Effect of Lead Time on the Efficient Delivery of Essential Drugs in Kenya: A Case Study of the Kenya Medical Supplies Authority

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Abstract: ***The study sought to investigate the effect of lead time on the delivery of essential drugs in Kenya with special reference to KEMSA. More specifically, the study sought to examine the effect of lead time, Mean Time To Repair (MTTR), Optimal planned lead time and Just-in-Time (JIT) inventory the delivery of essential drugs in Kenya. This study took the descriptive research design. The target population for the study was the procurement and distribution directorates at the Kenya Medical Supplies Authority, with a population of 160 employees. The determined sample size is 115 respondents out of a target population of 160. The study used primary data which was largely quantitative and descriptive in nature collected by use of structured questionnaires. After data collection, the filled-in and returned questionnaires were edited for completeness, coded and entries made into SPSS (version 21). Both descriptive and inferential analyses were then conducted. Findings revealed a positive correlation is seen between the each lead time variable and delivery performance. The strongest correlation was established between Optimal planned lead time and delivery performance, and the weaker relationship found between Just-in-Time inventory and delivery performance. MTTR and Waiting time are also strongly and positively correlated with performance respectively.***

Keywords: Waiting Time, Optimal Planned Lead Time, Mean Time to Repair (MTTR) and Just-in-Time (JIT) Inventory

1. Introduction

A typical healthcare supply chain is a complex network consisting of many different parties at various stages of the value chain. According to Ling and Ling (2012), the three major types of players are: Producers (product manufacturers), Purchasers (group purchasing organizations, or GPOs, and wholesalers/distributors), and health care providers (hospital systems and integrated delivery networks, or IDNs). Within the health care value chain, the products (drugs, devices, supplies, etc.), are transported, stored, and eventually transformed into health care services for thepatient.

Related to health service providers, supply chain management often refers to the information, supplies and finances involved with the acquisition and movement of goods and services from the supplier to the end user in order to enhance clinical outcomes while controlling costs. In doing so supply chain management puts a strong emphasis on the integration of processes among the producers, distributors and healthcare providers (Horatiu*et al.,* 2012). Within the healthcare sector these processes might refer to physical products like pharmaceuticals, medical devices and health aids but also to processes associated with the flow of patients (Nuruzzaman, 2011).

In this regard, supply chain management research in health care has been a topic of extensive research in the recent past, all with the aim of reducing the cost of healthcare without sacrificing service typically by improving the efficiency or productivity of the system. A roundtable discussion at the MIT Center for Transportation and Logistics (Meyer and Meyer, 2010) highlighted some of the important issues in healthcare, particularly in supply chains. Some of the problems and constraints discussed included the high cost of healthcare, long supply lead times, unreliable transit times, wasteful behaviors, and complex requirements and regulations. The solutions focused on making supply chains more demand driven, a move towards reduced lead times and elimination of excess stock levels, increasing collaboration between the various parties involved, increasing visibility of practices and inventories, and implementing more and better standards.

Supply chain management in government is guided by the Public Procurement and Disposal Act, 2011 that came into effect in October 2011. In general the user generates a requisition form to request for the item required. The stores then fill in the order if the item is available. If not available the requisition form is forwarded to the medical superintendent who then verifies the availability of funds to purchase the items. This is discussed at the facility procurement committee (Hassan, 2012). The supplier is then notified of the committee's decision and a Local Purchase Order (LPO) is drawn to allow for the supply and to commit the government to pay. The goods are supplied and received by the stores who verify that they are of the correct quantity and quality. Once received they are stored in proper condition and later issued to the department that ordered the goods (Bosire et al., 2011). The performance of most public health facilities in supply chain management has been wanting. In a report by the Public Procurement Oversight Authority review of procurement functions and procedures at New Nyanza Provincial General Hospital in 2014 it was found that the NNPGH does not have an internal audit unit. Record keeping, data and documentation controls and waiting time is a major challenge. Some records pertaining to execution of procurement process was incomplete (PPOA, 2010).

KEMSA was established as a state corporation under legal notice No. 17 of 2010. The legal notice outlined three key objects of KEMSA to include: Develop and operate a viable commercial service for the procurement and sale of drugs and other medical supplies; provide a secure source of drugs and other medical supplies for Public Health institutions; and advice the Health Management Boards and the general public on matters related to theprocurement, costeffectiveness and rational use of drugs and other medical supplies. KEMSA' core functions include procurement, warehousing and distribution of medical supplies.

