

**ASSESSMENTS OF PERFORMANCE OF SUPPLY CHAIN
MANAGEMENT SYSTEM FOR ARVs AND HIV TEST KITS IN
DODOMA**

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**MSc (Pharmaceutical Management) Dissertation
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By

Deborah Steven Loina

**A dissertation submitted in Partial Fulfillment of the Requirements for the Degree
of Master of Sciences in Pharmaceutical Management of
Muhimbili University of Health and Allied Sciences**

**Muhimbili University of Health and Allied Sciences
November, 2013.**

CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled "**Assessments of Performance of Supply Chain Management System for ARVs and HIV Test Kits**" in partial fulfillment for the requirements of the degree of Master of Science in Pharmaceutical Management of Muhimbili University of Health and Allied Sciences.

Dr. R. S. Malele.

Supervisor

Date

DECLARATION AND COPYRIGHT

I, **Deborah Steven Loina**, hereby declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature..... **Date**.....

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I give glory and honor to God the almighty who gave me the wisdom, strength and guidance to do this work successfully.

DEDICATION

To my daughter Serena Isabella, to my husband Augustino Makenya and to my parents Steven and Cecilia.

ABSTRACT

Background:

Effective supply chain management of ARVs and HIV test kits ensures availability of products, improves efficient utilization of resources, minimizes wastage and enhances accountability.

Objectives;

The study aimed to determine the performance of the supply chain management system for ARVs and HIV test kits in Dodoma region.

Methodology

The study was descriptive, both retrospective and prospective. Stock records, storage conditions, consumption data and Medicines fulfillment order of ARVs and HIV test kits, were assessed using designed checklists. Questionnaires were designed to collect information from health personnel about their knowledge on quantification, stock control and storage conditions of ARVs and HIV test kits.

Results

Stock out period of ARVs ranged from 9.41% to 0.4%, Determine reported range of 65% to 6.5% and Unigold showed 8.2%. ARVs reported 57.14% of record count greater than physical count, Determine reported 0.33% and Unigold reported 0.25%. Record count less than physical count of ARVs ranged from 57.14% to 14.3%. Three facilities reported to have working monitored cold storage.

Only MSD reported 100% accurate consumption record of ARVs, seven facilities reported accurate for determine and Unigold too. One facility reported 100% order fulfillment of request of ARVs. Seven facilities reported 100% for determine and four facilities reported 100% for Unigold. Of the staffs interviewed 39.4% showed to have good level of knowledge on quantification, storage conditions of medicines and stock keeping.

Conclusion

There is significant stock out period of ARVs and test kits in facilities. Records keeping of stock are not well managed. Some of the stores did not monitor cold storage and have working fire extinguishers. Incorrect consumption records were reported. The study observed that there was insufficient supply of ARVs and test kits at facilities which is not enough to facilities. Poor knowledge level is reported to be 36.4% among staffs interviewed.

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ABBREVIATIONS

ARV	Anti retroviral
ART	Anti retroviral therapy
CMS	Central Medical Stores
CTC	Care and Treatment Center
FEFO	First Expiry First Out
HIV/AIDS	Human Immunodeficiency Virus/ Acquired immunodeficiency syndrome
JSI	John Snow Inc
LMIS	Logistic Management Information System
MOHSW	Ministry of Health and Social Welfare
MSD	Medical stores department
MSH	Management Science for Health
NACP	National AIDS Control Program
OI	Opportunistic infection
PLHIV	People living with human immunodeficiency virus
PITC	Provider Initiated Testing and Cancellation
PMCTC	Prevention of Mother to Child Transmission
R&R	Report and Request
RHC	Rural Health Center
TB	Tuberculosis
WHO	World Health Organization
NGO	Non-Governmental Organization

DEFINITIONS OF KEY TERMS

Supply chain – The network of retailers, distributors, transporters, storage facilities, and suppliers that participate in the sale, delivery, and production of a product.

Logistics – The overall management of the way resources are moved to the areas where they are required.

Quantification-A process that involves estimating quantities of a specific item needed for procurement. Estimating needs within a given context the following finances, human resources capacity, storage capacity and capacity to deliver services

Inventory management and control- is the art or science of controlling the amount of inventory held in various forms such as RM, FG (finished goods), MRO (maintenance, repair and operational goods), etc within a business concern to meet economically the demand placed upon that business.

Pull system- a distribution system in which the personnel who receive the supplies determine the quantities to order.

Push system- a distribution system in which the personnel who issue the supplies determine the quantities to be issued.

Vertical system- a logistics system that supplies and manages products for only one program.

CHAPTER ONE

INTRODUCTION

BACKGROUND

With 42 million people now living with HIV/AIDS globally, expanding access to antiretroviral treatment for those who urgently need is one of the most pressing challenges in international health. Providing treatment is essential to alleviate suffering and to mitigate the devastating impact of epidemic.

The supply chain system ensures that the right quantities of quality products reach the right places at the right time. Products for ART program need to be selected and registered for use. Forecasting should be routinely updated and procurement plans adjusted accordingly. Logistics system, inventory management and distribution which include storage and transport at perhaps several levels, must be carefully coordinated so that the products reach the service delivery points where they can be used. Health care workers must be trained, infrastructure improved, communities educated and effective policy and legal framework .(1)

Successful procurement, distribution and use of HIV/AIDS products depends on support of an established laboratory infrastructure and capacity, a well functioning supply chain to ensure uninterrupted delivery of product. Effective and efficient supply chains help to maximize use of resources, reduce wastage, improve quality of service and ultimately, ensure that customers receive the products they need (2). See components of pharmaceutical management below.



Figure 1; pharmaceutical management component

The first case of HIV/AIDS was reported in Tanzania in the year 1983 and by year 1987 all regions of the country each one had reported a case in AIDS disease (3). By the year 2008 the prevalence of HIV in Tanzania was reported to be 6.8% in women and 4.7% in men and it was shown that Iringa had the highest prevalence of 14.7% and Zanzibar had the lowest prevalence of 0.6%. This shows that around 5% of adult population is living with HIV (4). In the year 2009, an estimated number of around 100,000 Tanzanians were newly infected with HIV. This means around 275 new infections of HIV happen every day. The report from the same year 2009 showed that an estimated number of 86,000 Tanzanians died from AIDS (5).

In 2001 the National Policy on HIV/AIDS was launched which accepted anti retroviral medicine as the right choice for people living with HIV, and during this time no Tanzanians were receiving anti-retroviral medicines (6). In the year 2003 the government of Tanzania promised to supply anti retrovirals free of charge to people living with HIV, but in the year 2004, only around 0.5% of those in need of anti retrovirals were receiving them. In the year 2010 nearly half of Tanzanians in need of these ARVs, were receiving them, according to WHO guidelines of 2010 (7). Since the introduction of Highly Active Antiretroviral Therapy (HAART), data of morbidity and mortality among the infected population with access to

ARVs has markedly dropped (5). But in the year 2010, data showed that only 18% of children were able to receive ARVs treatment compared to 47% of adult population (7).

A key element in determining the ability of the system to respond to future demand is estimation of likely ART patient uptake, it is considered that the most likely perspective is one of continued slow growth in the expansion of the HIV program and for the number receiving ART to remain modest compared to need. In relation to supply system, however it means that the current system as deficient as it is likely to be able to cope with the realistic projected growth in the short term. This removes the pressure for urgent, large scale system strengthening in the near future. The need for lifelong HIV/AIDS treatment, and the high cost of ant-retrovirals present, challenges to achieving and sustaining universal access. It has shown that around 21%-30% of people living with human immunodeficiency Virus (PLHIV) in the country have registered at care and treatment centers and among those only 63%-83% are eligible to receive ARVs treatment are receiving, which maybe enhanced due to social beliefs, unstable supply of ARVs to certain areas and society discrimination if disclosure . The estimated mortality in the first year of ARVs treatment initiation was 10% but in recent year there was decrease in mortality down to 3% per year (7).

The government of Tanzania under the National AIDS Control Program (NACP) has been collaborating with partners like USAIDS, WHO and since 2004 the government initiated CARE AND TREATMENT PROGRAM (CTC). In 2010, data showed that 740,000 of PLHIV had been registered at 1100 health facilities in the country. Scaling up ART has remained to be a problem in resource limited countries, out of the estimated HIV infected Tanzanians who are eligible only 76.2% are currently on ART (7).

Despite sustained effort by global HIV community and undeniable recent successes in financing antiretroviral treatment for AIDS in low and middle income countries, access to such treatment remains limited in many parts of the world. The causes are complex; they include lack of health system infrastructure, shortage of health care workers, lack of affordable treatment and other social behavior factors. The main cause remains to be lack of an effective and efficient antiretroviral supply chain. Supply chain management system for ARVs and associated test kits in resource limited countries is facing a lot of challenges, and the fall of

supply chain system are becoming a growing concern. In 2009, a survey was done by WHO and indicated that 38% out of 94 reporting countries had showed poor supply chain system by having stock out of ARVs in health facilities (8).

