

ADDIS ABABA UNIVERSITY

SCHOOL OF COMMERCE

**DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN
MANAGEMENT**



**ASSESSMENT OF SUPPLY CHAINS OF PHARMACEUTICAL AND
MEDICAL COMMODITIES FOR ANTI TB AND HIV/AIDS: IN THE
CASE OF PUBLIC AND PRIVATE HOSPITALS IN ADDIS ABABA**

BY

SEBLEWORK TEKLEHAYMANOT

A THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY SCHOOL OF COMMERCE IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF
ARTS DEGREE IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT

June, 2018

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**Assessment of Supply chains of Pharmaceutical and Medical Commodities for anti TB and
HIV/AIDS: in the Case of Public and Private Hospitals in Addis Ababa**

BY

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DECLARATION

I the undersigned, hereby declare that the work which is presented in this thesis entitled **“Assessment of Supply chains of Pharmaceutical and Medical Commodities for anti TB and HIV/AIDS: in the Case of Public and Private Hospitals in Addis Ababa”** is the original work of my own effort and done under the guidance of Matiwos Ensermu (Phd), and that all the sources of materials used for the study have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other university for the purpose of earning any degree.

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Abstract

Managing Anti-Retroviral & Anti-Tuberculosis pharmaceuticals and related commodities properly is crucial, to enhance smooth commodities flow and prevent frequent stock out of critical items which might hindering the program impact on the public. Anti-Retroviral & Anti-Tuberculosis drugs has been a unique challenge given that HIV treatment requires lifelong therapy and few or no substitution can be made if stock out occurs or if drug resistance happens due to treatment failure or missed opportunities for diagnosis as result of sock outs Hence, poor supply chain and logistics management of these items implies loss of significant resources. The general objective of this study is to assess the supply chain of pharmaceuticals and related commodities for HIV/AIDS and Anti-TB drugs in public and private hospitals of Addis Ababa. A facility based descriptive Survey design was used by using both quantitative and qualitative data collection techniques. A stratified random sampling method was in place to create different strata according to their type of facility. The quantitative data was entered and analyzed by using SPSS version 20 and excel 2016. The qualitative data was analyzed thematically. Descriptive statistics was used to compute frequencies and cross tabulation results. The finding of the study shows on average a normal order takes less than two weeks in 75% of the facilities. 75 % of the assessed hospitals have placed emergency order 1 or more time and 50% of them are through RRF. Stock out rate is high for cotrimoxazole 240mg/5 ml suspension followed by Lamivudine + Tenofovir (300 mg+300mg) tablet. It is also observed that stock out is high for Nevirapine 10mg/5ml suspension and INH pediatric dose. Expiry is high among ARV drugs handled by the Hospital, three types namely Efavirenz 600 mg caps, Lamivudine + Tenofovir 300mg + 300mg and Nevirapine 10mg/ml oral suspn. Availability of bin cards and RRF was confirmed in all hospitals but 87.5% of hospitals reported availability of IFRR. All of the facilities have engaged in inter facility overstocked item transfer, redistribution of near expiry pharmaceuticals and related health commodities. Most storage guidelines are fulfilled, among 17 storage guidelines assessed 12 guidelines are fulfilled by 75% and above of the hospitals.

Key words: - Pharmaceuticals and medical supplies, Supply chain

CHAPTER ONE

1. Introduction

1.1 Background of the study

Ethiopia is Africa's second most populous and rural country with high incidence of communicable diseases including tuberculosis (TB) and HIV/AIDS. (USAID,2012) The synergy between TB and HIV/AIDS is strong. In high HIV prevalence populations, TB is a leading cause of morbidity and mortality, and HIV is fueling the tuberculosis epidemic in Ethiopia. World Health Organization recommended package of collaborative TB/HIV activities to reduce the burden of TB/HIV includes HIV testing for TB patients. The latest estimates indicate that there were 8.6 million new TB cases and 1.3 million TB deaths in 2012. Short-course regimens of first-line drugs can cure around 90% of cases, if the right treatment with recommended quality of care is provided. (Gebrekidan, G. *et al.*2014)

While the government is committed to universal access to health care, there are severe restrictions, including unreliable supply chains, limited availability of trained health care personnel and poorly developed health systems. (USAID,2012)

The importance of having medicines and other supplies available at the health facility cannot be overstated, and their availability often depends on how well or how poorly the supply chain is performing. But, to improve supply chain performance, understanding how it is currently performing, e.g., it needs to be measured. Showing that where the supply chain is inefficient and will help to determine how to address these deficiencies. (Aronovich, et al., 2010)

Providing complete and acceptable health care services requires availability of safe, effective and acceptable drugs and pharmaceutical items with the right quality, right quantity and for the right patient/client at all times. Ethiopia pharmaceutical and related commodity supply chain management system had several problems like non-availability, unaffordability, poor storage and stock management and irrational use. PFSA became established and empowered to reorganization

and consolidation of logistics functions (i.e., central procurement, storage, distribution, LMIS, and inventory control. (PFSA,2015)

Since drugs and other Pharmaceutical items covers up to 40 % of the countries health care budget, proper logistics management of these items in the supply chain system is indispensable as poor management will lead to stock outs and shortage of items that would prevent access to medicines and poor health outcomes. In addition, poor management of these items may lead to overstock and wastage of items that will lead to health hazard and wastage of limited resources. (Management Science for Health,2015)

Logistics activities as the operational component of supply chain management, including quantification, procurement, inventory management, transportation and fleet management, and data collection and reporting. These components are in a continuous cycle where all components are interconnected, so decisions made at a single point directly impact other parts of the cycle. Supply chain management includes the logistics activities plus the coordination and collaboration of staff, levels, and related functions. Health logistics system is responsible to ensure every customer able to obtain and use quality health supplies.(USAID/DELIVER Project,.2011)

However developing a supply chain that can manage thousands of different and quality health commodities required to provide a comprehensive range of HIV/AIDS & TB related services can be challenging. (Tilahun A, et al., 2016)

Ethiopia has number of health intervention programs that requires efficient supply chain systems. In 2004 national assessment of the existing public health pharmaceutical supply system identified a number of challenges in the supply chain of health commodities. Hence Integrated Pharmaceutical Logistic System (IPLS) is the primary mechanism through which all public health facilities obtain essential and vital pharmaceuticals by fulfilling the six rights of logistics system through implementing effective, efficient and simple system . (PFSA,2015)

Logistics Management Information System (LMIS), inventory control system and storage of pharmaceutical are the main component of IPLS at facility level. Each component (sub- system) has its own indicators of measurement; thus supply chain for pharmaceuticals and related health

commodities can be measured through those different indicators of the sub systems. These indicators can also be used to check for leakage in the system, track timeliness in updating bin card records, and determine the extent to which facility complete and submit LMIS reports . (Tilahun A. et al., 2016)

HIV/AIDs pharmaceuticals and supplies were distributed by the PFSA distribution networks through PFSA central, PFSA Hubs and then to health facilities using monthly LMIS reports. With the introduction of IPLS, PFSA worked to establish an integrated health commodity supply chain that would include all health program commodities, and would connect all levels with accurate and timely data for decision making. The IPLS integrates the management of essential pharmaceuticals including pharmaceuticals that were used to be managed vertically: HIV/AIDS, Malaria, TB and Leprosy, EPI, MCH and purchased essential drugs. It is the primary mechanism through which all facilities obtain essential and vital pharmaceuticals. IPLS also standardizes and streamlines inventory management and LMIS to improve availability of essential medicines in health facilities. The SOP manual for the management of pharmaceuticals in public health facilities of the country has been developed to simplify and standardize the work required for the logistics management of pharmaceuticals used in public health facilities. It also serves as a reference for pharmacy and program staff and service providers in facilities supplied by PFSA and for the administrative units that provide management and supervisory support. The SOPs mainly focuses on the inventory control management, Logistics Management Information System and storage of pharmaceuticals in health facilities. (PFSA, 2014)

The role of the private sector in expanding access to priority health services has received considerable attention in Ethiopia. (Andualem W, et al. 2008) The private sector is a key partner to the government in the provision of health services to the public. PFSA also supplies pharmaceutical and related commodities to ART and anti TB service delivering private health facilities sites based on an approved plan; Like many countries, ensuring a continual supply of drugs is essential to maintaining quality care in both the public and private sectors. (USAID, 2012)

