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Original Article

INVESTIGATING THE EVOLUTION OF OPTIMAL PRODUCT AVAILABILITY FOR PUBLIC HEALTH PROGRAMS IN KATSINA STATE, NIGERIA

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ABSTRACT

Objective: This study aimed to explore the evolution of the availability of public health commodities across all the supported health facilities in Katsina State, northwestern Nigeria.

Methods: To achieve this, Quarterly Stock Status Reports (QSSR) were produced from the analysis of the Logistics Management Information System (LMIS) reports of facilities, local government stores, and central stores of all the public health programs in the state from April 2017 to March 2018 (one year). Analyses entailed computing the Month of Stock (MoS) for all commodities by dividing their Stock on Hand (SoH) by the Average Monthly Consumption (AMC). The product availability for the following public health programs was assessed for four consecutive quarters (Apr.-Jun. 2017, Jul.-Sep. 2017, Oct.-Dec. 2017, and Jan.-Mar. 2018)-HIV/AIDS, tuberculosis, malaria, reproductive health/family planning (FP), routine immunization, nutrition, Neglected Tropical Diseases (NTD), Maternal, Newborn, and Child Health (MNCH), and the state's Free Medicare Scheme (FMS).

Results: The one-year trend provided a precise representation of the commodity security of each public health supply chain across various programs within the state. While only one program (routine immunization) recorded 100% all-time product availability, TB appeared to be the most stable (95% of products in optimal quantities) of all the assessed public health programs employing MoS as a performance measure. It is important to note that nutrition, neglected tropical diseases, and the Free Medicare scheme did not operate with MoS as a measure of stock status but recorded product availability of 78.5%, 80%, and 84.6%, respectively.

Conclusion: There is a necessity for periodic stock assessment across all public health programs for other states to establish accurate stock positions and identify programs that require enhanced logistical and supply chain technical support.

Keywords: Month of stock, Stock on hand, Average monthly consumption, Public health, Katsina, Nigeria

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INTRODUCTION

To understand the availability and commodity security of public health commodities, Quarterly Stock Status Report (QSSR), which assesses how long stock will last, is paramount [1]. QSSR serves as a dashboard that gives several indicators on stock status-normal stock, under-stock, overstock, emergency order point, and stock out [2]. It is a management tool for deciding logistics and supply chain management. Before April 2017, no stock assessment of public health programs was conducted in Katsina State.

This study aimed to explore the evolution of the availability of public health commodities across all the supported health facilities in Katsina State, northwestern Nigeria, from April 2017 to March 2018.

Katsina State has a projected population of 8, 244, 051 (2017 estimate), a 24, 517 sq km square land, 34 Local Government Areas (LGAs) with 361 political wards, and 1,717 health facilities [3]. Katsina State's population comprises 51% females and 49% males. These are composed of the following sub-components: infants (below one year) at 3.9%, under-5 children at 20%, women of reproductive age (between 15-49 y) at 22%, children less than 15 y is 46%, average pregnant women 5%, and the elderly above 65 y is 4% [4, 5].

Due to emerging diseases, many organizations, mostly Non-Governmental Organizations (NGOs), have come to support the state [6-8]. As such, many vertical programs exist that need constant stock status-based assessment that should be done in collaborative and harmonized processes [9, 10]. This concept of harmonization will only come if complete qualitative data of all health commodities are collected, processed, and summarized to feed the logistics elements of quantification, procurement, consumption, and rational use of drugs with evidence-based data [11, 12].

The Federal Ministry of Health, through its Nigeria Supply Chain Integration Project (NSCIP), envisioned a single logistics management system for all health programs in Nigeria, thus facilitating the establishment of a Logistics Management Coordination Unit (LMCU) in all states of the federation [13].

The Logistics Management Coordination Unit (LMCU) was established to function as a 'PSM house' within the State Ministry of Health through which the transfer of ownership and drive of supply chain management capabilities, responsibilities, and accountability to the state can be effected most efficiently [14]. The LMCU comprises State Ministry of Health staff, health program staff, representatives of donors and implementing partners, and other relevant stakeholders. This unit's functions include collecting, collating, validating, and disseminating logistic management information and adverse drug reaction reports. It also coordinates the development of the Last Mile Distribution (LMD matrix) for pharmaceutical and other healthcare products, its implementation, and monitoring at all levels in the state [15-17].

QSSR assessment gives a clear picture of the Month of Stock (MoS), consumption trend, Month of Stock Cover (MOSC), and Potential Write-Off (PWO) which are the critical determinants of the duration of time that commodity will last. This, however, is seen from a state-wide perspective; that is, the MoS of any given product is a summation of all the Stocks on Hand (SOH) at facilities, LGA stores, and the central store divided by Average Monthly Consumption (AMC) of all facilities in the state.

