**Round up number Respondents**
National Referral Hospital	2	76	1.52	2
District Hospital	3	76	2.28	2
Other hospital	6	76	4.56	5
Health Center	28	76	21.28	21
Medical Clinic	10	76	7.6	8
Dispensary	66	76	50.16	50
VCT Center	12	76	9.12	9
Total	**127**		**96.52**	**97**

Source: E- Health Kenya Facility 2011, Ministry of Health, Kenya.

3.5 Data Collection Instruments and Procedures

Primary and secondary data was used. The primary data is the process of gathering information directly from the respondents and secondary data is information gathered from past studies done by others (Kothari, 1990). In order to collect large amounts of information in a short period of time and in a relatively cost effective way, the researcher make use of questionnaires to collect the primary data. The significance of using this tool is that it can be carried out by the researcher or by any number of people with limited effect to its validity and reliability. The questionnaires consisted of two parts. The first part contained bio data of the respondent and the second part contained questions on the objectives of the study. Closed ended questions were used to collect the data. The questionnaire was administered through drop and pick later method.

3.6 Data Analysis Techniques

The study used both quantitative and regression analysis. Upon successful completion of the data collection exercise, the researcher sorted and coded the quantitative data accordingly. The data collected for the objectives was in quantitative form. The descriptive data was analyzed using statistical packages for social sciences (SPSS). The findings were presented in tables and graphs. Factor analysis was used to establish the factors that impact lead time in public healthcare facilities. The hypothesis was tested using the Z or T tests.

Regression Model

$Y=a+b_1x_1+b_2x_2+b_3x_3+e$

Where;

Y = lead time

a. = y intercept when x is equal to zero

bi. = b_1, b_2, and b_3, are slopes of three independent variables respectively

x_1 = demand variability

x_2 = changes in costs of holding, ordering and Shortage

x_3 = utilization rate while

e = all other variables that were not considered in this model

CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter discusses the findings and data analysis. The data collected was analyzed using quantitative and regression analysis and presented in tables and graphs. Ninety seven questionnaires were distributed to key staff whose functions relate to providing logistics service within the public healthcare sector in Nairobi. The selection process was made through a stratified sampling method to avoid a biased selection. Out of the 97 questionnaires distributed. 64 responses were received thus giving a response rate of 65.9% in the study. The 65.9% was considered successful for the study. All of the 33 responses were non-responsive with some respondents communicating that they will complete the questionnaires the following week, but eventually did not do so despite the many follow-up by the researcher.

4.2 Organization Profile

This section provides data on the organization profile who participated in the study such as type of health facility and the qualification of personnel in charge. The purpose of this analysis is to establish the responses on the different type of public health facility and the background of the personnel in charge. The findings have been presented and explained below.

Table 4.1. Type of health facility

	Facility type	Frequency	Percent
Valid	District hospital	7	10.9
	Dispensary	25	39.1
	Health centers and clinics	19	29.7
	Others	13	20.3
	Total	**64**	**100**

It was established form the study that there are more dispensaries in Nairobi than other types of health facilities. The main reason behind this is that the government operates health centers and clinics in remote places where access to medical services is a problem. Dispensaries are therefore spread in most parts of the city to cater for the large population.

The study also sought to establish from the facilities whether they have in place a supply chain or related department. The findings indicate that 65% of the health facilities involved in the study do not have a supply chain department while 35% indicated the they have a supply chain department. Those without supply chain department used administrators in carrying out supply chain functions. This is an indication that supply chain functions may not be handled effectively due to absence of supply chain professionals.

Table 4.2. Qualification of person charge of SC

		Frequency	Percent
Valid	Certificate	26	40.6
	Diploma	22	34.4
	Other	16	25
	Total	**64**	**100**

It was also evident from the study that 40.6% of the employees who were in charge of the supply chain had certificate level training. 34.4% had diploma qualifications while 25% were not specific on the qualifications held by them. This is an indication that there is a wide gap that needs to be addressed in terms of recruiting expert personnel who can manage supply chain activities in health facilities.

4.3 Logistics Factors that Impact on Lead Time in Kenyan Public Healthcare in Nairobi.

Factor analysis is a multivariate statistical method that yields the general relationship between measured variables by showing multivariate patterns that may help to clarify the original data. The factor analysis is performed by examining the pattern of correlation or covariance between the observed measures. With factor analysis one produces a small number of factors from a large number of variables which explain the observed variance in the larger number of variables. The reduce factor will be used for further analysis.

Section B of the questionnaire was used to identify the logistics factors that influence lead time in public healthcare facilities in Nairobi, Kenya. To answer the research questions, 21 factors (explanatory variables) were identified as possible variables that influence lead time in the public health service. Each of the respondents reviewed each of the factors on the questionnaire and responded on a scale from one (very small extent) to five (very large extent). From the questionnaires completed and returned, factor analysis was used in analyzing section B of the data through the use of statistical packages for social sciences (SPSS).

The researcher sought to address the questions; what are the logistical factors that impact on lead time in the public healthcare in Nairobi, Kenya. The starting point of a factor analysis is a correlation matrix, in which the intercorrelations between the studied variables are presented. The correlation matrix in Table 4.3 below gives the correlation coefficients between each single variable and every other variable in the investigation. Correlations between all possible pairs of variables in the analysis are obtained. The diagonal elements which are all 1.000 are omitted.
The next item from the factor analysis output is the Kaiser-Meyer-Olkin and Bartlett's test. The KMO measures the sampling adequacy. The sample is adequate if the value of the KMO test is greater than 0.5 for a satisfactory analysis to proceed. Looking at Table 4.4, below the KMO measures is 0.82. From the table we can see that the Bartlett's test of sphericity is 17222.532.
The principal component analysis is used as a method of extraction as it seeks a linear combination of variable such that maximum variance is extracted from variables. It then removes the variance and seeks a second linear combination which explains the maximum proportion of the remaining variance.

The total variance table below shows the total percentage of variance that is explained by each of the factors that were under consideration. The first five factors explain 87.33% of the variance on lead time. This therefore means that the first five factors are the ones that contribute more towards lead time in the public healthcare sector in Nairobi. From the results in Table 4.5 overleaf, R-mode factor analysis was used to cluster the variables as shown on the component matrix Table 4.6. Component loadings from the principal component analysis were used to explain the percent of variance in the variable explained in the factor. The component matrix Table 4.6 summarizes the loadings for the 21 variables and the 10 components (factors). Varimax Rotation was used to make it easy to identify each of the 21 variables with a single factor. Table 4.7 illustrates the rotated component matrix for the data.

