



**Research/Technical Note**

# Logistic Challenges Associated with Supply Chain Management of HIV/AIDS Programs in Cross River State, Nigeria

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**Abstract:** *Background:* Life-saving drugs such as anti-retroviral therapy and other critical supplies are becoming more accessible to millions of people living with HIV/AIDS. The modern pharmaceutical and laboratory commodity supply and management chain is complex and ravaged with numerous challenges. *Objective:* of this study is to examine health commodity supply chain management in relation to project implementation of HIV/AIDS and make recommendation for proper management and improvement. *Results:* ARVs and RTKs formed the basis of most expired commodities encountered. ARVs had 13 (23%) different products of different expiry dates while laboratory reagents had 39 (77%) products with different expiry dates. Two Sample T-Test and confidence interval for the parameters were carried out and T-calculated for both parameters were found to be less than T-table. The T-Cal for ARVs were -2.82 while T-Table is 1.71, also the T-Cal for lab reagents were -3.62 while T-Table was 1.69. This shows that there is no significant difference between the total cost of expired ARVs and expired laboratory reagents since the T-Cal for both products were less than T-Table. *Conclusion:* Total cost of 51,369.02USD of fund that was lost to expiry was a colossal loss to the project implementation. More funds, time and energy will still be spent on the retrieval, transportation and destruction of these expiries. Activities of different implementing partners (IPs) should be streamlined and rationalized among the IPs to prevent parallel and multiple supply of health commodities to the facilities. Also facility staff should be properly mentored and adequate technical assistance should be rendered to ensure good inventory management and proper storage of all health commodities especially all the cold chain products.

**Keywords:** Commodity Logistics, HIV/AIDS, Supply Chain Management

## 1. Introduction

Life-saving drugs such as anti-retroviral therapy and other critical supplies are becoming more accessible to millions of

people living with HIV/AIDS. This has been in part due to the concerted effort of the international community, national governments, private industry, non-governmental organizations and others to improve the availability of supplies. The modern pharmaceutical supply chain is complex,

as medicines are made from ingredients sourced from different countries and need to be processed and transported down to various importing countries.

Nigeria like most other countries is gradually scaling up access in order to improve coverage. The success of these nationwide programs will depend on the ability of the host country and health systems to reliably and consistently supply the commodities to health facilities at all levels of the health system. Supply chain process is equally challenging most especially in developing countries leading to stock-outs and expired drugs. The deleterious implications of expired and counterfeit drugs is understood to be a central challenge to the integrity of public health systems around the globe, as well as a direct threat to individual health and welfare (Finlay, 2011).

Supplies often get interrupted for many reasons, including intra and inter professional conflicts, industrial strike, poor availability of resources to manage logistics, non-availability of transportation means, lack of technical knowhow on the part of the health care workers, poor donor support among several others. The consequence of supply interruption can be dire, including antibiotic and anti-retroviral drug resistance, which could have a wider global impact on the availability of drugs for treatment.

Several reasons for the complexity of commodity management of HIV/AIDS programs on systemic level are drug resistance; rapidly changing technologies, lack of reliable data on prevalence rates, stigmatization and cultural barriers may impact number of people accessing services, inadequate data from logistics report at the service delivery points, poor attitude of health facility personnel, poor capacity of health staff and frequent Equipment breakdown

Efficient logistics system makes a global economy possible by lowering the cost of living for the people of the world. Information technology has been adopted to support logistics for many years in the name of efficiency. Optimization of information flow to leverage the effectiveness and efficiency of the logistic system wholly is one of the key areas in which the logistic providers are competing with each other. (Hai & Yirong, 2002).

Ultimately, the goal of every public health logistics system is to help ensure that there is commodity security for every customer and its availability when needed. A proper functioning supply chain system is critical to ensuring commodity security—financing, policies, and commitment are also important. Effective and efficient supply chains system not only help to ensure commodity security or customer satisfaction, it also help determine the success or failure of any public health program.