Irregular supply of ARVs puts patients at high risk of disease progression and finally death (9). It also risks public health due to spread of broad resistance, and decreases the credibility of ART programmers in the eyes of the society. In many resource limited countries, the capacity of supply chain management system has been weak (10). The management of supplies for what is a serious disease needing lifelong therapy is becoming increasingly difficult with further scale up of HIV care and treatment.

STATEMENT OF THE PROBLEM

Antiretroviral medicines have been introduced in the world in recent years, and are still under modification each day so as to get the combination which is more effective and with fewer side effects. ARVs are expensive medicines and therefore require proper handling to prevent misuse of resources. For instance the budget of 2006/07 of the health sector was \$315.2 million, and ARVs used 18.0% of the budget in Tanzania. (11).

Despite the fact that, the government in collaboration with its partners is working on supplying ARVs and HIV test kits there is still a problem of maintaining constant flow of required medicines to some of health facilities. This problem may arise due to poor knowledge on ordering and quantification of medicines, receiving amount of medicines which is not enough to be used for the required time, poor storage condition of medicines which deteriorate the quality of medicines and medical supplies and poor inventory on control the amount of medicines which is present in the stores.

Health workers need to have enough knowledge on quantifying medicines and medical supplies, so that they can order the amount of medicines which are required for the period of time and to prevent stock out in the facilities. Medicines are required to be stored in good storage conditions; medicines which are not stored in required environments tend to lose their quality and decrease their strength and if they are used by patients tend to cause resistance. Facilities need to receive enough quantity of medicines they have requested so as to have

constant supply of medicines to be used to patients. Shortage of medicines may cause patients not to adhere to their medicines. Stock records need to be properly updated during issuing and receiving of medicines in the stores. Thus to have updated amount of quantity of medicines present in the stores and to know the amount required to be ordered. Poor management of records in the stores may cause accumulation of medicines without knowledge or shortage of medicines before time of re ordering.

This research aimed to explore the problems which cause poor supply chain of ARVs and test kits to the health facilities so as to come up with the possible interventions.

RATIONALE OF THE RESEARCH

Effective supply chain management system will bring about continuous flow of ARVs and medical supplies to customers. This is one component which will maintain patients' adherence to medicines and be treated at the right time and reduce the chance of drug resistance.

Supply chain management can maintain the quality and faith in the health system to people by ensuring the availability of medicines and laboratory test kits by using effectively the available resources.

In this study, Physical stock was compared to the recorded amount, Stock out time was checked, Storage conditions of medicines was checked if they comply with the storage condition of WHO, Ordering amount of medicines was compared with the estimated consumption amount and Ordering fulfillment of medicines from facilities was checked.

We expected that information from this study will give out the current situations of supply chain management system in Dodoma region and on how to tackle the gaps identified and maybe to review the health budget.

Also this information can be disseminated to relevant authorities including Medical Stores Department so that they can work on how to strengthen and replenish the supply chain system of ARVs and associated test kits.

This information can be used by health facilities, councils and other stakeholders on how to improve pharmaceutical supply chain system of ARVs and its associated test kits.

RESEARCH QUESTIONS

Our research questions were:

1. Is the stock on hand of ARVs and test kits the same as in the records? What are the stock out days of ARVs and test kits?
2. How are ARVs and test kits kept in the store?
3. How is the ordering and forecasting from district to MSD done?
4. What is the percentage of ARVs and test kits received in a period of one year from main Medical Stores Department?
5. What is the knowledge level of health care workers who manage ARVs and test kits in relation to quantification and ordering, storage condition and stocks management in district hospitals?

HYPOTHESES:

NULL HYPOTHESIS

Poor supply chain management system has no effect on availability and quality of ARVs and HIV test kits.

ALTERNATIVE HYPOTHESIS

Poor supply chain management system has negative effect to availability and quality of ARVs and HIV test kits.

OBJECTIVES OF THE RESEARCH

BROAD OBJECTIVE:

The main objective was to determine the performance of the supply chain management system of ARVs and HIV test kits in Dodoma region

SPECIFIC OBJECTIVES:

1. To determine the stock out days and stock levels of ARVs and HIV test kits in Dodoma health facilities and MSD.
2. To determine the storage conditions of ARV medicines and HIV test kits in Dodoma health facilities and MSD.
3. To determine the methods for preparing orders and forecasting of ARVs and HIV test kits in the Dodoma health facilities and MSD.
4. To determine the ordering fulfillment rate of ARVs and HIV test kits from MSD to the health facilities.
5. To assess the knowledge of health care workers who are working in pharmaceutical department in relation to quantification, storage condition and inventory management of ARVs medicines and HIV test kits

CHAPTER TWO

LITERATURE REVIEW

There is increase in number of people who are using ARVs, and it is expected to continue to grow in years to come. This is because of the sensitization that is being done by the government about the importance of anti-retroviral to people who have been affected by HIV virus. Most of the pharmaceutical supply chain systems which are weak will be weaker if supply of medications is increased. These weaknesses include inadequate skills to quantify needs for medications or to order, receive and store medications and to accurately record inventories (12). Also if one increases supply of drugs and medical supplies there is a chance of increasing inappropriate use of these medicines (13).

It has been seen that a major challenge in supplying of ARVs and its commodities is to maintain a constant supply of medicines and to avoid stock outs and expiry (14,15). Medical health supply chains are different because they usually have large, extended global pipelines, require high levels of product availability and have high un-certainty in supply and demand. In order for the supply chain to work properly and to be successful, all partners must be focused on improved coordination, information-sharing and serving the end customer.

Interruption of the supply chain system may cause harmful effects; ant-retroviral drug resistance is one of them which can have a wider global impact on the availability of drugs for treatment (16). A study done in Uganda showed that shortage of ARVs affected all ART providing clinics with considerable interruptions regarding capacities to take up new patients. ARVs were available at eighty three percent (83%), diagnostic kits at seventy percent (70%) and pediatric ARVs at less than half of health facility surveyed. This resulted into patient being advised to switch to more complex and different drug regimens which were most available so as to prevent treatment interruptions (17).

In Uganda a national level survey showed that supply of ARVs suffers both from oversupply and under supply (17). According to the research finding which was done in 2007, only a quarter of facilities receive ARVs on a monthly basis, which is the required frequency for consumption report (18). Health facilities on the average reported one (1) month of stock out

of testing kits per year 2005 (17). Also in the year 2008 some findings suggested that some facilities had shortage of test kits for months. It showed that only 15% of patients in need could be tested as a consequence (18). National laboratory assessment in Uganda in year 2004 showed that, nearly half of regional hospital could not perform confirmatory test for opportunistic infections and 20%-30% district hospitals could not perform basic STI and OI test (19).

The budget of 2006/07 of the health sector, in medicines delivered in health facilities cost \$315.2 million or just under \$ 8 per capital. Medicines which cost a lot of money were essential medicines (20.9%), Anti retrovirals (18.0%) and Anti-malarials (17.2%) (11). Also a report from the year 2007 showed that among 40 tracer medicines which were selected, about 11 medicines were available during the study in over 50% of public health facilities surveyed. It was a bit better for private facilities, because the report showed that 23 out of 40 medicines were available in, and 15 of medicines were available in NGO facilities (21).

Availability and access to medicines is a critical issue, with many studies showing problems with chronic stock outs of essential medicines. A study done in Jordan reported some similar results as others, facilities reported good control of essential and expensive medicines, correspondence between stock records and the physical stock count was acceptable and stock out period was low and within international figure. There were also some weaknesses for some of the health facilities which are, poor quantification, poor inventory record and improper recording practice and no facility kept emergency stock in case of any difficulties (19).

A study done in Tanah Papua, New Guinea reported that, there were problems with overstocking, with 30% to 58% of essential medicine items being more than 12 months in stock. Low stocks were also a problem with up to 27% being out of stock on the day of survey and further 7% to 19 % having less than 3 months supply. ARV drugs showed 15% stock outs for 3 to 6 months, 23% no stock out, 46% more than 6 months out of stock and 15% showed 12 months out of stock (20).

In Tanzania, central MSD and zonal offices stored their medicines according to the requirements needed. A study in 2007 found good storage condition to be 63% in hospitals

and 50% in health centre and dispensaries and acceptable quality. But 17% of health centres and dispensaries reported dirty and dust environments (21). For storage conditions, no hospital reported humidity and temperature monitoring, and the refrigerators did not record everyday temperature and also did not have calibrators. Some facilities did not have enough space for storage of drugs and medical supplies (19).