1.2 Statement of the problem

TB has become a major public health problem globally, there is a need to expand laboratory diagnosis services with well-functioning logistic system to address the challenges posed by the epidemic of HIV/AIDS, and the emergence of multidrug resistant (MDR) and extensively drug-resistant (XDR)TB. People with HIV infection need comprehensive services along a continuum from the point of infection through testing, treatment, monitoring and palliative care. Underdiagnoses and misdiagnosis of infectious diseases including HIV resulting from a lack of laboratory testing with quality laboratory commodities, can lead to incorrect prescribing of treatment, wastage of resources, and poor patient clinical management. (Tilahun A, et al., 2016)

Good supply chain helps to reduce stock outs, delay in delivery, drug expiry, also improves product availability by ensuring continuous supply of ARV and Anti-TB drugs and hence better service of treatment for HIV/AIDS and TB patients. (PFSA,2014 & USAID,2006)

Unless gaps and challenges of the supply chain are assessed, and appropriate measures are taken, all the consequences of poor supply chain such as stock outs, delay in delivery, drug expiry and wastage of finance and resources will result with ultimate negative impacts of poor health of the community. Such consequences are extremely severe especially when it comes to ARV drugs supply and Anti TB drug supply chain management as these items are lifesaving and lifelong treatments for people living with HIV/AIDS and don't need interrupted course of treatment for TB patients so as to prevent drug resistant TB ,i.e the negative consequences of poor supply chain for these items will result to treatment failure due to missed dose, developments of resistant strains of the virus, quick deterioration of health and death of patients.(Sisay A,2017)

Therefore, focusing entirely on ARV and Anti-TB drug , this study will try to assess the supply chain management of pharmaceuticals and related commodities for ARV and Anti –TB in private and Public hospitals in Addis Ababa using relevant indicators that help to measure logistic system performance (like tracer product availability, resupply period length, emergency order status and presence of stock out and expiry), proper use and functioning of the three components of supply chain management cycle which are the Logistic Management Information System, the

Inventory Control System and the Storage System . Therefore, focusing on the Anti-Retroviral (ARV) and Anti TB drugs supply chain management, doing this research on assessment of supply chain of pharmaceuticals and related health commodities for Anti-Retroviral (ARV) and Anti TB in the case of public and private hospitals in Addis Ababa is important to investigate bottle necks and challenges to its proper implementation of supply chain components at hospital level inclusive of the private sector, as well as in investigating, identifying further ingredients to its success by taking necessary and quick interventions.

1.3 Research Question

This study is to answer the following questions

1. which the logistic system performance measures are met in management of ARV drugs and Anti-TB drugs and related commodities within public and Private hospital in Addis Ababa
2. What Logistic management information system tools available and used in the management of ARV drugs and Anti-TB drugs and related commodities within public and Private hospital in Addis Ababa
3. What inventory management practices are there for the management of ARV drugs and Anti-TB drugs and related commodities within public and Private hospital in Addis Ababa
4. Which storage condition are fulfilled for ARV drugs and Anti-TB drugs and related commodities management in public and Private hospital in Addis Ababa.

1.4 Research objective

1.4.1 General objective

The general objective of this study is to assess the supply chain of pharmaceuticals and related commodities for HIV/AIDS and Anti–TB drugs in public and private hospitals of Addis Ababa.

1.4.2 Specific objectives

- ❖ To assess the logistic system performance of the supply chain for ARV drugs and Anti- TB drugs and related commodities within public and Private hospital in Addis Ababa
- ❖ To assess Logistic management information system in the management of ARV drugs and Anti-TB drugs and related commodities within public and Private hospital in Addis Ababa
- ❖ To assess inventory management ARV drugs and Anti-TB drugs and related commodities within public and Private hospital in Addis Ababa
- ❖ To assess storage condition for ARV drugs and Anti-TB drugs and related commodities within public and Private hospital in Addis Ababa.

1.5 Significance of the study

In health care, ensuring that there are adequate drugs and supplies especially ARV drugs for every patient is paramount as partial or interrupted treatment can lead to less than optimal results (USAID/DELIVER,2014)

Most importantly, the issue of absence of continuous and uninterrupted supply of ARV drugs in the right quality, quantity, from the right sources and at the right time is extremely critical and will result dire consequences such as treatment failure, drug resistance, deterioration of health status of the patient and subsequent death.(Osewe P, et al.2005) To avoid such severe consequences, improves quality of life and prolong their life, successfully supply chain for ARV and Anti –TB drugs supply in health facilities is so critical and indispensable. (USAID/DELIVER,2009)

Managing supply chains for these commodities is a unique challenge given that HIV treatment requires lifelong therapy with adherence rates above 95 percent, and that few or no substitutions can be made for many commodities if a stockout occurs. Since stock outs at health facilities can result in treatment interruption that can quickly lead to viral resistance or missed opportunities for diagnosis, the global community has invested significant resources for procuring and managing the supply of HIV and AIDS commodities. Disruption of the flow of drug supplies to private sector hospitals and clinics continues to be a problem. Thus, it needs effectively requesting and securing drugs well in advance of any potential stock-outs. (USAID/DELIVER,2009)

Hence, this study will help us to assess in detail how supply chain is being implemented for the supply drugs public and private Hospitals so that areas of strengths can be identified and reinforced for further improvements and bottle-necks and gaps that challenges sustainable availability of ARV and anti TB products in the hospitals can be sorted out for corrections, amendments and necessary actions to promote effective and efficient supply of drugs especially ARV and anti TB drugs can be realized to save the life of PLHIV. In addition, this study will contribute in academics & training by providing important insights to learners and trainees on strength and weakness of supply chain for ARVs and Anti-TB, gaps & challenges of the supply chain at facility level and gives insight on what actions that should be taken to enable the supply chain delivers sustainable supply system.

Finally, since there are no enough studies done both in public and private health sector in the area, this study is believed to provide a comprehensive starting point and will help as a source of information for future research that is aimed to go in-depth to the subject matter and also for any study that is aimed to assess supply chain of ARV and Anti TB pharmaceuticals and related or to sort out any other challenges related to these has not been identified in this study.

1.6 Scope of the Study

This study will focus on assessing the supply chain of pharmaceuticals and related health commodities for HIV/AIDS and Anti-TB in the case of public and private hospitals. Because of the wide nature of the subject of supply chain for different health program as well as and because the large number of patients treated in private and public hospitals, the scope of the study is limited in assessing the supply chain of pharmaceuticals and related health commodities for HIV/AIDS and Anti-TB in the case of public and private hospitals of Addis Ababa City.

1.7 Limitation of the study

- ✓ The didn't include all the components of supply chain management done at higher level like selection, quantification and procurement , the study mainly focused on supply chain components implemented in the hospital level like inventory management, storage and LMIS.

- ✓ The study did not include all stakeholders in the supply chain like PFSA, AACAHB and donors. The study was done only in Hospitals found in Addis Ababa .
- ✓ Lack of similar studies especially in private hospitals of Ethiopia in the assessment of supply chain related

1.8 Definition of terms

Acceptable storage practice: - The extent to which the Hospital store fulfils at least 80% of the storage requirement as per the set storage guideline.

Availability of LMIS tools: Presence of different tools such as IRRF, IFFR, bin cards and stock cards which are important for reporting and recording data related to drugs supply and distribution. These tools are important for successful operation and implementation of LMIS.

Logistics Management Information System (LMIS): is a system that generates basic logistics information, which is needed to make logistics decisions

Proper use of LMIS tools: correct and timely recoding and reporting of drugs supply and distribution data using the LMIS tools. **Commodities:-** are include reagents and test kits, laboratory equipment and supplies, condoms, and other medical supplies and equipment such as specimen collection tools

Product Availability:- the amount of stock on hand at the time of visit

Stock out on the day of the visit:- was defined as not having any available stock on the day that the data collector arrived

1.9 Organization of the study

This study is organized in the following five major chapters.

