



STOCK ASSESSMENT OF CO-TRIMOXAZOLE TABLETS IN HIV/AIDS PROGRAM OF KEBBI STATE, NIGERIA

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ABSTRACT

Purpose: This research was aimed at determining the inventory level of Co-Trimoxazole tablets used in the HIV/AIDS program of Kebbi State, Nigeria, and assess the inventory level to find out if it fell within the required range as pre-determined by the inventory control system in Nigeria.

Method: In achieving the stated objectives, visits were made to all hospitals offering HIV/AIDS services in Kebbi State where Co-Trimoxazole tablets are normally used. Data collected were 'stock on hand' and 'bi-monthly consumption' and cut across all the three types of Co-Trimoxazole tablets namely: Co-Trimoxazole 120 mg, Co-Trimoxazole 480 mg and Co-Trimoxazole 960 mg. Microsoft Excel spreadsheets were prepared for each type of Co-Trimoxazole across all the nine hospitals visited and the data were processed by inserting arithmetical formulae in the spreadsheets. The measure of inventory level called month of stock (MoS) was calculated and charts were developed to present the results obtained.

Findings: The study found out that none of the Co-Trimoxazole tablets was within the inventory control system of 4 months maximum stock and 2 months minimum stock. Across the entire state, the inventory level of Co-Trimoxazole 120 mg was 1.9 MoS, and that of Co-Trimoxazole 480 mg was 1.4 MoS while the inventory level of Co-Trimoxazole 960 mg was 5.7 MoS.

Practical Implications: The research as much as it is monitoring in nature is as well evaluative because it showed that the logistics system is not functioning as designed.

Keywords: Stock on Hand (SoH), Month of Stock (MoS), Average Monthly Consumption (AMC), Inventory Control System, Co-Trimoxazole

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INTRODUCTION:

1.1 CO-TRIMOXAZOLE AND HIV CONTINUUM OF CARE

Co-Trimoxazole (also known as Bactrim or Septrin) is a name for a combination of Trimethoprim and Sulphamethoxazole antibiotics¹. It is the main drug used to treat and prevent *Pneumocystis carinii* pneumonia (PCP) now called *Pneumocystis jiroveci* pneumonia². Co-Trimoxazole is also used in the treatment of toxoplasmosis, an infection that can affect the brain.

People that have been diagnosed with Human Immunodeficiency Virus (HIV) infection are at a risk of developing PCP, this risk increases if result of virological

test shows that their CD4 count is below 200 cells per cubic millimeter of blood³. Treatment of the HIV infections itself is rarely an emergency and is only initiated principally when the CD4 count of a patient falls below 500 cells per cubic millimeter of blood however, there are also other criteria used to initiate treatment.

It is recommended that people diagnosed with HIV who are yet to start taking drugs to manage the disease or those whose CD4 count falls below 200 cells per cubic millimeter of blood are prescribed Co-Trimoxazole to reduce the risk of PCP. This kind of treatment is called prophylaxis in other words: it is aimed at preventing the infection rather than treating it. Use of Co-Trimoxazole in HIV/AIDS infection is aimed at preventing and managing common opportunistic infections that will likely worsen HIV/AIDS infection and associated morbidity and mortality. The choice of Co-Trimoxazole is majorly because of its wide efficacy against these common infections, less interaction, low side effects profile and

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relatively low cost in comparison to other antibacterial agents with the same indications profile.

PCP is a potentially fatal illness that until now is the most common cause of death in people with Acquired Immunodeficiency Syndrome (AIDS) which is an advanced stage of HIV infection. PCP is now becoming less common as a result of effective HIV treatment, use of Co-Trimoxazole for prophylaxis, and better treatment for patients who develop PCP.

1.2 HIV/AIDS SERVICE POINTS IN KEBBI STATE, NIGERIA

HIV/AIDS services are available at two levels- "comprehensive sites" (hospitals providing counselling, testing and treatment of HIV for PMTCT, pediatrics and adults including Tuberculosis/HIV integration) and "standalone sites" (hospitals providing Prevention of Mother to Child Transmission-PMTCT of HIV/AIDS services). By design of patient retention in HIV treatment, the comprehensive sites are more client-engaging and elaborate in services therefore, use of Co-Trimoxazole is only common in this category of hospitals. Whereas for PMTCT sites, they are only designed to cater for pregnant women diagnosed with HIV infection whom after delivery and found to be stable are referred to comprehensive sites for continuation of care and treatment.

Therefore, data collection will be focused in comprehensive sites because they request for and receive Co-Trimoxazole on regular basis. There are a total of nine (9) comprehensive sites in Kebbi State.

In calculating the state-wide inventory level of Co-Trimoxazole tablets, a summation is made of all inventories across all locations where these commodities are kept: hospitals, local government stores and central medical store in the state. However, in HIV/AIDS program in Kebbi State, these drugs are supplied from the regional warehouse directly to health facilities. In view of this, the local government stores and central medical store in the state do not stock these commodities as such; the stock position in the nine (9) comprehensive sites is representative of the entire state. Co-Trimoxazole tablets used in HIV/AIDS program are of three (3) types namely: Co-trimoxazole 120 mg dispersible tablets (used for pediatric patients), Co-trimoxazole 480 mg tablets (for adults), and Co-trimoxazole 960 mg tablets for adults as well.