Another study done in Tanzania reported that stores in health facilities did not have enough space for storage of forecasted quantities of essential medicines and medical supplies included infusions and hospital beds; it showed that of 56% of facilities surveyed only 33% of health facilities had adequate storage space. One of the requirements for storage is to separate expired medicines from used ones, but this study showed that only 41% of facilities had space for storage of expired medicines. Regarding cold storage only 52% of facilities had cold storage condition for medicines. Also the study showed that MSD followed the method of inventory control of First Expiry First Out (FEFO) and traceability of batches was also done. However the majority of health facilities followed the system of FEFO by 89% and stock cards were present in 75% of the facilities. The study reported higher percentage of availability of tracer medicines in health facilities than in MSD (88.9% by 82.5%) of 20 tracer medicines selected. But the health facilities showed a high number of stocks out period, which reached up to 4 months for some medicines and this is because of poor quantification and lack of finances and also late arrival of medicines and medical supplies from MSD (22).

Overstocking and under stocking may be a result of poor quantification and forecasting. Over stocking of drugs and medical supplies leads to expiry of large number of medicines, increasing cost of storing medicines for long periods, and high incidence of misuse and loss of potent and vital medicines. Under stocking may lead to increase in number of stock out medicines, which increases mortality and morbidity rates, incidence of resistance because of insufficient use and irrational use of medicines (23). A study done in Uganda reported problems during quantification of the needed amount of medicines. It showed that most medicines were not quantified properly according to the amount needed because health personnel involved in procurement of medicines were not trained properly in procurement and

quantification of medicines, which may lead to overstocking or under-stocking of medicines (24).

When you have effective inventory management some costs of holding inventory can be reduced across different stages of supply. Over stocking may lead to medicines piling up at the health facility and then expiring, while under stocking of serving medicines may lead to loss of lives (25). A study done in Dar es Salaam on medicines stock out and inventory management problem in public hospitals, reported that during assessment of the methods during quantification, 65% of participants were unable to mention the method they were using, while only 22% mentioned consumption method. Twenty seven percent mentioned that they quantified their requirements according to the budget, 65% said they did not know what type of inventory method they were using. In addition the study reported the presence of dust in the shelves for storage of medicines and in some stores air conditioners did not have the capacity to keep the rooms in the required temperature because of the large area (14,25).

The supply chain of ARVs needs to be effectively managed, because of increasing number of people who are in need of ARVs. In order for the medicines to reach those who are in need, there have to be effective selection, effective procurement and inventory management and storage. Managers have to be aware of every detail and change that is occurring in the supply system and the need of the patients. A study done in Malawi on antiretroviral drug supply challenges in the era of scaling up ART, reported that pharmaceutical supply system was facing some challenges because of the increasing number of people who are in need of ARVs. Managers again became aware of and forecast accurately the required amount of ARVs and their related commodities. However it was difficult to forecast for patient who changed from first line to another alternative for the reason of toxicity or patients who changed to second line because of treatment failure. This caused at one time to have an oversupply of second line ARVs and thus contributed to shortage and even site stock outs of alternative first-line ARVs (14).

A study done in 2011 on medicines and medical supplies availability showed a shortage of gauze in health facilities which was caused by improper quantification of gauze starting from medical stores and even health facilities did not order their requirements properly. The study

reported shortage of gauze by 48% in 71 districts interviewed and it lasted for a period of three to six months without gauze. Only 8% of districts had required amount of gauzes. The pharmacist and facility in charges did not order exact the amount which was required maybe because they did not have knowledge or because of shortage of funds. It showed they ordered fewer amounts than what was required (26).

A study done in West and Central Africa reported that, there are recurrent stock outs in health facilities mainly due to inadequate forecasting and inadequate information flow between stakeholders. The presence of management tool is not systematic, 33.3% of centers use either stock management software or stock cards. Only 13% of stock managers benefited from training in the last six months before survey about inventory management. Thirteen percent (13%) of these managers did not receive any training. All health facilities experienced stock outs caused by multiple reasons: delivered quantities were less than expressed need of 58%, need were underestimated when order was placed 33% and drug expiry 38%. Hardly half of the centers (54%) had enough storage space. Storage conditions were not satisfactory in half of them (42%) and were poor in one center out of four, but the cold chain was operational in 90% of the health facilities (27).

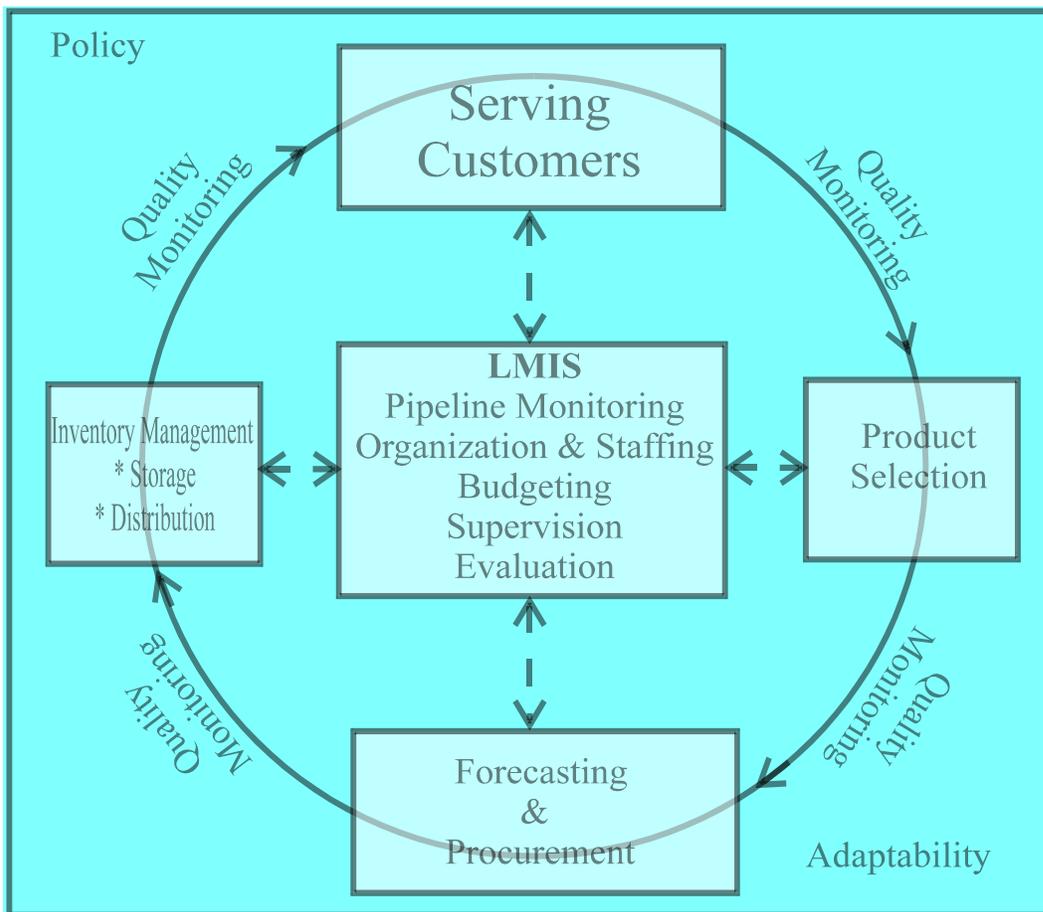
Quantification is explained by consumption or distribution pattern, funds available, stock on hand and expiry dates of stock at hand and procured one. In additional one has to consider factors such as donation, standard treatment guideline treatment and seasonal variation.

One factor which will enhance non adherence is interrupted supply of anti retrovirals. It is expected to have continuity supply of these medicines (31). A study done on scaling up ARVs, reported a continuous flow of first line alternative medicines is needed and is essential so as to enable substitution in case of drug toxicity or adverse reactions (28). The use of fixed dose combination pill does help to ease pressure on supply chain, but few such combinations are available and their further development and use is being threatened by patent protection (29).

CONCEPTUAL FRAMEWORK

Supply chain system deals with logistics activities in a cycle which are serving customers, product selection, forecasting & procurement and Inventory management-Storage and distribution which are interdependent so as to perform in their capability.

The logistics cycle:



Note below:

LMIS –Logistic Management Information System

Serving customer

All health personnel must remember that, whatever activities they are working in must be to meet the requirement of the customer who is a patient; these activities include selection, procurement, storage and distribution of medicines and medical supplies (30).

A pharmacist/pharmaceutical technician must know to what extent, he/she has to work so as to contribute in providing excellent customer service. Customers driven supply chains (in which all partners of supply chain are focused on customer not only benefits the consumers).

Product selection

Drugs and medical supplies must be selected according to the requirements of patients, according to standard treatment guidelines and national essential medicines list (30). But above all medicines selection must go hand in hand with the budget of the facility.