It is therefore important to evaluate the effects of disruptions on logistic and supply management in order to estimate costs to the health systems and projects. There is poor accountability to the disposal of medicines which complicates the work of the drug regulatory agency, NAFDAC (WHO, 2005) The objective of this study is to examine health commodity supply chain management in relation to project implementation of HIV/AIDS and make recommendation for

proper management and improvement.

## 2. Methods

**Study Area:** The study was conducted in secondary and tertiary health facilities in Cross River state, Nigeria.

**Study design:** descriptive cross sectional explorative study of logistics systems in selected health facilities. Retrospective facility utilization and supply chain data were examined, and no control group was used.

**Inclusion criteria:** only health facilities supported by USAID funding were recruited into the study. In addition, only commodities related to HIV programming were examined at facility level to access the effectiveness of the logistics systems used in commodity management.

**Research instruments:** A checklist was used to collect retrospective data from the pharmacy and laboratory units of selected facilities. Data examined was between the periods of March 2013 to August 2014. Data was counter-verified by the attendant logistics officer on duty at the health facility.

**Data analysis:** data collected were analyzed using the excel software. Data were presented in form of table and pie charts. Cost estimates were also made for the expired drugs in US dollars to showcase the magnitude of the problem of expired drugs as logistics problems.

**Hypothesis**

Ho: There is no significant difference in the sample mean

H1: There is significant difference in the sample mean.

## 3. Result

Table 1 showed that the total quantity of ARVs expired 35721 (99.4%) were much more than the expired laboratory products that had only 229 (0.6%) expired products.

Table 2 & 3 showed Two Sample T- Test at 95% Confidence Interval unit price and Total unit price per item for Lab Reagents (-3647, -556) and ARVs (-801, -232). The T Cal were -2.82 and -3.62, P at 0.0094 and 0.0005, DF at 24 and 76. The absolute value of T – Cal (-2.82, -3.62) < T – Table (1.71, 1.69) shown that there was no significant difference in the sample mean of the two products and null hypothesis was rejected.

**Table 1.** Quantification of expired commodities supplied to studied facilities.

Commodities	Quantity (n)	%
ARVs	35721	99.4%
Laboratory	229	0.6%

**Table 2.** Two Sample T- Test and Confidence Interval @ 95% for unit price Vs Total unit price per item (Lab Reagents).

N	N	Mean	StDev	SE Mean
Unit Price	13	2.56	2.37	0.66
Total Price	13	2109	2692	747

95% CI for mu Unit Price – mu Total Price: (-3647.80, - 566)

T-Test mu Unit Price (vs not=): T=-2.82, P=0.0094, DF=24

Both use Pooled StDev = 1904

T- Table = 1.71

**Table 3.** Two Sample T- Test and Confidence Interval @ 95% for unit price Vs Total unit price per item (ARVs).

N	N	Mean	StDev	SE Mean
Unit Price	39	151.6	90.0	14
Total Unit	39	669	887	142

95% CI for mu unit price – mu total un: (-801, -232)

T- Test Mu unit price = Mu Total un (vs not =): T= -3.62, P= 0.0005, DF= 76

Both use Pooled StDev = 631

T-table = 1.69

## 4. Discussions

Movement of ARVs and RTKs for example is from the Central Medical Stores down to the health facility and then specifically to the service delivery point at which the customer or user receives and/or uses the products. This followed logistics cycle/steps such as product selection, forecasting and quantification, procurement, warehousing/inventory management and distribution.

The products are numerous with different expiry dates and the work of the logistics officer much more difficult and technical, because he has to take cognizance of each of the expiry dates and take appropriate action to management them in and out of its facility without getting expired and damaged.

Several reasons were given for the inability of the supply system in successful management of ART and laboratory commodities.

- (1) Products forecasted on the basis of targets such as prevalence rates will result in over-estimation of commodity requirements and subsequent cases of expiry when consumption is constant.

