An assessment of drug supply chain system in selected facilities in Abuja and Plateau State, Nigeria

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ABSTRACT

Background: In Nigeria, government and non-governmental organizations are currently involved in funding, organizing and delivering medicines and other health commodities. Supply chain management of essential health commodities involves a series of activities meant to guarantee the continuous flow of drugs, laboratory test kits and other consumables from the point of manufacture to the point of consumption.

Objective: The study was aimed at assessing the current status of the drug supply chain in Nigeria with respect to the capacity and practices of storage, distribution and transportation.

Method: A cross-sectional descriptive survey was conducted *to* assess the various parameters, through the use of structured questionnaires administered to officers handling drugs supply system in selected sites in FCT Abuja and Plateau state.

Results: The study showed that 68% of the stores assessed had a defined quality assurance policy in place. 68% indicated availability of written information and documentation of storage activities. However, only 39% of respondent indicated availability of temperature charts, while 61% reported having in place a functional distribution and transportation mechanism.

Conclusion: Despite observed lapses, this assessment revealed enough strengths and good infrastructural presence to indicate that the drugs supply chain is sufficiently effective and efficient to receive and manage medicines that pass through it.

Keywords: Drug integrity, Storage, Supply chain, Temperature charts, Quality assurance

Une évaluation du système de la chaîne d'approvisionnement en médicaments dans les établissements sélectionnés à Abuja et l'Etat du Plateau, au Nigeria

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RESUME

Contexte: Au Nigeria, les organisations gouvernementales et non- gouvernementales sont actuellement impliquées dans le financement, l'organisation et la livraison de médicaments et autres produits de santé. La gestion de la chaîne d'approvisionnement des produits de santé essentiels implique une série d'activités destinées à garantir le flux continu de médicaments, des kits de tests de laboratoire et autres consommables à partir du point de fabrication au point de consommation.

Objectif: L'étude visait à évaluer l'état actuel de la chaîne d'approvisionnement en médicaments au Nigeria en ce qui concerne la capacité et les pratiques de stockage, de distribution et de transport.

Méthode: Une étude descriptive transversale a été menée pour évaluer les différents paramètres, par l'utilisation de questionnaires structurés administrés aux agents s'occupant du système d'approvisionnement des médicaments dans des sites sélectionnés à Abuja FCT et l'Etat du Plateau.

Résultats: L'étude a montré que 68% des magasins évalués avaient une politique définie d'assurance qualité en place. 68% ont indiqué la disponibilité d'information et de documentation écrite des activités de stockage. Cependant, seulement 39% des répondants a indiqué la disponibilité des cartes de température, tandis que 61% ont déclaré avoir mis en place une distribution et un mécanisme de transport fonctionnels.

Conclusion: Malgré les défaillances observées, cette évaluation a révélé assez de points forts et une bonne présence d'infrastructure pour indiquer que la chaîne d'approvisionnement des médicaments est suffisamment efficace et efficient pour recevoir et gérer les médicaments qui passent à travers elle.

Mots-clés: Intégrité des médicaments, stockage, chaîne d'approvisionnement, cartes de température, assurance qualité

INTRODUCTION

Managing a supply chain effective involves coordinating production, inventory, location and transportation among suppliers, manufacturers, wholesale distributors, re-packagers, third-party logistics providers, pharmacies and dispensers.[1,2] Others involved in making supply chains work include donors and funders, government policymakers, procurement agents, program managers and regulators, from the public, private, and faith-based sectors. In a typical supply chain, raw materials are procured and items are produced at one or more factories, shipped to warehouses for intermediate storage, and then shipped to retailers or customers.[3,4] Simply put, supply chain activities transform natural resources, raw materials and components into finished product that is delivered to end users.[5]

Supply chain management also combines the logistics activities plus the coordination and collaboration of staff, levels, and functions.[6] Logistics tends to focus more on specific tasks within a particular program health system and is an integrating function, which coordinates and optimizes all logistics activities, as well as integrates logistics activities with other functions including marketing, sales manufacturing, finance, and information technology.[7] Logistics activities, as the operational component of supply chain management, include the quantification, procurement, inventory management, transportation and fleet management, and data collection and reporting.[8]