Quantification and Procurement

It is important to know the estimates requirement on amount of medicines and medical supplies which will be needed for a specified period of time.

Pharmaceutical purchasing represents the single largest health expenditure after personnel cost. Effective procurement includes transparent and ethical manner, procure most of the right medicines in the right quantity, obtaining the lowest practical purchase price and arranging timely delivery to avoid stock outs (31).

Inventory management: storage and distribution

A pharmacist needs to have information about his supplies on when to order or issue, how much to order or issue, and how to maintain an appropriate stock level of all products to avoid shortages and oversupply.

Also a pharmacist must ensure the quality of products and its packaging. Proper storage procedures can ensure that only high quality products are issued by storage facility.

Logistic management information systems

The logistic cycle is driven by information, without information the logistic cycle cannot run smoothly. Information is gathered from each activity which is taking place in the system and information is analyzed to coordinate another action. In order to organize the logistic cycle, other activities are needed in logistic management information systems which are;

Organization and staffing

A proper logistic cycle can work well if it has staffs and health personnel who are trained efficient and they know how to handle their jobs properly. Health programs must be organized to provide the appropriate resources to make logistics cycle work properly.

Budget

In order for the logistic cycle to work properly the budget is the most important thing which, decides in product selection, the quantity of product to be procured, the storage capacity of the store and number of staffs who can be employed to work in managing the logistic cycle. Availability of enough funds is important for the logistic system to work effectively.

Supervision

If there is effective supervision it will avoid most problems or resolve them quickly before they increase to be bigger. It will also help to make the logistic cycle run effectively and anticipate needed changes.

Evaluation

At the end evaluation is needed, so as to demonstrate the impact of effective logistic cycle in health facility.

Policies

Government regulation and procedures affect all elements of the logistics system. Many governments have established policies on selection, procurement and distribution.

Adaptability

This is the logistics system's ability to successfully obtain the resources and that are necessary to address the demand.

CHAPTER THREE

METHODOLOGY

STUDY DESIGN

This was a cross-sectional study with a retrospective component. Unstructured questionnaires, storage assessment tool, stock out data form, consumption data form and medicine fulfillment data form were used to collect information from selected health facilities.

STUDY AREA

The study was conducted in Dodoma region which has 7 districts namely, Kondoa, Mpwapwa, Dodoma municipal, Kongwa, Chemba, Chamwino (which uses Mvumi hospital), and Bahi; and There are 33 health facilities which provide ART services in Dodoma region. These include 5 hospitals, 22 health centers and 6 dispensaries. Below is a

Table indicating names of health facilities and their levels in each district.

No	District	Hospital	Health center	Dispensary
1	Kongwa	Kongwa	Mlali Kibaigwa Mkoka	Hogoro
2	Mpwapwa	Mpwapwa	Rudi Kibakwe	Pwaga Chisogoro
3	Bahi		Bahi Mudemu Chipanga Mtitaa	
4	Chamwino	Mvumi	Mpwayungi Haneti Handali Chamwino	
5	Manispaa		Kikombo St gema Hombolo UDOM Makole	Dodoma cenral Natumburu Isanga prison
6	Kondoa	Kondoa	Busi Hamai Kwamtoro Kisese	

STUDY PARTICIPANTS AND SAMPLE SIZE

The study included health personnel who are managing ARVs medicines and HIV test kits; these included pharmacists, pharmaceutical technicians, nurses who dispense drugs from each district hospital and workers from MSD. Sample size of the study was 33 health personnel who were present during the first day of visit in health facilities. A convenient sampling technique was used to get the study sample size. This technique was used because of the small

number of the pharmaceutical personnel. Therefore this study involved all pharmaceutical health personnel that were present during the study time in all of the selected health facilities

SAMPLING

Three (3) out of seven (7) districts were selected, by random sampling using lottery method for inclusion, in the study. These were Bahi, Chamwino and Mpwapwa. Again, by random sampling, two (2) health centers were selected from each district and by convenient sampling, all hospitals and all dispensaries in Mpwapwa and Mvumi districts as they were the only hospitals and dispensaries were selected, because they are two (2) hospitals in the selected districts and two (2) dispensaries only present in Mpwapwa district.

DATA COLLECTION

Data were collected using designed checklists for stock out records of ARVs and HIV test kits, storage conditions of medicines and medical supplies, consumption data of ARVs and HIV test kits and medicines fulfillment order of each district and MSD. Traced ARVs which are used to monitor supply chain were assessed, which are Efavirenz/Tenofovir/Emtricitabine (Atripla), Lamivudine/Zidovudine/Nevirapine (Duovir N), Tenofovir/Lamivudine/Efavirenz (TLE), Lamivudine/Zidovudine (Combivir), Efavirenz, Lamivudine/Zidovudine/Nevirapine (Duovir N child), Tenofovir/Lamivudine/Efavirenz (TLE child). Ledgers were used to assess amount recorded comparing with the physical amount present. Dispensing register of ARVs and test kits were used so as to count the consumption amount used for the past one year, and comparing with the record of consumption written in R&R form for ordering. Issue vouchers from MSD and ledgers were used to count the amount of medicines and test kits received and compared with the amount ordered which was recorded in R&R form.

Questionnaires were used to collect information from health personnel who are working on ART clinics about their knowledge on quantification, stock control and storage conditions of ARVs and HIV. The health staff interviewed included pharmaceutical/nurse personnel, in charge of the clinic and nurse personnel who are working on ART clinics as explained in the study participants below.

On determining the knowledge of health personnel, three levels were used which are good, fair and poor according to the number of questions they answered (table 1). There were a total of 20 questions which were designed to assess knowledge (Appendix V) required the health staffs to answer. More on the table below;

Table 1: Criteria of knowledge

Conditions	Proportion	Number of correct questions
Good	70-100	14-20
Fair	50-69	10-13
Poor	0-49	1-9

Stock out data form

Stock out data form was designed to collect information of physical stock which was present during the day of visit and comparing it with the record stock in the ledger. It also informed about number of days that products were out of stock for the period of one year.

Storage condition tool

This tool was designed according to the WHO guideline for storage of medicines. The tool had questions which were used to assess condition for storage of medicines in stores of selected health facilities. It had nine questions.

Consumption data form

This form was designed to collect information on amount of medicine which was used (amount of ARV drug dispensed) and comparing with the amount which was written for ordering for the period of one year. ART program in our country uses consumption method for ordering the required medicines, which means dispensed medicines will be nearly to the amount ordered.

Medicines fulfillment form

The form was designed to collect information on the amount of medicines ordered by each health facility comparing with the amount received. This was in order to see if the amount requested was the amount delivered.

Questionnaires form

Questionnaires were designed to collect information on health personnel about their knowledge on stock control, storage of medicine and ordering of medicines. The questions were open and close ended so that the interviewers can explain themselves on what they know.

DATA ENTRY AND ANALYSIS

Data was entered in MS excel spreadsheet and then re-entered and analyzed using Inventory Management Assessment Tool (IMAT) and statistical package for social sciences (SPSS) version 17. The chi square test was used to compare obtained proportions and p value of 0.05 was considered as statistical significant at the 95% confidence interval.

Variables which were considered are;

- Percentage average time of stock out of ARVs and HIV test kits.
- Percentage of consumption data of ARVs and HIV test kits and ordering data
- Percentage of medicine fulfillment of ARVs and HIV test kits
- Knowledge of health personnel on inventory control, storage of medicines and ordering of medicines.

ETHICAL CONSIDERATION

Ethical clearance was obtained from the Directorate of Research and Publication committee of MUHAS and consent was obtained from all participants as well as heads of hospital/health centers/dispensaries and confidentiality was observed.

Health workers ie pharmacists, pharmaceutical technicians, pharmaceutical assistant and nurses who dispense ARVs were informed on the importance of the study and if they will be willing to be interviewed. Also they were explained that data collected will be used only for the purpose of the study and their names will not be mentioned.

CHAPTER FOUR

RESULTS

During the study period which included data of one year period (from September 2011-August 2012), 11 health facilities were visited to collect data and 33 health care staffs were interviewed using questionnaires.

Average stock out period

Stock out period of seven (7) ARVs namely Combivir, Duovir N, Duovir N child, Efavirenz, Atripla, TLE and TLE child, which are used to assess supply chain system in health facilities and test kits were determined. Health facilities included, ranged from dispensaries, health centers and hospitals.

From table 1 below of stock out period, average stocks out period of ARVs have been seen to be high by 9.41% and low by 0.4%. Among all 11 facilities surveyed, 4 facilities showed no stock out period of ARVs.