Chapter 1 presents general introduction to the thesis which begins with providing back ground information on the overall concept of supply chain followed by describing other components of

the chapter such as statement of the problem, research question, objectives, significance, and limitation of the study. **Chapter 2** presents a review of relevant literatures related to the subject matter supply chain of ARV and Anti TB pharmaceuticals and related commodities including different empirical studies as well as conceptual fram work of the study. **Chapter 3** presents the methodology used in conducting the research. **Chapter 4** presents the result (findings) and discussions part of the research work based on the analysis done. Finally, **Chapter 5** presents summary of findings , conclusion and recommendations part of the research work.

CHAPTER TWO

2. Review of Related Literatures

2.1 Introduction

This chapter reviews relevant literature on the key areas that the study covers. This chapter presents the theoretical underpinnings of the study. With a focus on the objectives and theoretical thresholds of this study, the chapter reviews related and contemporary literature on the assessment of supply chain ARV and anti TB drugs and related commodities. The chapter examines various research studies and reports done locally (Ethiopia), regionally (Africa).

2.2 Theoretical Review

2.2.1 Importance of effective supply chain in program success

The goal of a health logistics system is much larger than simply making sure a product gets where it needs to go. Ultimately, the goal of every public health logistics system is to help ensure that every customer has commodity security. Commodity security exists when every person is able to obtain and use quality essential health supplies whenever he or she needs them. A properly functioning supply chain is a critical part of ensuring commodity security. Effective supply chains not only help ensure commodity security, they also help determine the success or failure of any public health program. Both in business and in the public sector, decision makers increasingly direct their attention to improving supply chains, because logistics improvements bring important, quantifiable benefits. Well-functioning supply chains benefit public health programs in important ways by increasing program impact enhancing quality of care and improving cost effectiveness and efficiency. So, Logistics increases program impact. If a logistics system provides a reliable supply of commodities, more people are likely to use health services. Customers feel more confident about the health program when they have a constant supply of commodities, it motivates them to seek and use services. (USAID/DELIVER, 2011)

2.2.2 Overview of logistic and supply chain management in health facilities of Ethiopia.

Currently Ethiopia in the era of integrated pharmaceutical logistic system i.e the IPLS where the implementation was given by proclamation to PFSA. Accordingly, Hospitals order different program drugs including ARVs and Anti TB drugs and related commodities , every two months using and LMIS tool called RRF that is used to report previous consumption while at the same time requesting to refill for the next two months consumption for the Hospitals. PFSA after reviewing the RRF sent by the Hospitals will directly refill items requested by the Hospitals. The decision to refill by PFSA with the required quantity as requested by the hospital and with the expected re-supply period depends on the timely submission of the RRF report with good quality of logistic data i.e three essential logistic data items must be reported through the system so that PFSA can easily decide for next time resupply. These three essential data items are such previous period consumption, stock on hand at the time of report, loss/adjustment. Based on this the facility calculate and request for next period refill i.e by calculating maximum stock level, quantity needed to reach maximum. In addition to this considering stock out day if there is any in calculating maximum stock quantity have great impact on order quantity calculation. Once PFSA received good quality and timely LMIS data, this data will help the PFSA to prepare for future logistic management decision such as in forecasting the future demand and procuring the items so that it can have sufficient stock in the future to provide uninterrupted supply of program drugs to health facilities like hospitals and health centers. (PFSA 2015, & Sisay A,2017)

In order to enable hospitals have successful supply chain for ARVs and Anti-TB , all of its three components/ functions of logistic management should successfully be in place with all requirements of quality, availability and functionality as briefly described below.

A. Logistics Management Information System (LMIS).

The purpose of Logistics Management Information System (LMIS) is to collect, organize, and report information to other levels in the system in order to make important logistic management decisions which govern the logistic system and ensure that all the six rights are fulfilled for each

patient. Important LMIS tools (recording and reporting tools) such as Bin Cards, Stock Cards, Internal Facility Report and Resupply Forms (IFRR), and Report and Requisition Forms (RRF) should always be available as blank forms in the facility for use, and should also be used timely and accurately to record and report quality LMIS data. Proper, timely and accurate use of LMIS tools helps to well organized LMIS data that would help to make logistic management decisions at higher level like PFSA for timely resupply and appropriate refill of pharmaceuticals when requested by lower level facilities like Hospitals. (PFSA 2015, & Sisay A,2017)

B. Inventory Control System in IPLS.

The purpose of an inventory control system is to inform personnel when and how much of pharmaceutical items to order so that appropriate stock level of every items can be maintained

each time to meet the needs of patients. A well designed and well functioned inventory control system helps to prevent shortages, stock outs, over supply, and expiry of pharmaceuticals which all are the ultimate goals of successfully supply chain system. A well functioned inventory control system can be realized by maintaining adequate stock levels of each items by analyzing timely collected and good quality LMIS data. In addition to preventing stock outs (ensuring stock availability), preventing expiry, over stock and wastage of pharmaceuticals, a well-functioning inventory control system will reduce frequent emergency orders that would happen due to understock of items below the expected minimum levels of stock. (PFSA 2015,& Sisay A,2017)

C. Storage of pharmaceuticals

Storing is the safe keeping of drugs to avoid damage, expiry, and theft so that items stored can remain useful throughout their shelf life. Poor storage condition will affect the quality of pharmaceuticals being stored i.e if the recommended storage condition by the manufacturer is not kept drugs and supplies may expire before the meant expiry date printed . Rooms that are too hot, stacks of carton that are too high, and other poor storage condition can cause damage or deterioration of the pharmaceutical product that would contribute for reduction of shelf life.

A well-organized store will keep items safe, help simplify the facility's work and reduces time wastage in trying to find needed items. Health facility pharmacy store improvement is one of the IPLS related pharmaceuticals management initiatives which includes having a well-organized and well spacious store room that contains all the required storage facilities and adhering to the good pharmaceutical storage guidelines & practices.(MSH,2015 & USAID ,2006)

2.2.3 Overview of Private facilities supply system in Ethiopia

The national design for the flow of pharmaceuticals and information in the IPLS doesn't accommodate Private facilities involved in key public health services including ART and TB care and treatment as it basically designed for public setting. Currently program commodities available in private facilities in a mixed approach which varies from region to region and even with in a region from zone to zone and different woreda. In addition to this existing IPLS SOP manual lacks clarity in inclusion of private health facilities in accessing program commodities and monitoring of pharmaceutical services. In May 2017 PFSA included the private facilities in IPLS SOP by preparing addendum. PFSA believes that this supplement for the new national approach on management of supply chain system of public health commodities has to address the need of private facilities involved in provision of public health services in a comprehensive way in order to have a complete national design for flow of pharmaceutical and information. Due to the absence of formal guiding document for supply linkage to private health facilities before the addendum, medicine and supplies required for public health program services in private facility are provided from different government bodies at different levels including regional health bureaus, Zonal health office, woreda health offices Town health offices and PFSA branches.

Due to formal guiding document, the supply system of program commodities in private facilities is not clear and well established, this has created several challenges including stock-outs, supply interruption, excess stock as well as near expiry and unwanted commodities. (PFSA,2017)

2.3 Empirical Review

2.3.1 Supply chain management of HIV/AIDS and TB commodities in Africa

In 2009 in Malawi supply chain assessment conducted in selected facilities showed that the system result in inefficiency, Observation of the stock cards during the field visits showed that many were not kept up-to-date or well-maintained. Supplies were overstocks, stock outs, and waste of resources 60%, 20% and 8% of the district-level laboratories were stocked out of Chemistry, hematology reagents and HIV test reagents respectively on the day of the visit. (Butao D, et al., 2009)

Another study conducted in Malawi on Antiretroviral drug supply challenges in the era of scaling up ART revealed that even though number of people receiving antiretroviral treatment (ART) has increased considerably in recent years and is expected to continue to grow in the coming years, a major challenge is to maintain uninterrupted supplies of antiretroviral (ARV) drugs and prevent stock outs. Managing supplies through a parallel system has the advantage that weaknesses in the national system have limited influence on the ARV procurement and supply chain management system. However, as the current system operates without a central warehouse and national buffer stock capacity, it diminishes the ability to prevent ARV stock outs. The process of ordering ARVs, from the time that estimates are made to the arrival of supplies in health facilities, takes approximately one year. Addressing the challenges involved in maintaining ARVs through an efficient procurement and supply chain management system that prevents ARV stock outs through the establishment of a dedicated procurement team, a central warehouse and/or national buffer stock is a priority. (Erik J Schouten et al., 2011)

