Drug Supply Chain Management in Public Secondary Health Facilities in Lagos State Nigeria

Emmanuel E. Ege
Department of Geography
University of Lagos, Akoka, Nigeria
egemanuel2002@yahoo.com +2348072182635

Moses O. Adeyi
Department of Transport School
Nigeria Institute of Transport Technology (NITT), Zaria
moadeyi1@gmail.com ; moadey1@nitt.gov.ng +2348023783731

Abstract

This study was conducted to analyze the drug supply chain at nineteen selected public secondary health centers (SHC) commonly referred to as General Hospitals, in Lagos State. Data was collected from both primary and secondary sources. The primary data were collected through a well-structured questionnaire while the secondary data were sourced from journals, Lagos State Ministry of Health, Lagos Bureau of Statistics (LBS), National Agency for Food and Drug Administration and Control (NAFDAC), etc. A descriptive statistical method was employed for data analysis using the statistical package for Social Science (SPSS) version 2.0 and ArcGIS 10.8 version. Maps, frequency counts, percentages, and analysis of variance (ANOVA) were also used to test the hypothesis The study contributed to the existing body of knowledge by establishing the Euclidean distance of SHC from Central Medical Store (CMS) Oshodi, the residences within and outside the buffer zone of 2km radius around the SHC in Lagos state and the distribution and accessibility of patients to essential drugs in the study area. Findings confirmed that 79.6% of Pharmacists have received training on supply chain practices. The respondents also said that SHC in Lagos gets about 75% of their drug supplies from Central Medical Store. The result also revealed there is a significant relationship between the number of dispensing outlet and the amount paid for drug by patients. Also, 57.5% of the patients preferred to have their drugs delivered at home and 49.5% were willing to pay extra cost for home delivery. The study suggests strong regulation and strict enforcement of National Drug Distribution Guidelines of 2012 (NDDG) by the regulator. The study concludes that effective supply chain will deliver safe, efficient, and quality drugs to meet the health need of the patients.

Keywords: Supply Chain, Secondary Health Facilities, Drug Distribution, Central Medical Store, Pharmacist, Patient

1.0: Introduction

An effective and trustworthy drug supply chain is crucial to the delivery of public health services because it guarantees that patients receive the prescription drugs they need on time and every time. This is especially important for public secondary health institutions, which act as a layer of intermediate treatment between tertiary hospitals and basic health care clinics. (Yadav, Tata, & Babaley, 2011). The enormous and expanding population of Lagos State, Nigeria, present particular difficulties for the state's secondary healthcare institutions for keeping an efficient medicine supply chain. In the entire healthcare delivery system, these institutions are vital since they are frequently the initial point of contact for significant health disorders requiring specialist treatment. (Olayiwola & Okoh, 2014).

Several processes are involved in the drug supply chain, including acquisition, storage, distribution, and the eventual dispensing of medications to patients. Any inefficiencies or disruptions within this chain can lead to medicine shortages, overstocking, wastage, and, most critically, negative health outcomes for patients (Mubyazi et al., 2017). Similar issues, for example, have been noted in Tanzania, where structural inefficiencies have had a major impact on the medicine supply in the public health sectors. (Mubyazi et al., 2017). It has been reported in Kenya that ineffective medicine supply chain management results in detrimental health effects, highlighting the necessity of an efficient and adaptable supply chain system. (Achieng' et al., 2020).

An effective supply chain helps to minimize the cost and avoid frequent stockouts of essential drugs, frequent re-orders, and rampant cases of expiry drugs, etc. Lagos state public hospitals have introduced some innovative policies like Drug Revolving Fund (DRF), General Outpatient Department (GOPD), National Health Insurance Scheme (NHIS), Lagos State Health Insurance Scheme (LSHIS), Community Health Pharmacy where free antiretroviral drugs are given to HIV/AID patients, and fee-paying drug outlets under the public-private partnership arrangement (PPP), among others. These interventions were introduced to drug distribution networks to increase patients' access to essential drugs.

Drugs are stored at the Central Medical Store Oshodi from where distribution to public secondary health facilities takes place. The brief intervention of the Petroleum Trust Fund

(PTF) in public drug supply brought about some decentralization in drug delivery, as deliveries were made directly to State Medical Stores from where redistribution to local government medical stores took place. However, a comprehensive distribution arrangement to move pharmaceutical products and other medical supplies from the medical stores to the service points is lacking and as such has become a major bottleneck for access to these items (GNDP, 2004). There is a need for an effective supply chain to build a smarter, safer, and lower cost of pharmacy operations to achieve optimal availability and rational use of drugs. Drugs are transported through various modes including roads, railways, and by air, depending on how far apart the hospital storage points are from the central storage area and the nature of the drugs being transported. Road transportation is however the major mode of drug distribution to public SHC in Lagos state. Figure 1.1 below shows the conceptual framework of the flow of drugs from the manufacturer to the patient
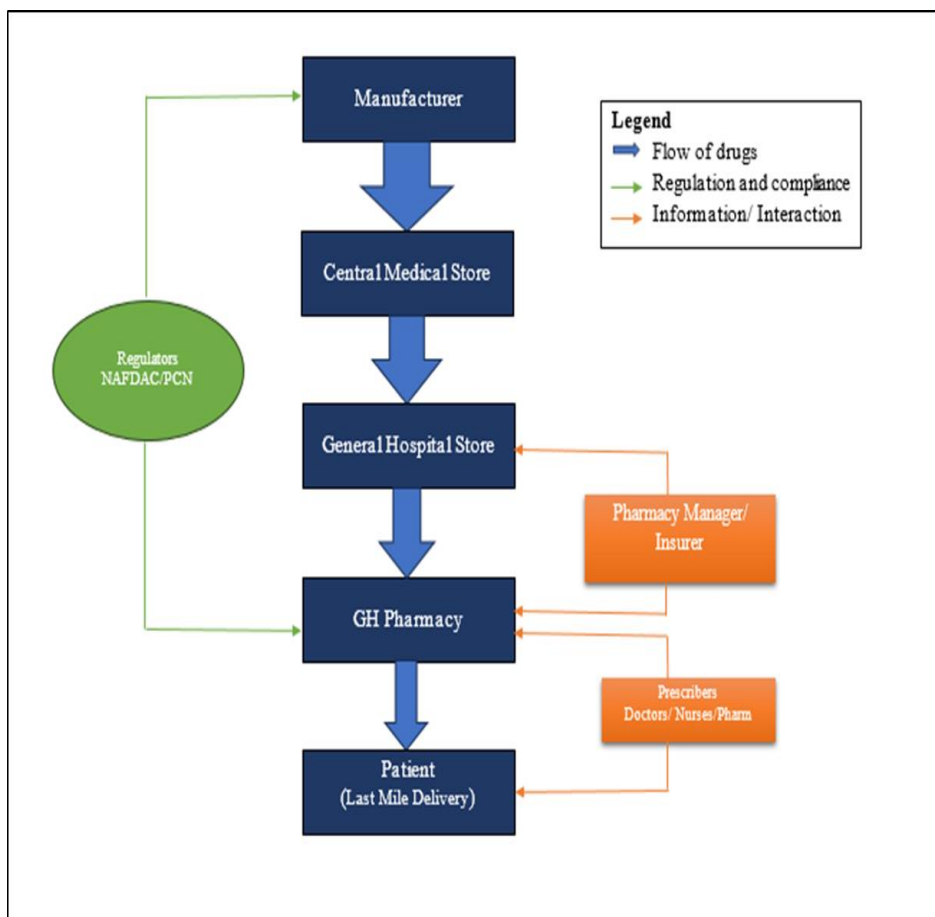
Figure 1.1: Flow of Drugs from Manufacturer to Patients
Source: Modified from Andrew *et al.,* (2021)