From the screen plot in figure 4.2 below, it is evident that the graph starts to attain a plateau form from the 10^{th} component onwards. This therefore indicates that we can choose ten components as our main factors that impact on lead time in the public healthcare sector in Nairobi. The other factors from the 10^{th} where the slope is more less constant do not contribute much to lead time hence are insignificant and can be ignored.

From the rotated component matrix below we are therefore able to extract the five factors that contributed to 87.33% of the total variance as shown in Table 4.5. From each of the five columns the component with the highest loading was picked. In column one there are five components with the highest loading. They are: Equipment failures; poor warehouse management; poor flow of information and poor order shipping, listing and sorting. In the second column, ordering costs was picked. The third column had bureaucracy in government with the highest loading, the fourth column had order packaging challenges and the fifth column had poor warehouse planning.

Based on the findings presented in the tables above it is clear therefore that there are 10 factors that impact on lead time among healthcare facilities in Nairobi. They include: Equipment failures; poor warehouse management; poor flow of information; poor order shipping, poor order listing; poor order sorting; ordering costs; bureaucracy in government; order packaging challenges and poor warehouse planning.

4.4 Impact of Logistics Management on Lead Time in public Healthcare in Nairobi, Kenya

The respondents were asked various questions aimed at establishing the impact of logistics management on lead time in public healthcare in Nairobi Kenya. In this section, descriptive statistics with the used of means and standard deviation as well as regression analysis were used to analyze the second objective in the study. The findings were presented in tables and figures as follows.

Descriptive statistics captured in the study was derived from the logistics management impact on lead time with the used of means and standard deviation in analyzing the second objectives of this study. The means score was structured from highest to lowest to establish the variables which negatively affect the logistics management on lead time in the public healthcare in Nairobi. The table below revealed the various variables with their respective mean scores and standard deviation.

Table 4.3 Correlation Matrix

	Product waiting time	Equipment failures	Irregularities in order picking	Poor ware house planning	Poor warehouse management	Poor flow of information	Poor transportation networks	Bureaucracy in government	Poor order listing	Poor order shipping	Order packing challenges	Challenges in order sorting	Integrity due to theft	Transportation delay	Information failure	Demand variability	Loss of demand	Changes in holding costs	Utilization rate
Product waiting time	1	0.103	0.103	0.001	0.103	0.103	-0.199	0.037	0.103	0.103	-0.27	0.103	0.393	0.054	0.153	0.072	-0.27	-0.289	-0.041
Equipment failures	0.103	1	0.162	-0.128	1	1	-0.172	0.009	1	1	0.491	1	0.112	0.167	0.023	-0.11	-0.25	0.047	0.149
Irregularities in order pickir	0.103	0.162	1	0.285	0.162	0.162	0.162	-0.333	0.162	0.162	0.724	0.162	-0.316	-0.116	0.019	0.204	0.07	0.664	-0.198
Poor ware house planning	0.001	-0.128	0.285	1	-0.128	-0.128	0.136	-0.075	-0.128	0.128	0.237	-0.128	-0.288	-0.058	0.281	0.053	0.339	0.32	-0.409
Poor warehouse management	0.103	1	0.162	-0.128	1	1	-0.172	0.009	1	1	0.491	1	0.112	0.167	0.023	-0.11	-0.25	0.047	0.149
Poor flow of information	0.103	1	0.162	-0.128	1	1	-0.172	0.009	1	1	0.491	1	0.112	0.167	0.023	-0.11	-0.25	0.047	0.149
Poor transportation networks	-0.199	-0.172	0.162	0.136	-0.172	-0.172	1	0.63	-0.172	0.172	-0.07	-0.172	-0.201	0.602	0.474	-0.264	0.093	-0.413	0.041
Bureaucracy in government	0.037	0.009	-0.33	-0.075	0.009	0.009	0.63	1	0.009	0.009	-0.53	0.009	-0.414	0.191	-0.13	0.245	0.103	-0.409	0.498
Poor order listing	0.103	1	0.162	-0.128	1	1	-0.172	0.009	1	1	0.491	1	0.112	0.167	0.023	-0.11	-0.25	0.047	0.149
Poor order shipping	0.103	1	0.162	-0.128	1	1	-0.172	0.009	1	1	0.491	1	0.112	0.167	0.023	-0.11	-0.25	0.047	0.149
Order packing challenges	-0.272	0.491	0.724	0.237	0.491	0.491	-0.066	-0.529	0.491	0.491	1	0.491	-0.073	0.044	0.291	-0.243	-0.03	0.561	-0.243
Challenges in order sorting	0.103	1	0.162	-0.128	1	1	-0.172	0.009	1	1	0.491	1	0.112	0.167	0.023	-0.11	-0.25	0.047	0.149
Integrity due to theft	0.393	0.112	-0.32	-0.288	0.112	0.112	-0.201	-0.414	0.112	0.112	-0.07	0.112	1	0.537	0.417	-0.592	-0.5	-0.567	-0.335
Transportation delay	0.054	0.167	-0.12	-0.058	0.167	0.167	0.602	0.191	0.167	0.167	0.044	0.167	0.537	1	0.586	-0.572	-0.2	-0.639	-0.361
Information failure	0.153	0.023	0.019	0.281	0.023	0.023	0.474	-0.129	0.023	0.023	0.291	0.023	0.417	0.586	1	-0.68	0	-0.379	-0.449
Demand variability	0.072	-0.11	0.204	0.053	-0.11	-0.11	-0.264	0.245	-0.11	-0.11	-0.24	-0.11	-0.592	-0.572	-0.68	1	0.382	0.363	0.186
Loss of demand	-0.274	-0.254	0.07	0.339	-0.254	-0.254	0.093	0.103	-0.254	0.254	-0.03	-0.254	-0.503	-0.204	0	0.382	1	0.172	-0.211
Changes in holding costs	-0.289	0.047	0.664	0.32	0.047	0.047	-0.413	-0.409	0.047	0.047	0.561	0.047	-0.567	-0.639	-0.38	0.363	0.172	1	-0.018
Utilization rate	-0.041	0.149	-0.2	-0.409	0.149	0.149	0.041	0.498	0.149	0.149	-0.24	0.149	-0.335	-0.361	-0.45	0.186	-0.21	-0.018	1
Ordering costs	-0.233	-0.084	0.274	0.315	-0.084	-0.084	-0.232	0.032	-0.084	-0.084	0.127	-0.084	-0.816	-0.829	-0.45	0.495	0.392	0.786	0.282
shortage costs	-0.379	-0.298	0.44	0.223	-0.298	-0.298	-0.375	-0.255	-0.298	0.298	0.169	-0.298	-0.679	-0.726	-0.6	0.659	0.521	0.801	-0.005