Determines test kit reported stock out period of high by 65% at health centre and low by 6.5% at health centre too, and seven facilities reported no stock out period of Determine test kit for the time surveyed. Unigold test kit had 8.2 % stock out period which was in health centre and no stock out period in ten facilities. See table 2 below for more results:

Table 2: Average stock out period of ARVs, Determine and Unigold test kits in health facilities surveyed.

no	Facility name	Average percentage of time that product are out of stock		
		ARVs	determine	Unigold
1	Rudi RHC	0	0	0
2	Chipanga RHC	0	0	0
3	Mudemu RHC	9.41	65	8.2
4	Handali RHC	1.74	57.5	0
5	Chipogoro dispensary	3.4	0	0
6	Kibakwe RHC	1.11	6.50	0
7	Pwaga dispensary	1.60	0	0
8	Chamwino RHC	0.40	0	0
9	Mvumi hospital	0	0	0
10	Mpwapwa hospital	3.0	0	0
11	Medical Stores Department	0	0	0

Average percentage of record counts greater than physical counts of ARVs, Dertemine and Unigold test kits.

On assessing percentage of record count that is greater than physical count (RECORD COUNT>PHYSICAL COUNT) result showed that,

ARVs record counts greater than physical count was high by 57.14% at health centre and low by 14.3% at dispensaries and hospitals. Determine test kit reported percentage of record count greater than physical count in one dispensary which reported 0.33%, Unigold test kit was seen to show percentage of record greater than physical count also in one dispensary which was 0.25%. See results on table 3 and 4 below:

Table 3: Percentage of ARVs record count greater than physical count in the surveyed health facilities.

No	Facility name	Percentage of ARVs record count greater than physical count (%)
1	Rudi RHC	28.57
2	Chipanga RHC	0
3	Mudemu RHC	28.57
4	Handali RHC	42.86
5	Chipogoro dispensary	42.86
6	Kibakwe RHC	57.14
7	Pwaga dispensary	14.3
8	Chamwino hospital	0
9	Mvumi hospital	14.3
10	Mpwapwa hospital	28.57
11	MSD	0

Table 4: Percentage of Determine and Unigold test kit record count greater than physical count health facilities surveyed

No	Facility name	Percentage of record count greater than physical count (%)	
		Determine	Unigold
1	Rudi RHC	0	0
2	Chipanga RHC	0	0
3	Mudemu RHC	0	0
4	Handali RHC	0	0
5	Chipogoro dispensary	0	0
6	Kibakwe RHC	0	0
7	Pwaga dispensary	0.33	0.25
8	Chamwino hospital	0	0
9	Mvumi hospital	0	0
10	Mpwapwa hospital	0	0
11	MSD	0	0

Percentage of record counts less than physical counts of ARVs, Determine and Unigold test kits.

During assessment of record counts less than physical counts (RECORD COUNT<PHYSICAL COUNT) of ARVs, one of health centers showed high value of 57.14%. The lowest value was also seen in the health centers again by having 14.3% of record counts less than physical counts. On assessing Determine test kit, five health facilities showed 100% value of having record counts less than physical counts. These facilities included are health centers and hospitals which gave a total of 45.4% among the health facilities surveyed.

Unigold test kit results showed to have high value of record counts less than physical count in 3 facilities, which include health center and two hospitals, which account for 27.2% of all facilities. See results on table 5 and 6 below:

Table 5: Percentage of ARVs record count less than physical count in the surveyed health facilities.

No	Name of facility	Percentage of ARVs record count less than physical count
1	Rudi RHC	0
2	Chipanga RHC	0
3	Mudemu RHC	0
4	Handali RHC	14.3
5	Chipogoro dispensary	0
6	Kibakwe RHC	0
7	Pwaga dispensary	42.86
8	Chamwino RHC	57.14
9	Mvumi hospital	0
10	Mpwapwa hospital	28.57
11	MSD	0

Table 6: Percentage of Determine and Unigold test kits record count less than physical count in surveyed health facilities.

No	Name of facility	Percentage of record count less than physical count	
		Determine	Unigold
1	Rudi RHC	100	100
2	Chipanga RHC	0	0
3	Mudemu RHC	0	0
4	Handali RHC	100	0
5	Chipogoro dispensary	0	0
6	Kibakwe RHC	100	0
7	Pwaga dispensary	0	0
8	Chamwino RHC	100	0
9	Mvumi hospital	0	142.8
10	Mpwapwa hospital	100	100
11	MSD	0	0

Storage conditions

Storage condition was checked in 11 health facilities. Among them, all 11 stores showed 100% secure for water penetration, 100% storage on dry well place and 81.8% medicines stored away from insecticides.

But also on 11 visited health facilities only 1 store (9.1%) showed presence of working fire extinguisher and 3 stores (27.3%) showed presence working monitored cold storage condition. Five 5 (45.5%) stores showed enough space for storage of medical supplies, and 6 (54.5) stores were clean from dust by disinfectant. See more results on table 7

Table 7: Percentage of storage conditions in the surveyed health facilities.

no	Storage condition		N (number of site)
1	Presence of enough space	Yes	5 (45.5%)
		No	6 (54.5%)
2	Clean for dust by disinfectant	Yes	6 (54.5%)
		No	5 (45.5%)
3	Supplies stored in well dry place	Yes	11 (100%)
		No	0 (0%)
4	Secure from water penetration	Yes	11 (100%)
		No	0 (0%)
5	Presence of working cold storage	Yes	3 (27.3%)
		no	7 (63.6%)
6	Presence of pallets and shelves	Yes	8 (72.7%)
		no	2 (18.2%)
7	Stored away from insecticides	Yes	10 (81.8%)
		No	0 (0%)
8	Stored in manner of FEFO	Yes	9 (81.8%)
		No	1 (9.1%)
9	Store have space to separate damaged and expire items	Yes	8 (72.7%)
		No	2 (9.1%)
10	Presence of working fire extinguisher	Yes	1 (9.1%)
		No	9 (81.8%)

Percentage of accurate consumption records

Accurate consumption records of ARVs and test kits, is essential step on forecast of ARVs and test kits in facilities

Assessment of eleven facilities showed, one facility to have high value of 100% in having accurate consumption records according to use of ARVs. Secondly six facilities reported 85.72% of accurate consumption records of ARVs. Low percentage accurate consumption record was observed at one health center, which had 57.14%.

Determine test kit was assessed in eleven facilities and among them seven had accurate record of consumption, and one dispensary reported low percentage of 20 values. Again Unigold test kit reported the same accurateness to seven facilities, and the value of 33.3% was reported in health center. See results on table 8 and 9 below:

Table 8: Percentage of ARVs consumption record which is accurate in comparison with the with consumption data in R&R in the surveyed health facilities.

No	Name of facility	Percentage of ARVs consumption record which is accurate with record in R&R
1	Rudi RHC	71.43
2	Chipanga RHC	85.72
3	Mudemu RHC	71.43
4	Handali RHC	85.72
5	Chipogoro dispensary	85.72
6	Kibakwe RHC	85.72
7	Pwaga dispensary	71.43
8	Chamwino RHC	57.14
9	Mvumi hospital	85.72
10	Mpwapwa hospital	85.72
11	MSD	100

Table 9: Determine and Unigold test kits consumption record accurate as in R&R in surveyed health facilities.

No	Name of facility	Percentage of consumption record which is accurate with record in R&R	
		Determine	Unigold
1	Rudi RHC	50	100
2	Chipanga RHC	60	100
3	Mudemu RHC	100	66.7
4	Handali RHC	100	66.7
5	Chipogoro dispensary	20	100
6	Kibakwe RHC	100	100
7	Pwaga dispensary	100	100
8	Chamwino RHC	100	33.3
9	Mvumi hospital	100	50
10	Mpwapwa hospital	60	100
11	MSD	100	100

4.1. Percentage of ordering fulfillment

On surveying eleven facilities, one health facility reported high value of 100% of ordering fulfillment of ARVs, that means this facility received amount of ARVs it requested for the period of time. Two health centers and one hospital reported to receive 85.72% of ARVs requested.

The lowest percentage was observed at MSD, which reported to receive 42.86% of ARVs requested from headquarter. More results on table 9. On assessment of Determine test kit, seven facilities reported to receive the amount requested, that is equal to 63.63% of all facilities surveyed. 20% was reported as the lower value in health center and dispensary.