1.3 OVERVIEW OF INVENTORY CONTROL SYSTEM

Inventory refers to the number/quantity of stocked goods (drugs). It is required to be taken at different locations within a facility or within many locations of a supply network to precede the regular and planned course of production/requisition/purchase and stock of materials.

The continuous supply of quality Co-Trimoxazole can only be guaranteed through the selection, design, and proper implementation of an appropriate inventory control system. An inventory control system informs the storekeeper of the following⁴:

- a. When to order or issue,
- b. How much to order or issue, and
- c. How to maintain an appropriate stock level of all products to avoid shortages and oversupply.

In understanding inventory control system, there are key terms that are important to note and they are-

- a. Maximum-Minimum (Max-Min) Inventory Control System: This system is designed to ensure that quantities in stock fall within an established range. In practice, most inventory control systems used for managing health commodities are max-min systems of one type or the other.
- b. Max stock level: The max stock level is the level which stock should not rise above, under normal circumstances.
- c. Min stock level/min quantity: This is the level of stock at which actions to replenish inventory should occur under normal conditions.
- d. Review period/review period stock: It is the routine interval of time when stock is assessed to know whether additional stock is needed.
- e. Stock on hand (SoH): This is the quantity of usable stock available at a particular point of time for the client. This usually is determined by physical count of the available balance of commodities in the facility.
- f. Consumption: It is the quantity of stock used or dispensed to the clients within a defined period of time.
- g. Average monthly consumption (AMC): This is the consumption of stock over two 'typical' months taken as average.
- h. Month of stock (MoS): Month of stock is the quantity of a commodity expressed in the number of months it can last. It is determined by dividing stock on hand by the average monthly consumption. For example, if the stock on hand of Co-Trimoxazole is 200 tablets and the average monthly consumption by clients is 50 tablets, this implies that the month of stock is 4. That is to say, 200 tablets will last for 4 months serving those clients in that particular hospital/facility.
- i. Safety stock level: This is the additional buffer, cushion or reserve stock kept on hand to protect against stock outs caused by delayed deliveries, markedly increased demand, or other unexpected circumstances.
- j. Lead time stock level: This is the level of stock used between the time new stock is ordered to when it is delivered and made available for use.
- k. Emergency order point (EOP): This is the level of stock that triggers emergency order. It can be reached within any time of the review period. EOP is usually less than the min stock level.

1.4 INVENTORY CONTROL SYSTEM IN PLACE IN NIGERIA

In Nigeria, the adopted inventory control system for the HIV/AIDS program is the max-min inventory control system. The max has been set at four (4) months of stock while the min at two (2) months of stock⁵. Therefore, commodities used in HIV/AIDS continuum of care are expected to fall within four and two months respectively. If the level of stock is more than four MoS, it means the system is over-stocked i.e., keeping more than it is desired to keep. On the other hand if the level of stock is less than two MoS, it means the system is understocked and will soon experience danger of stock out.

There are three types of max-min inventory control systems and they are:

- a. Forced ordering system: In this system, trigger for ordering is end of the review period. Forced ordering is adopted for HIV/AIDS commodities in Nigeria and the review period takes place after every two months.
- b. Continuous review system: The trigger for placing an order in this system is when the stock level reaches the min stock level.
- c. Standard version: Ordering is only made for those commodities that reach the min inventory level.

1.5 DEFINING DATA COLLECTION PERIOD

Assessment of inventory level is characteristic of a review cycle or period so defined. Inventory level of one review period will definitely differ from inventory level of another review cycle due to variations in stock on hand and consumption which are used to determine stock level. For the purpose of this research, the most current inventory level can be known by evaluating 1st November - 31st December, 2015 review cycle which was reported from 1st - 7th January, 2016.

There could be no more new information for this research as the next review cycle will be 1st January - 29th February, 2016 which will be reported from 1st to 7th March, 2016.

The results of this research will therefore be characteristic of November-December, 2015 review cycle.

BACKGROUND AND LITERATURE REVIEW

Assessing inventory level also known as stock status assessment is essentially finding out how long a stock will last (which is better referred to as month of stock). This is an important exercise in logistics as it gives insight on the inventory level of any commodity in the program and as well is a direct pointer about how well the logistics system is functioning.

As much as it is a stock monitoring exercise it is as well an evaluative tool.

The inventory control system used in Nigeria states that all commodities used in HIV/AIDS continuum of care should be maintained within an inventory level of two months of stock as minimum level and four months as maximum level.

In a research on quarterly stock status report conducted by Urama et al (2014) in Abia State of Nigeria, findings revealed that of all the three types of Co-Trimoxazole tablets assessed; only Co-Trimoxazole 960 mg was within the required inventory level. Co-Trimoxazole 120 mg and 480 mg tablets were all above the required inventory level stipulated by the program⁶.

Similarly, Agusiobo et al (2014) in their research on stock assessment of HIV/AIDS and malaria commodities in Akwa Ibom State of Nigeria found out that none of Co-Trimoxazole 120 mg, 480 mg and 960 mg was within the required inventory level. They found out that Co-Trimoxazole 120 mg was above the maximum level while Co-Trimoxazole 480 mg and Co-Trimoxazole 960 mg were well below the minimum level of inventory desired to be at facilities⁷.