Table 4.4. KMO and Bartlett's Test

Kaiser-Mayer- Olkin Measure of Sampling Adequacy.		0.82
Bartlett's Test of Sphericity Chi-Square	Approx.	17222.532
Df		154
sig.		0

Table 4.5 Total Variance Explained

Component	Initial Eigen values			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.802	32.392	32.392	6.447	30.702	30.702
2	5.219	24.853	57.245	5.029	23.947	54.649
3	2.901	13.814	71.059	2.461	11.721	66.37
4	2.169	10.327	81.386	2.282	10.865	77.235
5	1.248	5.945	87.331	2.12	10.096	87.331
6	0.903	4.3	91.632			
7	0.789	3.756	95.388			
8	0.455	2.167	97.554			
9	0.21	1.001	98.555			
10	0.141	0.672	99.227			
11	0.105	0.499	99.726			
12	0.044	0.208	99.934			
13	0.014	0.066	100			
14	0	0	100			
15	0	0	100			
16	0	0	100			
17	0	0	100			
18	0	0	100			
19	0	0	100			
20	0	0	100			
21	0	0	100			

Table 4.6 Component Matrix (a)

Variable	Component				
	1	2	3	4	5
Product waiting time	0.15	-0.095	-0.198	-0.786	0.139
Equipment failures	0.994	-0.057	-0.02	0.021	-0.06
Irregularities in order picking	0.204	0.213	-0.231	0.618	0.363
Poor ware house planning	-0.07	0.103	0.019	0.086	0.833
Poor warehouse management	0.994	-0.057	-0.02	0.021	-0.06
Poor flow of information	0.994	-0.057	-0.02	0.021	-0.06
Poor transportation networks	-0.169	-0.483	0.769	0.245	0.183
Bureaucracy in government	0.036	0.052	0.942	-0.25	-0.105
Poor order listing	0.994	-0.057	-0.02	0.021	-0.06
Poor order shipping	0.994	-0.057	-0.02	0.021	-0.06
Order packing challenges	0.495	-0.068	-0.35	0.693	0.299
Challenges in order sorting	0.994	-0.057	-0.02	0.021	-0.06
Integrity due to theft	0.053	-0.727	-0.514	-0.364	-0.206
Transportation delay	0.126	-0.879	0.228	-0.014	0.109
Information failure	0.012	-0.77	0	0.08	0.458
Demand variability	-0.046	0.816	0.151	-0.227	0.111
Loss of demand	-0.225	0.363	0.269	0.063	0.561
Changes in holding costs	0.09	0.681	-0.346	0.535	0.212
Utilization rate	0.158	0.352	0.444	-0.007	-0.65
Ordering costs	-0.027	0.855	0.066	0.257	0.165
shortage costs	-0.259	0.831	-0.175	0.349	0.18

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 8 iterations.

The descriptive statistics captured in the Table 4.8 below revealed that poor logistics management as the variable with a highest means of 4.53 and a standard deviation of 0.664 as the variable which frequently affects the logistics management on lead time in the public healthcare sector in Nairobi. The second highest variable is poor communication with a means score and standard deviation of 4.03 and 0.886, followed by delayed delivery with mean score of 3.98 and standard deviation 0.669. The variable with the lowest means score in the analysis is misclassification of product with means and standard deviation of 2.8 and 1.224.

Figure 4.2. Screen Plot

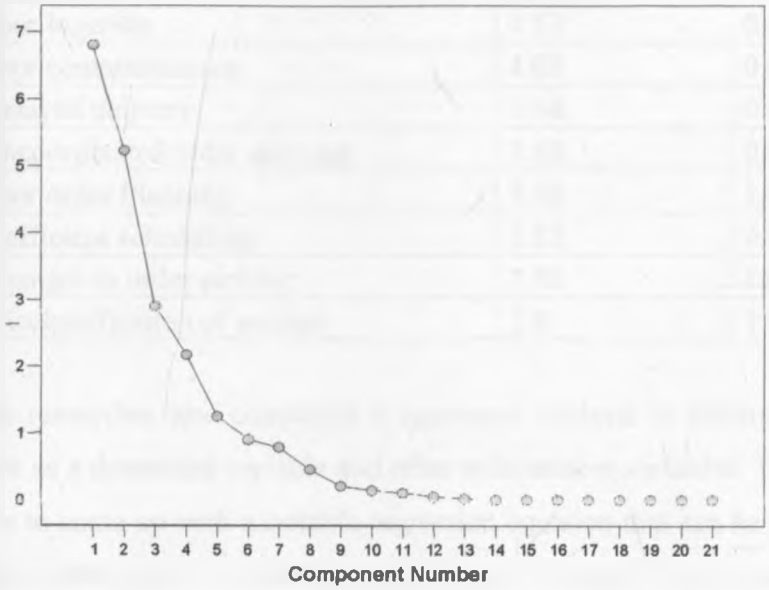


Table 4.7 Rotated Component Matrix

Variable	Component				
	1	2	3	4	5
Equipment failures	0.994				
Poor warehouse management	0.994				
Poor flow of information	0.994				
Poor order listing	0.994				
Poor order shipping	0.994				
Challenges in order sorting	0.994				
Ordering costs		0.855			
shortage costs		0.831			
Demand variability		0.816			
Transportation delay		-0.88			
Information failure		-0.77			
Integrity due to theft		-0.73			
Bureaucracy in government			0.942		
Poor transportation networks			0.769		
Order packing challenges				0.693	
Changes in holding costs		0.681		0.535	
Product waiting time				-0.786	
Poor ware house planning					0.833
Loss of demand					0.561

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a Rotation converged in 8 iterations.