The health system of countries, including Nigeria, is hinged on a strong supply chain, as a broken supply chain can cripple the health system and undermine positive health outcomes.[9] The capacity of supply chains at the national, state and local government levels in Nigeria to forecast, procure, and deliver essential medicines and other medical commodities, is a major limitation to the smooth running of such chains.[10] Poor infrastructure, limited financial, human and material resources, as well as limited availability of logistics and consumption data are specific issues confronting public health supply chains in Nigeria today.[11] Evidence exists regarding performance improvements related to supply chain management, though relatively few empirical studies exist to measure the extent of performance improvements resulting from the SCM programs especially in the Nigerian context.[12]

The USAID/DELIVER project reported that in Nigeria, programs are managed separately at the national level, while at the state level, many of these vertically managed programs (TB and leprosy, immunizations, malaria) begin to merge as the medicines/commodities are often stored

in the same warehouse.[11] According to the same document, states also manage the procurement of essential medicines for hospitals and primary health care (PHC) facilities, while the local government areas (LGAs), acting autonomously, often procure the products and deliver to the service delivery point. These LGAs usually handle this process in their own way.

Effective supply chains not only help ensure commodity security, they also help determine the success or failure of any public health program.[8] This is particularly critical considering that access to medicines is currently a priority for the populace in order to meet their health needs. These medicines need to be efficacious, accessible and available at all times, in adequate amounts, at appropriate dosages and at affordable prices.[10]

Well-functioning supply chains benefit public health programs in important ways by increasing program impact, enhancing quality of care and improving cost effectiveness and efficiency.[8] A well-functioning supply chain has certain key attributes including: clarity of roles and responsibilities: roles, responsibilities, and processes (such as reporting or resupply procedures) are established and publicized throughout the supply chain; agility: logistics functions are performed quickly, accurately and effectively so products, information, and decisions can move swiftly through the supply chain to respond promptly to customer needs; streamlined processes: bureaucratic hurdles and processes that impede the flow of information and commodities are eliminated; visibility of information: data are visible throughout the supply chain, usually through computerization, so stakeholders at different levels can see where products are and what the demand is, and use this information to better meet customers' needs; trust and collaboration: a collaborative environment exists that can help break down existing functional and organizational barriers to improve supply chain performance; alignment of objectives: organizations and levels have a compatible vision, goals, and objectives to ensure consistency in direction within the supply chain.[6]

A good supply chain system should have good storage and handling facilities at all strategic points.[13] This structure minimizes leakages while maintaining a streamlined structure, good condition of drugs, constant supply, and provides reliable information for forecasting.[14,15,16] Better information ensures better use of resources, which are often in short supply. For

example, accurate information about consumption patterns that is captured at the service delivery point and flows back up the chain can be crucial for effective quantification and ordering at all tiers in the supply chain.[16] Proper stock levels at service delivery points should be established to determine replenishment rates at the different levels of the supply chain (e.g., central warehouses and regional stores).[17] Maintaining desired stock levels would limit the probability of both stock-outs and excess inventory, which often lead to product expiry.[17] Stock information flowing up through the system will, critically, inform upstream decisions about procurement quantities.[17]

This research will contribute to indigenous literature on drug supply chain and its overall impact on the health of individuals. It will serve as a useful reference point for researchers who will undertake a similar study on a national scale; it is also hoped that it will motivate stakeholders in Nigeria to re-evaluate the drugs supply chain system with a view to making it more efficient, effective and successful.

The study was aimed at assessing the current status of the supply chain system in selected facilities in Abuja and plateau state, Nigeria. Specifically, the study was aimed at assessing the capacity and practices of storage, handling/information management, and distribution and transportation at all levels of the supply chain.

METHODS

Study area

Abuja Central Medical Store (ACMS), Central Medical Store (CMS) Jos and bulk stores located in Jos University Teaching Hospital (JUTH) and Plateau State Specialist Hospital in Plateau state were selected for this study.

Study population

Officers working at sites listed above involved in drugs supply chain management.

Study design

The study was a cross-sectional descriptive survey of the current status of the drug supply chain system in selected stores in FCT Abuja and Plateau State.

Data collection

Self-administered structured questionnaire used for the study was designed to elicit respondents' knowledge of drugs supply chain, good storage practices, Information management/documentation, inventory management and distribution/ transportation in drugs supply chain which were key factors in assessing the current status of the supply chain system.