Qualitative and quantitative baseline survey was conducted in Ghana Laboratory Logistics System showed that 60% of the facilities were fully stocked on the day of the visit, 83.3% the facility store follow first-to-expire, first-out (FEFO) principles and Expired products were typically separated from usable supplies. (Kwei N, et al., 2006)

Studies conducted in Botswana to assess the status of supply chain system showed that the current laboratory system is the consistent interruption of testing services resulting from unplanned

activities, reagents stock outs and expiries, excessive emergency order situations that interrupts the supply plan and lack of documented procedures was also identified, the occurrences of stock-outs is an important indicator of poor inventory management, stock outs of reagents and supplies translate into the inability of a laboratory to perform tests . (Andersson and Marasi ,2009)

A study conducted in Uganda on assessing Supply Chains for HIV/AIDS Commodities laboratory services for HIV and TB were not widely available and often lacked key commodities, while at the same time, the country worked to scale up HIV testing, ART, TB, and other infectious disease services, all requiring laboratory facilities. A health facility survey was conducted in June 2002 and looked at the availability of HIV/AIDS prevention, treatment, and care services and commodities. this survey identified certain supply chain deficiencies that affected the availability and the quality of laboratory services in the country. Many laboratories experienced frequent stock-outs of key commodities, and many staff members had not been trained to use the necessary laboratory equipment and materials.(Aronovich,2006)

Another study conducted on Scaling up antiretroviral therapy in Uganda using supply chain management to appraise health systems strengthening indicates that at Iganga District ARV shortages affected all ART providing facilities with considerable fluctuations regarding capacities to take up new patients. ARVs were available at 83%, diagnostic kits at 70% and pediatrics ARVs at less than half of the health facilities surveyed. Switches to more complex and different drug regimens were frequent to avoid treatment interruptions. Strategies to cope with stock-outs included lending and borrowing among facilities, duo-therapy, late initiation of ART for new patients and treatment interruption. ARV regimens from ten different manufacturers were found. Health workers reported insufficient knowledge regarding safe drug substitution and a general lack of guidance to deal with shortages of ARVs. They faced difficulties in forecasting needs given the lack of data. District medical officers (DMO) were bypassed as facilities communicated directly with the NMS. Lack of feedback from the NMS on placed orders further reduced their capacity to address potential bottlenecks.

National level surveys substantiate that provision of ARVs suffers from both over and undersupply. According to findings from 2007 only a quarter of facilities receive ARVs on a

monthly basis, which is the required frequency for consumption reporting . At the same time USD 0.5 million of ARVs are reported to have expired in 2005 . In 2008 the estimated expired value was in the range of USD 1.3 - 2 million . 58% of government facilities reported holding expired ARVs, compared to 29% of NGO facilities . Test kits, prophylactic treatment and pediatrics ARVs are especially affected by short supply. According to a health facility survey in 2005 fewer than 25% of facilities were maintaining adequate stock levels on Nevirapine, HIV test kits, and antibiotics to treat opportunistic infections (OI) and sexually transmitted infections (STIs) . Health facilities on average reported 1 month of Stock-outs of testing kits per year in 2005 . Undersupply of test kits was mainly caused by unexpected supply disruptions from two donors and resulted in rationing with a focus on preventing mother-to-child transmission (PMTCT) clients instead of the general population. Findings from 2008 suggest that some facilities faced shortages over several months. Only about 15% of patients in need could be tested as a consequence.(Richard W.,2011)

A report on Sub Saharan Africa ARV drug and HIV testing states in 2014, UNAIDS announced bold new targets for the global response to HIV, aptly named the 90-90-90 strategy, that 90% of people living with HIV (PLHIV) know their status, 90% of diagnosed PLHIV are on treatment and 90% of PLHIV on treatment achieve an undetectable viral load, by 2020. Each “90” poses specific challenges due largely to already strained infrastructure, but also opportunities for innovation, particularly in sub-Saharan Africa which accounts for over 70% of persons living with HIV. As regards the first 90, at most 50% of infected persons currently know their status, globally, despite few strains in the global supply chain for testing commodities, and many community actors keen to bring testing to their neighbor’s. The second 90 poses the greatest challenge with estimates that, to support over 28 million on treatment in sub-Saharan Africa alone, means delivering 30 containers of medicines across Africa each day, every day (Iain Barton, personal communication). Lessons to tackle this huge logistical challenge in the most affected countries can be taken from commercial sector supply chains. The final 90 is already changing with efforts to bring viral load (VL) monitoring to countries that currently rely on a symptom driven approach or CD4 testing to gauge the treatment progress. (David and Scott,2016)

A study conducted in Lesotho showed that only 17 % of Hospitals had SOP for medicine supply management system and only 53 % of facilities had stock record cards to keep stock record of

reagents. And none of the facilities had a practice of separating damaged or expired items from usable ones which is one of a sign of poor storage management. In addition the study showed that there is poor management and supervision in logistics management issues. Most facilities were found to have over 80 percent of basic ARVs in stock, although inventory management continues to be a problem. This situation is due largely to a lack of or insufficient supervision which, in turn, is caused by low staffing levels. Logistics is a serious problem in the laboratory services, with no logistics management information system (LMIS) in place and few of the laboratories using stock cards. The placing of orders was found to be erratic and inconsistent and less than 50 percent of the laboratories sent stock reports to the district or central levels. The laboratories were generally well-stocked and had service contracts with suppliers, but infrastructure can be improved. (Pharasi B, 2007)

In 2010 in Dominican Republic Assessments revealed that fragmentation of the pharmaceutical system contributed to stock-outs and expiration of antiretroviral (ARVs) and other medicines and supplies used by disease control programs (DCPs). The implementation of an integrated system was proposed as the most efficient and sustainable alternative to confront the HIV/AIDS pharmaceutical supply problems. Since 2011, the MoH with the support of USAID partners is integrating vertical DCP systems—including Tuberculosis and HIV/AIDS—into a single pharmaceutical management system. As a result of different interventions in 2014 and 2015, the availability of ARVs has increased from 40% to a 97% in health facilities. (Valdez, Barillas and Espinoza, 2010)

According to a cross sectional study conducted in Zimbabwe public health facilities on HIV/AIDS commodities logistic system assessment, found a high stock out rate for all HIV/AIDS commodities, including antiretroviral (ARV) drugs. In addition, the commodities had been out of stock for long periods during the previous six months. However, there was 100 percent availability of complete first-line ARV regimen on the day of visit. A significant number of facilities were stocked out of Nevirapine and rapid HIV test kits, on the day of the visit. Expired stocks of Nevirapine were also found at some facilities on the day of visit. The team also found a very high stockout rate of cotrimoxazole during the period under review and on the day of visit. On average, those facilities with cotrimoxazole in stock had very low stock levels. The lead time¹ for delivery

of essential drugs was reported to be very long, but the lead time for antiretroviral drugs (ARVs) and prevention of mother-to-child transmission (PMTCT) commodities was often less than one month. There were no standard logistics management forms for the national ARV program. Except for PMTCT, existing logistics management tools do not capture the three essential data items (stock on hand, consumption, and losses and adjustments). Available logistics data were also found to be inaccurate. Most PMTCT sites received formal training on ordering and reporting, but most of the ART facilities did not receive logistics training. It was also noted that fewer than half the surveyed facilities reported receiving logistics training for essential drugs management. The lack of frequent logistics supervisory visits was noted as well.(Jabulani N, et al ,2005)

A national health commodity survey conducted in Rwanda showed that 39% and 42% of the laboratory were stock-outs of HIV test kits & reagents respectively during the past six months of before surveyed, when a key informant interview conducted in one referral level laboratory experienced frequent shortages because of bureaucratic procedures, although some laboratories surveyed had excellent inventory management systems that included separation of like items in storage areas, bin cards for each storage item, and up-to-date records on movement of stock, other laboratories had partial or nonfunctioning inventory management systems .(Lijdsman C, et al.,2003)