Table 4.8 Descriptive Statistics

Variable	Mean	Standard Deviation
Poor logistics	4.53	0.664
Poor communication	4.03	0.886
Delayed delivery	3.98	0.699
Uncoordinated order shipping	3.68	0.662
Poor order Planning	3.48	1.168
Inefficient scheduling	3.12	0.845
Changes in order picking	2.86	1.096
Misclassification of product	2.8	1.224

The researcher also conducted a regression analysis to illustrate the relationship between lead time as a dependent variable and other independent variables. The aim of the regression analysis was to come up with a suitable regression equation that can be used to explain the variables that affect lead time in healthcare in Nairobi, Kenya. The researcher proposed that following multivariate regression equation: $Y=a+b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5+p$. The actual regression results as shown below indicate that the independent variables demand variability, ordering costs, shortage costs, Changes in holding costs and Utilization rate explain 64.9% of the variance in lead time changes. This is an indication that 38.1% of the variance is explained by other variables outside the ones mentioned above.

Table 4.9. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.806[a]	.649	.619	.397

a. Predictors: (Constant), Utilization rate, shortage costs, Demand variability, Ordering costs, Changes in holding costs

Table 4.10. Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.608	.553		6.521	.000
	Demand variability	.262	.066	.456	3.953	.000
	Ordering costs	.652	.150	.671	4.339	.000
	shortage costs	-.647	.233	-.500	-2.779	.007
	Changes in holding costs	-.571	.135	-.697	-4.246	.000
	Utilization rate	.267	.117	.209	2.279	.026

a. Dependent Variable: Lead time

From the table of coefficients above, it can be noted that the five independent variables, three of them have a positive relationship with lead time and the remaining two have a negative relationship. Using the regression model suggested earlier in chapter three, the researcher was able to obtain the following regression equation that explains the impact of the five variables on lead time. $Y= 3.608 + 0.262x_1+0.652x_2- 0.647x_3- 0.571x_4 + 0.267x_5 + 0.381$. This multivariate regression equation can be used to explain lead time in healthcare sector in Nairobi, Kenya. The five variables do not completely explain lead time hence the reason why 0.381 is added to cater for the remaining unexplained variance.

The Beta coefficients in the above table show both direct and inverse relationships between the dependent and independent variables. The beta coefficient for x1 is 0.456 which have moderate direct relationship between demand variability and lead time. The beta coefficient for ordering costs is 0.671 which is a strong direct relationship hence very significant in the regression equation. The beta coefficient for shortage costs is -0.500 which is a moderate inverse relationship between lead time and shortage costs. It significance tend towards zero thus a sign that it is very important in the regression equation. Changes in holding costs have a strong inverse relationship of -0.697 and a significance of zero which is an indication of very high significance. Utilization rate has a weak direct relationship and a significance value of 0.26 which is a weak factor.

4.5 Hypothesis Thesis

The study had two hypotheses: The impact of logistics management on lead time in public health care in Nairobi, Kenya is not statistically significant and logistics management has a significant impact on lead time in public health care in Nairobi, Kenya.

The table below shows the one sample test on the first hypothesis that stated the impact of logistics management on lead time in public health care in Nairobi, Kenya is not statistically significant. The results indicate that the standard error mean is 0.083 which is slightly above the 0.05 threshold for rejecting the hypothesis. This therefore means that we reject the hypothesis. It therefore means that logistics management impact on lead time is statistically significant.

Table 4.11. One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Logistics management and lead time	64	4.53	.666	.083

Table 4. 12. One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Uncoordinated order shipping	64	3.69	.664	.083

4.6 Discussion and Interpretation of Findings and Results

The results of the study reflect the respondents viewed on all the twenty one logistics factors and the nine variables on the impacts of logistics management on lead time in public healthcare in Nairobi, Kenya. A detailed examination of all the factors and impacts were undertaking in deriving an authentic conclusion.

The evaluation of the logistics factors is a high priority for research over the years. Researchers have examined the various impacts of the logistics factors in developed countries. However, existing studies devoted to assessing logistical factors influencing lead time are on the increase in Kenya. This study complements existing literature by focusing on the determination of factors of importance influencing lead time in the public healthcare in Nairobi, Kenya.

Using the following information from the tables above on logistics factors, Table 4.7 was produced to provide an interpretation which can be used to answer the research question on determining the logistic factors influencing lead time in public healthcare in Nairobi. Kenya.

4.6.1 Interpretation of the Logistics Factors

Following the analysis, 10 logistics factors influencing lead time in public healthcare were derived. By looking at the 10 labels derived from the factors, it is possible to interpret the important role of these factors to the public healthcare in Nairobi. Table 4. 13 below indicate the 10 logistics factors.

Equipment failure can increase lead time in the public healthcare in the provision of basic healthcare services. The failure of equipments which such as generator, vehicles, communications and operational equipment that may be needed to take care of surgery on patient on a timely basis. The failure of these equipments can adversely affect the healthcare system leading to death and complication in the patient. Poor warehouse management also increases the lead time in the public healthcare system. Distribution center hold inventories, which makes them crucial links in the supply chain. They allow inventories to be readily available to customers and enable goods to be acquired in an efficient manner. If the distribution centers perform poorly, then this may seriously impair the entire healthcare services in meeting the service needs of patients and other facility users. Poor warehouse management increases poor customer service. This may results to empty shelves on stores. In critical time situations it may render the patient's healthcare operation ineffective.

Poor flow of information has negative effects on the health system, quality of healthcare and the saving of lives. The handling of information from medical practitioners to administrators and procurement officers whose responsibilities are to procure the right and appropriate drugs and other medical equipments and supplies, when poorly communicated can create shortage of those

medical supplies and therefore delay the time it takes to service the patient effectively. Poor order shipping: It is necessary to define which operations and which supplies will be needed to keep the health facility functional. In most cases the facilities received drugs from NGO and faith-based sectors in addition to their own procurement. But specific list of commodities to be procured are not agreed upon in defining the most required keeping patient treated in such case, shipping to those facilities will not be needed and this may increase the costs of holding those drugs and supplies.

Poor order listing can also increase the lead time in the public healthcare. A rational listing of order leads to a better supply, lower costs and a more effective prescription and use of drugs in the health facilities. Orders that are poorly selected and listed will increase the costs of holding those orders supplies and increase an unnecessary waiting time for essential supplies that are needed by the target population whereas, poor order sorting occur when the medical supplies and drugs sorted are not arranged in sequence or by appropriate prescription pattern to remedy prevailing health condition in provide effective healthcare operations.