Dick et al (2014) in their research in Bayelsa State of Nigeria on finding out inventory levels of malaria and HIV/AIDS commodities found out that only Co-Trimoxazole 960 mg fell within the inventory level of 2 months minimum and 4 months maximum. Co-Trimoxazole 120 mg & 480 mg were above the maximum level with Co-Trimoxazole 480 mg with an unusually high inventory level that had oversaturated the system⁸.

Another research conducted by Iwheye-Adie et al (2014) on stock status assessment of malaria, family planning and HIV/AIDS commodities in Cross River State, Nigeria revealed that the inventory levels of Co-Trimoxazole 480 mg and 960 mg were within the required level. However, the stock status of Co-Trimoxazole 120 mg was above the maximum level of inventory⁹.

Still in Nigeria, Hashimet al (2015) in their first edition of Quarterly Stock Status Report in Kano State, Nigeria found out that of the three types of Co-Trimoxazole tablets used in the HIV/AIDS continuum of care, only Co-Trimoxazole 120 mg was within the required inventory level. Co-Trimoxazole 480 mg was slightly below the minimum level while Co-Trimoxazole 960 mg was by far above the maximum level¹⁰.

In addition, Hashimet al (2015) conducted the second edition of their earlier research later in the same year and found an improvement in inventory control level over the first edition. They reported that Co-Trimoxazole 480 mg and Co-Trimoxazole 960 mg were within the required inventory level however Co-Trimoxazole 960 mg was slightly above the maximum level¹¹.

Last year, a research conducted by Abubakar et al (2015) on Kebbi State Quarterly Stock Status Report for Public Health Commodities also contained inventory assessment of Co-Trimoxazole tablets. Results revealed that only Co-Trimoxazole 960 mg was within the required inventory level. Co-Trimoxazole 480 mg was below inventory level while Co-Trimoxazole 120 mg was above the required level¹².

The most recent research in this field conducted by Agbeninet al (2015) in their Quarterly Stock Status Report of Ondo State, Nigeria found out that all the three types of Co-Trimoxazole tablets were within the

inventory control level¹³. In light of research reports reviewed so far, this is the only state with optimal and ideal level of inventory as pre-defined by the national guidelines.

All these implied that research on stock assessment of Co-Trimoxazole tablets revealed that only one state in Nigeria has recorded the optimal inventory level across all types of Co-Trimoxazole tablets used in the HIV/AIDS continuum of care.

PROBLEM STATEMENT/RESEARCH QUESTION

While Abubakar et al (2015) conducted their research from January-March, 2015, it is important to note that inventory level assessment is time-relevant. In other words, inventory assessment of one review period will differ from another because the determinants of stock assessment (stock on hand and bi-monthly consumption) cannot be the same for any two periods.

The results obtained in January-March, 2015 cannot be extrapolated forward or backward to any review period. They reported that only Co-Trimoxazole 960 mg tablets fell within the required inventory level while other types of Co-Trimoxazole were not within the required levels. The recommendation drawn from this research was to sustain techniques on logistics management of health commodities that will ensure all the stock levels remain within required inventory control system levels which will guarantee Co-Trimoxazole security and ready access to the clients that will need them and avoiding wastage across the levels.

The entire problem is that similar inventory level assessments of Co-Trimoxazole tablets in other states of Nigeria revealed lapses in commodity management because of all research reports seen so far, only one out of the thirty six states reported optimal inventory level across all types of Co-Trimoxazole tablets. More so, the research conducted by Abubakar et al in 2015, a year ago, revealed that only one type of Co-Trimoxazole (960 mg) is within the required inventory level in Kebbi State of Nigeria.

Owing to the fact that stock status assessment is time-relevant, the question to answer in this research is to find out whether the current inventory levels of all types of Co-Trimoxazole tablets (Co-Trimoxazole 120 mg, Co-Trimoxazole 480 mg and Co-Trimoxazole 960 mg) are in the required inventory level as specified by the inventory control system of HIV/AIDS program management of Nigeria.

METHODS

4.1 RESEARCH DESIGN

The research is primarily evaluative in context. This is so because the max-min inventory control system adopted in Nigeria stipulates a max quantity of four months of stock and a min quantity of two months of stock at the states level. It is therefore expected that stock levels at any given time should be within two and four months of stock under normal circumstances.

Any variation seen reflects a deviation from the desired logistics system setting and calls for correction,

adjustment or intervention to bring the system back to the normal-established levels.

From another perspective, the research is also comparative in nature because a research conducted by Abubakar et al in 2005 contained an evaluation of anti-retroviral drugs, Co-Trimoxazole, HIV test kits, etc.

4.2 SOURCES OF DATA

In conducting this research, the primary sources of data included:

- a. Inventory Control Cards (ICC): These are stock-keeping records that are used to record all transactions of "receipt" and "issue" of Co-Trimoxazole from the store or dispensary. All three types of Co-Trimoxazole have different cards for keeping records of transaction. In large facilities ICC can be found in two places- the bulk store and the dispensary, whereas in smaller facilities ICC is found only where the drug is kept which could either be the store or dispensary. Information found on ICC gives us stock balance (stock on hand) at any particular date. For this research which the defined period is November-December, 2015, the stock balance of interest is as of 31st December, 2015.
- b. Adult ART Worksheet: This is a daily entry record book for all transactions that issued/dispensed Co-Trimoxazole to clients. The particular period of interest is from 1st November, 2015 to 31st December, 2015. Information from this document gives us consumption of Co-Trimoxazole for two months (November and December). This is known by summing up all quantities of Co-Trimoxazole dispensed daily in the pre-defined period. Dividing this consumption by two gives the average monthly consumption which is the second data element after stock on hand that is used to calculate month of stock of Co-Trimoxazole tablets. However, this register only gives us information on Co-Trimoxazole 480 mg and Co-Trimoxazole 960 mg. This is because they are the two types of Co-Trimoxazole used by adults and pediatric Co-Trimoxazole has a separate register where it is as well recorded.
- c. Pediatric ART Worksheet: Similar to Adult ART Worksheet, the Pediatric ART Worksheet records all transactions that issued/dispensed Co-Trimoxazole 120 mg to pediatric clients. Records of Co-Trimoxazole 120 mg dispensed from 1st November, 2015 to 31st December, 2015 are summed up to get the consumption for the pre-defined period. Dividing the consumption by two gives the average monthly consumption which is used to calculate the month of stock of Co-Trimoxazole 120 mg.

The secondary source of information of this research is the bi-monthly report generated by hospitals for resupply of Co-Trimoxazole tablets. This report is recorded in a

particular form called the Combine Report, Requisition, Issue and Receipt Form (CRRIRF). The CRRIRF report of interest is that of November-December, 2015. While this source of information is important, the primary source alone could have sufficed. CRRIRF report are used to see if SoH and bi-monthly consumption of Co-Trimoxazole are the same as those recorded on ICC and Adult & Pediatric ART Worksheets.

Information fed into the CRRIRF is essentially from ICC and Adult & Pediatric ART Worksheets but not limited to them. Comparison with CRRIRF is a kind of double-checking to see that there is no variation between the two data sources.

4.3 METHOD OF DATA COLLECTION

The method of data collection was by visiting the hospitals, obtaining ethical clearance to conduct the research and conducting the research by studying the sources of data at the pharmacy department. The following hospitals were visited:

1. General Hospital Argungu
2. General Hospital Jega
3. General Hospital Koko
4. General Hospital Kamba
5. General Hospital Wasagu
6. General Hospital Yauri
7. Sir Yahaya Memorial Hospital, Birnin Kebbi
8. Martha Bamaayi Memorial Hospital, Zuru
9. Federal Medical Center, Birnin Kebbi

These are the only hospitals offering comprehensive HIV/AIDS services across Kebbi State. Therefore the results obtained in this research represent the inventory level of Co-Trimoxazole tablets of the entire state.

4.4 ANALYTICAL PROCEDURE/METHOD OF ANALYSIS

After collecting the useful data elements namely- stock on hand and bi-monthly consumption of Co-Trimoxazole 120 mg, 480 mg & 960 mg respectively, the data were processed using spreadsheets of MS Excel package.

Data from hospitals need only to be inputted in the first two rows of the spreadsheets, the last two rows were set to be auto-calculated or computed based on the contents of each cell in the first two rows by inserting appropriate formulae. A formula was inserted across the third row (AMC) which was to divide all contents of cells in the second row (bi-monthly consumption) by two. Another formula was inserted across the fourth row (MoS) which was to divide all contents of cells across the first row (SoH) by all the contents of cells across the third row (MoS).

After inputting all the data for different types of Co-Trimoxazole tablets in separate figures of the MS Excel spreadsheets, bar charts were generated using the "Insert" chart option in the menu bar. The charts show the hospitals on the horizontal axis and MoS on the vertical axis.

After the above analyses which were done hospital by hospital, aggregates of data of each type of Co-

Trimoxazole tablet were used to generate a state-wide inventory level of Co-Trimoxazole tablets from HIV/AIDS comprehensive health care centers. This spreadsheet was used to generate a bar chart showing the inventory level of the different types of Co-Trimoxazole tablets in one chart. In this chart, the MoS is on the horizontal axis while the types of Co-Trimoxazole tablets on the vertical axis.

DATA PRESENTATION/RESULTS

The figures below are the results obtained from visiting hospitals offering HIV/AIDS services in Kebbi State by collecting data on stock on hand and bi-monthly consumption of Co-Trimoxazole 120 mg, 480 mg & 960 mg respectively.

5.1 INVENTORY LEVEL OF CO-TRIMOXAZOLE 120 mg TABLETS

	General Hospital Argungu	General Hospital Jega	General Hospital Koko	General Hospital Kamba	General Hospital Wasagu	Martha Bamaayi Memorial Hospital, Zuru	General Hospital Yauri	Sir Yahaya Memorial Hospital, Birnin Kebbi	Federal Medical Center, Birnin Kebbi
Stock on Hand (SoH)	1000	2700	390	0	1950	3000	4510	7690	0
Bi-monthly Consumption	3060	1660	1410	0	1050	2000	4350	8820	0
Average Monthly Consumption (AMC) = Bi-monthly consumption ÷ 2	1530	830	705	0	525	1000	2175	4410	0
Month of Stock (MoS) = SoH ÷ AMC	0.7	3.3	0.6	0.0	3.7	3.0	2.1	1.7	0.0

Fig. 1: Spreadsheet showing data collected on stock on hand, bi-monthly consumption, average monthly consumption and month of stock for Co-Trimoxazole 120 mg across the nine (9) comprehensive care hospitals.