The research instruments were first tested on 7 purposely-selected respondents from National drugs supply chain management program as pilot to ascertain the consistency and clarity of the questions in the study, after which irrelevant questions were eliminated. This pilot study was useful to test the practicability of the questionnaires to be used. However, to minimize the rate of non-response, follow up calls were made.

Data analysis

The data was collected, collated, crosschecked and stored in excel worksheet. Descriptive analysis of respondent's characteristics and responses to questionnaire items were performed. Frequencies and proportions described independent categorical variables. All analyses were performed using SPSS software, version 20 (SPSS) (SPSS Inc, Chicago, Illinois, USA).

RESULTS

Respondent's knowledge of supply chain system is summarized in table 1. Over 90% of the respondents reported having knowledge of supply chain systems. Most respondents (68%) indicated a defined quality assurance policy in place, and 50% had received proper training in good storage practice, regulations, procedures, and safety in store.

Table 1: Assessment of knowledge of supply chain systems

Assessment question/Responses	Frequency	Percentage
Do you know what supply chain system is?		
Yes	26	92.9
No	1	3.6
Do not know	0	0.0
No response	1	3.6
Is there a defined quality structure and quality assurance policy?		
Yes	19	67.9
No	6	21.4
Do not know	3	10.7
Are store officers and staff responsibilities clearly defined?		
Yes	26	92.9
No	2	7.1
Have all personnel received proper training in relation to good storage practice, regulations, procedures, and safety?		
Yes	14	50.0
No	11	39.3
Do not know	3	10.7

About 43% of the respondents reported that precautions were not always taken to prevent unauthorized persons entering storage areas. Most (75%) of the respondents agreed that their stores were designed or adapted to ensure good storage conditions (table 2).

Table 2: Assessment of good storage practice

Assessment questions/Responses	Frequency	Percentage
Have precautions been taken to prevent unauthorized persons from entering storage areas?		
Always	16	57.1
Not always	12	42.9
Have storage areas been designed or adapted to ensure good storage conditions?		
Yes	21	75.0
No	7	25.0
Are all containers clearly labeled with at least the name of the material, the batch number, the expiry date or retest date, the specified storage conditions, and reference to the pharmacopoeia, where applicable?		
Yes	23	82.1
Not all	4	14.3
Do not know	1	3.6
Are containers carefully inspected for possible contamination, tampering and damage?		
Yes	26	92.9
No	2	7.1
Are all due precautions observed to prevent the issue of outdated pharmaceutical products?		
Yes	25	89.3
No	3	10.7

About 42% of the respondents do not maintain temperature-monitoring data; while over 60% reported that permanent information does not exist for stored products indicating storage conditions and other precautions (Table 3).

Table 3: Information management and documentation

Assessment questions/Responses	Frequency	Percentage
Is recorded temperature monitoring data available?		
Yes	16	57.1
No	9	32.1
Don't know	3	10.7
Are written instructions and records available that document all activities in the storage areas including the handling of expired stock?		
Yes	19	67.9
No	7	25.0
Don't know	2	7.1
Does permanent information, written or electronic, exist for each stored product indicating recommended storage conditions, any precautions to be observed, and retest dates?		
Yes	8	28.6
No	17	60.7
Don't know	1	3.6
Are records kept for each delivery?		
Sometimes	4	14.3
Most of the time	24	85.7
Are all pharmaceutical products stored in containers that do not adversely affect the quality of the materials or products concerned, and which offer adequate protection from external influences?		
Yes	22	78.6
No	3	10.7
Don't know	3	10.7

Standard inventory control practices reported included regular or consistent checking of incoming delivery against relevant purchase order (53.6%), periodic stock reconciliation (85.7%), and handling of returned or recalled goods according to approved procedures (67.9%) (table 4).

Table 4: Assessment of inventory control system

Assessment questions/Responses	Frequency	Percentage
Is each incoming delivery checked against the relevant purchase order and each container physically verified, e.g., by the label description, batch number, type of material or pharmaceutical product, and quantity?		
Regularly	15	53.6
Occasionally	3	10.7
Sometimes	2	7.1
All times	8	28.6
Is periodic stock reconciliation performed by comparing the actual and recorded stocks?		
Yes	24	85.7
No	2	7.1
Should each delivery comprise mor e than one batch, is it subdivided according to the supplier's batch number?		
Yes	15	53.6
No	8	28.6
Don't know	3	10.7
No response	2	7.1

Distribution and transportation practices are described in table 5 below. The most common (54%) product delivery system was "pull" or requisition system and about 61% of respondents reported that pharmaceuticals are transported in such a way that the integrity is not impaired and under appropriate storage conditions. About 75% reported having established dispatch procedures. Most (79%) respondents agreed that there are mechanisms in place to track delivery of products to their intended users.