Ordering cost also greatly influences the increase in the lead time in the public healthcare system. The size and frequency of orders is affected by how much lead time is required before a delivery can be made. Also, the facility's location relative to the supplier may affect ordering cost. For example, a public healthcare center located near a medical warehouse will probably receives frequently deliveries than a healthcare center located a distance from the medical warehouse. Bureaucracy in government increases lead time as well. Bureaucracy in government is good if it allows order. But, if care is not taken it makes a system rigid and this causes unnecessary delay in implementation of policies, projects, etc. This also affects the healthcare system most especially in the absence of one or more decision makers, which will cause the loss of lives. Bureaucracy in government will increase lead time in the public health service as it will resists changes, creativity and timeliness.

Order packaging may increase lead time in the public healthcare if the medical drugs and equipments are not safeguard against damages and be suited for ensuring safe transport. Order packaging also affects supply chain effectiveness within the healthcare system because it represents and interfaces between the supply chain and it customers. In conclusion, poor

warehouse planning can result in the storage of drugs and medical equipments which cannot be accessed on a timely basis for usage by healthcare staff in providing cost effective healthcare service to patients.

The management and delivery of medical equipments and supplies throughout the healthcare supply chain are proportionally as complex and important as it size and location. The process of distributing pharmaceutical product is similar to that of other industries. The review of the literature revealed the comparison made to this research under investigation. An evaluation of the logistic factors influencing lead time in the public healthcare sector is a high priority for researchers over the years. Researchers have examined the different logistics factors that influence lead time in the public healthcare sector. However, the review of the literature shows that findings from the studies are similar to previous studies conducted. For instance, Zong (2008), argue that there are many factors contributed to lead time. Equipment failure was mentioned as one of the significant factor, which also through this research was identified as one of the logistics factors influencing lead time.

Additionally, the finding also agrees with the literature in that order is also a factor that increase lead time. These include listing orders, order picking, order sorting, order packaging and order shipping. Piroird and Dale (1998) also identified that warehouse planning is one of the most important factors affecting lead time such the case in this research where poor warehouse planning significantly increases the lead time in the public healthcare sector.

Table 4.13 Interpretation of the Logistics Factors on Lead Time

Component	Logistics Factors
1	Equipment failures
2	Poor warehouse management
3	Poor flow of information
4	Poor order listing
5	Poor order shipping
6	Challenges in order sorting
7	Ordering costs
8	Bureaucracy in government
9	Order packing challenges
10	Poor warehouse planning

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the findings, conclusions based on the findings, the recommendations drawn from the findings and suggestions for further research. The study had two main objectives to achieve: To determine the logistics factors that impact on lead time in Kenyan public healthcare in Nairobi and to establish the impact of logistics management on lead time in Kenyan public healthcare in Nairobi.

5.2 Summary of Findings

The study established that there are ten main factors that affect lead time in public healthcare in Kenya. Equipment failures are said to lead to irregularities in the production of the required products and services thus leading to changes in lead times. poor warehouse management was also found to be one of the factors which contributes to high lead time among healthcare provision in Kenya. When warehousing as a supply chain function is not properly managed, it delays the delivery and exit of various products thus causing varied changes to lead times.

Poor flow of information was also found to be one important factor that affects lead time in public healthcare in Nairobi Kenya. Information is very important in logistics since it facilitates the movement of products in both upstream and downstream in the supply chain. When information is not well communicated or does not flow as required, it creates what can be referred to as asymmetry where one party in the chain knows what the other party does not know. This lack of full information therefore leads to high lead times since what is required cannot be delivered or communicated effectively. It was also established that even when there is better flow of information. the people responsible for shipping orders to various destinations may not be able to do the correct shipping of orders. Once this happens, then the recipients may have to wait much longer thus causing high lead time. Poor order listing and sorting was also established as another factor that needs to be addressed.

The study also identified ordering costs as another factor that contributes to lead time changes in healthcare sector in Nairobi. The costs of ordering various product required by the public health facilities in Nairobi are said to be high thus causing delays in placing orders and delivery of the same. The other main factor that leads to changes in lead time is the level of bureaucracy in government. The government is known to have high level bureaucracy that requires things to be performed in a given order. This bureaucracy is meant to enhance transparency and accountability but in most cases it ends up becoming detrimental to healthcare logistics.

Order packaging challenges are also causes of lead time changes in public healthcare in Nairobi. The respondents indicated that there were several challenges concerning packaging of orders and this was a major cause of changes in lead time in public healthcare logistics. It was also realized that lead time was also affected by poor warehouse planning in public healthcare. Most of the facilities did not have proper warehouse planning in addition to not having a fully functioning warehouse that serves the public health facilities.

The regression analysis conducted established that the five independent variables: demand variability, ordering costs, shortage costs, Changes in holding costs Utilization rate explain 64.9% of the variance in lead time changes. This is an indication that 38.1% of the variance is explained by other variables outside the ones mentioned above. These factors may not be immediately established but further research can be able to establish what they actually represent.

The Beta coefficients in the analysis show both direct and inverse relationships between the dependent and independent variables. The beta coefficient for x1 is 0.456 which have moderate direct relationship between demand variability and lead time. The beta coefficient for ordering costs is 0.671 which is a strong direct relationship hence very significant in the regression equation. The beta coefficient for shortage costs is -0.500 which is a moderate inverse relationship between lead time and shortage costs. It significance tend towards zero thus a sign that it is very important in the regression equation. Changes in holding costs have a strong inverse relationship of -0.697 and a significance of zero which is an indication of very high significance. Utilization rate has a weak direct relationship and a significance value of 0.26 which is a weak factor.

5.3 Conclusions

It is clear from the study that there are ten factors that affect lead time in public healthcare in Nairobi. These factors include: Equipment failures; poor warehouse management; poor flow of information; poor order shipping, poor order listing; poor order sorting; ordering costs; bureaucracy in government; order packaging challenges and poor warehouse planning. The regression equation $Y= 3.608 + 0.262x_1+0.652x_2- 0.647x_3- 0.571x_4 + 0.267x_5 + 0.381$ derived from the study can be able to explain 64.9% of the variance in lead time changes in public healthcare.