A study in supply chain of PMTCT commodities in Cameroon shows a reliable supply of medicines to SDPs is ensured. However, for PMTCT and ART commodities, distribution to the SDPs was unreliable (in 2013, 40% of prescriptions remained unfilled). (Nfor E., et al.,2015)

In depth assessment of supply management system in Tanzania conducted in 2008 showed that of the twenty tracer items it was found about 50% were out of stock for a period ranging from 1- 120 days, Also 78% of the respondents affirm that very minimal initiatives are in place to provide continuous training on supply chain activities to Health facility staffs, the study has also found that factors such as error in forecasting non adherence to FEFO lead to both un-availability and expiry of health products at facility level. These along other factors such as receiving supplies excess of order, or with short expiry dates or supplies not based on what was demanded are contributed to stock out of lab products .(MOH & social welfare Tanzania,2008)

Another study in Tanzania 2009, it was fully rolled out the ARV logistics system, modeled after the ILS, which provided a coordinated ordering and distribution system. Since 2011, reporting rates have been maintained above 80 percent. In Tanzania, there has been a marked drop in mother to child transmission rates from 30 percent in 2009 to 9 percent in 2014. In addition to PMTCT program Following the TB and leprosy (TBL) system assessment, the National TB and Leprosy Program (NTLP) and SCMS completed a redesign of the TBL system in 2012 to optimize logistics system performance. Certain components of the optimized TBL system tap into aspects of the ILS and ARV systems,. However, unlike other systems, T BL uses a pull system up to District stores and a push system to Direct Observed Treatment centers due to patients changing phase and the fact that they are managed only by sites that have patients on a specific TBL drug regimen, SCMS designed the TBL system as a separate system, which still benefited from the ILS and ARV system, by leveraging existing reporting tools,supportive supervision frameworks,and commodity management principles. LMIS Achieved reporting rates of 93 percent and 91 percent for the ARV and ILS systems. (SCMS & USAID/DELIVER,2016)

Study conducted in Kenya on stock status and logistics system assessment in 2006; the survey collected data on both stock on hand, stock outs on the day of visit, stock outs during the previous six months prior to the survey, and the frequency and duration of stock outs during the same 6 month period. The finding showed that the performance of the logistics systems at district stores was better than at the health facilities. More than 70 percent of district/health center stores use stock cards to manage health commodities. This contrasts with the availability and use of stock cards at the facilities level; Data collectors also observed the accuracy of the balance on stock cards at those facilities that both managed the product and had stock cards available and also for a stock card to be considered accurate, no discrepancies could be found between the stock card and the physical count. The study examined the level of compliance with 14 guidelines for proper storage, assessing through direct observation and interview questions asked of facility staff. (Elizabeth B, et al., 2006)

According to a study made on the inventory management of ARV drugs at community health centers in the Cape Metropole in western Cape town in 2015, 86.7% of CHCs utilized a logistics tool (either manual or electronic) to manage ARV drugs. About 82.7 % of ARV drugs have

logistics recording tools out of which only 21.9 % are accurately used. Out of the total available logistic tools in use only 32.9% had up-to-date records. In addition, the variation between stock records and physical counts for the ARV drugs assessed was 51.6% and no historical data on stock outs and monthly usage (monthly consumption) could be retrieved in any of the CHCs, although there were no actual stock outs on the day of the fieldwork. (Mahoro A ,2015)

A study on the assessment of pharmaceutical logistic system in south Sudan showed that among the total health facilities included in the study, 89% of them had all tracer medicines in stock, 11 of health facilities had expired tracer medicines, 39% of the health facilities had LMIS tools such as logistic formats and 27 % of them experienced accurate logistics records. In addition, in 17 % of the facilities, staff were trained to use logistics forms, 24 % of health facilities received the quantity of medicines they ordered to refill. 35 % of the health facilities maintained acceptable storage condition and practice. Concerning product availability, 25 % of the health facilities had stock levels that ensures near term product availability and 27 % of the health facilities showed stock outs of one or more drug at the time of visit. (Dick, Farai and Joseph, 2011)

In November 2003, a situation analysis of ARV drug use in Nigeria was carried out Eighty percent of the facilities assessed had three drugs in stock i.e. Nevirapine, Stavudine and Lamivudine, while 44% of the facilities did not have adequate stock balance of the drugs. Eight facilities had experienced stock outs for periods ranging from one to three months. Expired drugs were found in 64% of the facilities with total loss due to expiry estimated at \$146,717. Only three centers provided drugs free of charge to patients. The study also revealed that the goal of the ART program, which was to provide uninterrupted drug supply to treatment centers and to patients in a timely manner, was not achieved. (GHAIN, 2011)

Another study conducted in Nigeria reveal reporting rates of 81% for ARVs, 79% for RTKs and 17% for CD4 reagents reports. The reviewed report and requisition for ARVs revealed faults with quality of data ranging from wrong reporting units to incomplete data capturing of the essential report elements such as dispensed data, SoH, quantity to order, etc.

This report was prepared using the data from LMIS on commodity utilization and Stock on Hand (SoH) information. These were obtained from 250 health facilities that submitted October-

December 2014 TB commodities quarterly LMIS reports in January 2015 out of the expected 299. Among all the health facilities providing TB services are expected to submit quarterly LMIS report, 84% submitted their LMIS reports for the quarter under review. The remaining 16% of these facilities did not submit any report. The quarterly LMIS reports of TB commodities reviewed are of good and acceptable quality with minimal errors. However the review revealed the following issues with inventory management: health facilities reported stock out and were at emergency point of SoH as well as SoH below the minimum stock level.(Gulma et al.,2015)

In the assessment of HIV/AIDS pharmaceutical Supply management systems **in east Africa** countries results of the assessments showed that problems with ART commodities-supply management existed widely in Kenya, Rwanda, Tanzania and Uganda. These problems ranged from the inability of the existing systems to adequately handle scale-up programmes to lack of readiness of the workforce to efficiently use and manage large supplies of antiretroviral, including inadequate capacity to quantify needs and distribute the medications and inappropriate medication-distribution practices. Inadequate skills were cited as the main reason for the identified problems in all four countries. There was thus a need to build skills in HIV/AIDS pharmaceutical supply management in all four countries. Skills-building processes that included local institutions were preferred, as these would cover wider geographical areas. These were also regarded as more sustainable. (Matowe et al.,2008)

2.3.2 Supply chain management of HIV/ADIS and TB commodities in Ethiopia

A study on long lead time of TB laboratory commodities in Amhara region showed that a total of 20(24.4%) health centers took more than two weeks to receive TB laboratory reagents from Woreda Health Office and the longest lead time was 1 to 2 month(s) in 10 (12.2%) health centers. Transportation delay of consumables was 5 times higher among PFSA and 4 times higher among Woreda as compared to health center truck. Generally, one fourth of health centers had longer lead time of TB laboratory commodities because of transportation delay. (Mulusew et al.,2016)

A study done by MSH Heal TB project on IPLS reduces Drug stocks outs in Amhara and Oromia region of Ethiopia identifies IPLS was implemented in 229 health facilities (33% of the HEAL TB-supported facilities) in Ethiopia. Facilities not using IPLS had TB drug stock out rate of 23%. Facilities using IPLS had TB drug stock out rate of just 17%. Facilities not using IPLS had a 1.5 times higher TB drug stock out rate than health facilities using IPLS. (Legesse M, et al.,)

The study on HIV/AIDS related commodities supply chain management in public health facilities of Addis Ababa revealed that 16(80%) of Health Center and 1(25%) of hospital pharmacies properly report and have the record of patients by regimen data. Six months prior to the study, 14(70%) of Health Centers and 2(50%) of the hospitals stopped VCT service due to lack of adequate supply. The majority of the hospitals 3(75%) and 18(94.7%) of Health Centers were able to submit the requisition and report of ARV drugs to PFSA according to the schedule. More than three- fourth of the Health Centers had one or more emergency order of ARV drugs, while all of hospitals had emergency order more than 3 times within 6 months prior to the study. All of the hospitals and nearly half of the Health Centers had an emergency order of test kits more than 3 times in the past 6 months. There was high mean percentage difference between quantity ordered and received for 3TC300/TDF300 (69.6% in hospitals and 51.7% in HCs). (Birhanemeskel E, 2014)