The Kenya Medical Supplies Agency (KEMSA) is a specialized medical logistics provider for Ministries of Medical Services/Public Health and Sanitation-supported health facilities and programmes. KEMSA works to support the National Health Strategic Plan and the Kenya Health

Package for Health in providing public health facilities with the "right quantity and quality of drugs and medical supplies" at the best market value. KEMSA's overall mandate is to procure, warehouse and distribute medical commodities to public health facilities operated by the Ministry of Medical Services and the Ministry of Public Health and Sanitation.

2. Statement of the Problem

The recent trends in efficient distribution, such as just-in-time (JIT) deliveries and reductions in the amount of inventory held, has caused many industries, including the health care industry, to focus more on streamlining their supply chain in an effort to be more competitive while still meeting the requirements of their customers (Beeny, 2010). These changes are more evident in the health care industry, an industry that has not traditionally seen distribution and inventory management as a competitiveadvantage. Although many health care organizations have recognized the importance of adopting supply chain management practices, the application of techniques, methods and best practices originally developed in an industrial setting clearly is often problematic. Organizations even with most efficient internal processes do not facilitate supply chain management across borders. Collaboration is minimized and other players resort to traditional methods of operations that may not be cost effective (Bliss, 2012).

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 (Bosire*et al.,* 2011). 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., 2010*).

Supply chain management practices and innovation have been found to positively influence supply chain performance as well as the overall performance of the organizations (Ling and Ling, 2012). Nachtmann and Pohl (2014) 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. In Kenya, Bosire et al. (2011) conducted a study on the impact of outsourcing on lead time and customer services in supermarkets in Nairobi and found that supermarkets outsource several services such as; marketing and advertising, maintenance, fleet operation among others.

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 little known studies conducted on the effect of lead time on the delivery of essential drugs in Kenya with special reference to KEMSA. This is the gap that the study sought to address.

2.1 General Objective of the study

To investigate the effect of lead time on the delivery of essential drugs in Kenya with special reference to KEMSA

2.2 Specific Objectives of the study

The study was guided by the following objectives:
1) To examine the effect of waiting time on the delivery of essential drugs in Kenya
2) To determine the effect of Mean Time To Repair (MTTR) on the delivery of essential drugs in Kenya
3) To establish the effect of Optimal planned lead time on the delivery of essential drugs in Kenya
4) To assess the effect of Just-in-Time (JIT) inventory the delivery of essential drugs in Kenya

3. Literature Review

3.1 The Resource Based View Theory

To study IT value in automated supply chains is drawn primarily on the RBV on how technology creates value (Zhu & Kraemer, 2011). The RBV attributes improvement in firm performance to valuable MTTR or resource bundles (Barney, 2010; Peteraf, 2012). For supply chain agility to happen, firms needs to leverage the connectivity of the Internet to create an inter-firm digital platform, enabling real-time information sharing, and improving coordination of allocated MTTR across the supply chain (Lee, 2011). The digital platform helps establish connections among separate MTTR owned by supply chain partners, thus translating them into bundles of coexisting MTTR responsive to each other (Zhu & Kraemer, 2002).

This is consistent with the notion of creating resource synergy as advocated by the RBV (Conner, 1991). The value, in our supply chain contexts, may be manifested in flexibility, revenue generation and cost reduction. This may eliminate the burden of acquiring duplicate MTTR (which are required by operations at other stages), thus increasing resource utilization and decreasing operational costs. Cost reduction can be further achieved through resource synergy among horizontal partners (Lee, 2002). This is because of the risks of supply disruption; firms often keep safety stocks for key components. The theory leads to the findings on the role of Backend Integration on supply chain agility.

3.2 Transaction Cost Economics Theory

While the RBV suggests value creation through resource synergy, Agility in a supply chain can also be achieved by efficient coordination. This can be understood through the lens of Transaction Cost Economics (TCE). Explicitly recognizing the costs of coordination among economic entities in markets, TCE stresses that a firm's central task is to coordinate transactions efficiently (Williamson, 2011).

An important feature of a competitive environment is the extensive competitive actions in the markets, such as competitive entry, price change, supplier alliances, and new product introduction (Ferrier, 2010). To improve performance or even survive in competitive environments, a firm needs to adapt its businesses to respond quickly to competitive actions (Sambamurthy*et al.,* 2012). If a manufacturer's operation is frequently affected by competitors' actions, it may face greater needs to coordinate with supply chain partners. For example, a manufacturer that needs to modify the design of its product, because of market entry or new products launched by competitors, also needs to modify the design of upstream components that constitute the product; it may also need to rearrange downstream channels for new product distribution. These may induce considerable coordination tasks (Williamson, 2011).