The Beta coefficients in the analysis show both direct and inverse relationships between the dependent and independent variables. The beta coefficient for x1 is 0.456 which have moderate direct relationship between demand variability and lead time. The beta coefficient for ordering costs is 0.671 which is a strong direct relationship hence very significant in the regression equation. The beta coefficient for shortage costs is -0.500 which is a moderate inverse relationship between lead time and shortage costs. It significance tend towards zero thus a sign that it is very important in the regression equation. Changes in holding costs have a strong inverse relationship of -0.697 and a significance of zero which is an indication of very high significance. Utilization rate has a weak direct relationship and a significance value of 0.26 which is a weak factor.

5.4 Recommendations

There is need to find ways of reducing bureaucracy in public healthcare so that lead time can be drastically reduced. Warehouse management and planning are issues that also need to be addressed if lead time has to be reduced in healthcare management in Nairobi, Kenya.

There need to ensure that the correct orders are shipped to the correct destinations. Packaging of the orders needs to be accurate since it costs a lot of time to have them rectified and reshipped to the correct destination. Equipments maintenance and the right equipments are procure in order to reduce the brake down of specialized equipments which are essential for the efficient and effective operations of the health facilities, which in turn will reduce the waiting time for patients care.

It is also recommended that variables which show strong relationships to demand variability and lead time can be taken seriously in reducing lead time in public healthcare. Those factors are: ordering costs, shortage costs, holding costs. Utilization rate has a weak direct relationship and is not significance in reducing lead time therefore healthcare providers can ignored it importance.

5.5 Limitations of the study

The findings of this study and their application thereof are limited to the public healthcare logistics sector in Nairobi, Kenya. They may not be directly applicable to another country since the situations or circumstances may be different.

The public healthcare sector is vast and has a very wide network hence could not be studied as a whole due to time and budgetary limitations. The situation therefore reflects the position of lead time in public healthcare in Nairobi and not the entire country.

5.6 Suggestions for Further Research

There is need to carry out further research to establish the other factors that can explain the 38.1% in lead time changes in public healthcare in Nairobi.

A comparative study can be done to establish the impact of logistics on lead time in public healthcare in Liberia and Kenya. Since both are developing countries in the same continent, it will be interesting to find out whether there are any similarities and differences.

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APPENDICES

Appendix I: Research Questionnaire

Serial No_____

My name is Gabriel P. Tarty. I am a master's student in Business Administration and specializing in procurement and supply chain management at the University of Nairobi. I am kindly asking you to fill this questionnaire to facilitate me collect data for this study. The questionnaire is intended to collect information on the impact of logistics management on lead time in public healthcare in Nairobi, Kenya. Lead time is therefore defined as the time it takes from getting order from a customer and receiving the delivered product by that customer.

Kindly tick the most appropriate response in the boxes provided. The information provides will be treated as strictly confidential and at no instance will your name be cited in this research. This study is purely intended for an academic purpose only.

Section A: Organization profile

1. Classification of facility

- ☐ National Referral hospital
- ☐ District Hospital
- ☐ Dispensary
- ☐ Health centers and clinics
- ☐ Others

2. Do you have a supply chain/procurement department?

- ☐ Yes
- ☐ No

3. Highest qualifications of supply chain/procurement officer/ administrator

- ☐ Certificate
- ☐ Diploma

☐ Bachelors

☐ Masters

☐ Other qualification

Section B

Kindly indicate the extent to which the following factors influence lead time in your hospital, clinic, health centre, VCT centre etc.

Use the following scale:

5= Very large extent; 4 =Large extent; 3 = Moderate extent; 2= Small extent; 1= Very small extent

	Factors	1	2	3	4	5
1	The time taking to wait for products/supplies					
2	Equipment failures that affect operations					
3	Irregularities in order picking					
4	Poor warehouse planning					
5	Poor warehouse management					
6	Poor flow of information					
7	Poor transportation networks					
8	Bureaucracy in the public sector					
9	Poor order listing					
10	Poor order shipping					
11	Order packing challenges					
12	Challenges in order sorting					
13	Delay or unavailability of either inbound or out bound transport to move supplies due to breakdown or weather problem					
14	Integrity of products due to theft or tempering					
15	Failure of information in orders processes due to computer hardware, software or virus attacks					
16	Demand variability					
17	Loss of demand due to economic downturn or lack of fund					

18	Changes in holding costs					
19	Utilization rate					
20	Ordering costs					
21	Shortage costs					

22 State others factors that can influence lead time

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Section C

Kindly indicate the extent to which you agree with the following statements on the impact of logistics management on lead time in public healthcare in Kenya.

Use the following scale:

5= strongly agree; 4= Agree; 3=Not sure; 2= Disagree; 1=strongly disagree

	Impact	**1**	**2**	**3**	**4**	**5**
1	Poor communication leads to lead time changes					
2	Inefficient scheduling of products/supplies leads to lead time changes					
3	Poor Logistics activities leads to high lead time					
4	Poor order planning leads to high lead time					
5	Delayed delivery of products/supplies leads to high lead time					
6	Changes in order picking affects lead-time					
7	Uncoordinated order shipping affects lead time					
8	Miss classification of products/supplies affects lead time v					

10 State other impact logistics has on lead time in public healthcare

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Thank so much for taking your time to participate in this study.

APPENDIX II

Public Health Facilities in Nairobi, Kenya

NO	Facility Name	Province	District	Type	Owner
1	Kenyatta National Hospital	Nairobi	Nairobi West	National Referral Hospital	State Corporation
2	National Spinal Injury Hospital	Nairobi	Nairobi West	National Referral Hospital	Ministry of Health

NO	Facility Name	Province	District	Type	Owner
1	Mama Lucy Kibaki Hospital - Embakasi	Nairobi	Nairobi East	District Hospital	Ministry of Health
2	Mbagathi District Hospital	Nairobi	Nairobi West	District Hospital	Ministry of Health
3	Mathari Hospital	Nairobi	Nairobi North	District Hospital	Ministry of Health