5.2 INVENTORY LEVEL OF CO-TRIMOXAZOLE 480 mg TABLETS

	General Hospital Argungu	General Hospital Jega	General Hospital Koko	General Hospital Kamba	General Hospital Wasagu	Martha Bamaayi Memorial Hospital, Zuru	General Hospital Yauri	Sir Yahaya Memorial Hospital, Birnin Kebbi	Federal Medical Center, Birnin Kebbi
Stock on Hand (SoH)	0	10000	55820	10140	13840	39700	18610	0	64000
Bi-monthly Consumption	22050	15000	45860	10460	9160	102100	360	80000	16000
Average Monthly Consumption (AMC) = Bi-monthly consumption ÷ 2	11025	7500	22930	5230	4580	51050	180	40000	8000
Month of Stock (MoS) = SoH ÷ AMC	0.00	1.3	2.4	1.9	3.0	0.8	103.4	0.0	8.0

Fig. 2: Spreadsheet showing data collected on stock on hand, bi-monthly consumption, average monthly consumption and month of stock for Co-Trimoxazole 480 mg across the nine (9) comprehensive care hospitals.

5.3 INVENTORY LEVEL OF CO-TRIMOXAZOLE960 mg TABLETS

	General Hospital Argungu	General Hospital Jega	General Hospital Koko	General Hospital Kamba	General Hospital Wasagu	Martha Bamaiyi Memorial Hospital, Zuru	General Hospital Yauri	Sir Yahaya Memorial Hospital, Birnin Kebbi	Federal Medical Center, Birnin Kebbi
Stock on Hand (SoH)	22000	27000	0	0	18000	0	29780	88000	500
Bi-monthly Consumption	4965	13000	0	0	1000	0	35650	6000	4500
Average Monthly Consumption (AMC) = Bi-monthly consumption ÷ 2	2482.5	6500	0	0	500	0	17825	3000	2250
Month of Stock (MoS) = SoH ÷ AMC	8.9	4.2	0.0	0.0	36.0	0.0	1.7	29.3	0.2

Fig. 3: Spreadsheet showing data collected on stock on hand, bi-monthly consumption, average monthly consumption and month of stock for Co-Trimoxazole960 mg across the nine (9) comprehensive care hospitals.

5.4 AGGREGATED RESULTS CO-TRIMOXAZOLE120 mg, 480 mg and 960 mg TABLETS IN KEBBI STATE

	Co-Trimoxazole 120 mg	Co-Trimoxazole 480 mg	Co-Trimoxazole 960 mg
TOTAL Stock on Hand (SoH)	21240.00	212110.00	185280.00
TOTAL Average Monthly Consumption (AMC)	11175.00	150495.00	32557.50
STATE-WIDE Month of Stock = SoH/AMC	1.9	1.4	5.7

Fig. 4: Spreadsheet showing aggregated data on stock on hand, average monthly consumption and month of stock of all the nine hospitals visited for Co-Trimoxazole120 mg, 480 mg and 960 mg representing the state-wide inventory level assessment of Co-Trimoxazole tablets

INTERPRETATION OF RESULTS/DISCUSSION

The figures (charts) in this section are a graphical representation of figures 1-4 of the results obtained in this research. It is important to know that while determining inventory level is the subject of this research, the technical terminology used as an indicator of inventory level is the Month of Stock (MoS). Therefore, the only term used in this section to interpret the results obtained is the MoS.

The charts show all hospitals visited on the horizontal axis while the month of stock is on the vertical axis. In other words, each column of the bar chart represents a hospital as appropriately labelled and the MoS even though shown on the vertical axis are as well shown by a data label above each column.

Studying figure 5 above and bearing in mind the max-min inventory control system of 2 months min and 4 months max, only four out of nine hospitals fall within the inventory control level. The hospital included: General Hospital Jega with MoS of 3.3, General Hospital Wasagu has MoS of 3.7, General Hospital Yauri with MoS of 2.1, and Martha Bamaiyi Memorial Hospital, Zuru having MoS of 3.0.

6.1 INVENTORY LEVEL OF CO-TRIMOXAZOLE120 mg TABLETS

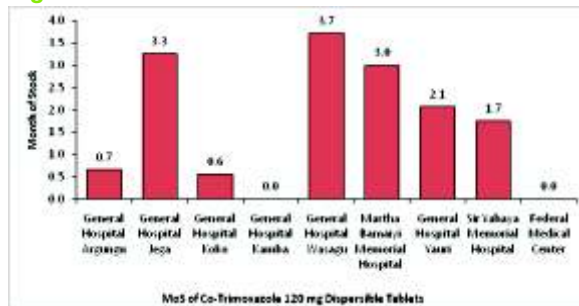


Fig. 5: Months of Stock of Co-Trimoxazole120 mg tablets across all the nine (9) hospitals visited

General Hospital Kamba and Federal Medical Center, Birnin Kebbi had been in a situation of complete stock out as the months of stock indicate "0". It means these hospitals do not have any quantity of Co-Trimoxazole120 mg left in stock for dispensing to patients.

On the other hand, MoS of General Hospital Argungu (0.7), General Hospital Koko (MoS= 0.6), and Sir Yahaya Memorial Hospital (MoS= 1.7) revealed they do not have up to the minimum inventory level of Co-Trimoxazole120 mg tablets.