Table 5: Assessment of distribution and transportation system

Assessment questions/Responses	Frequency	Percentage
What distribution mechanism do you use for delivery of your products to the end users?		
Push/allocation	8	28.6
Pull/requisition	15	53.6
None	2	7.1
No response	3	10.7
Are pharmaceutical products transported in such a way that their integrity is not impaired and that storage conditions are maintained?		
Sometimes	10	35.7
Always	17	60.7
No response	1	3.6
Are there dispatch procedures established and documented, taking into account the nature of pharmaceutical products concerned and any special precautions taken?		
Yes	21	75.0
No	2	7.1
Don't know	4	14.3
No response	1	3.6
Are there mechanisms on ground to track the delivery of products to their intended users?		
Yes	22	78.6
No	3	10.7
Don't know	2	7.1
No response	1	3.6

In terms of job designations, nine different job designations were described, with store officers accounting for 25% of the respondents and pharmacists (21%) of respondents (fig. 1).

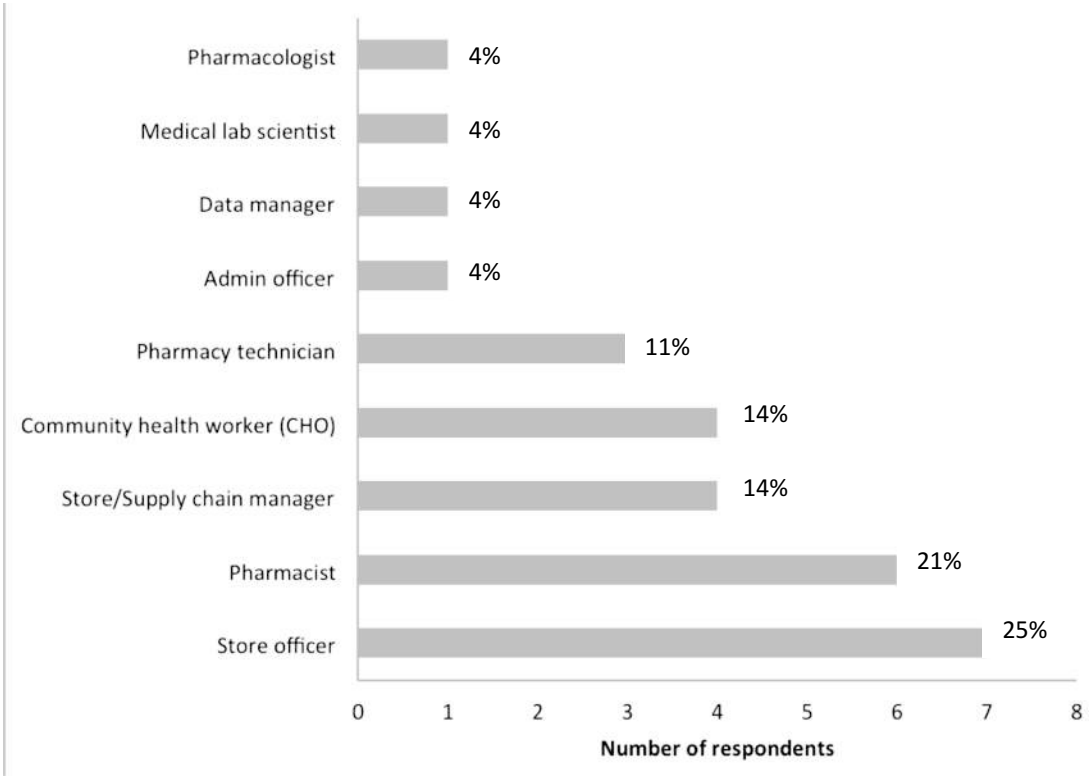

Figure 1: Respondents' job designation

Over 60% of respondents reported that forms and records available for logistic management information system included: stock card, delivery notes, issue and receipts voucher and stock ledger, while temperature chart availability was reported by only 39% (fig. 2).