This research is motivated by series of interactions between the producers, the supplier, pharmacists and other members of health care delivery team in providing accessible and adequate health services to the patients. Therefore, it is imperative to conduct a thorough analysis of the medication supply chain in Lagos State's public secondary health institutions. Research from other African nations, including Uganda, has shown how important efficient drug supply chain management is to medicine availability and improved health outcomes. (Muhindo et al., 2015). The study examined how drugs are distributed from the central medical store in Oshodi to the public secondary health centres in Lagos state and how the General Hospitals are integrating the distribution system to achieve optimal drug availability to the patient

2.0: Statement of the Problem

The search for quality and affordable health has been the concern of man from time immemorial. This is because everyone has a health need and access to drugs is crucial to meeting such need. Therefore, healthcare organizations all over the world are looking for ways to improve operational efficiencies and reduce costs without affecting patient care and services. Material requirements for healthcare delivery are numerous, creating a complex supply network of relationships from the supplier to the customer. However, resources to meet the health care need of the people are limited, and that is why health providers worldwide are striving to improve drug supply chain processes in order to reduce costs (NHS, 2004).

Lagos State's public secondary health institutions play a vital role, yet the medicine supply chain still confronts several obstacles that reduce its efficacy. There have been reports of regular medicine shortages, delivery delays, and inadequate inventory control. (Mubyazi et al., 2017). Systemic inefficiencies including poor funding, bureaucratic delays, and a shortage of supply chain management experts exacerbate these problems. (Ngoma-Hazemba et al., 2019; Achieng' et al., 2020). In addition, the issue is made more difficult by outside variables including unstable economies, obstacles to regulations, and logistical challenges, which make it challenging to keep a consistent supply of necessary drugs. (Maina et al., 2016).

The ramifications of these disturbances in the supply chain are significant. The public health system is often mistrusted by patients as a result of treatment delays that frequently worsen their diseases and raise death rates. (Muhindo et al., 2015) Furthermore, the provision of effective treatment without the requisite resources presents operational obstacles and frustrations for healthcare providers. (Govindaraj et al., 2014). There is an urgent need for a comprehensive evaluation of the drug supply chain processes within these facilities to identify

root causes, assess the extent of the problems, and develop actionable strategies to enhance the system's efficiency and reliability.

It is imperative that these issues be resolved in order to strengthen Lagos State's healthcare system as a whole and to improve patient outcomes. Public secondary health institutions may secure greater resource use, enhance service delivery, and eventually support the more general objective of universal health coverage by streamlining the medication supply chain. (Yadav et al., 2011; Olayiwola & Okoh, 2014; FMoH Nigeria, 2019).

Supply Chain Integration which refers to seamless collaboration among supply chain partners, has been considered as a means to reduce operations costs and supply chain inefficiencies, as well as improving the service level in a pharmacy department. Most of the patients have confidence in procuring drugs from general hospital pharmacies because of fear of fake and adulterated drugs which are rampant nowadays. Hospital pharmacy also have the advantage of having specialized and control drugs which cannot be easily accessed elsewhere. To be able to serve effectively this large number of patients without room for delays and stock outs, the procurement of pharmaceuticals, systems for quantification of drugs and inventory management systems must be highly effective. There is also the need to upgrade the skills of trained staff in implementing standard operating procedures prepared for the management of medicines, supplies and equipment.

Public drug supply in Nigeria is largely financed through government budgets. Donor agencies and NGO's have however complemented government funding. For example, in 1989, the British government under a programme known as "British Aids" gave to Nigeria's tertiary hospitals medicine worth two million pounds. World Bank, under counterpart funding arrangement, also executed Essential Drug Projects in some states in Nigeria. (Adenika, 1992). In spite of efforts to improve fund management, several challenges persist. These include inadequate funding, bureaucratic delays, corruption, and inefficiencies in the supply chain. These challenges often result in drug shortages, poor quality of care, and reduced public trust in the healthcare system (Oshikoya & Senbanjo, 2010).