4. Conceptual Framework

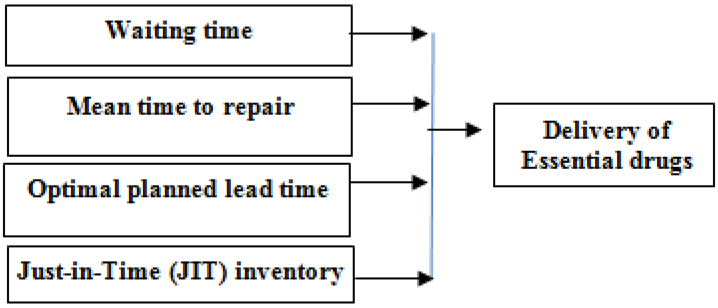

Figure 2.1: Conceptual framework

1) Waiting Time

Nordas*et al*., (2012) define waiting time as the time interval for which one has to wait after placing an order and before the order is actually received, executed and the order delivered to the customer. According to Penfield (2013), 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. Zong (2010) also argues that in manufacturing systems there are many factors contributed to long production lead-times. 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 producer 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 producer 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 (Su *et al.,* 2014).

Since process times are relatively constant for most production systems, reducing waiting times has been the major approach to lead-time reductions. When a system has parallel bottlenecks, the waiting time reduction of one of the bottlenecks (a regional improvement) may not become visible in light of the reduction of the system lead-time (a global improvement).

2) Optimal Planned Lead Time

Bartlett (2014) 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. According to Chan (2014) 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 (Lambert, 2011). 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.

As Nordas et al. (2012) points out, on the scheduling level several other variables besides the capacity, affect the queueing behavior in complex production environments. These variables are, amongst others, lot sizes, release times of batches and the coordination of these release times, sequencing at machines, production mix, and the heterogeneity of items. By using planned lead times there is the possibility to produce earlier. While in models without planned lead times production starts as late as possible, the production can already start at the beginning of the planned lead time in the model of (Romano and Vinelli, 2011).

3) Mean Time to Repair (MTTR)
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 (Zong, 2010). 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% (Spitter*et al.,* 2010).

Most researchers have focused their attentions on the effects of average parameters of machine failures, such as Mean Time to Failure (MTTF), Mean Time between Failure (MTBF), and mean time to repair (MTTR). These include machine installation and operation influence on MTBF (Bloch, 1999), effects of machine parameters on MTTF (Nuruzzaman, 2011), reliability and availability of M/M/1 queue with failures and repairs (Hines, 2014), M/G/1 queuing models with arbitrary repair-time distribution (Chan, 2014), and using supplementary variable method to measure machine availability, failure frequency and queue length (Ling and Ling, 2012). These researchers utilized analytical and simulation tools to study the effects of MTTF, MTBF, and MTTR, but not repair-time variability.

4) Just-in-Time Inventory
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 (Keller and Ozment, 2014). 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 (Bowersox, 2012).

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 (Barratt and Oke, 2013). According to Bourne *et al.,* (2010), the JIT principle supply of materials should be exactly in the right time and quantity with the shortest possible lead time. It should be based on pull demand and minimum amount of inventory.

5. Research Methodology

This study took the descriptive research design. The target population for the study was the procurement and distribution directorates at the Kenya Medical Supplies Authority, with a population of 160 employees.The researcher used stratified random sampling to select the respondents**.** The determined sample size is 115 respondents out of a target population of 160.

Table 3.2: Sampling Frame

Category	Population	Sample	Percentage
Senior management	13	9	8%
Middle management	24	17	15%
Operational staff	123	88	77%
Total	160	115	100%

The study used primary data which was largely quantitative and descriptive in nature through the questionnaires administered through a drop and pick later method. Validity of the questionnaires was tested through piloting. The filled-in questionnaires were edited for completeness, coded and entries made into SPSS (version 21). Data collected both descriptive and inferential statistics. Descriptive analysis involved the use of frequencies in their absolute and relative forms (percentage). Mean and standard deviations were also used as measures of central tendencies and dispersion respectively. Inferential statistics on the other hand was done to show the nature and magnitude of relationships established between the independent and dependent variables using regression analysis.

6. Results and Discussions

A response rate of 85.2% was established with 98 respondents reached, out of the 115 targeted.