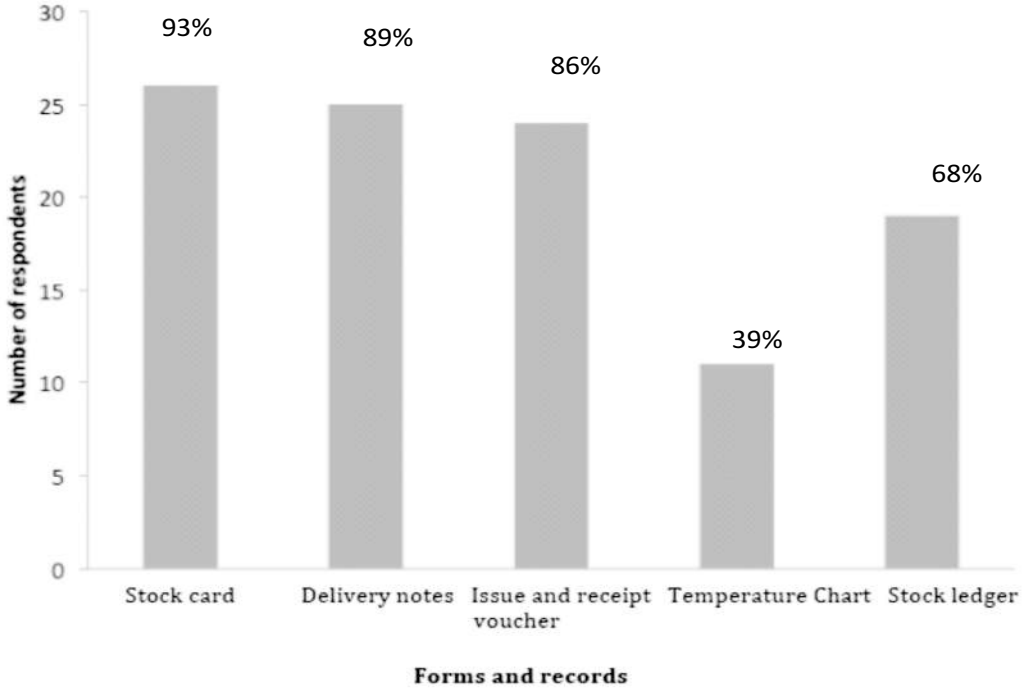

Figure 2: Forms and records available for logistic management information system

Type of information maintained on the computerized information system included stock on hand, quantity received, quantity issued, batch number and expiration date (fig. 3).