6.2 INVENTORY LEVEL OF CO-TRIMOXAZOLE480 mg TABLETS

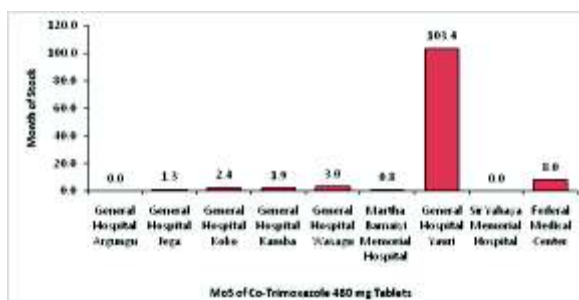


Fig. 6: MoS of Co-Trimoxazole480 mg Tablets across all the nine (9) hospitals visited

Figure 6 above gives insight on inventory level of Co-Trimoxazole480 mg. Of all the nine hospitals, two hospitals were within the max-min inventory control level of 2 months min and 4 months max. These hospitals are: General Hospital Koko (MoS= 2.4) and General Hospital Wasagu (MoS= 3.0).

Two other hospitals were by far above the max level. While Federal Medical Center had double the max level of four months (MoS= 8.0), General Hospital Yauri had bizarre MoS of 103 months. It thus means that the quantity of Co-Trimoxazole480 mg kept in stock in General Hospital Yauri can last for up to 103 months. This is a logistics malfunction as it points to the fact that the hospital kept recording wrong data which lead to requisitions of Co-Trimoxazole480 mg and this probably happened over a span of time for the hospital to have accumulated this amount of the drug. Moreover, there

will be risk of expiry because the rate of bi-monthly consumption will take more than four years (103 months) to consume this drug. Very likely, some of the drugs if not evacuated will expire at the facility unused.

Other hospitals were below the 2 months min inventory level and they included: General Hospitals Argungu (MoS= 0), Jega (MoS= 1.3) and Kamba (MoS= 1.9), Martha Bamaïyi Memorial Hospital (MoS= 0.8) and Sir Yahaya Memorial Hospital (MoS=0). These hospitals were at risk of stock out because they had small quantities of this drug kept in stock which cannot last up to two months.

6.3 INVENTORY LEVEL OF CO-TRIMOXAZOLE960 mg TABLETS

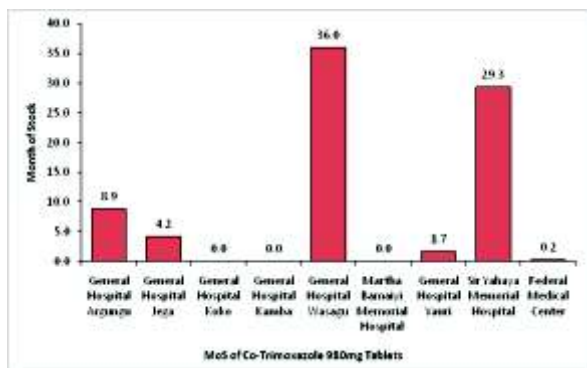


Fig. 7: MoS of Co-Trimoxazole960 mg tablets across all the nine (9) hospitals visited

Figure 7 above shows MoS of Co-Trimoxazole960 mg across all the nine hospitals visited. The interpretation of the chart shows that there was no hospital that has optimal inventory level of Co-Trimoxazole960 mg.

Federal Medical Center (MoS= 0.2), Martha Bamaïyi Memorial Hospital (MoS= 0) and General Hospitals Koko (MoS= 0), Kamba (MoS= 0) and Yauri (MoS= 1.7) had inventory levels of Co-Trimoxazole960 mg far below the minimum level. General Hospital Yauri had inventory level close to the minimum level and would normalize if the facility had placed a requisition for refill. Three of these hospitals namely-General Hospitals Koko and Kamba and Martha Bamaïyi Memorial Hospital have exclusively "0" MoS which means they do not have any quantity of this drug for use by the clients. The fourth hospital- Federal Medical Center has MoS of 0.2 which means it is as well at the verge of stock out situation.

General Hospitals Argungu (MoS= 8.9), Jega and Wasagu and Sir Yahaya Memorial Hospital had inventory levels above the max level of four months. By implication, they had stocked more than the hospitals require for optimal management of the commodity in question. While they may not be able to consume this commodity, Co-Trimoxazole960 mg is at risk of expiry before consumption because except General Hospital Jega which had a MoS of 4.2, the other two hospitals General Hospital Wasagu (MoS= 36) and Sir Yahaya

Memorial Hospital (MoS= 29.3) have stocked Co-Trimoxazole960 mg that will last for 36 months for the former and 29 months for the latter.

6.4 AGGREGATED MONTH OF STOCK FOR CO-TRIMOXAZOLE TABLETS IN KEBBI STATE

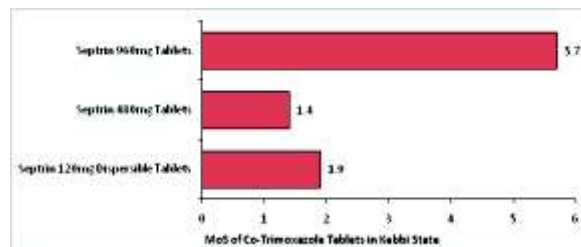


Fig. 8: MoS of Co-Trimoxazole Tablets in Kebbi State

Figure 8 above gives the summary of results of this research. The aim of this research was to assess the inventory level of Co-Trimoxazole tablets in Kebbi State by finding out how long stock of each type of Co-Trimoxazole tablet will last and which of them is within the required quantity as specified by the inventory control system of Nigeria.