MATERIALS AND METHODS

The study was conducted in Katsina State, located in the northwest geographical zone of Nigeria. The stock status reports were produced from the analysis of the Logistics Management Information System (LMIS) reports of facilities, local government stores, and central stores of all the public health programs in the state from April 2017 to March 2018. The unit of stock status, Month of Stock (MoS) for every single

commodity is calculated by adding Stock on Hand (SoH) of all commodities in the central store, local government stores, and Service Delivery Points (SDPs) and dividing this sum by average monthly consumption at SDPs. The public health programs assessed were HIV/AIDS, tuberculosis, malaria, reproductive health/family planning (FP), vaccines, nutrition, Neglected Tropical Diseases (NTD), Maternal, Newborn, and Child Health (MNCH), and the state's Free Medicare Scheme (FMS). The criteria for inclusion are that a program must be a public health program, have commodities given to clients for free, and have available logistics records for the past year. The programs above are public health programs, have commodities given to clients for free in Katsina State, and have available logistics records. Therefore, all of them were included.

This study does not require ethical clearance as there is no direct involvement of humans or animals. A team of program officers of the public health programs reviewed only LMIS reports for four quarters (comprising a year).

RESULTS

This study evaluated logistics reports of 1,718 Katsina State, Nigeria health facilities. Table 1 gives the breakdown of the number of facilities visited per program. It is important to mention that all facilities have more than one of the programs running. However, only the malaria program is implemented in all the 1,718 health facilities in the state. In April–June 2017, only the TB program could maintain 93% of commodities in the optimal inventory level. Other programs' Month of Stock (MoS) revealed that HIV had stockouts, malaria had some overstock, the MNCH program had many commodities below minimum stock, and vaccine stock levels are virtually always optimal. For July–September 2017, all commodities had optimal MoS, except Capreomycin (stock out) for TB; Exluton and Microgynon (overstock) and Implanon and Jadelle (under-stock) for FP; Hepatitis B vaccine (overstock); Praziquantel for NTDs (stockout); and under-stock for MNCH tracer drugs. In October–December 2017 review, only five products had between 2-4 MoS for HIV, 2 out of 12 products had MoS between 3-6 for malaria, the Hepatitis B vaccine was overstocked, the TB program had all commodities with optimal MoS, and FP stock status was not assessed due to a delay in conducting a review meeting. January–March 2018 revealed that only AL3 had optimal MoS for the malaria program; other commodities were overstocked. Only Implanon had MoS between 2-4; other commodities were overstocked; all TB commodities had optimal MoS; up to 11 HIV commodities did not have MoS between 2-4; and the MNCH program had only two commodities with MoS of 3-6.

Table 1: Number of health facilities supported by each program and the number of reports analyzed

S. No.	Program areas	Number of facilities supported	Number of reports analyzed per quarter
1	HIV/AIDS	212	212
2	Malaria	1,718	1,718
3	Family planning	393	393
4	MNCH	204	204
5	Tuberculosis	163	163
6	Neglected tropical diseases	1,664	1,664
7	Routine immunization (vaccines)	1,623	1,623
8	Nutrition	111	111
9	Free medicare scheme	25	25

Table 2: Trend analysis of stock status of public health programs in Katsina State, Nigeria

Program areas	Min-max at SDP (Months)	Apr-Jun 2017	Jul-Sep 2017	Oct-Dec 2017	Jan-Mar 2018
		% of products in optimal inventory level			
HIV/AIDS	2–4	6/18 (33%)	4/21 (19%)	5/22 (23%)	7/22 (32%)
Malaria	3-6	2/12 (17%)	4/12 (33%)	2/12 (17%)	1/12 (8%)
Family planning	2–4	0/7 (0%)	0/7 (0%)	Not Assessed	1/9 (11%)
MNCH	1–3	0/9 (0%)	4/9 (44%)	1/9 (11%)	2/9 (22%)
Tuberculosis	3–6	13/14 (93%)	17/18 (94%)	15/15 (100%)	14/15 (93%)
Neglected tropical diseases	N/A	MoS, N/A	MoS, N/A	MoS, N/A	MoS, N/A
Routine immunization (Vaccines)	N/A	MoS, N/A	MoS, N/A	MoS, N/A	MoS, N/A
Nutrition	N/A	MoS, N/A	MoS, N/A	MoS, N/A	MoS, N/A
Free medicare scheme	N/A	MoS, N/A	MoS, N/A	MoS, N/A	MoS, N/A

*MoS-Month of Stock; N/A-Not Applicable as a unit of stock status

Table 3: Percentage availability of products for programs that do not use MoS as a measure of stock status