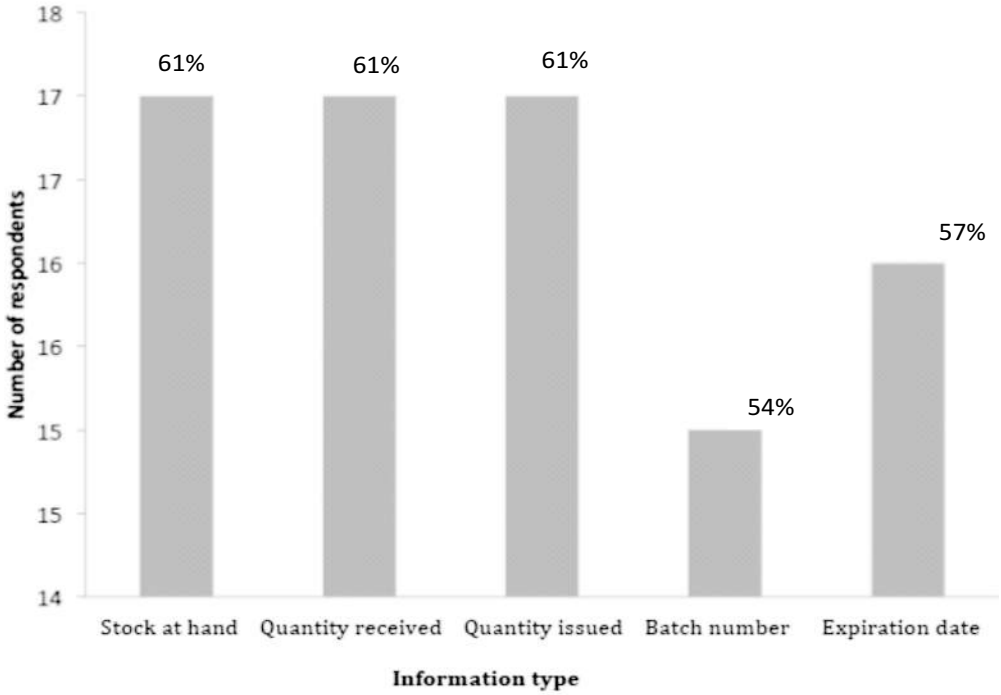

Figure 3: Type of information captured by computerized information system

DISCUSSION

Our assessment of the drug supply chain system indicates some important strengths, as well as bottlenecks and system failures. Table 1 summarizes the respondents' knowledge of a defined quality structure and quality assurance policy, their roles and training received regarding good storage practice, regulations, procedures, and safety.

The findings from this study showed that just half of the respondents had been trained on good storage practice, regulations, procedures, and safety. Poor training of personnel would impact negatively on the smooth running of a drug supply chain, an observation supported by a previous report in Tanzania, where poor training and knowledge was shown to impact on access to essential drugs within a drug supply.[18] The authors of the study reported that personnel at the sampled health facilities responsible for ordering were not fully aware of how to perform that task correctly and, as a consequence, were unable to estimate how much of a certain drug was needed. Another case in point that emphasizes the need for adequate training is that reported in a research conducted in Kenya, where inadequate skill was found to be a major factor affecting efficiency of inventory management.[19] Well-functioning supply chains are characterized by clarity of roles that can help improve communication and accountability, responsibilities, visibility of information, collaboration, and alignment of objectives.[6] As can be observed from the result (table 1), this requirement has been met, as almost all respondents reported having clearly defined roles and responsibilities.

The importance of an effective drug quality assurance policy within the supply chain management is critical, with results from this current study showing that majority of the stores had a defined quality assurance policy in place (table 1). The importance of having a clearly outlined quality assurance policy is buttressed by Enemark,[20] who stated that drug quality assurance throughout the entire supply chain must be a priority for every program in order to ascertain the anticipated therapeutic effect of each medicine that gets to the populace for treatment of specific disease conditions.

Drug supply chain systems, even in Nigeria, are required to meet global regulatory requirements while handling, storing, and distributing medicines, especially environmentally sensitive ones.[21] As part of the requirements, storage areas should not be accessible to unauthorized personnel to reduce pilferage[18]; a condition that close to half of the stores sampled failed to meet in this current study as respondents reported that precautions were not always taken to prevent unauthorized persons from entering storage areas (table 2). In addition to pilferage, unauthorized entry into such stores come with increased risk of introduction of contaminants that could affect the integrity of such medicines.

Medicines requiring controlled-temperature storage

conditions must be distributed in a manner that ensures their quality will not be adversely affected. Due to the presence of multiple uncontrolled variables in the distribution process, developing an appropriate temperature and humidity-monitoring program is essential to protect the quality of environmentally sensitive pharmaceutical products and ensure patient safety.[21] Adequate temperature monitoring was however a major issue in this current study as only slightly more than a quarter of the respondents indicated the availability of temperature charts in their stores (fig. 2).

Despite these shortcomings, most of the respondents indicated that their stores had well designed and equipped receiving and dispatched bays, clear labeling of containers in accordance with reference standards was ensured, careful inspection for possible contamination, tampering or damage were routinely performed, adequate lighting in storage areas were provided and precautions to prevent the issue of expired pharmaceuticals were put in place (table 2). All these indicate deliberate efforts to observe good storage practice, thus ensuring that medicines reach the end user (practitioners and patient/consumers) with quality intact; conditions stated by Edmond.[9] Our findings are however inconsistent with that of an assessment carried out at the Federal Central Medical Store in Lagos by the West African Health Organization.[6] The assessment discovered serious lapses regarding labeling of medicines, absence of bulk racking and standardized pallets, with the concomitant risk of damage.