In the chart above, all types of Co-Trimoxazole tablets were not within the 2 months min and 4 months max inventory level.

Co-Trimoxazole120 mg had MoS of 1.9 which was too close to 2 MoS. It however has to be classified as below the inventory level of 2 months min.

Co-Trimoxazole480 mg had MoS of 1.4 which was quite well below the minimum inventory level of 2 months.

It thus means that Kebbi State is approaching a state of stock out of these commodities. While different results from all hospitals contributed to this, it is important to note that hospitals that are out of stock can request from other hospitals that have enough stock. When taken as a whole the entire state-wide picture of the commodities is still below the required minimum because hospitals that are out of stock collect from other hospitals that have stock all of which are in the same pool.

On the other hand, Co-Trimoxazole960 mg had MoS of 5.7 which was quite far above the max level of 4 months. The system is a bit saturated with Co-Trimoxazole960 mg.

6.5 FURTHER DISCUSSION

Having conducted the research and obtained all data elements needed to formulate results and conclusion, it is important to discuss another dimension and implication of results obtained from this research.

Information was obtained from updated records of all the hospitals, the question to ask is: despite adequate record keeping, why were there variations from the yardstick of inventory control system? The answer could be none other than error in reporting during review periods.

6.5.1 INVENTORY LEVELS BELOW THE MINIMUM

For hospitals with below the minimum level or those that were completely out of stock, the reason could be despite adequate and updated record keeping, the hospitals were not submitting bi-monthly requisitions using the Combined Report, Requisition, Issue and Receipt Form (CRRIRF). It thus means there was adequate commodity management at hospital level by keeping good record on the Inventory Control Cards (ICC) and daily worksheets but no reporting for the affected commodity line.

Generally this should be the assumption however; Co-Trimoxazole 480 mg and Co-Trimoxazole 960 mg have a different interpretation of low inventory level.

In clinical practice, the use of Co-Trimoxazole 480 mg and Co-Trimoxazole 960 mg is interchangeable. While Co-Trimoxazole 480 mg is a single strength taken as two tablets twice a day, Co-Trimoxazole 960 mg is the double equivalent taken as one tablet twice a day. Therefore, a deficiency in one is not enough to question low level of inventory so far the hospital has adequate inventory of the other. In this regards, we need to study the results of Co-Trimoxazole 480 mg and Co-Trimoxazole 960 mg comparatively. In doing this, a hospital with low level of Co-Trimoxazole 480 mg will be checked to see if the alternative Co-Trimoxazole 960 mg is in adequate quantity. If a hospital has either type of Co-Trimoxazole in adequate quantity, it will be regarded as okay but low levels of both is a real program deficiency. However, it is important to note that an adequate quantity of both is not over-saturation of the system.

On the other hand, the use of Co-Trimoxazole 120 mg is exclusively for pediatric patients (children).

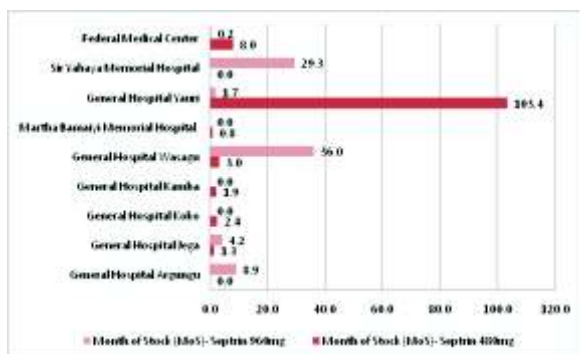


Fig. 9: Comparison of Month of Stock (MoS) of Co-Trimoxazole 480 mg versus Co-Trimoxazole 960 mg across hospitals in Kebbi State

In comparing the results of Co-Trimoxazole 480 mg and Co-Trimoxazole 960 mg using Figure 9 above, the following interpretation can be made.

General Hospital Argungu had MoS of 0 for Co-Trimoxazole 480 mg and MoS of 8.9 for Co-Trimoxazole 960 mg. Even though it has one type of Co-Trimoxazole in place of the other, the MoS of Co-

Trimoxazole 960 mg is more than double the maximum level. As such it is expected the hospital will not make requisition of this drug for some time until the inventory falls within the required range.

General Hospital Jega had MoS of 1.3 for Co-Trimoxazole 480 mg and MoS of 4.2 for Co-Trimoxazole 960 mg. While the former was below the minimum level, the latter was slightly above the maximum level.

For General Hospital Koko, the MoS of Co-Trimoxazole 480 mg was 2.4 against MoS of 0 for Co-Trimoxazole 960 mg. While the former was in adequate range, the latter was lacking. In this regard, dispensing Co-Trimoxazole will not be a problem as well.

The result from General Hospital Kamba revealed that the hospital had MoS of 1.9 for Co-Trimoxazole 480 mg and MoS of 0 for Co-Trimoxazole 960 mg. This is a bit worrisome as the former was below the minimum level while the latter is completely lacking. In this case adequate requisition has to be made to achieve the required inventory level.