To efficiently manage a supply chain, suppliers, manufacturers, wholesale distributors, re-packagers, third-party logistics providers, pharmacies, and dispensers must coordinate production, inventory, location, and transportation (Felea and Albastroiu, 2012) (Thaul 2013). Donors and funders, government policymakers, procurement agents, program administrators, and regulators are among those who contribute to the success of supply chains. A typical supply

chain involves the acquisition of raw materials, the production of goods at one or more factories, transportation to warehouses for interim storage, and finally transportation to merchants or consumers. (Li and Schulze 2011; Benoit 2010). In other words, supply chain activities turn natural resources, raw materials, and components into completed goods that are distributed to end customers or users. (Jacoby 2009)

Supply chain management also combines the logistics tasks with the organization and cooperation of personnel at all levels and across all functions. (West African Health Organization, 2013. Logistics tends to concentrate more on specific tasks within a particular program or health system. (Council of Supply Chain Management Professionals (C.S.C.M.P) 2011) Quantification, procurement, inventory management, transportation and fleet management, as well as data collecting and reporting, are all examples of logistics activities, which are the operational part of supply chain management. (Kumurya 2015)

A robust supply chain is essential to a country's health system because a weak one can destabilize it and jeopardize good health outcomes, as is the case with Nigeria. (Edmond, 2009). The ability of supply chains at the national, state, and local government levels in Nigeria to plan, obtain, and transport needed medications and other medical supplies is a significant to the efficient operation of such chains. (Yadav, Tata and Babaley 2011) Public health supply chains in Nigeria are currently faced with a number of difficulties, including poor infrastructure, a lack of financial, human, and material resources, a lack of logistics information, and a lack of consumption statistics. (USAID/DELIVER PROJECT, (2010) there is evidence for performance enhancements connected to supply chain management, however there aren't many empirical studies to assess the size of performance enhancements brought on by SCM initiatives, particularly in the Nigerian environment. (Adebayo, 2012)

In Nigeria, according to the USAID/DELIVER initiative, programs are administered individually at the national level, but at the state level, many of these vertically controlled programs (such as those for TB and leprosy, vaccinations, and malaria) start to converge because the medications and other supplies are frequently kept in the same warehouse. (USAID/DELIVER PROJECT, 2010). The same USAID report notes that while local government areas (LGAs), acting independently, frequently purchase the drugs and deliver to the service delivery point, states also oversee the procurement of necessary medications for hospitals and primary healthcare (PHC) facilities.

A public health program's ability to succeed or fail depends on having efficient supply chains, which also help assure commodity security. (Kumurya 2015) This is especially important in light of the fact that the public now prioritizes access to medications in order to meet their healthcare demands. These medications must be cost-effective, readily available, and effective at all times, as well as available in sufficient quantities and at the right dosages. (Yadav, Tata and Babaley 2011) Effective supply chains increase program impact, improve care quality, and boost cost effectiveness and efficiency, all of which are major benefits for public health initiatives. (Kumurya 2015)

Good handling and storage facilities should be present at all key important locations in a supply chain system. (Onyebuchi, 2016). This system keeps the structure streamlined, the pharmaceuticals in good condition, the supply steady, and the leaks to a minimum while also giving trustworthy forecasting data. (Bennett *et al*, 2008); (Federal Ministry of Health (ed.) 2012); (Ogbonna *et al*, 2015) A better utilization of resources, which are frequently few, is ensured through improved knowledge. For successful quantification and ordering at all levels of the supply chain, for instance, precise data on consumption patterns that is recorded at the point of service delivery and flows back up the chain is essential. (Ogbonna *et al*, 2015). In order to estimate replenishment rates at the various levels of the supply chain (such as central warehouses and regional stores), proper stock levels at service delivery locations should be established. (Lysons and Farrington 2012). It would be less likely to experience stock-outs and excess inventory, which frequently result in product expiration, if targeted stock levels were maintained. Critically, upstream decisions concerning purchase quantities will be influenced by stock information coming through the supply chain system. (Lysons and Farrington 2012)

Some progresses have been made in drug production but much have not been done in entrenching a distribution system that ensure that the medicine that gets to the consumers are effective, qualitative, safe and affordable. This was why the Federal Government released National Drug Distribution Guidelines (NDDG) in 2012. The National Drug Distribution Guidelines (NDDG) outline a comprehensive framework for the distribution of pharmaceutical products, ensuring that consumers receive safe and high-quality medications. The model described in the guidelines emphasizes the role of various stakeholders, including physicians' offices, pharmacies, and dispensaries, in facilitating the distribution process. In this model, most consumers obtain their medicines from authorized channels such as physician's offices, pharmacies, and dispensaries. These establishments serve as key points of access for patients to acquire prescribed medications and over-the-counter drugs. By centralizing the distribution

through these regulated outlets, the NDDG aims to streamline the process and minimize the risk of counterfeit or substandard products reaching consumers. (Uzochukwu et al 2015).

Furthermore, the guidelines emphasize the importance of a cohesive drug distribution network supported by an effective regulatory framework. This framework encompasses stringent quality control measures at every stage of the distribution chain, from manufacturing to retail. Regulatory bodies play a crucial role in overseeing compliance with these standards, ensuring that pharmaceutical products meet established safety and efficacy requirements. Overall, the NDDG seeks to enhance the efficiency, safety, and reliability of drug distribution while safeguarding public health. By establishing clear guidelines and regulatory mechanisms. It aims to promote transparency and accountability within the pharmaceutical supply chain. . (Uzochukwu et al 2015).

Since the formulation of NDDG in 2012 there has not been sufficient empirical research to assess the effectiveness of its implementation in the drug distribution network in Nigeria. This work therefore provides an insightful understanding about drug distribution network for sustainable drug supply in Lagos State general hospitals. The study assessed the pharmacist's knowledge of the supply chain system and evaluated drug distribution and transportation from the central medical store to the patients.

3.0: Methodology

A reconnaissance survey was carried out in order to get acquainted with the study area during which a visit was paid to the 19 selected SHC. Ethical approval was obtained from the Health Research Ethics Committee of the College of Medicine University of Lagos, Idi-Araba. Also, necessary approval was sought from the Lagos State Health Service Commission before embarking on this research.