According to Gyimah,[22] the use of logistics management information systems (LMIS) helps to assure an effective and efficient supply chain management system. The findings in this study showed adequate documentation of activities that are sufficient to provide good basis for decisions with regards to logistics information and product accountability (table 3). Specifically, respondents reported the availability of written information and documentation of all activities in the storage area (using data capturing tools like stock cards, delivery notes, issue and receipts voucher and stock ledger for recording transactions), with records kept for each delivery, as well as the storage of products in containers that do not adversely affect the quality of the product stored. The importance of maintaining records on every step and activity in the drug supply chain is further buttressed by Bossert,[23] who described LMIS as an essential tool for effective logistics systems. This finding from our study is also similar to a joint report by the United Nations Foundation, the Federal Ministry of Health and the Saving Lives Initiative where it was reported that the electronic/computerized Logistics Management Information System (LMIS) for supply chain management, in use in one of the states assessed, enables analysis to inform planning and decision-making.[26] The importance of the LMIS data for decision-making in any drug supply chain was further buttressed by Global HIV/AIDS Initiative Nigeria (GHAIN) in an end of project report published in 2011.[27] However, an assessment of an electronic logistics management information system in Bauchi State, Nigeria in 2012 showed no consistent reporting of logistics data.[28]

Standard inventory control practices reported in this study include regular or consistent checking of incoming delivery against relevant purchase order and physical verification of containers, periodic stock reconciliation and handling of returned or recalled goods according to approved procedures (table 4). This implies that the inventory control system in the drugs supply chain is strong enough to account for the drugs within the pipeline, as well as get the essential data of logistics. This is similar to a previous study which reported that a good inventory system should keep track of items in inventory as well as to keep track of the inventory in storage and on order.[24] However, an earlier assessment of the inventory system at the Federal Central Medical Stores in Lagos in 2013 revealed that there was no recording of expiry and batch number of medicines.[6]

In an end of program report by GHAIN, which assessed logistics management services in Nigeria, the "pull" system was reported to have the advantage of ensuring that drug order quantities were determined by the health facilities after analysis of their consumption data; hence supply requisition was based on actual needs.[21] This observation is similar to the finding from our study, where majority of respondents also reported that a "pull" or requisition system was in use in their facilities/stores (table 5). This, together with the finding that pharmaceutical products were mostly transported in such a way to assure their integrity; that storage conditions were maintained; that dispatch procedures were properly established and documented, taking into account the nature of pharmaceutical products concerned and any special precautions taken; that there are mechanisms on ground to track the delivery of products to their intended users all point to the fact that the distribution and transportation system utilized was good enough to guarantee effective and efficient supply chain system aimed at maintaining commodity security. This supported the report of Manso,[30] who stated that even distribution and transportation of drugs and health commodities was a prerequisite for effective and

efficient logistics management in the health supply system.

In their assessment of the weaknesses and strengths of the procurement and distribution network for medicines in Nigeria, a group of researchers reported that management information systems to report problems in procurement exist in the form of written reports from the central medical stores where drugs are kept upon arrival.[29] These include tracking records of the products ordered and delivered, records of quality assurance information, and evidence of communication between the procurement office and the central medical store when problems arise. This is similar to observations made from this present study. Another assessment however revealed that some areas of operations at the stores assessed lacked comprehensive data for decision-making; thus affecting timely and informed decision-making by this lack of current management information.[6]

The availability of computerized information system (CIS), as observed in this study, containing information on stock on hand, quantity received, quantity issued, batch number and expiry date assists personnel in charge of inventory to respond to program needs and ensure drugs get to end-users.[9,11] The use of this data capturing tool is similar to that earlier reported by a group of researchers in Kano State, Nigeria.[25] Without good information on needs and inventory, it will be difficult for each level to perform its other functions well. In other words, information must flow before goods can also flow. This makes for timely and informed decision making critical for managing drug supply chains successfully. In addition, the computerized information system will also ensure availability of commodities to clients/patients who need them and ultimately to avoid wastages and minimize expiries.

CONCLUSION

This assessment revealed enough strengths and good infrastructural presence to indicate that the drugs' supply chain at the facilities assessed is sufficiently effective and efficient to receive and manage medicines and medical commodities. The implication of this is that the right medicines for a particular intervention or disease mitigation will be delivered in the right quantity and condition to the right place and at the right time and at the right cost.

ACKNOWLEDGMENT

The authors wish to acknowledge Pharm. Isaac Abah for assisting with the data analysis and Pharm. Mamot Haruna for his kind assistance in distributing the questionnaires.

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