Multiple venues for distribution of HIV/AIDS programs often use non-traditional distribution sites, taking advantage of market segmentation for product distribution (public sector, social marketing, etc.). Yadav et al in 2012 mentioned that private pharmacies and private wholesalers function well, delivering products to even the most remote areas, if incentives are structured appropriately

- (2) Poor Cold or cool chain system: The health commodities that expired within the period of review are ARVs and laboratory reagents in which most of the laboratory reagents are cold chain products. Like other commodities, one of the major problems facing Nigeria's vaccine supply chain is the lack of adequate vaccine storage facilities (Shittu et al., 2016)
- (3) Poor inventory management: usually from wrong forecasting and quantification, multiple source of commodities supply. Using first expired first out (FEFO) or other management protocols may not properly work in the absence of proper

forecasting, drug selection and storage in the midst of unpredictable consumption by stigma stricken people living with HIV/AIDS (PLWHAs); all leading to expiry of drugs which eventually cost the funders millions of US dollars. Short shelf-life of some HIV/AIDS products such as test kits/reagents and ART drugs, increase the risk of loss due to expiry.

- (4) Instability in health sector: Health sector conflicts and industrial strike actions contributes to reasons why health care workers neglect their duty and subsequent drug management systems (Adebimpe and Owolade, 2010). These has led to poor inventory management and create storage issues.

The higher average unit price of antiretroviral (ARVs) compared to that of rapid test kits (RTKs) or other laboratory agents was because ARV has a larger quantity of expiries than laboratory reagents hence the volume of ARVs to be disposed and incinerated is high compare to laboratory reagents. High cost of expired drugs is a waste in the present era of funds dwindling from funders. Implication of these are enormous to the health system coping with the increasing number of PLWHAs and community people being tested and recruited into HIV care in Nigeria, moreover funders are getting more stringent with the available financial and material resources while the host country (Nigeria) is only doing little to complement efforts of IPs and USA ID and other multilateral agencies.

## 5. Conclusion

The expiry of health commodities (ARVs and lab reagents) from March 2013 to August 2014 has a total cost of 51,369.02USD, this is a fund that will be lost to expiries. This is a colossal loss to the project implementation as the fund will have being useful in other thematic areas of the project. However, more funds, time and energy will still be spent on the retrieval, transportation and destruction of these expiries which might also increase the loss of resources significantly. Activities of different IPs should be streamline and rationalized among the IPs to prevent parallel and multiple supply of health commodities to the facilities. This will enhance coordination and effective and judicious use of resources. Proper coordination of distribution, need for monitoring and evaluation team should complement well trained program technical staff to enhance their capacity towards ensuring quality and efficient logistics management of health commodities as well improve expiries management.