Primary and secondary data were used for the study. The primary data for this research was collected from the field through the use of a structured questionnaire which was validated by a director of Pharmacist with over 25 years' experience in hospital pharmacy. The questionnaire items were administered to gather information from patients and pharmacists and the regulator of the pharmacy practice in Nigeria. A total of 685 copies of the questionnaire were administered using systematic and purposive random sampling method out of which 605 copies representing 88.3% were retrieved

Secondary data were also sourced from journals, official gazettes, academic publications, websites, Pharmaceutical Council of Nigeria (PCN), Nigeria Medical Association

(NMA), National Bureau of Statistics (NBS), Lagos Bureau of Statistics (LBS), Central Medical Store (CMS) Oshodi, Lagos State Ministry of Health, Federal Ministry of Health, National Agency for Food and Drug Administration and Control (NAFDAC) and other relevant government agencies.

Descriptive statistical method was employed for data analysis using statistical package for Social Science (SPSS) version 2.0. ArcGIS 10.8 version was also used to determine Euclidean distances of the SHC from the CMS and Buffering analysis of residential settlements in relation to the location of SHC in Lagos state. Maps, frequency counts, percentages and analysis of variance (ANOVA) was also used to test the hypothesis.

4.0: Result and Discussion

Table 1: Knowledge of Supply chain system

S/N	Knowledge of Supply chain system	Yes	%	No	%
1.	Do you know what supply chain system is?	129	79.6	33	20.4
2.	Is there a defined quality structure and quality assurance policy?	160	98.2	3	1.8
3.	Are Store Officers and Staff responsibilities clearly defined?	160	98.8	2	1.2
4.	Have all personnel received proper training in relation to good storage practice, regulations, procedures, and safety?	126	79.7	32	20.3
5.	Do you have adequate number of staff in the Pharmacy Department?	77	47.2	86	52.8

Source Author's Analysis (2023)

4.1: Knowledge of Supply Chain

Knowledge of supply chain is very crucial for effective distribution of drugs, therefore drug logistics and supply chain management is an integral part of Pharmacists education and training. As indicated in Table 1 above, 79.6% of the pharmacists in SHC in Lagos state have adequate knowledge of supply chain and pharmacist's responsibilities were clearly defined. The remaining 20.4% who did not have good knowledge of supply chain were Pharmacy technicians. The results also indicate that there are inadequate number of Pharmacists to drive the sustainable drug supply in SHC in the study area as evidenced by 47.2% number of respondents who said that the number of staff in the pharmacy department are not adequate for effective drug distribution.

Table 2: Drug Transportation Mechanism

Are pharmaceutical products transported in such a way that their integrity is not impaired and that storage conditions are maintained?	Response	Percentage
Sometimes	70	42.9
Always	93	57.1
Total	163	100.0

Source Author's Analysis (2023)

Pharmaceutical products are transported in a way that the integrity of the drugs are not compromised and the storage condition is maintained. Loading and offloading arrangements of drugs into the vehicles must take note of the peculiarities of the drugs being transported. For example the last drug loaded should the first drug to be off loaded i.e. Last in First out (LIFO). From the result, 70 respondents representing 42.9% are of the opinion that drugs are sometimes transported in a way that their integrity is not impaired while another 93 respondents representing 57.1% are of the opinion that drug are always transported in a way that its integrity is not impaired as depicted in Table 2

Table 3: Drug Dispatch Procedure

Are there dispatch procedures established and documented, taking into account the nature of pharmaceutical products concerned and any special precautions taken?	Response	Percentage
Yes	154	94.5
No	6	3.7
Do not know	3	1.8
Total	163	100.0

Source Author's Analysis (2023)

A standard dispatch procedure is established by WHO as regards the documentation of pharmaceutical products in transit. This has been incorporated into National Drug Policy in Nigeria. The result in the table below shows that 154 dispensing Pharmacists which represents 94.5% out of the 163 respondents in the 19 SHC in Lagos complied with this standard procedure while the remaining 9, representing 5.5% dissented as shown in Table 3.

Table 4: Drug Tracking Mechanism

Are there mechanisms on ground to track the delivery of products to their intended users?	Response	Percentage
Yes	80	49.1
No	64	39.3
Do not know	19	11.7
Total	163	100.0

Source Author's Analysis (2023)

The drug distribution design model of SHC in Lagos state is Distributors storage with last mile delivery. In this model the end users which are the patients, get their medicines from a designated centre, which is the pharmacy department of the general hospital. The patients medicine at the general hospitals are also prescribed by the doctors and dispensed by the pharmacy, therefore there are records, albeit manual, to trace the delivery of the prescribed drugs to the patients. There are also operational procedures by SHC to order and receive supplies from the CMS. But the result of the respondents shows that 80 pharmacists (49.1%) agreed that there are mechanism on ground to track the delivery of products to their intended users while 64 (39.3%) pharmacists said no. The remaining 19 (11.7%) did not know as shown in Table 4

Table 5: Drug Distribution Vehicle

How many vehicles do you have for drug distribution	Response	Percentage
1	134	84.8
2	16	10.1
3	0	0.0
More than 4	8	5.1
Total	158	100.0

Source Author's Analysis (2023)

As indicated in the Table 5 above, majority of the general hospitals in the study area have only one vehicle for drug distribution. Out of 158 respondents 134 (84.4%) have one; 16 (10.1%) have two while 8 (5.1%) have more than two.

Table 6: Drug Distribution Vehicle Maintenance

What is the average cost to fuel/maintain the vehicle in a month	Response	Amount
Between N10,000-N20,000	1	15000
Between N20,000-N30,000	4	100000
Between N30,000-N40,000	22	770000
N40,000 and above	126	5670000
Total	153	6,555,000
Average		42,843.1

Source Author's Analysis (2023)

The cost of maintenance of vehicle for drug distribution at the general hospitals in the study area are analyzed as in the table below. Based on the result of the data collected through questionnaire each SHC spend an average of N42, 843 naira to maintain the vehicle for a month and this gives a state average of N6, 555,000 for 19 general hospitals in Lagos state. With the removal of fuel subsidy the amount could have increase by more than 100% of the cost depicted in Table 6.