Program areas	Min-Max at SDP (Months)	Apr-Jun 2017	Jul-Sep 2017	Oct-Dec 2017	Jan-Mar 2018
		% of products in optimal inventory level			
Neglected tropical diseases	N/A	7/7 (100%)	4/5 (57%)	6/7 (86%)	5/7 (71%)
Routine immunization (Vaccines)	N/A	9/9 (100%)	9/9 (100%)	9/9 (100%)	9/9 (100%)
Nutrition	N/A	Not assessed	Not assessed	Not assessed	4/5 (80%)
Free medicare scheme	N/A	*99/99 (100%)	97/138 (70%)	*101/101 (100%)	124/179 (69%)

*Supplies data was used!

Table 4: Percentage of products reported as overstocked

Program areas	>Max at SDP (Months)	Apr-Jun 2017	Jul-Sep 2017	Oct-Dec 2017	Jan-Mar 2018
		% of products with>max MoS			
HIV/AIDS	>4	5/18 (28%)	8/21 (38%)	5/12 (42%)	3/22 (14%)
Malaria	>6	3/12 (25%)	5/12 (42%)	2/12 (17%)	7/12 (58%)
Family planning	>4	7/7 (100%)	7/7 (100%)	Not assessed	9/9 (100%)
MNCH	>3	0/9 (0%)	2/9 (22%)	5/9 (56%)	6/9 (67%)
Tuberculosis	>6	1/14 (7%)	0/18 (0%)	0/15 (0%)	0/15 (0%)

Table 5: Percentage understocked, emergency order point, or stockout reported

Program areas	<Min at SDP (Months)	Apr-Jun 2017	Jul-Sep 2017	Oct-Dec 2017	Jan-Mar 2018
		% of products with<min MoS			
HIV/AIDS	<2	7/18 (39%)	9/21 (43%)	2/12 (16%)	13/22 (59%)
Malaria	<3	7/12 (58%)	3/12 (25%)	8/12 (67%)	4/12 (33%)
Family Planning	<2	0/7 (0%)	0/7 (0%)	Not assessed	0/9 (0%)
MNCH	<1	9/9 (100%)	3/9 (33%)	3/9 (33%)	1/9 (11%)
Tuberculosis	<3	0/14 (0%)	1/17 (6%)	0/15 (0%)	1/15 (7%)

DISCUSSION

In Nigeria, generally, public health products are donor-driven. Whereas commodity security is expected and achieved in some programs, this is not so for some interventions, especially those that consumption cannot be accurately projected.

In this study, nine public health programs were evaluated, one of which is fully funded by the government. It is important to note that the measure of availability per standard logistics practices is the Month of Stock (MoS). However, due to the peculiarity of some programs like routine immunization, nutrition, Neglected Tropical Diseases (NTDs), and the Free Medicare Scheme, MoS cannot be applied. Instead, percentage availability and commodity security are used to measure their efficiency.

The analyses of the results were in four parts: the trend of MoS, percentage availability for programs not using MoS, programs with reported overstocking, and programs with reported understocking, emergency order point, and stock out.

MoS can be applied to five programs as the measure of availability and performance (HIV/AIDS, malaria, Family Planning (FP), Tuberculosis (TB), and Maternal, Newborn, and Child Health (MNCH)). These have different reporting intervals for resupplies; hence, the minimum and maximum stock quantities differ at any time. For HIV/AIDS, the reporting interval is bimonthly and minimum and maximum stock quantities for all products used by the program are expected to be not less than two months and four months, respectively. Even though HIV/AIDS program is known to be stable and often guarantees commodity security due to massive funding from the United States Agency for International Development (USAID), the one-year trend analyses found a non-ideal picture. Across the four quarters assessed (Apr.-Jun. 2017, Jul.-Sep. 2017, Oct.-Dec. 2017, and Jan.-Mar. 2018) showed that only 6/18 (33%), 4/21 (19%), 5/12 (42%), and 7/22 (32%) products respectively achieved optimal stock levels. Some products have been reported to be overstocked. Precisely, 5/18 (28%), 8/21 (38%), 5/12 (42%), and 3/22 (14%) were reported to have maximum stock quantities beyond four months, as shown in table 4. On the other hand, 7/18 (39%), 9/21 (43%), 2/12 (16%), and 13/22 (59%) products have been reported to be understocked, at emergency order point or out of stock, as shown in table 5.