Over all 14(73.7 %) of the Health Centers and 3(75%) of the hospitals faced stock out of one or more ARV drugs on the day of visit. Stock out was high for nvp200 in hospital 2(50%) and it was high for tdf300/3tc300 in HCs 7(36.8%). Regarding the stock status of test kits on the day of visit; only 7(36.8%) of the HCs were fully stocked, while the rest of them were stock out of one or more selected test kits. Whereas, all of the hospitals were stock out one or more test kits on the day of visit. Unlike ARV drugs, only 10(52.6%) of HCs and 2(50%) of hospitals had bin card for the selected test kits on the day of visit. All of the health facilities used both computerized ii and paper based LMIS; they used computerized electronic dispensing tool at dispensary and Health Commodities Management Information System in the store. The study concludes that there was not adequate data on patient by regimen and stock status of ARV drugs and Test kits. In addition, there were frequent stock outs of ARV drugs and HIV test kits, which are an indicator of weak supply chain. The reporting and receiving system of ARV drugs were more organized compared

to HIV test kits. It was also noted that in majority of the cases the professionals were unable to handle the computerized LMIS, as desired. (Birhanemeskel E., 2014)

A study on Barriers in the implementation of isoniazid preventive therapy for people living with HIV in Northern Ethiopia shows overall isoniazid preventive therapy coverage of the region was estimated to be 20 %. Among the reasons for this low coverage Isoniazid stock out is the main barrier hindering implementation of isoniazid preventive therapy. (Gebrehiwot T, et al.,2016)

Assessment on laboratory logistics management information system practice for HIV/AIDS and tuberculosis laboratory commodities in 43 selected public health facilities in Addis Ababa shows there exists a well-designed logistics system for laboratory commodities with trained pharmacy personnel, distributed standard LMIS formats and established inventory control procedures. However, majority of laboratory professionals were not trained in LMIS. Majority of the facilities (60.5%) were stocked out for at least one ART monitoring and TB laboratory reagents and the highest stock out rate was for chemistry reagents. Expired ART monitoring laboratory commodities were found in 25 (73.5%) of facilities. Fifty percent (50%) of the assessed hospitals and 54% of health centers were currently using stock/bin cards for all HIV/AIDS and TB laboratory commodities in main pharmacy store, among these only 25% and 20.8% of them were updated with accurate information matching with the physical count done at the time of visit for hospitals and health centers respectively. In summary Even though there exists a well -designed laboratory LMIS, keeping quality stock/bin cards and LMIS reports were very low. Key ART monitoring laboratory commodities were stock out at many facilities at the day of visit and during the past six months. (Adino D, et al.,2013)

A study done in Addis Ababa on Integrated Pharmaceutical Logistics System for HIV/ AIDS and Tuberculosis (TB) Laboratory Diagnostic Commodities management in Public Health Facilities, revealed among A total of 33 public health facilities were involved in the survey 6(18.1%) were hospitals and 17(51.5%) health center. Availability of IPLS formats for recording and reporting bin cards, internal facility report and requests (IFRR), and report and request forms (RRF) - was reported in 25 (92.6%) facilities. Regular update of bin cards was reported in 16 (61.5%) facilities, while IFRR and RRF were completed by 22(84.6%) and 24(92.6%) facilities, respectively.

Utilization of bin cards was higher at health centers (76.5%) compared to hospitals (33.3%). Majority of the facilities (88.5%) facilities reported RRF report was submitted to PFSA every two month. 24(96%) of facilities were reported one or more reagents stocked out during the last six months. Furthermore, management supports on Integrated pharmaceutical Logistic System implementation was significantly associated with acceptable data quality and utilization of IFRR. The study concludes its study stating that the majority of facilities reported the availability and utilization of IPLS tools to manage HIV/AIDS and TB laboratory commodities. However, most experienced stock out of one or more commodities during the last six months, which could be due to failure to implement IPLS in full scale. (Tilahun A, et al., 2016)

Assessment done on health commodities inventory management practices and challenges in Zewditu memorial hospital, Addis Ababa, found that health commodities to be long-term agreements between the hospital and its suppliers, maintain proper store management the majority of the store managers had adequate knowledge how to store and practiced health commodities and they had also a positive attitude towards the importance of appropriate storage of commodities, obsolete, expired, or damaged inventories properly identified and segregated, inventory records reconciled to advantage reports on a regular basis and management have review the reconciliation of physical inventory counts to the inventory records applied at the hospital . the study indicated the main challenges of the hospital in managing inventory are: lack of modern technologies, insufficient funding, lack of inventory management training, the length of bureaucratic processes in the procurement system and stock out of health commodities. In general the consequences of the above were occurred high level of stock out which might have led to services interruptions at ZMH health commodities. (Semahegn A., 2017)

A study done on black lion hospital showed that all (100% of) the required blank logistics recording and reporting tools such as bin cards, RRF Formats, IFRR formats and IPLS SoP Manuals are available in the hospital. Even though bin card is available for all the 17 ARV drugs, it is only for seven (41.2 %) of them are bin cards are updated. In this study, in addition to checking timely update of bin cards, the quality of updated data on bin card was cross checked by comparing the accuracy of bin card balance with the physical count for all the 17 ARV drugs available in the Hospital store. Out of the 17 types of ARV drugs handled in the Hospital store, only for 14 (82.4%)

of them showed accurate bin card balance recording & 17.6% in accuracy when compared with the physical balance. In this study, it is observed that the Hospital store uses RRF and the dispensing unit uses IFRR formats for reporting of previous consumption and requisition of resupply for the next period consumption. While utilizing the RRF and IFRR formats by the hospital store and IFRR by the dispensing unit is an encouraging practice, it is also observed that there is still some gap in that some columns of the IFRR and RRF remains unfilled which may contribute to provide incomplete information for decision making. This gap may be caused due to the work load and limited man power available in the hospital which is evidenced at the time of visit by the principal investigator and the response of key informants for questions related to challenges to IPLS implementation in the hospital. (Sisay A,2017)

The study also assessed that LMIS data quality by checking the data quality reported on the most recent RRF reports sent to PFSA hub (higher supplying unit) and comparing this data with the balance recorded at the time of the most recent RRF report. Hence out of the 17 ARV drugs, for 14 items (82.4%), the data reported on the RRF is different to that recorded on the bin card which shows a very poor LMIS data quality. The result of this study showed that the hospital staff engaged in the implementation of IPLS obtain occasional supportive supervision a 3 to 6 months interval by higher level such as PFSA, in different areas such as pharmaceutical logistics and inventory management including checking the logistics reports, storage conditions etc. As per the result of the study, from the total pharmacy staff available in the hospital only 61.5% have got training on IPLS while the remaining are not. This shows more than 50 % of the staffs are trained in IPLS which seems encouraging but more effort is required to training the remaining staff. (Sisay A,2017)

Out of the 17 types of ARV drugs, 2 of them (11.8%) are out of stock from the hospital main store. But in addition to checking stock availability at the store room, further assessment of stock availability is done in the hospital dispensary (where drugs are dispensed directly to patients) to check whether those two drugs(Lopinavir + Ritonavir 200mg + 50mg and Nevirapine 10mg/ml oral suspn) that are out of stock at the day of visit are stocked out or not in the dispensary. As it is described in the result part, even though these drugs were out of stock in the store room they are found available in the dispensary with quantity of 42 and 2, respectively. In addition, for the past

six months prior to the day of visit, 3 of the 17 (17.6 % ARV drugs) , were found to be stock outs for one, one, and five times and with a total number of days of stock outs of 15,23,and 35 days, respectively (with average duration of 24 days). (Sisay A,2017)

During assessing the storage condition and performance, there was expired items at the time of visit. Out of the 17 types of ARV drugs handled by the Hospital, four drugs are found to expired with significant quantities. Assessing the storage condition of the Hospital, it is observed that among the 17 standard criteria set to measure compliance of the storeroom with acceptable standard condition, it is observed that the store room fulfilled 12 of them (70.6%). Hence, since this figure is less than 80%, which is a minimum requirement for having acceptable storage condition for Pharmaceuticals, the Hospital store is considered that it doesn't fulfil normal storage condition for pharmaceuticals storage as per the storage guideline. The length of the resupply period for a normal order, it will take, approximately greater than two weeks between sending an order and receiving products form the main supply point which is PFSA hub. (Sisay A,2017)

Pertaining to the order fill rate, out of the 13 items recently requested by the hospital for resupply, only 9 items were fully resupplied with the requested quantity (100% fill rate), while for the remaining four items, 3 items are received with less quantity (90.3 – 40%), while one items is not totally delivered (0% order fill rate) even though requested by the Hospital. This result shows that among the total of 13 drugs requested only 8 of them (61.5%) had a perfect fill rate (100%).