Table 7: Drug Transportation Duration from SHC to CMS/LSMS

How long does it take to transport the drug from store to the hospital	Response	Percentage
(a) Less than I hour	6	3
(b) Between 2 hours to 3 hours	32	80
(c) Between 4hours to 5 hours	30	135
(d) More than 5 hours	94	564
Total	162	782
Average		4.8

Source Author's Analysis (2023)

As discussed under the drug distribution chain, all the SHC in Lagos got 75% of their drugs from CMS/LSMS at Oshodi. The table below shows how long it takes, in terms of hours, each of the selected general hospitals to transport the drugs from CMS to their respective hospitals. The result shows that it takes an average of 5 hours in a day for the each of the

hospitals while the general hospitals at Ibeju Lekki, Epe, Badagry and Ikorodu could take more 5 hours. As shown in Table 7

4.2: Drug Dispensing Procedures

As noted earlier, general hospitals in Lagos State receive the bulk of their drug supply from the Federal Central Medical Store and Lagos State Medical store at Oshodi. The drugs received are kept in the at Pharmacy facility and then dispensed to the patients on doctor's prescription. WHO standard for drug dispensing procedure checklist were administered to the dispensing pharmacists at the study area. There are 16 indicators on the checklist for the assessment of drug dispensing and the standard operation procedures of the WHO is for the health care centres to achieve 100%, in the checklist while the area where they score less than 100% needs to be improved upon or implemented.

Table 8: Drug Dispensing Procedure Checklist

S/N	Drug Dispensing Procedures	Yes	%	No	%
1.	At the beginning of the day or clinic session, a health worker issues all items needed from the store to the appropriate dispensing area.	162	100.0	0	0.0
2.	The health worker records the movement of each item on its stock card.	162	100.0	0	0.0
3.	The items in the dispensary are organized in the same way as the items in the store.	162	100.0	0	0.0
4.	The dispenser checks that the prescription is appropriate for the patient.	162	100.0	0	0.0
5.	The dispenser collects a container of the prescribed item and checks its expiry date.	162	100.0	0	0.0
6.	The dispenser collects a small container so the patient can take the drug home.	156	96.3	6	3.7
7.	The dispenser labels the package with the patient's name, date, name of the item, quantity dispensed, and written instructions for the patient.	161	99.4	0	0.0
8.	The dispenser opens the container and checks the quality of its contents.	160	98.8	2	1.2

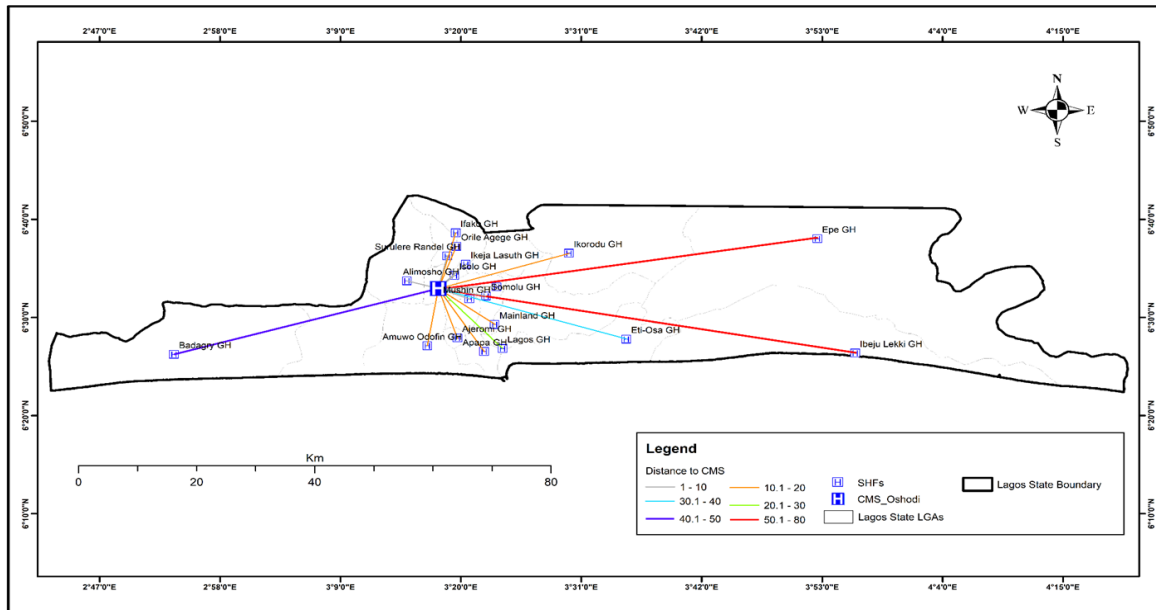Source Author's Analysis (2023)

As shown in table 8 above, all the general hospital in the study area achieved 100% mark for indicators number 1 to 13 but scored 34%, 37% & 16% for indicators number 14,15 and

16 respectively. The state average score for all the general hospital is 86.1%. Therefore the dispensing pharmacists in the study area need to improve in drug counselling to patients by asking patients to repeat the dosage instruction and by telling them to keep the drugs out of the reach of children. This is to ensure the rational use of drugs which is one of the strong advocacy of WHO. Also Lagos state government should give incentive to the pharmacist to motivate them to dispense generic drug at the public hospital. This is to ensure sustainable drug supply.

4.3: Central Medical Store

There are two central medical store in Lagos, these are federal and state medical store and both of them are located at Oshodi. The Lagos pharmaceutical store serve as a critical component of the healthcare infrastructure. It plays a central role in the storage, distribution, and management of pharmaceutical products and medical supplies within the state. The central pharmaceutical store is responsible for procuring pharmaceutical products, including medicines, vaccines, and medical supplies, on behalf of the Lagos State government. This involves sourcing products from reputable manufacturers and distributors, providing proper storage conditions, including temperature control, humidity control, and security measures to ensure the quality and safety of stored medications as well as the distribution of pharmaceutical products to various healthcare facilities across the state. The central store should be within a reasonable distance to enable efficient and cost-effective transportation of pharmaceutical products.