1) Delivery Performance
The study was particularly interested in four key indicators, namely Turnaround time, Timely Purchases-stock out reduction and cost reduction, with all the three studied over a 5 year period, running from 2011 to 2015. Findings revealed improved financial performance across the 5 year period running from the year 2011 to 2015. Turnaround time recorded positive growth with a majority affirming to less than 10% in 2011 (42.3%) and 2012 (37.7%), to 10% in 2013 (36.1%) then more than 10% in 2014 (41.1%) and 2015 (37.5%). A similar trend was recorded in timely Purchases-stock out reduction with a majority affirming to less than 10% in 2011 (37.9%) and 2012 (35.9%), to 10% in 2013 (35.9%) and 2014 (35.3%) then by more than 10% in 2015 (36.2%). Cost reduction further recorded positive growth, growing from less than 10% (44.1%) in 2011, to more than 10% in 2013 (36.4%), 2014 (40.4%) and 2015 (37.3%). It can be deduced from the findings that key delivery performance indicators have considerably improved as influenced by among other lead time attributes, the influence of waiting time, Mean Time To Repair (MTTR), Optimal planned lead time and Just-in-Time (JIT) inventory.

2) Effect of waiting time on the delivery of essential drugs

With a composite mean of 3.695, it can be deduced that a majority of respondents highly agreed with most statements posed with regard to the effect of waiting time on the delivery of essential drugs. A majority of respondents were particularly found to highly agree that there is shortened period between ordering of medical supplies by health facilities and reception of the order by KEMSA (4.013);Orders are prioritized according to urgency (3.976); A framework exists for scheduling of products/supplies according to lead time changes (3.791); There is shortened period between reception of the order by KEMSA and actual delivery (3.713); There is shortened period between procure and warehouse of medical commodities to public health facilities (3.701); and that there is shortened period between warehousing and distribution of medical commodities to public health facilities (3.652). As such, it can be concluded that overall, waiting time is adequately observed in the study area's delivery process.

3) Effect of Mean Time To Repair (MTTR) on the delivery of essential drugs

With a composite mean of 3.689, it can be deduced that a majority of respondents highly agreed with most statements posed as regards the effect of mean time to repair (MTTR) on the delivery of essential drugs. A majority of respondents were found to highly agree that there is a capable team to oversee pro-active service and performance of machine and equipment involved in medical supply (3.991); there is an operational control and monitoring tool for assessing the relevant machines involved in medical supply (3.824); the organization ensures only the right staff handle machines involved in medical supplies (3.815); the technical team controls capabilities to accelerate the remediation process and decrease the MTTR (3.752); and that the framework in place saves time by automating workflows for set-up and tear down of services (3.643). As such, the foregoing findings reveal that MTTR is a pertinent consideration in the delivery of essential drugs in Kenya.

4) Effect of Optimal planned lead time on the delivery of essential drugs

At a composite mean of 3.757, a majority of respondents were found to highly agree with most statements posed with a view to determine the effect of optimal planned lead time on the delivery of essential drugs. A majority were particularly found to highly agree that management has put measures to ensure the shortest time involved in planning deliveries (3.993); procurement and distribution systems ensure timely delivery of appropriate quantities of drugs (3.923); the management ensures reliable supply of high-quality products (3.914); management has put measures to ensure minimal paperwork involved in planning deliveries (3.857); management has put measures to ensure the shortest time involved in Just-in-Time inventory (3.825); management has put measures to ensure the proper prediction of lead time (3.739); and that they employ computerized systems exist particularly involving software for improved management of logistics (3.718). The foregoing findings depict high levels of optimal planned lead time in the study area.

5) Effect of Just-in-Time (JIT) inventory the delivery of essential drugs

At a composite mean of 3.672, a majority of respondents highly agrees with most pertinent statements aimed at analyzing the effect of Just-in-Time (JIT) inventory the delivery of essential drugs. A majority of respondents highly agreed that there is a framework in place for low wastage (3.901); delivery team ensures minimal amount of inventory (3.883); there is a framework in place to eliminate work-in-process queues (3.842); delivery departments ensure high quality production and packaging of products (3.674); they ensure fast equipment setup times to make it economical to create very short production runs (3.629); they have control of timing of supplies shipment (3.619); and that deliveries are made with the smallest possible quantities (3.603). Findings reveal that Just-in-Time (JIT) inventory is a key consideration in the study area's procurement process in the delivery of essential drugs.

6) Pearson Correlation Analysis

The study further conducted inferential statistics entailing both Pearson and regression analysis with a view to determine both the nature and respective strengths of associations between the conceptualized lead time (independent) variables and delivery performance (dependent variable) in the public sector in Kenya.