The result obtained from the respondent interview showed that the two reasons for not having the exact type and amount of items requested by the hospital are absence of adequate stock at the resupplying PFSA hub and sock out of items during the resupply period at the resupplying PFSA hub. In addition to using the RRF and IFRR, the Hospital places emergency orders through phone or orally for the resupply of items. For the last three months the hospital made two emergency orders of ARV drugs from the PFSA supplying hub. (Sisay A,2017)

As per the result obtained from the interview with key Hospital informants, the study showed that the major challenges related to IPLS implementation at the Hospital level can be categorized in to Human resource related factors (poor commitment of staff, execs work load and severe shortage of manpower, lack of data clerk in the pharmacy store); Management related factors (absence of

performance measurement practice, lack of incentives for staffs); Supply problem related factors (Stock outs, shortage of items and supplying items with short shelf life by the higher supplying unit (PFSA hub)); LMIS related factors (huge paper work involved in IPLS, and, poor data quality on documentation and reporting);Infrastructure related factors(insufficient space of pharmaceutical storage and inadequate vehicles for transportation of items to and from the facility.). (Sisay A,2017)

A study done in Distribution and Availability of Essential Tuberculosis Diagnostic Items in Amhara Region, thirty-three (40.2%) health centers were under stocked for at least one of the key items for tuberculosis diagnosis at the time of visit. Fifteen (18.3%) health centers had no stocks of at least one of the key items. Of the 82 health centers, 77 (93.9%) did not fulfill the criteria for effective distribution of tuberculosis laboratory reagents and consumables. There were many health centers that had no or only low stocks of key tuberculosis laboratory reagents and consumables as a result of ineffective distribution system. It is necessary to strengthen supply chain management to ensure uninterrupted TB diagnostic service.(Sinishaw, Gebregergs and Shiferaw,2015)

A Report SCMS and USAID | DELIVER PROJECT in titled 10 Years of Supporting PEPFAR through Stronger Public Health Supply Chains states that in 2013 survey of 42 facilities showed that 95% of ARV drugs were available. The commodity wastage rate is less than 2%, there are virtually no stockouts, and the country has experienced no ART interruption since 2006. (SCMS,2015)

Summative project evaluation of TB DOTS sites of private health sector project indicated Nearly all facilities had a sufficient amount of first-line anti-TB drug combinations RHZE, RHZ, and EH at the time of the assessment. The shelf-life of available drugs was extremely short, which may suggest challenges with drug supply chain management. It is well documented from the public sector that drug stock-outs have the potential to hamper the delivery of quality TB services at the selected sites. Efforts should be made to improve drug logistics and forge better public-private partnerships.(Andualem W, et al.,2008)

An assessment conducted on impact of the national HIV/AIDS laboratory logistics management information system on the harmonization of laboratory commodities in Ethiopia claimed that, after implementation of the vertical national HIV/AIDS laboratory logistics management information system; stock outs for ART laboratory monitoring tests, emergency orders and Commodity wastage were decreased significantly. In addition, laboratory reagents and related supplies were arriving on time in quantities needed. (Nigatu A, et al.,2009)

According to the national survey conducted by PFSA in 2015, the availability of blank bin cards, IFRRs, and RRFs are high at hospitals (above 90 percent) and health centers (close to 80 percent).nHowever, the availability of the recording and reporting formats decline when moving down the supply chain. The availability of bin cards which are the fundamental logistics records that captures essential inventory data was 40 percent at the health post level. In addition, the study stated that the accuracy of balances on bin cards by facility level showed at hospitals, accurate balances ranged from 29 percent to 71 percent per different items with an average of 49 percent. The survey result also showed that there is a variation in use of RRF by phase of IPLS implementation (phase I, II, and III). For Example, The RRF use was high (97 percent) among phases I and II facilities, both in hospitals and health centers. This was not the case for phase III health centers, where only 54 percent used the RRF. (Abiy S., et al.,2015)

2.4 Conceptual Frame work of the study

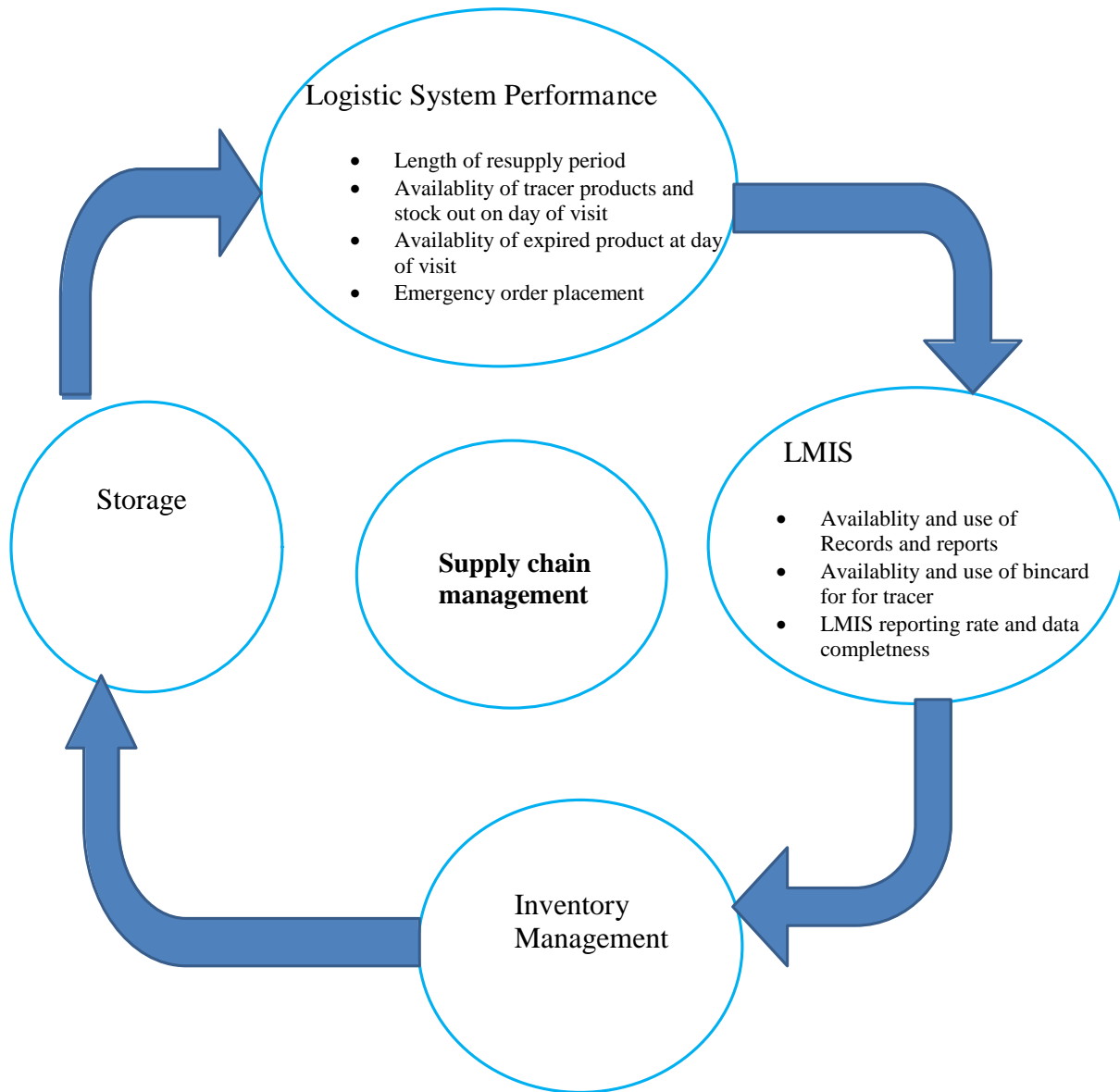


Figure 1: A Conceptual Framework of ARV and Anti-TB Drugs and related commodities Supply Chain Management (DELIVER/JSI, 2017)