Unigold test kit, on the other hand had reported 36.36% ordering fulfillment in eleven facilities surveyed. See results on table 10 and 11 below;

Table 10: ARVs percentage of order fulfillment as requested in surveyed health facilities

No	Name of facility	Percentage of ordering fulfillment of ARVs request
1	Rudi RHC	71.43
2	Chipanga RHC	85.72
3	Mudemu RHC	100
4	Chipogoro dispensary	57.14
5	Kibakwe RHC	71.43
6	Pwaga RHC	71.43
7	Chamwino RHC	85.72
8	Handali RHC	71.43
9	Mvumi hospital	85.72
10	Mpwapwa hospital	71.43
11	Medical Stores Department	42.86

Table 11: Percentage of Determine and Unigold test kits order fulfillment as requested in surveyed health facilities

No	Name of facility	Percentage of order fulfillment of requests	
		Determine	Unigold
1	Rudi RHC	100	9.09
2	Chipanga RHC	100	100
3	Mudemu RHC	100	66.7
4	Chipogoro dispensary	20	50
5	Kibakwe RHC	20	100
6	Pwaga dispensary	100	100
7	Chamwino RHC	50	20
8	Handali RHC	88.3	11.7
9	Mvumi hospital	100	33.3
10	Mpwapwa hospital	100	100
11	MSD	100	87.4

4.2 Characteristics of health care workers in relation to quantification, storage condition and inventory management

During data collection, a total of 33 health personnel were interviewed using questionnaires.

Social-demographic characteristics of study participants

A total of 33 health personnel were interviewed, in which minimum age was 22, and maximum age was 62. Mean age was 39.94 and median age was 37.

This included nurses 14 (42.4%), medical attendant 5 (15.2%), clinician 8 (24.2%), pharmaceutical personnel 3 (9.1%) and others 3 (9.1%) as shown in table 12 below.

Table 12: Socio-demographic characteristics of staff who were interviewed in the surveyed health facilities.

Characteristic	Number	Percentage (%)
Age group		
< 35	11	33.3
35 – 45	11	33.3
> 45	11	33.3
Profession		
Nurse	14	42.4
Clinician	8	24.2
Medical Attendant	5	15.2
Pharmaceutical personnel	3	9.1
Others	3	9.1

Others include warehouse officers.

Knowledge scores

Results showed that, on assessment of knowledge for quantification, stock management and stock control, among thirty three interviewers, 39.4% had good knowledge, 24.2% had fair knowledge and 36.4% showed to have poor knowledge. This is according to the number of questions they answered right, in twenty (20) questions they were interviewed about (table 13)

Table 13: knowledge scores of health staff who were interviewed in the surveyed health facilities.

Conditions	Frequency	Percentage
Good	13	39.4
Fair	8	24.2
Poor	12	36.4

Knowledge level for each profession

Looking at knowledge level in each profession, pharmaceutical personnel had good knowledge on quantification, stock control and storage of medicines by having 23.1%, and had zero percent on other levels. Warehouse officers who are included in others had 15.4% of good knowledge and had 12.5 of fair knowledge.

Clinicians had knowledge level as; good 15.4%, fair 62.5% and 8.3% of poor level. Nurses had 38.5% of good level, 25% of fair knowledge and lastly 58.3% of poor knowledge level. Medical attendants had good level of knowledge by 7.7% and had poor knowledge of 33.3%. See table 14 for more results:

Table 14: Profession verses knowledge as indicated in surveyed health facilities.

No	Profession	Knowledge level percentage (%)					
		No	good	No	fair	No	Poor
1	nurses	13	38.5	8	25	19	58.3
2	Medical attendants	3	7.7	0	0	11	33.3
3	clinicians	5	15.4	21	62.5	3	8.3
4	Pharmaceutical personnel	8	23.1	0	0	0	0
5	others	5	15.4	4	12.5	0	0

Obtained p value =0.022

Knowledge level for each category of the age

Looking at the age category, results showed that less than thirty five years 38.5% had good knowledge and 25% had poor knowledge level. Age between 35 to 45 years, 38.5% had good knowledge and again 25% had poor knowledge. Above 45 years results showed 23.1% had good knowledge and 50% had poor knowledge. See table 15 for more results:

Table 15: Knowledge level for age group of staff interviewed in the surveyed health facilities.

No	Age category	Knowledge level percentage					
		No	Good	No	Fair	No	Poor
1	< 35	13	38.5	12	37.5	8	25
2	35-45	13	38.5	12	37.5	8	25
3	> 45	7	23.1	9	25	17	50

P value = 0.741

CHAPTER FIVE

DISCUSSION

Poor supply chain management system is being enhanced by poor conditions, human resources and poor information. This study, aimed to assess supply chain management system of ARVs and HIV test kits, in Dodoma region. Among ten health facilities surveyed provided ART services to customers, and provided counseling and testing for HIV status.

In the health facilities surveyed, results of stock out time of ARVs reported to range within 3.4%-9.41% and test kits showed stock out time of 8.2%-65% during a period of one year surveyed. From this study, results showed that there was a problem of maintaining constant flow of ARVs and its associated test kits in some of the health facilities surveyed. Stock out period can be explained as the time during which medicines are not available in the store or to be dispensed to customers for a period of time. In this study it is time when medicines were not available for a period of one year surveyed.

Stock out of these supplies may be attributed as a result of poor quantification and forecasting done by unqualified health personnel, receiving amount of medicines which is not enough to be used for the period of time and receiving amount of medicines and medical supplies which are near to expiring time. A study done in Dar es salaam shows that there is a problem in maintaining inventory or stocks of medicines at the required level. In the three district hospitals about 20% of tracer medicines were out of stock at the time when this study was carried out (25). Stock out of ARVs puts patient health at high risk of increasing resistance due to non constant flow of medicines.

Stock out of test kits was high at Mundemu health center and this means proportion of checking HIV status will be low during stock out period.

The study reported record counts greater than physical count and record count smaller than physical count of ARVs and test kits from health facilities surveyed. These results were from Chipogoro, Kibakwe, Mpwapwa, Chamwino, Rudi and Handali health facilities. These kinds of result can be interpreted as a result of not frequently updating of records in the stores of health facilities. It can occur during issuing of medicines or when receiving medicines in

stores. Health staff are supposing to update records all the time they issue or receive medicines and medical supplies, so that physical stock present in the stores to be the same as the record in the ledger. This will minimize loss of medicines, and it will help to know the amount of medicines present in the stores and to know the amount of medicines which can be requested for future use. A similar study was done in Dar es salaam mentioned that, for Temeke hospital records showed that recorded balances were greater than physical count which means that recording of issues of supplies was very poor. One of the contributing factors was that there were many record books to be filled in such that a person issuing the medicines did not record directly on the bin card (25).

Assessment of storage conditions was done in stores of health facilities surveyed, results reported good conditions according to WHO requirements for storage of medicines and medical supplies, to all stores surveyed which were; storage of medicines in well dry place, medicines were stored away from water penetration and away from insecticides material and flammable solution.

Most of stores in health facilities showed to keep medicines on pallets and shelves, and also medicines were stored in manner of FEFO (first expire first out), so as to reduce the accumulation of expired medicines in the stores. Stores indicated separation of expired supplies and damaged products so as to avoid mixing of materials during issuing and to increase the space of stores so as to use it for other activities. Goods store keeping practices and eliminating accumulated clutter in stores will increase usable space in a distribution network with little cost. Because supplies move from higher to lower administrative levels, supervisory tasks can sometimes be combined with distribution tasks to have a multiple of tasks done at the same time for purposes of saving time and improving quality of health care (32).

The study discovered that, four facilities (36.4%) had working refrigerators which were monitored and had temperature control instrument for storage of medicines and test kits. Cold storage is crucial for maintaining of quality of medicines and medical supplies which require cold environment to maintain their standard quality. Also one facility had presence of fire extinguisher which was working properly and that is total of 9.1% of all facilities surveyed.

To operate an efficient supply chains, that will guarantee their customers a dependable supply of quality drugs and essential products, health and other organizations need reasonably accurate forecasting of future consumptions (32). When quantifying the amount of medicines required two methods are recommended, the consumption method and the morbidity method (23). The consumption method takes the average amounts of medicines consumed monthly as the basis for calculations. The morbidity method requires knowledge of disease pattern of the area which the health facility is serving and from that the incidence of common diseases, the expected attendances and standard treatment patterns are considered to estimate the needs (25).

On forecasting the quantity of ARVs and test kits required in the facility, consumption method is used during quantification. When dispensing ARVs to patients, consumption record is written in the dispensing register and the same for test kits when used are recorded in test kit consumption register.

The study assessed consumption amount recorded in the consumption register comparing it with the record written in the R&R ordering book for ordering of ARVs and test kits.

Results indicated that only MSD had an accurate amount of consumption record used for ordering ARVs, Determine and Unigold, MSD stores data using computer and all activities of issuing and receiving medicines are recorded in the computer system. The remaining facilities didn't have accurate consumption record of ARVs which was used in the R&R book. Seven facilities reported accurate consumption record amount of test kits, thus account for 63.63% of records of test kits in health facilities surveyed.