General Hospital Wasagu had MoS of 3.0 for Co-Trimoxazole 480 mg and MoS of 36 for Co-Trimoxazole 960 mg. Co-Trimoxazole 480 mg was in the required range while the hospital had overstocked its system with Co-Trimoxazole 960 mg. The best practice will be to stop requisition of both types of Co-Trimoxazole tablets until the MoS of 36 months is brought between 2-4 months. This should be the case even if Co-Trimoxazole 480 mg will become out of stock because its alternative is available for use by patients.

In Martha Bamaiyi Memorial Hospital, the MoS of Co-Trimoxazole 480 mg was 0.8 while the MoS of Co-Trimoxazole 960 mg is 0. The hospital was in a situation of stock out as Co-Trimoxazole 960 mg is already finished while the other is approaching stock out.

General Hospital Yauri had MoS of 103.4 for Co-Trimoxazole 480 mg and MoS of 1.7 for Co-Trimoxazole 960 mg. The MoS of Co-Trimoxazole 480 mg was the most bizarre in this research. The best approach to solve this problem could be to stop making further requisition for both drugs and make efforts to transfer as much quantity out as possible of Co-Trimoxazole 480 mg. As it was, the hospital will take more than four years to dispense all of its Co-Trimoxazole 480 mg which will lead to expiry of most of it definitely. That is why the hospital has to transfer some out to other facilities will low level of Co-Trimoxazole 480 mg.

Sir Yahaya Memorial Hospital had MoS of 0 for Co-Trimoxazole 480 mg and MoS of 29.3 for Co-Trimoxazole 960 mg. While the former was out of stock, the latter was more than enough for the hospital as it is seven times more than the maximum level recommended. The facility may stop requisition of both drugs until a time comes when the MoS of Co-Trimoxazole 960 mg is in the required range.

Federal Medical Center had MoS of 8.0 for Co-Trimoxazole 480 mg and MoS of 0.2 for Co-

Trimoxazole 960 mg. Its remedy is as well to stop requisition until level of Co-Trimoxazole 480 mg is within the required range.

6.5.2 INVENTORY LEVELS ABOVE THE MAXIMUM

All inventory levels above the maximum level are reflective of one of two things. First, it could be the hospital is making arithmetical errors in quantities to order. Or it could be the hospital made the right requisition but the issuer at the Central Medical Store interpreted the result differently. In bi-monthly reporting, Co-Trimoxazole tablets are reported in tablets and not in packs. An error can occur in converting the number of tablets to packs which can result in over or under-supply. Secondly, hospitals may be requesting for drugs blindly without information on average monthly consumption and stock on hand.

CONCLUSION

The aim of this study which was to assess the inventory level of Co-Trimoxazole tablets in HIV/AIDS program of Kebbi State, Nigeria has been achieved. Applying the principle of inventory control system of Nigeria, 4 months of maximum stock level and 2 months of minimum stock level, the study found out that none of Co-Trimoxazole 120 mg, Co-Trimoxazole 480 mg and Co-Trimoxazole 960 mg was within this required range. Therefore, the inventory level of Co-Trimoxazole tablets in the HIV/AIDS program of Kebbi State, Nigeria was not optimal for the period this research was conducted.

Across the entire state, the inventory level of Co-Trimoxazole 120 mg was 1.9 MoS, and that of Co-Trimoxazole 480 mg was 1.4 MoS while the inventory level of Co-Trimoxazole 960 mg was 5.7 MoS.

It can be inferred that the inventory control system of Co-Trimoxazole in Kebbi State has declined further. This is in light of the fact that Abubakar et al (2015) reported only Co-Trimoxazole 960 mg was in the inventory control range as of March 2015. This study found out that none of the types of Co-Trimoxazole tablets is within inventory control range.

Even though the study found out that records were well kept, variations from record keeping and adequate inventory level point to obvious inability of hospital staff concerned to use logistics data in making requisitions. The problem might as well be error in calculating "quantity to order". For results that were below the minimum level, it could as well be due to non-reporting for resupply.

RECOMMENDATIONS

Owing to the results obtained and conclusion drawn thereafter, the following recommendations can be made on the subject of this research.

1. There should be inter-facility transfer of Co-Trimoxazole tablets from places of high stock to places of low stock volume in order to bring all facilities to the inventory control level pre-defined by the program. In doing this, expiry dates of the

commodities in question should be considered in such a way that hospitals with high consumption be given commodities whose expiry dates are near, whereas hospitals with low consumption be given commodities with far expiry.

2. For hospitals that have unusually high amount of any type of the commodity in question, requisition of that commodity or its substitute should be put on hold until stock level is within the inventory control range.
3. Staff responsible for making requisitions should be adequately trained to use essential data elements in placing orders, these are: stock on hand, consumption and losses and adjustments. By studying these and taking into account previous records, stock-piling of commodities will be greatly minimized.
4. Staff in charge of commodity management should also be trained on how to use logistics data to make informed decisions regarding commodity management.
5. Record keeping should be perfected most especially the filling of daily worksheets which is exactly the quantity of drugs dispensed to patients per day.
6. This type of research should be conducted at least once in a quarter to have a picture of stock levels in hospitals. By this, stock monitoring and evaluation of the performance of the logistics system can be known.
7. Kebbi State Government should key into this as "consumption" of these commodities is an essential element in quantification forecasting for future needs of its citizens when the donor funding eventually terminates as it shall when the project life span is reached.

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