NO	Facility Name	Province	District	Type	Owner
1	Pumwani Maternity Hospital	Nairobi	Nairobi North	Other Hospital	Local Authority
2	St.Mac's Hospital	Nairobi	Nairobi West	Other Hospital	Community
3	Moi Air Base Hospital	Nairobi	Nairobi North	Other Hospital	Ministry of Health
4	Memorial Hospital	Nairobi	Nairobi West	Other Hospital	Armed Forces
5	Kamiti Prison Hospital	Nairobi	Nairobi North	Other Hospital	Ministry of Health
6	Lady Northey Dispensary	Nairobi	Nairobi West	Dental Clinic	Local Authority

NO	Facility Name	Province	District	Type	Owner
1	7KR MRS Health Centre	Nairobi	Nairobi West	Health Centre	Armed Forces
2	APTC Health Centre	Nairobi	Nairobi East	Health Centre	Armed Forces
3	Dandora I Health Centre	Nairobi	Nairobi East	Health Centre	Local Authority
4	Dandora II Health Centre	Nairobi	Nairobi East	Health Centre	Local Authority
5	Eastleigh Health Centre	Nairobi	Nairobi North	Health Centre	Local Authority
6	Embakasi Health Centre	Nairobi	Nairobi East	Health Centre	Local Authority
7	Garrison Health Centre	Nairobi	Nairobi East	Health Centre	Armed Forces
8	JKIA Health Centre	Nairobi	Nairobi East	Health Centre	Ministry of Health
9	Kahawa Garrison Health Centre	Nairobi	Nairobi North	Health Centre	Ministry of Health
10	Kahawa West Health Centre	Nairobi	Nairobi North	Health Centre	Local Authority
11	Karura Health Centre(Kiambu Rd)	Nairobi	Nairobi West	Health Centre	Local Authority
12	Kayole I Health Centre	Nairobi	Nairobi East	Health Centre	Local Authority
13	Kayole II Sub-District Hospital	Nairobi	Nairobi East	Health Centre	Local Authority
14	Nairobi Remand Prison Health Centre	Nairobi	Nairobi East	Health Centre	Ministry of Health

15	Ngara Health centre(City Council of Nairobi)	Nairobi	Nairobi North	Health Centre	Local Authority
16	PSTC Health Centre	Nairobi	Nairobi North	Health Centre	Ministry of Health
17	Umoja Health Centre	Nairobi	Nairobi East	Health Centre	Local Authority
18	Ushirika Medical Clinic	Nairobi	Nairobi West	Health Centre	Community
19	Waithaka Health Centre	Nairobi	Nairobi West	Health Centre	Local Authority
20	Westlands Health Centre	Nairobi	Nairobi West	Health Centre	Local Authority
21	Redemeed Health Centre	Nairobi	Nairobi North	Health Centre	Ministry of Health
22	Ruai Health Centre	Nairobi	Nairobi East	Health Centre	Local Authority
23	NSIS Health Centre (Ruaraka)	Nairobi	Nairobi North	Health Centre	Ministry of Health
24	Mathare North Health Centre	Nairobi	Nairobi North	Health Centre	Local Authority
25	Langata Health Centre	Nairobi	Nairobi West	Health Centre	Local Authority
26	Makadara Health Centre	Nairobi	Nairobi East	Health Centre	Local Authority
27	Kangemi Health Centre	Nairobi	Nairobi West	Health Centre	Local Authority
28	GSU Training School	Nairobi	Nairobi East	Health Centre	Ministry of Health

	Facility Name	Province	District	Type	Owner
1	Dagoretti Approved Dispensary	Nairobi	Nairobi West	Dispensary	Ministry of Health
2	DOD Mrs Dispensary	Nairobi	Nairobi West	Dispensary	Armed Forces
3	Dog Unit Dispensary (O P. Kenya Police)	Nairobi	Nairobi West	Dispensary	Other Public Institution
4	GSU Dispensary (Nairobi West)	Nairobi	Nairobi West	Dispensary	Ministry of Health
5	GSU HQ Dispensary (Ruaraka)	Nairobi	Nairobi North	Dispensary	Other Public Institution
6	Hono Clinic	Nairobi	Nairobi East	Dispensary	Local Authority
7	Innoculation Centre	Nairobi	Nairobi North	Dispensary	Local Authority
8	Karen Health Centre	Nairobi	Nairobi West	Dispensary	Local Authority
9	Kasarani Health Centre	Nairobi	Nairobi North	Dispensary	Local Authority
10	Kenyatta University Dispensary	Nairobi	Nairobi North	Dispensary	Other Public Institution
11	Lagos Road Dispensary	Nairobi	Nairobi North	Dispensary	Local Authority
12	Lower Kabete Dispensary(kabete)	Nairobi	Nairobi West	Dispensary	Local Authority
13	Makina Clinic	Nairobi	Nairobi West	Dispensary	Community
14	Makogeni Clinic	Nairobi	Nairobi East	Dispensary	Local Authority
15	Mji wa Huruma Dispensary	Nairobi	Nairobi West	Dispensary	Local Authority
16	MOW Dispensary	Nairobi	Nairobi East	Dispensary	Other Public Institution
17	Multi Media UNiversity Dispensary	Nairobi	Nairobi West	Dispensary	Parastatal
18	Nairobi Remand Prison Health Centre	Nairobi	Nairobi East	Dispensary	Other Public Institution
19	National Youth Service HQ dispensary (Ruaraka)	Nairobi	Nairobi North	Dispensary	State Coorporation
20	Ngong Road Health Centre	Nairobi	Nairobi West	Dispensary	Local Authority
21	Njiru Dispensary	Nairobi	Nairobi East	Dispensary	Local Authority
22	P & T Clinic	Nairobi	Nairobi East	Dispensary	Parastatal
23	Port Health Dispensary (Langata)	Nairobi	Nairobi West	Dispensary	Ministry of Health
24	Pumwani Clinic	Nairobi	Nairobi North	Dispensary	Local Authority
24	Pumwani Majengo Dispensary	Nairobi	Nairobi North	Dispensary	Local Authority