Malaria has three months reporting interval; therefore, it is expected to have all stock levels between a minimum of three MoS and a maximum of six MoS. However, due to high malaria burden in northern Nigeria, the forecasted quantities are not always enough to ensure commodity security. MoS of 2/12 (17%), 4/12 (33%), 2/12 (17%), and 1/12 (8%) across the assessed intervals are clearly underperforming. The US President's Malaria Initiative (PMI) funds the malaria program and regularly supplies commodities. Whereas few products across one year were maintained at optimal quantities, table 4 shows that 3/12 (25%), 5/12 (42%), 2/12 (17%), and 7/12 (58%) products are in quantities above the maximum stock. On the other hand, in table 5, it can be seen that 7/12 (58%), 3/12 (25%), 8/12 (67%), and 4/12 (33%) were reported to be either understocked at emergency order point or completely out of stock. Several factors, such as high malaria cases and pilferage of the supplied commodities sold in the open market due to non-branding, have continued to be the underlying reasons why the program cannot easily achieve commodity security and keeps recording MoS below the recommended level.

FP is one area where many commodities have been supplied beyond the recommended maximum stock level. With a reporting interval similar to HIV/AIDS (bimonthly), the program also has two months of minimum stock and four months of maximum stock. Of all the assessed periods, no commodity was within the recommended month of stock. While in table 4, it can be seen that 100% of all the commodities are overstocked. The supply greatly exceeds the utilization. In table 5, no FP commodity was reported to be either understocked, at an emergency order point, or out of stock. This shows that utilization of FP commodities in Katsina State, with the 5th largest population in Nigeria, is low.

MNCH is an important program in Katsina and Nigeria at large because of the high maternal mortality rate. The UK's Department has funded MNCH for International Development (DfID) in Katsina State for about 12 y. With the intense intervention, it is expected that there will be commodity security for maternal health. The program reports monthly and has one month at the minimum and six months at maximum stock quantities of products the program supplies. For the tracer commodities assessed, 0/9 (0%), 4/9 (44%), 1/9 (11%), and 2/9 (22%) have optimal stock quantities. In addition, it was found that 0/9 (0%), 2/9 (22%), 5/9 (56%), and 6/9 (67%) have been reported overstocked, as shown in table 4. Accordingly, 9/9 (100%), 3/9 (33%), 3/9 (33%), and 1/9 (11%) have been reported under-stocked, at emergency order points, or stocked out.

TB program recorded the most optimal stock quantities for the periods evaluated. The program reports every three months; it is expected to have all stock levels between a minimum of three MoS and a maximum of six MoS. In table 2, 13/14 (93%), 17/18 (94%), 15/15 (100%), and 14/15 (93%) products were reported to have optimal quantities. Across the periods, this shows the stability of operating within the set stock quantities and ensuring commodity security. Only one product, 1/14 (7%), was reported to be overstocked, and only one product each for Jul.–Sep. 2017 and Jan.–Mar. 2018 was reported under-stocked, at emergency order point, or out of stock.

Table 3 shows other public health programs that do not use the MoS due to their peculiarities. One is the routine immunization program funded and supported by the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) majorly. The products of this program reported 100% availability with guaranteed commodity security for every child that needs to be immunized.

The nutrition program was only assessed once due to the limitation of data. For the assessed period, 4/5 (80%) of products were available for the intervention.

The NTDs program recorded 7/7 (100%), 4/7 (57%), 6/7 (86%), and 5/7 (71%) product availability.

Lastly, the Katsina State Government's Free Medicare Scheme (FMS) recorded 99/99 (100%), 97/138 (70%), 101/101 (100%), and 124/179 (69%) product availability. This is a laudable achievement for the government to sustain such efforts fairly.

The relative stability of product availability for the public health programs only showed donors' commitment to supporting the programs in question. The government's Free Medicare Scheme also showed stability, directly reflecting the political commitment to sustain the program.

CONCLUSION

The one-year stock availability trend gave an accurate picture of the logistics and supply chain management of the different programs in the state. While no program was perfect, routine immunization and TB appeared to be the most stable of all the assessed public health programs. It is important to note that nutrition, neglected tropical

diseases, the Free Medicare Scheme, and routine immunization did not operate with MoS as a measure of stock status. There is a need for regular (quarterly) stock assessments of all public health programs for other states to establish stock positions and identify programs that need more logistics and supply chain technical support.

LIMITATIONS OF THE STUDY

This study only addresses pharmaceutical product availability in public health programs (that are essentially free) in Katsina State, Nigeria. Therefore, the optimal product availability of pharmaceutical outlets and other private organizations has yet to be assessed. In addition, this assessment covers only one year (2017-2018); the previous years and years after that have not been assessed.

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AUTHORS CONTRIBUTIONS

Kabiru Abubakar Gulma designed the study, developed the data visualization dashboard, analyzed the results, and drafted the manuscript.

CONFLICT OF INTERESTS

Declared none

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