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## Appendix

**Table 4. Raw Data of Expired Drugs and Laboratory Reagents.**

#Name?	Item description	Pack size	FORMULATION (kits, tabs, granules, solution, paste, powder)	BATCH NO	Quantity	Expiry Date	Unit Price (USD)/Pack	Total Price (USD)/Item
<b>Antiretroviral Drugs</b>								
1	Nevirapine 50mg	25ml	oral	G10340	257	Apr-13	0.6	154.2
2	Nevirapine 50mg/5ml	25ml	oral	G10917	7300	Sep-13	0.6	4380
3	Nevirapine 50mg/5ml	25ml	oral	G10929	9489	Sep-13	0.6	5693.4
4	Nevirapine 50mg/5ml	25ml	oral	G10930	2280	Sep-13	0.6	1368
5	Lamivudine 150mg	60	tabs	LV1511048A	56	Nov-13	2.33	130.48
6	Nevirapine 50mg	30	tabs	NB5011011-A	425	Nov-13	0.6	255
7	Nevirapine 50mg/5ml	25ml	oral	CP2011	14906	Dec-13	0.6	8943.6
8	Zidovudine 300mg	60	tabs	X10490	22	Feb-14	8.2	180.4
9	Stav/Lam 6/30mg	60	tabs	G24645	20	May-14	1.9	38
10	Stav/Lam/Nev 6/30/50mg	60	tabs	G27296	177	May-14	4.3	761.1
11	Stav/Lam/Nev 6/30/50mg	60	tabs	G27782	295	Jul-14	4.3	1268.5
12	Stav/Lam/Nev 6/30/50mg	60	tabs	G27709	494	Aug-14	4.3	2124.2
	Total				Oct-97		28.93	25296.88
<b>Lab reagents and consumables</b>								
1	Ise Diluent	1X12ml	Solution	11-2899	4	Jan-13	233.33	933.32
2	Ise Diluent	1X12ml	Solution	12-0620	3	Apr-13	233.33	699.99
3	Elitrol 1	1X12ml	Solution	11-0641	6	Oct-12	198.67	1192.02
4	ALT/GPT	9X50ml	Solution	11-1115	1	Dec-12	69.05	69.05
5	ALT/GPT	9X50ml	Solution	12-0745	7	Oct-13	69.05	483.35
6	Glucose STD	1X12	Solution	12-0201	2	Dec-12	39.72	79.44
7	FACSC Control	pck	Solution	11-0781	2	Dec-12	300	600
8	AST/GOT	9X50ml	Solution	11-0764	1	Dec-12	75.75	75.75
9	AST/GOT	9X50ml	Solution	12-0225	3	Sep-13	75.75	227.25
10	Creatinine Jaffe	4X250ml	Solution	11-0781	6	Dec-12	64.35	386.1
11	Eight Check Control	12X1.5ml	Solution	12-0745	3	Sep-13	250	750
13	Elical 2	1X12ml	Solution	11-0764	2	Sep-13	39.72	79.44
14	Ise Calibrator High	1X12ml	Solution	12-0201	2	Dec-13	250	500
15	Ise Calibrator Low	1X12ml	Solution	11-0781	2	Oct-13	250	500
16	Ise Conditioner	1X12ml	Solution	12-0225	2	Dec-13	187.5	375
17	Ise Cleaner	1X12ml	Solution	12-0745	2	Nov-13	187.5	375
18	Acid Solution	40ml	Solution	11-0764	3	Sep-13	174.67	524.01
19	Electrol 2	10X5ml	Solution	12-0201	2	Dec-12	326	652
20	Glucose PAP	4x250ml	Solution	12-0747	5	Jul-13	51.68	258.4
21	Glucose PAP	4X250ml	Solution	11-0781	2	Sep-13	51.68	103.36
22	Glucose PAP	4X250ml	Solution	A110800	2	Oct-13	51.68	103.36
23	Stromatolyzer	500ml	Solution	D2017	1	Jun-13	324.03	324.03
24	Cell Clean	50ml	Solution	A2011	2	Apr-13	127.61	255.22
25	Potasium	90ml	Solution	4900112	3	Jan-14	62.05	186.15
26	Reflotron Potasium	1x15	Strip	212052-03	30	Jul-13	92.48	2774.4
27	Reflotron Glucose	1x15ml	Strip	218077-02	13	Sep-13	68.38	888.94
28	Reflotron Potasium	1x15ml	Strip	214 179-03	8	Sep-13	92.48	739.84
29	Reflotron Urea	1x15ml	Strip	218 356-02	55	Sep-13	90.18	4959.9
30	Reflotron GPT	1x15ml	Strip	216102-01	15	Dec-13	92.48	1387.2
31	Reflotron BILI	1x15ml	Strip	219261-02	20	Dec-13	89.48	1789.6
32	Reflotron Creatinine	1x15ml	Strip	214 179-03	2	Sep-13	87.18	174.36
33	Reflotron GOT	1x15ml	Strip	218 073-04	3	Dec-13	92.48	277.44
34	Sheath Fluid	1x5lit	Solution	120601	2	Aug-13	269.46	538.92
35	Sheath Fluid	1x5lit	Solution	116227	1	Nov-13	269.46	269.46
36	Sheath Fluid	1x5lit	Solution	120529	5	Jul-13	269.46	1347.3
37	Decontamination Solution	1x250ml	Solution	1131500009	2	Dec-13	162.67	325.34
38	Triglycerides	9X50ml	Solution	12-0225	2	Sep-13	127.6	255.2
39	coulter AC 5diff Control plus	2X2.3ml	Solution	0913	1	Nov-13	216	216
40	Count check Beads	25ml	Solution	KW120726	2	Sep-13	198	396
	Grand Total				229		5910.91	26072.14
							5939.84	51369.02

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