26	Rhodes Ches Clinic (CCN)	Nairobi	Nairobi North	Dispensary	Local Authority
27	Rhodes Chest Clinic	Nairobi	Nairobi North	Dispensary	Local Authority
28	South B Police Band Dispensary	Nairobi	Nairobi East	Dispensary	Other Public Institution
29	State House Clinic	Nairobi	Nairobi West	Dispensary	Local Authority
30	State House Dispensary(Nairobi)	Nairobi	Nairobi West	Dispensary	Other Public Institution
31	University of Nairobi Dispensary	Nairobi	Nairobi West	Dispensary	Parastatal
32	Upendo Dispensary	Nairobi	Nairobi North	Dispensary	Ministry of Health
33	Woodley Clinic	Nairobi	Nairobi West	Dispensary	Local Authority
34	Uhuru Camp Dispensary (O P. Admin Police)	Nairobi	Nairobi West	Dispensary	Armed Forces
35	The Co-operative University College Of Kenya Dispensary	Nairobi	Nairobi West	Dispensary	Parastatal
36	Special Treatment Clinic	Nairobi	Nairobi North	Dispensary	Local Authority
37	Riruta Health Centre	Nairobi	Nairobi West	Dispensary	Local Authority
38	Ruaraka Clinic	Nairobi	Nairobi North	Dispensary	Ministry of Health
39	Ngaira Rhodes Dispensary	Nairobi	Nairobi North	Dispensary	Local Authority
40	Pangani Dispensary	Nairobi	Nairobi North	Dispensary	Local Authority
41	Mutuini Sub District Hospital	Nairobi	Nairobi West	Dispensary	Ministry of Health
42	Nairobi West Men's Prison Dispensary	Nairobi	Nairobi West	Dispensary	Ministry of Health
43	Railway Training Institute Dispensary South B	Nairobi	Nairobi East	Dispensary	Academic (if registered)
44	Maringo Clinic	Nairobi	Nairobi East	Dispensary	Local Authority
45	Langata Women Prison dispensary	Nairobi	Nairobi West	Dispensary	Ministry of Health
46	Loco Dispensary	Nairobi	Nairobi East	Dispensary	Other Public Institution
47	Lunga Lunga Health Centre	Nairobi	Nairobi East	Dispensary	Ministry of Health
48	Lungalunga Health Centre	Nairobi	Nairobi East	Dispensary	Local Authority
49	Kibera D O. Dispensary	Nairobi	Nairobi West	Dispensary	Ministry of Health
50	KIKOSHEP Kenya(Mugumoini)	Nairobi	Nairobi West	Dispensary	Community
51	Kariobangi Health Centre	Nairobi	Nairobi North	Dispensary	Local Authority
52	Kariokor Clinic	Nairobi	Nairobi North	Dispensary	Local Authority
53	Kabete Approved Dispensary(Lower Kabete)	Nairobi	Nairobi West	Dispensary	Ministry of Health
54	Kabete Barracks Dispensary	Nairobi	Nairobi West	Dispensary	Armed Forces
55	Huruma Lions Dispensary	Nairobi	Nairobi North	Dispensary	Local Authority
56	Kaloleni Dispensary	Nairobi	Nairobi East	Dispensary	Local Authority
57	KEMSA Staff Clinic	Nairobi	Nairobi East	Dispensary	Ministry of Health
58	DSC Karen Dispensary (Armed Forces)	Nairobi	Nairobi West	Dispensary	Armed Forces
59	Chandaria Health Centre	Nairobi	Nairobi West	Dispensary	Community
60	Jericho Health Centre	Nairobi	Nairobi East	Dispensary	Local Authority
61	Jinnah Ave Clinic	Nairobi	Nairobi West	Dispensary	Local Authority
62	Babadogo Health Centre	Nairobi	Nairobi North	Dispensary	Local Authority
63	Bahati Clinic	Nairobi	Nairobi North	Dispensary	Local Authority
64	Community Health Foundation	Nairobi	Nairobi North	Dispensary	Community
65	Bomas of Kenya Dispensary	Nairobi	Nairobi West	Dispensary	Parastatal
66	Afya house dispensary	Nairobi	Nairobi West	Dispensary	Ministry of Health

NO	Facility Name	Province	District	Type	Owner
1	KARI Health Clinic	Nairobi	Nairobi West	Medical Clinic	Ministry of Health
2	Mbotela Clinic	Nairobi	Nairobi East	Medical Clinic	Local Authority
3	Muthurwa Clinic	Nairobi	Nairobi North	Medical Clinic	Local Authority
4	Nairobi South Clinic	Nairobi	Nairobi East	Medical Clinic	Local Authority
5	Ofafa I Clinic	Nairobi	Nairobi East	Medical Clinic	Local Authority
6	Shauri Moyo Clinic	Nairobi	Nairobi North	Medical Clinic	Local Authority
7	Rays International Clinic Kariobangi	Nairobi	Nairobi East	Medical Clinic	Community
8	Kariobangi South Clinic	Nairobi	Nairobi East	Medical Clinic	Local Authority
9	Jerusalem Clinic	Nairobi	Nairobi North	Medical Clinic	Local Authority
10	Biafra Lions Clinic	Nairobi	Nairobi North	Medical Clinic	Local Authority

NO	Facility Name	Province	District	Type	Owner
1	KMTC VCT	Nairobi	Nairobi West	VCT Centre (Stand-Alone)	Ministry of Health
2	Ministry of Education (MOEST) VCT Centre	Nairobi	Nairobi North	VCT Centre (Stand-Alone)	Other Public Institution
3	Mtaani VCT	Nairobi	Nairobi West	VCT Centre (Stand-Alone)	Community
4	NASCOP VCT	Nairobi	Nairobi West	VCT Centre (Stand-Alone)	Ministry of Health
5	Pumwani Maternity VCT Centre	Nairobi	Nairobi North	VCT Centre (Stand-Alone)	Local Authority
6	Rural AID VCT	Nairobi	Nairobi North	VCT Centre (Stand-Alone)	Community
7	Teachers Service Commission	Nairobi	Nairobi North	VCT Centre (Stand-Alone)	Other Public Institution
8	Single Mothers Association of Kenya (SMAK)	Nairobi	Nairobi North	VCT Centre (Stand-Alone)	Community
9	KIE/KAPC	Nairobi	Nairobi North	VCT Centre (Stand-Alone)	Other Public Institution
10	Kikoshep K VCT	Nairobi	Nairobi West	VCT Centre (Stand-Alone)	Local Authority
11	Kapu Medical Clinic	Nairobi	Nairobi East	VCT Centre (Stand-Alone)	Ministry of Health
12	Kemri VCT	Nairobi	Nairobi West	VCT Centre (Stand-Alone)	Ministry of Health

Source: E- Health Kenya Facility 2011, Ministry of Health, Kenya