Table 4.8: Pearson Correlation Matrix

	Delivery Performance	*Waiting time*	*MTTR*	*Optimal planned lead time*	*Just-in-Time inventory*
Delivery Performance	*1*				
Waiting time	.716**	1			
	.000				
Mean Time to Repair	.708**	.692**	1		
	.000	.000			
Optimal planned lead time	.798**	.724**	.300	1	
	.000	.000	.057		
Just-in-Time inventory	.436**	.650**	.485**	.115	1
	.004	.000	.001	.474	

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

From the findings, a positive correlation is seen between each lead time variable and delivery performance. The strongest correlation was established between Optimal planned lead time and delivery performance (r = .798), and the weaker relationship found between Just-in-Time inventory and delivery performance (r = .436). MTTR and Waiting time are also strongly and positively correlated with performance at correlation coefficient of .708 and .716 respectively. All the independent variables were found to have a statistically significant association with the dependent variable at 0.05 level of confidence.

The regression model was as follows:

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X3 + \beta_3 X3 + \epsilon$

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Delivery Performance = α + β_1 (Waiting time) + β_2 (MTTR)+ β_3 (Optimal planned lead time) + β_4 (Just-in-Time inventory) + ε.

Regression analysis produced the coefficient of determination and analysis of variance (ANOVA). Analysis of variance was done to show whether there is a significant mean difference between dependent and independent variables. The ANOVA was conducted at 95% confidence level.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.865[a]	0.748	0.72	1.94285
a. Predictors: (Constant), Waiting time, MTTR, Optimal planned lead time, Just-in-Time inventory				
The result showed a coefficient of determination value (R) of .865[a] which depicts that a strong linear dependence between all the lead timeindictors and delivery performance. With an adjusted R-squared of .720, the model shows that MTTR, Optimal planned lead time, Just-in-Time inventory and Waiting time collectively explain 72.0% of the variations in delivery performance while 28.0% is explained by other factors not included in the model.				

ANOVA[b]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	402.892	4	100.723	26.684	.000[a]
	Residual	135.888	36	3.775		
	Total	538.78	40			
a. Predictors: (Constant), Waiting time, MTTR, Optimal planned lead time, Just-in-Time inventory						
b. Dependent Variable: Delivery Performance						

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.242	8.138		0.521	0.01
	Waiting time	0.336	0.112	0.353	3.011	0.01
	Mean Time to Repair	0.61	0.998	0.099	0.611	0
	Optimal planned lead time	2.435	0.867	0.421	2.809	0.01
	Just-in-Time inventory	1.576	0.905	0.205	1.742	0
a. **Dependent Variable: Delivery Performance**						

The P-value of 0.000 implies that procurement performance has a highly significant joint relationship with MTTR, optimal planned lead time, just-in-time inventory, waiting time which is significant at 90% confidence level.

The established regression equation was thus:
Delivery Performance = 4.242 + .336 (Waiting time) + .610 (MTTR) + 2.435 (Optimal planned lead time) + 1.576 (Just-in-Time inventory) + 8.138

A unit change in MTTR would thus lead to a .610 increase in procurement performance ceteris paribus; a unit change in Optimal planned lead time would lead to a 2.435 change in Performance ceteris paribus and a unit change in Just-in-Time inventory would lead to a 1.576 change in Performance ceteris paribus while a unit change in Waiting time would lead to a .336 change in Performance. This implies that among other factors, waiting time, MTTR, Optimal planned lead time, Just-in-Time inventory and are strong and significant determinants of delivery Performance in the supply of essential drugs.

7. Recommendations

Based on the foregoing findings and conclusions, it is hereby recommended that the Ministry of Health as the policy makers can oversee the work of the distribution agency using suitable indicators for measuring effectiveness and efficiency of the distribution. To reduce inventory, orders should be placed to manufacturers on fortnightly or monthly basis as per the yearly rate contracts; also based on the demand and consumption patterns, reorder level (ROL) and re-order quantity (ROQ) at each health facility. The distribution agency should ensure minimum 2 deliveries to maximum 8-10 deliveries per months depending on the location of public health facilities.

Further, timely procurement and un-interrupted supply chain management is crucial in the provision of quality essential medicines for all. It would guarantee the timely supply of required quantity of essential medicines to all the health facilities located in the remotest part of the country. Invariably it is presumed that the targeted population are being benefited when such programmeare initiated and implemented. However, it has been observed that often systems are not effectively functioning causing problems like stock-outs or over supply thus leading to shortage of medicines or accumulation of medicines well past their expiry date. This results in not only loss of much needed finances but failure to provide much needed essential medicines to all who urgently need them.

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