In this work, effort were made to determine the distance from the Lagos state central medical store Oshodi to the selected general hospitals in the study area as a crow flies using GIS. The result as analyzed in Figure 4.1 indicated the relative distances of the CMS from the SHC across the Lagos state which varies from 10 to 80km.

Figure 4.1: Spatial Accessibility of CMS by SHC in the Study Area

Source: Author's Analysis (2023)

Table 9: Distance from CMS to SHC

S/N	Distance to CMS (Km)	Frequency	Percentage (%)
1.	1 – 10	7	36.8
2.	10.1 – 20	7	36.8
3.	20.1 – 30	1	5.3
4.	30.1 – 40	1	5.3
5.	40.1 – 50	1	5.3
6.	50.1 – 80	2	10.5
	Total	**19**	**100.0**

Source: Author's Analysis (2023)

As indicated in Table 9, the relative distances of general hospitals from CMS shows that 7 out of 19 SHC which represents 36.8% are between 1-10 km away from CMS Oshodi. Another 7 are between 10.1-20km (36.8%); one is between 20.1-30km (5.3%); one is also between 30.1-40km (5.3%); similarly one is between 40.1-50km (5.3%) and finally 2 are between 50.1-80km

Table 10: Relationship between Dispensing Outlets and the Amount paid for Drugs at SHC

S/N	Name of HF	No of Pharmacy outlets	Amount Paid for Drugs
1.	Ajeromi GH	5	10920
2.	Alimosho GH	6	11294.1
3.	Amuwo Odofin GH	3	11602.2
4.	Apapa GH	4	9863.64
5.	Badagry GH	4	10380.95
6.	Epe GH	3	10750
7.	Eti-Osa GH	3	9045.5
8.	Gbagada GH	5	11000
9.	Ibeju Lekki GH	4	9428.6
10.	Ifako GH	4	9160
11.	LASUTH, Ikeja	6	7476.2
12.	Ikorodu GH	5	10666.7
13.	Isolo GH	3	8750
14.	Lagos GH	7	7260.8
15.	Mainland GH	3	10800
16.	Mushin GH	3	7400
17.	Orile Agege GH	5	7520
18.	Somolu GH	5	6315.8
19.	Randle GH	5	9904.76
	Total	**83**	**179539.25**

Source Author's Analysis (2023)

To improve the access of patients to medicines at the general hospitals, Lagos state government has increased the number of dispensing outlets through various reforms and drug revolving initiatives. Some of the general hospitals visited during the survey have between 3 to 8 dispensing outlets like General Outpatient Department (GOPD), Public Private Partnership (PPP) National Health Insurance Scheme/Lagos State Health Insurance Scheme (NHIS/LSHIS), Community Health (CH), Maternal Child Centre (MCC). etc.

Evidence from research has proved that increasing the number of dispensing outlets bring the medicines closer to the patients at the lower cost but increases the inventory cost. In the survey, the average total cost of 10 prescribed medicines cost less at the hospitals where there are more dispensing outlets. Analysis of data from the survey indicated that there is a significant relationship between the number of dispensing outlet and the amount paid for drugs as shown in Table 10.

Testing of Hypothesis 1

$H_0 1$ There is no significant relationship between drug dispensing outlets and the price of
.   drugs in the study area

Table 11: SUMMARY OF ANOVA

Groups	Count	Sum	Average	Variance	Source of Variation	SS	df	F	P-value
No. of Pharmacy outlets	19	83	4.15	227.79	Between Groups	3.22	1	4.44582	0.04163
Amount Paid for Drugs	19	179539.25	9449.4	1.45E+09	Within Groups	2.75	38		

Source Author's Analysis (2023)

Only one value is important in interpretation from the ANOVA table (Significant value). If the significant is < 0.05, the null hypothesis is rejected. If it is > 0.05, then the null hypothesis is not rejected. If a null hypothesis is rejected, it means there is an impact. However, if a null hypothesis is not rejected, it means there is no impact. In this case, the significant value 0.04163 < 0.05 hence, the analysis was considered to be statistically significant and the null hypothesis is rejected. There is a significant relationship between the number of available drug dispensing outlets and the amount paid for drugs in each hospital. This means that hospitals with higher

number of pharmacy outlets pay less for drugs and while hospitals with lower number of pharmacies pay more as indicated in the analysis of variance in Table 11.

These findings reveal that the total cost of medications can be decreased in large part by efficient inventory management. Effective inventory management programs reduce drug waste, which may be extremely expensive for healthcare institutions and result from overstocking or expired medications. (Jacobs et al., 2018). Healthcare providers can also save money by avoiding the expenses of last-minute purchases and unnecessary storage by keeping ideal inventory levels. Better inventory management also makes it possible to negotiate prices and buy in bulk, which may further save expenses. (McKone-Sweet, Hamilton, & Willis, 2005).

Table 12: Summary of Drug Distribution and Accessibility Indicators

	Indicator of Drug Inventory System	Public health facilities and their pharmacies	WHO Standard Recommendation
1	% medicines adequately labeled	96.2%	100%
2	% patients that know how to take medicines	84.3%	100%
3	Average number of medicines per prescription	9.2	1.8
4	Average amount paid for the purchased medicines	N9,403.4	-
5	Average amount spent on transport to and from the hospital	N1,219	-
6	Average hour spent from patient's house to the hospital?	90 min	30 min
7	Average hour patient spends waiting for drugs at the hospital pharmacy	80 min	30 min
8	% of patients given expired drugs from hospital pharmacy	10.3%	-
9	% of patients experiencing adverse drug reaction	53.7%	-
10	% of patient who prefer drug delivery at home	57.5%	-
11	% Number of patients who are willing pay extra cost for home delivery of drugs	49.5%	-
12	Pharmacists' Knowledge of supply chain	80.7	-
13	% of drug dispensed to patients at public SHC in Lagos state	79.1%	-
14	Average amount spent on drug vehicle maintenance in a month	42,843.1	-

Source: Authors compilations (2023)

4.4   Service Radius of Public SHC in Lagos State

Buffering analysis was performed to ascertain the World Health Organization's recommendation that public SHCs should be at most 2Km away from settlements. The findings revealed as shown in Figure 4 that 41.9% of the residents traveled more than 2Km in seeking health services. It was also observed that most LGAs in Lagos central region are adequately covered within the 2-km buffer zone of the health care facilities while Settlements in the eastern and western senatorial districts of Lagos state are mostly located outside the buffer zone and are poorly covered or underserved by the general hospitals with the 2-km service radius.