It can be seen that some facilities didn't count correctly their consumption amounts used to forecast future requirement of ARVs and test kits. These kinds of results can arise due to shortage of health personnel to record data and still working on providing health services to patients, it can also occur due to lack of knowledge on how to record data. Problems which can arise due to incorrect data of consumption amount used for ordering is quantifying amount of medicines which is not enough for the period of time and quantifying amount which is greater than the quantity required for the period of time.

Incorrect data brought about shortage of medicines and medical supplies and thus cause stock out of these products. Again accumulation of medicines can occur and if they are not fast moving items can lead to expiring and wastage of funds.

Logistics fulfills the six rights by delivering; the right products, in the right quantity, in the right condition, to the right place, at the right time, for the right cost (33).

To receive the right product at the right quantity is part of enhancing good supply chain system, when facilities request medicines and medical supplies they are supposing to receive them in the amount and type they requested.

This study assessed the amount requested by facilities to the high level so as to provide services to the customers. The results showed that only one health center received the right quantity of ARVs it requested for the time surveyed. MSD did not receive the amount requested in most of the time so it had 42.86% of ordering fulfillment. On assessment test kits were received as requested to some of health facilities surveyed but some of them also did not receive the amount they requested. In poor resources countries this problem may be caused by low amount of budget given to health sector thus causing few amount of medicines to be procured, it can also be caused by incorrect ordering of medicines as according to consumption which is needed and unavailability of required medicines in the MSD.

In Uganda a national level survey showed that supply of ARVs suffers both from oversupply and under supply (17).

According to the research finding which was done in 2007, only a quarter of facilities receive ARVs on a monthly basis, which is the required frequency for consumption report (18). Health facilities on the average reported one (1) month of stock out of testing kits per year 2005 (17).

From these results we can see that central MSD had low percentage of received amount of medicines and medical supplies as requested from headquarters. Thus because of few amount of medicines received MSD did not have the capacity to supply the amount requested to all facilities as they requested. On observation most of facilities received the amount which was low compared to the amount requested.

Demographic characteristics showed that, interviewed health personnel had age ranged from minimum of 22 years to maximum of 62 years. The median average year was 37 years.

Nurses took a big part of 42.4% of interviewers in the study, pharmaceutical personnel who included one pharmaceutical technician and two pharmaceutical assistants had 9.1%.

On assessment of knowledge level in this study, it showed that knowledge varies with each profession. Pharmaceutical personnel had showed to have only good knowledge level. This shows that on interviewed questioner pharmaceutical personnel had knowledge on quantifying ARVs and medical supplies, stock control and storage of medicines. Medical attendant reported to show most percent in poor knowledge level. On assessment p-value was found to be 0.022, which is less than 0.05. This means that, there is relation in the results obtained. Results showed that, those who are pharmaceutical personnel knew to quantify, to manage stocks and to store medicines in proper environment than those who are not pharmaceutical personnel.

A study done in Jordan reported some similar results of poor quantification, poor inventory record and improper recording practice (19).

On discussing results of age varies knowledge level, results showed no relationship, thus we can say that knowledge of these health workers did not relate on how old they are

These results also were reported in a study done in west and central Africa reported that, there are recurrent stock outs in health facilities mainly due to inadequate forecasting and inadequate information flow between stakeholders (34).

CONCLUSION

Government under the Ministry of Health and Social Welfare, in collaboration with other partners has tried to ensure constant availability of ARVs and test kits in health facilities.

But we can still see significant amount of stock out period, poor management of stock records, and poor storage condition in some of health facilities, poor ordering and quantification and ordering un fulfillment in some of medicines and medical supplies requested.

Stock out period was observed to some of the facilities, ARVs and test kits are very essential in affected people so as to provide good health status and decrease mortality ratio. So there is need to maintain constant flow of these supplies in facilities.

Poor management of stock records was also observed, this may cause loss of product in some of the areas due to theft and over or under stocking of materials in the stores without knowledge because of having records which do not correlate with the stock which is present. ARVs and its associated test kits need close monitoring because they are very expensive products.

It was also observed, storage places do lack working fire extinguishers and inadequate working cold storage in some of the facilities.

Stores need to be clean from dust and to have enough space for storage of forecasted medicines and medical supplies for the time needed, so there is need to improve storage conditions to the standard level so as to maintain the quality of supplies.

Poor forecasting was indicated because of incorrect consumption record count used for ordering. In order to have enough stock for saving customers, health personnel must know and use correct data for ordering. It was observed that the consumption data used for ordering did not correlate with the consumption amount used.

The study observed that, there was insufficient supply of amount of ARVs and test kits requested according to the orders. Central MSD did not receive the amount it requested from MSD headquarters thus central zonal did not have the capability to fulfill the requested amount required by the health facilities.

On assessment of knowledge of health personnel, results showed that, there was poor level of knowledge among health workers interviewed about quantification, stock control and storage of medicines. But some showed good and fair level.

RECOMMENDATION

MOHSW and its partners should increase on job training of health personnel who control and store medicines and medical supplies on stock record management, good storage condition and proper quantification of required medicines.

This will enhance good management of drugs and thus streamlines good supply chain system of ARVs and test kits

MOHSW should increase funds to MSD so that, the institution can buy and pay for all the requirements needed to provide constant flow of medicines and medical supplies.

MOHSW should provide facilities with refrigerators which are working and monitor temperature for drug storage. Fire extinguishers should be provided in each facility and to make sure that they are working and that health personnel have been trained on how to use them.

MOHSW should provide dispensing registers of ARVs and test kits, so that consumption can be recorded properly.

Supervision should be facilitated every time; this will maintain the health quality service.

MOHSW should develop health policy which enhance good SCMS and thus provide constant availability of medicines and medical supplies.

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Appendix 2: Storage Condition Tool

Name of facility

Date

Tick the correct answer.

1. Does the store have enough space to store all drugs and medical supplies forecasted for a period of time?
 - Yes **1**
 - No **2**
2. Is the store clean for dust and disinfectant?
 - Yes **1**
 - No **2**
3. Are the store supplies in a dry well list, well ventilated storeroom and out of direct sunlight?
 - Yes **1**
 - No **2**
4. Is the store secure from water penetration and theft? (Presence of ceiling, drainage system and locked doors and windows)
 - Yes **1**
 - No **2**
5. Does the store maintain cold storage, including a cold chain for commodities that require it?(a working refrigerator, a sensor to record changes of temperature and chart that they record temperature change)
 - Yes **1**
 - No **2**
6. Is there presence of pallets and shelves for storage of medicines and test kits?
 - Yes **1**
 - No **2**
7. Are supplies stored away from insecticides and other chemical materials?

- Yes **1**
 - No **2**
8. Are supplies stored in a manner accessible for FEFO, counting and general management?
- Yes **1**
 - No **2**
9. Does the store separate damaged or expired products immediately from daily used products?
- Yes **1**
 - No **2**
10. Does the store have working fire extinguisher and security alarm?
- Yes **1**
 - No **2**

Appendix 5: Questionnaires: Pharmacy Staff

Name of facility

Date

Profession

Age

1. If you attend training on quantification, storage conditions of medicines and stock control you will be competent on these areas.

- Agree
- Not sure
- Disagree

2. Write one method of supplying medicines which you know.

.....
.....

3. Which tools are used for record keeping and control of supplies in the stores? Name one tool.....

.....

4. Which forms are used to store medicines in the health stores? Mention one.

.....
.....

5. Storekeeper is supposing to update record of store every time she add/reduce product from the store.

- Agree
- Not sure
- Disagree

- 6. How many times do you have to do stock taking and to counter check your balance in the store?
- 7. Do you know there is specific time to order ARVs and HIV test kits in the year?
 - Agree
 - Not sure
 - Disagree
- 8. Participating on ordering of supplies is needed so as to have quantity needed
 - Agree
 - Not sure
 - Disagree
- 9. Why do we update records in the store?
.....
- 10. Where do we obtain the estimated quantity of ARVs and HIV test kits for ordering in the facility?
.....

From number 11-15 list the required conditions for storage of medicines and medical supplies you know.

- 11.
- 12.
- 13.
- 14.
- 15.

From number 16-20, list what is needed to maintain constant flow of ARVs and HIV test kits to the health facilities?

- 16.
- 17.
- 18.
- 19.
- 20.

Appendix 5: Consent Form

ASSESSMENT OF PERFORMANCES OF SUPPLY CHAINS MANAGEMENT SYSTEM
IN RELATION TO ARVs AND HIV TEST KITS IN DODOMA REGION, TANZANIA.

NAME OF INVESTIGATOR: LOINA, Deborah Steven

SPONSOR: MINISTRY OF HEALTH AND SOCIAL WELFARE

ADDRESS: MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

P.O BOX 65001,

DAR-ES SALAAM.

Identification number: _____

Introduction:

This consent form contains information about the research named above. In order to be sure that you are informed about being in this research, we are asking you to read or have this consent form read to you. You will also be asked to sign it or make a mark in front of the witness. You will be given a copy of this form. This consent form might contain some words that are unfamiliar to you. Please ask me to explain anything you might not understand.

Reason for research:

You are being asked to take part in this research that aims to assess performance of supply chain management system in relation to ARVs and HIV test kits in Dodoma region, how effective is supply chain system in management of ARVs and test kits in availability and records control.

General information and your part in research:

If you agree to be in this research you will be required to answer a series of questions in the questionnaires. The interview will be conducted at the health facility where you will be working. Therefore there will be no additional costs for travelling.

Risks:

We do not expect any harm to happen to you because of joining this study

Benefits:

Like all participants in the study, you will benefit from gaining more knowledge about how to participate in making the supply chain system of drugs and medical supplies to be working effectively. And the information you will provide us with will help to provide constant flow of drugs, of high quality, at the right time and at the amount which is required.

Taking part in this study is completely your choice. You can stop participating in this study at any time, even if you have already given your consent. Refusal to participate or withdrawal from the study will not involve penalty

Confidentiality:

All the information obtained from this study will be used for the research purpose only, and will not be shared to any one without the participant consent.

Who to contact:

If you have any questions about your rights as a participant, you may call Ms. LOINA, Deborah Steven (Tel: 0717-428448), or Dr. R. S. Malele, who are the coordinators of this study, MUHAS PO BOX 65001, Dar es Salaam. If you have any questions about your right as the participant you may contact Prof MAINEN MOSHI, Chairman of the College Research and Publications Committee, P.O Box 65001, Dar-es-salaam, Tel: 2150302-6.

Your right as participant:

This research has been reviewed and approved by the IRB of Muhimbili University of Health and Allied Sciences. An IRB is a committee that reviews research studies in order to help and protect participants.

KITENDEA KAZI CHA HALI YA UTUNZAJI

Jina la kituo

Tarehe

Weka alama ya v kwenye jibu sahihi

Je bohari ina nafasi ya kutosha kutunza dawa na vifaa tiba vyote vilivyokadiriwa kwa kipindi husika?

Ndio **1**Hapana **2**

Je bohari ni safi kutokana na vumbi na viua vijidudu

Ndio **1**Hapana **2**

Je bidhaa zimewekwa sehemu safi na kavu yenye mzunguko mzuri wa hewa na mbali na mwanga?

Ndio **1**Hapana **2**

Je bohari ipo salama kutokana na maji(mvua) na wezi?(uwepo wa dari, mfumo wa maji, milango na madirisha imara)

Ndio **1**Hapana **2**

Je bohari lina mfumo wa mnyororo baridi kwa bidhaa zinazohitajika (friji inayofanya kazi, kifaa cha kuhifadhi mabadiliko ya joto na je wanaweka kwenye chati taarifa hizo)?

Ndio **1**Hapana **2**

Je kuna chaga na rafu kwa ajili ya utunzaji wa dawa na vifaa tiba?

Ndio 1

Hapana 2

Je bidhaa zimeifadhiwa mbali na viatilifu na kemikali nyingine za sumu?

Ndio 1

Hapana 2

Je bidhaa zinatuzwa kurahisisha utunzaji na utoaji kwa FEFO , uhesabu na usimamizi kwa ujumla?

Ndio 1

Hapana 2

Je bohari limetenganisha bidhaa **zilizoharibika** au kuisha muda wa matumizi kutoka zile zinazotumika kila siku?

Ndio 1

Hapana 2

Je bohari lina mitungi ya kuzima moto inayofanya kazi na kengele za usalama

Ndio 1

Hapana 2

Appendix 6: Dodoso ya Wafanyakazi

Jina la kituo

Tarehe.....

Kazi yako

Umri.....

JIBU MASWALI KWA USAHIHI KULINGANA NA ULIVYOULIZWA

1. Kama umehudhuria mafunzo ya uagizaji dawa, utunzaji kmbukumbu za dawa na utunzaji dawa utakua na uwezo mzuri wa kumudu mambo haya.

- Nakubali
- Sina uhakika
- Sikubali

2. Andika aina moja ya ugavi unayoifahamu.
.....

3. Ni aina gani ya vifaa vinatumika kutunzia kumbukumbu za utunzaji dawa kwenye bohari.andika moja unayoifahamu.

.....
.....

4. Dawa zinaweza kupangwa na kutolewa kwenye bohari kwa mpangilio upi?

Taja moja.
.....

5. Mtunza bohari anatakiwa kuhuisha kumbukumbu za dawa kila anpotoa na kuongeza dawa kwenye bohari

- Nakubali
- Sina uhakika
- Sikubali

6. Ni mara ngapi unahitajika kuhakiki mali kama inaendana na maandishi kwenye kitabu cha kumbukumbu?

7. Inapasa ukagwe kumbukumbu za bohari kila mwisho wa mwezi, ili kuangalia kama zinaendana na mali iliyopo

- Nakubali
- Sina uhakika
- Sikubali

8. Kuna muda maalumu wa uagizaji dawa za ARVs na vifaa tiba, kulingana na mzunguko wa kila kituo

- Nakubali
- Sina uhakika
- Sikubali

9. Kwanini tunahuisha kumbukumbu za utunzaji mali kwenye bohari?

.....
.....

10. Ni wapi tunapata makadirio ya dawa za ARVs na vitendanishi?

.....
.....

Kuanzia namba 11-15 jibu ni mazingira yapi yanahitajika kutunzia dawa Kwenye bohari.

11.

12.

13.

14.

15.

Kuanzia namba 16-20, je unafikiria nini kifanyike ili dawa za ARVs na vitendanishi vipatikane muda wote katika vituo vya huduma?

16.

17.

18.

19.

20.

Appendix 7: Fomu ya Maridhiano ya Mshiriki

UTENDAJI/UBORA WA MFUMO WA KUAGIZA NA KUPATA VIFAA; DAWA NA VIFAA VYA KUPIMA VVU KWA MKOA WA DODOMA, TANZANIA.

Mtafiti mkuu: LOINA, Deborah Steven

Mfadhiri: MINISTRY OF HEALTH AND SOCIAL WELFARE

Anwani: MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

S. L. P 65001,

DAR-ES SALAAM.

Namba ya utambulishi: _____

Tafadhari soma fomu hii kwa umakini kabla ya kuweka sahih yako. Kama kuna neno au kipengele chochote ndani ya fomu hii ambacho haujachielewa na unahitaji maelezo zaidi, tafadhari tuulize.

Ushiriki katika utafiti huu ni wa hiari na mshiriki ana uhuru wa kujitoa katika ushiriki muda wowote katika kipindi cha utafiti, hasa baada ya kusaini fomu ya ushiriki. Hakuna adhabu yeyote itayoambatana na kujitoa au kukataa kushiriki.

Malengo ya utafiti huu:

Malengo ya utafiti huu ni kuhakiki utendaji na ubora wa mfumo wa uagizaji, upatikanaji na utunzaji wa vifaa tiba hasa kwa kuangalia dawa za VVU na vifaa vya kupima VVU katika mkoa wa Dodoma.

Madhara yatonayo na ushiriki:

Hakuna madhara yeyote yatokanayo na ushiriki katika utafiti huu.

Faida za ushiriki:

Hakuna faida za moja kwa moja zitokanazo na ushiriki katika utafiti huu. Lakini matokeo ya utafiti huu yanaweza kuchangia katika kuboresha mfumo wa uagizaji na upatikanaji wa vifaa tiba hasa kwa dawa na vipimo vya VVU.

Usiri:

Taarifa zote zitakazokusanywa katika utafiti ni siri na zitatumika kwa matumizi ya utafiti tu.

Kwa mawasiliano

Kama una maswali yoyote kuhusiana na haki zako kama mshiriki wa utafiti huu, unaweza kuwasiliana na D.Loina simu 0717 428448 au Dr.R.S.Malele, ambaye ni mratibu wa utafiti huu MUHAS Dar es salaam. Pia waweza kuwasiliana na Prof Mainen Moshi, mwenyekiti wa kamati ya utafiti na uchapishaji, S.L.P 65001, Dar es salaam Tanzania.

Haki zako kama mshiriki

Utafiti huu umepitiwa na kuidhinishwa na bodi ya uidhinishaji ya Chuo Kikuu cha Sayansi za Tiba Muhimbili. Hii ni kamati ambayo inapitia kazi zote kabla ya kuidhinishwa ili kuwasaidia na kuwalinda washiriki.

Sahihi

Miminimesoma maelezo yote ya kwenye fomu hii, maswali yangu yamejibiwa, nimekubali kushiriki katika utafiti huu .

Sahihi ya mshiriki.....tarehe