As indicated in fig 4 below, all settlements in blue are within the 2km buffer zone from the SHC while majority of the settlements in red colour are found outside the buffer zone.
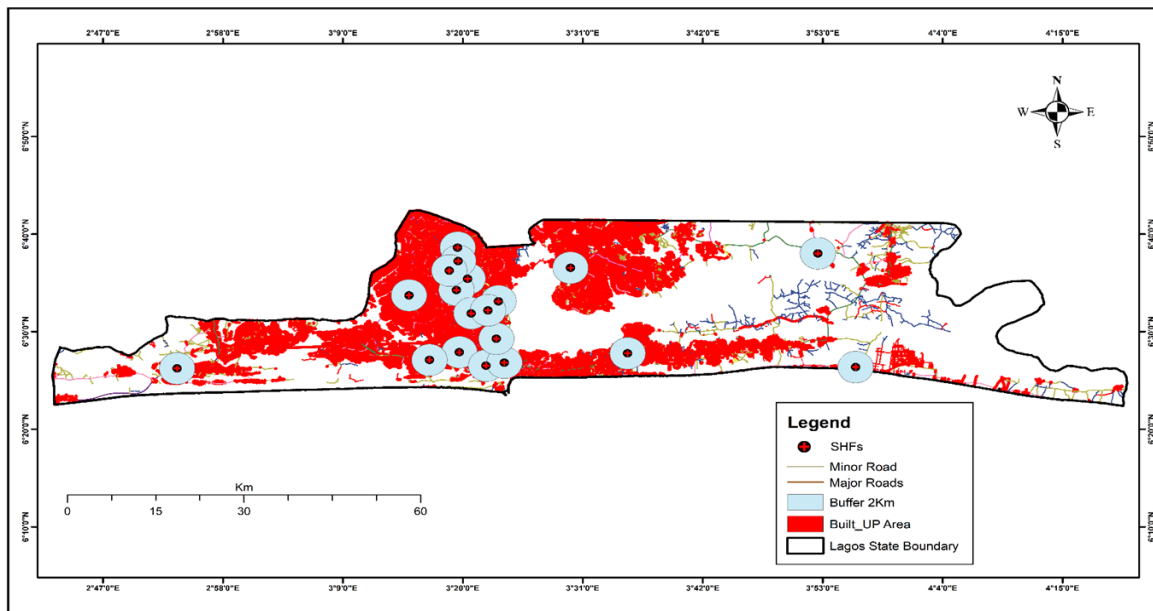

Figure 4. Buffer Analysis showing the Relative Location of SHC to the Settlements in the study area

Source: Author's Analysis (2023)

5.0 Conclusion and Recommendations

Conclusively, to achieve sustainable development goal of universal health coverage in 2032 there is need to develop resilience in drug distribution mechanism to forestall unforeseen disruption to the supply chain and to ensure drug security.

In the light of research findings, the following are recommended:

i. The study indicates that about 20% of the pharmacists have no knowledge of supply chain therefore there is need for training and retraining of pharmacists and other health workers in the drug procurement, supplies, storage, dispensing etc. to ensure effective distribution and supply chain management

ii. Lagos state ministry of health should make effort to increase the capacity of drug stores at the various SHC. Also medical stores should be established at the LGA and LCDA to bring drugs closer to the SHC which is the last mile delivery for patients

iii. Lagos state government should provide additional vehicles for effective drug distributions at the SHC. Such vehicles should be equipped with cooling system to ensure that the storage condition is maintained during transit.

iv. Government at federal, state and local levels should increase the minimum wage of workers and make policies that will reduce poverty or capture the poor in the social health safety net. This will go a long way to narrow the economic access to essential drugs.

v. The study also alludes to the fact that the prices of drugs are cheaper at SHC with many dispensing drug outlets, therefore Federal and Lagos state government should fund the NHIS/LSHIS adequately. This will enable those who are registered under the scheme to have access to essential drugs.

References

Adebayo I.T (2012). Supply Chain Management (SCM) Practices in Nigeria Today: Impact on SCM Performance. European Journal of Business and Social Sciences 1(6): 107-115.

Adenika, E.B. (1992) Principle of Essential Drugs Management, Shaneson C.I. Limited, Ibadan, Nigeria. 1992; Pp. 10-11.

Achieng', A., et al. (2020). Assessment of Drug Supply Chain Management Practices and their Effects on Health Outcomes in Kenya: A Case of Public Health Facilities in Kisumu County. *Journal of Health Care Quality Assurance*. DOI: [10.1108/JHOM-05-2020-0139](https://doi.org/10.1108/JHOM-05-2020-0139).

Andrew L.L, Pengwah, A.B, Fang, L, & Razzagh, R (2021) Topology Identification of Radial Distribution Networks using Smart Meter Data. IEEE Systems Journal 16(4), 5708-5719

Benoit S (2010). Addressing the human factor in public health supply chains. Optimize 7: 2-3.

Chopra, S., and Meindl, P. (2001) Supply Chain Management: Strategy, Planning, and Operation. New Jersey, Prentice Hall, p448 [Accessed on 15 February, 2011)

Council of Supply Chain Management Professionals (CSCMP) (2011).Logistics Management. Available at http://cscmp.org/aboutcscmp/definitions.asp. Accessed 3rd May, 2023.

Edmond J.P (2009). Study for Temperature Sensitive Products: Preliminary Testing, University of Florida. Available at http://www.sensitech.com Accessed 20th October, 2015.

Federal Ministry of Health (ed.) (2012). National Guidelines on Drug Distribution in Nigeria: 1-31.

Felea & Albastroiu (2012). Supply Chain Strategies. Valahian Journal of Economic Studies 3(3): 45-52

FMoH (Federal Ministry of Health) Nigeria. (2019). National Drug Policy. Federal Government of Nigeria.

GNDP. (2004) Report on Public Drug Supply and Distribution. Gross National Disposable Product

Govindaraj, R., Herbst, C. H., & Cave, S. (2014). Strengthening Post-Ebola Health Systems: From Response to Resilience in Guinea, Liberia, and Sierra Leone. The World Bank.

Jacoby D (2009). Guide to Supply Chain Management: How Getting It Right Boosts Corporate Performance (The Economist). Bloomberg Press: New York, NY.

Kaiser (2005).Kaiser Family Foundation Report see https://www.kff.org/wp-content/uploads/2013/01/follow-the-pill-understanding-the-u-s-commercial-pharmaceutical-supply-chain-report.pdf

Kumurya AS (2015). Supply Chain Management of Health Commodities and Logistics: Fundamental Components of Booming Medical Laboratory Services. European Journal of Logistics, Purchasing and Supply Chain Management 3(4): 62-72.

Li L and Schulze L (2011). Uncertainty in Logistics Network Design: A Review. In Proceedings of the International Multi Conference of Engineers and Computer Scientists. Available at http://www.iaeng.org/publication/IMECS2011/I MECS2011_pp1466-1471.pdf. Accessed 30th April, 2023.

Lysons, K. and Farrington, B. (2012) Purchasing and Supply Chain Management, 8th ed. Pearson Educ, Harlow.

Maina, M., et al. (2016). Evaluation of Drug Supply Chain Management Systems in Sub-Saharan Africa: A Comparative Study of the Kenya Medical Supplies Authority and Tanzania

Medical Stores Department. Journal of Health Care Quality Assurance. DOI: [10.1108/JHOM-03-2016-0044](https://doi.org/10.1108/JHOM-03-2016-0044).

McKone-Sweet, K. E., Hamilton, P., & Willis, S. B. (2005). The ailing healthcare supply chain: A prescription for change. *Journal of Supply Chain Management*, 41(1), 4-17. DOI: 10.1111/j.1745-493X.2005.tb00185.x.

Mubyazi, G. M., et al. (2017). Assessment of Drug Supply Chain Management Practices and their Effects on Availability of Drugs in the Public Health Sector: A Case of Kigoma Region, Tanzania. International Journal of Health Policy and Management. DOI: [10.15171/ijhpm.2017.53](https://doi.org/10.15171/ijhpm.2017.53).

Muhindo, R., et al. (2015). Assessment of Drug Supply Chain Management Practices and their Effect on Health Outcomes in Uganda's Public Health Facilities. Journal of Pharmaceutical Policy and Practice. DOI: [10.1186/s40545-015-0043-0](https://doi.org/10.1186/s40545-015-0043-0).

Ngoma-Hazemba, A. M., et al. (2019). Drug supply chain management practices and its implications on health outcomes: Evidence from public health facilities in Dar es Salaam, Tanzania. Journal of Health Research. DOI: [10.1108/JHR-03-2019-0154](https://doi.org/10.1108/JHR-03-2019-0154).

NHS Purchasing and Supply Agency (February, 2004). Annual Report and Accounts. Retrieved August 20, 2005, from: http://www.ontariobudget.fin.gov.on.ca

Ogbonna BO, Ilika AL, Nwabueze SA.(2015) National Drug Policy in Nigeria, 1985-2015. World Journal of Pharmaceutical Research. 2015; 4(6): 248-264. Olayiwola, N. W., & Okoh, M. (2014). Management of drug supply in public health facilities in Nigeria. International Journal of Pharmaceutical and Healthcare Marketing, 8(2), 149-168. DOI: (10.1108/IJPHM-07-2013-0042) (https://doi.org/10.1108/IJPHM-07-2013-0042).

Olayiwola, N. W., & Okoh, M. (2014). Management of drug supply in public health facilities in Nigeria. International Journal of Pharmaceutical and Healthcare Marketing, 8(2), 149-168. DOI: [10.1108/IJPHM-07-2013-0042](https://doi.org/10.1108/IJPHM-07-2013-0042).

Onyebuchi O.B (2016). National drug distribution in Nigeria; Implications for the goals of national drug policy. European Journal of Pharmaceutical and Medical Research 3(1): 1-4.

Oshikoya, K. A., & Senbanjo, I. O. (2010). Sources of drug information and their influence on the prescribing behaviour of doctors in a teaching hospital in Ibadan, Nigeria. Pan African Medical Journal 5(1), 14. DOI: [10.4314/pamj.v5i1.56194](https://doi.org/10.4314/pamj.v5i1.56194).

Squire, Jr. (2008). Strategies for Safer and More Efficient Medication Management [Online] www.cardinalhealth.com/.../hospitals/.v [Accessed on January 5, 2023]

Thaul S (2013). Pharmaceutical Supply Chain Security. Congressional Research Service. Available at http://www.rx360.org: Accessed 26 April, 2023.

USAID | DELIVER PROJECT, Task Order 1. (2010). Nigeria: Segmentation of the Supply Chain for Essential Medicines. Arlington, VA, USAID/DELIVER. Project, Task Order 1 https://usaid.gov.pdf.doc/pnaea 966pdf .

Uzochukwu, B., Onwujekwe, O., Akpala, C., & Ogujiofor, O. (2015). The Drug Distribution Guidelines in Nigeria: An evaluation. African Journal of Pharmaceutical Research and Development, 7(2), 45-53.

West African Health Organization (2013). Assessment of Central Medical Stores to host Regional Antiretroviral Medicines Stock Security in Four Countries. Available at http://www.wahooas.org/IMG/pdf/WAHO. Accessed 5th May, 2023.

World Health Organization (WHO). World Drug Situation, Geneva, Switzerland.1988:54- 116

Yadav P, Tata H and Babaley M (2011). The world medicines situation 2011: Storage and supply chain management. Geneva: World Health 76 West African Journal of Pharmacy (2016) 27 (1) Drug supply chain system Organization.