CHAPTER THREE

3. Methodology

3.1 Description of the study area

The study was conducted in Addis Ababa (AA) city administrative, Ethiopia. Addis Ababa divides in to 10 sub cities and 116 districts with a total land area of 54,000 hectares or 540 km². It has a population of 3,433,999. (FMOH,2017) In 2017, there were 11 governmental hospitals and 97 health centers (HCs) plus privately owned 998 clinics and 25 hospitals in Addis Ababa.(FMOH,2017). Reports showed that as of October , 2017 there are 128,268 patients had ever started ART and 83,566 patients were currently on ART. Also New TB detection rate was 8013 cases in the region with treatment success rate of 89.5% and Cure rate of 84.8%. (FMOH,2017) HIV/AIDS care in Ethiopia was mainly dominated by partners with some involvement of national government and other stakeholders. The major donors and sources of HIV/AIDS funding in the country, among others, include the Global Fund, the US Presidential Emergency Program for AIDS Relief (PEPFAR) and the UN system. (Birhanemeskel E.,2014)

Pharmaceutical Fund and Supply Agency (PFSA) is a governmental pharmaceutical importer and distributor which is mainly involved in the supply of ARV and Anti TB drugs , HIV test kits, TB diagnostic reagents and supplies to the health facilities. PFSA had 18 hubs in the country. The Addis Ababa City Administration Health Bureaus (AACAHB) and PFSA is responsible for distribution of test kits to regional hospitals and health centers .

3.2 Research approach

The type of research approach used was an descriptive survey approach whereby the LMIS, the inventory control system and the storage system of the hospital was assessed and examined against the requirements and standards of supply chain management for ARV and Anti TB pharmaceuticals and related commodities.

3.3 Research design

The study was a facility based descriptive survey design and used both quantitative and qualitative data collection techniques will be used to gather the required information on the supply chain of pharmaceuticals and related commodities on ARV and Anti -TB.

3.4 Population and sample

The Study population for this assessment was all the Five federal specialized hospitals, six hospitals under AARHB, and five private hospitals providing ARV and Anti -TB service was included in this study.

The sample of health facilities was calculated by using the Logistic System Assessment Tool and Logistic Indicators Assessment Tool for ARV drugs and Test kits of USAID/DELIVER according to the guide to conducting Supply Chain Assessments. This document suggested that it is enough to take 15% of the targeted health facilities as sample for the study (JSI,2005 & USAID/DELIVER,2009). The selection of sample hospitals was from all available hospitals in Addis Ababa considered ownership of the hospital and patient burden.

A stratified random sampling method was used to create different strata according to their type of facility. These includes 5 federal hospitals, 6 hospitals under AARHB, 5 private hospitals providing ART and Anti-TB service providing . Accordingly health facilities grouped in to two strata i.e Government owned public hospitals and private owned Hospitals serving ART and Anti-TB service for free,then the available public hospitals in Addis Ababa was grouped into two major categories i.e. those administered by the AACAHB and those under the Federal Ministry of Health (FMOH). From each category the initial selection of the hospitals will be followed by (extreme/deviant sampling) and accordingly four governmental hospitals, two from FMOH and two from AACAHB, and from the second strata (private owned hospitals) four hospitals will be selected based on extreme/deviant sampling technique (one with high patient burden and the other one with lowest patient burden will be selected in each strata for goverement owned hospitals i.e atotal of 4 (four) plus for private owned two with high patient burden and the other two with lowest patient burden i.e atotal of 4 (four) will be selected).

3.5 Data sources and type

The source population was all the Hospitals getting ARV and Anti -TB pharmaceuticals and related commodities from Addis Ababa PFSA branch. This includes all public and private Hospitals providing services for HIV and TB diagnosis, monitoring and treatment services. These are all federal specialized hospitals, all public and private hospitals under AARHB providing ARV and Anti -TB service.

3.6 Data collection procedure

Survey team and data collection period

The principal investigator (PI) collected the majority of the information used as input for the study. A research assistant assisted the PI with collecting information from hospitals pharmacy stores. The research assistant have had a half day training on the survey tool before being involved in the data collection. Data was collected & completed over a three weeks period starting from March20 ,2018, with provision of intensive supervision.

Data collection instruments

Quantitative & qualitative data collection methods were used for this study. A combination of semi-structured questionnaire and observation check list used to collect data on the supply management of HIV/AIDS and Anti TB drugs & related commodities .This questionnaire which was originally developed by USAID/DELIVER, The Logistics Indicator Assessment Tool (LIAT), was used to conduct a facility-based survey to assess health commodity supply chain performance and commodity availability at health facilities. The semi-structured questionnaires in combination with observation check lists was used to collect data on ordering, logistic management information system, inventory control procedures, storage conditions of HIV/AIDS and Anti TB drugs and related commodities from the different respondents including the head of the pharmacy, ART dispenser, ART store manager/general store manager and laboratory head, VCT personnel and ART coordinator. Furthermore physical counts of ARVs and Anti-TB pharmaceuticals and related commodities was conducted in order to check data quality by comparing the actual counts with

the available records. Open ended questions were also asked with the key designated supply chain managers using standard point of supply chain issues adapted from logistics system assessment tool (LSAT).

3.7 Data quality assurance

The data collection tool were pretested prior to the data collection. The study were discussed with the research assistant on regular basis and reviewed the collected data for completeness. The collected data was summarized on the same day of the data collection.

3.8 Ethical Consideration

Letter of support from A.A University School of commerce was provided to the researcher to be presented to selected private and public Hospital Head (Medical Director) to obtain permission to conduct the research work. There was a high degree of confidentiality during data collection and no name of any health facility and participating subjects to be put in the result instead the aggregate result of the facilities and summary results of open ended questions projected.

3.9 Data Analysis

Data analysis was guided by considering core and important indicators helps to assess supply chain of ARV and anti TB pharmaceuticals and related commodities in health facility.

The collected data was manually checked for completeness and consistencies before being entered into the computer. The quantitative data was entered and analyzed by using SPSS recent version (version 20) and excel 2016. The qualitative data was analyzed thematically. Descriptive statistics was used to compute frequencies and cross tabulation results. Results was presented using tables and graphs. The qualitative portions of the study was summarized in narrative format.

CHAPTER FOUR

4.Data analysis, Result and discussion

4.1 Result /findings of the study

In this part of the study data that were collected using questionnaires and observation are presented. The data were important to assess the supply chain of HIV and TB pharmaceuticals and related commodities in public and private hospitals of Addis Ababa. The findings and results are helpful to forward recommendations. Questionnaires were used to collect data from hospital dispensing units (laboratory, ART pharmacy, TB dispensing unit, store and pharmacy manager). In addition, documents such as recording and reporting were reviewed and observation at storage was done at the hospitals. The results are organized as follows:

4.1.1 Characteristics of study Health facilities and study participants

A total of 8 hospitals involved in the assessment of HIV/AIDS and TB pharmaceuticals and related commodity management were participated in this study, of these 50% were private hospitals and 4 (50%) were public hospitals. All hospitals surveyed provide ART and Anti TB service to the public for free and their product delivery modality is directly from PFSA most of the Items except for test kit.

At these facilities, study participants number of years of experience in the hospital range from months to 8 years 50 % of them stayed in the hospital for more than 2 years. 75 % were the principle person managing ART and TB pharmaceuticals and related commodities at hospital.

There were 164 pharmacy staffs under the pharmacy unit of these hospitals among them 58 of them trained on IPLS.

Table 1 Characteristics of study facilities

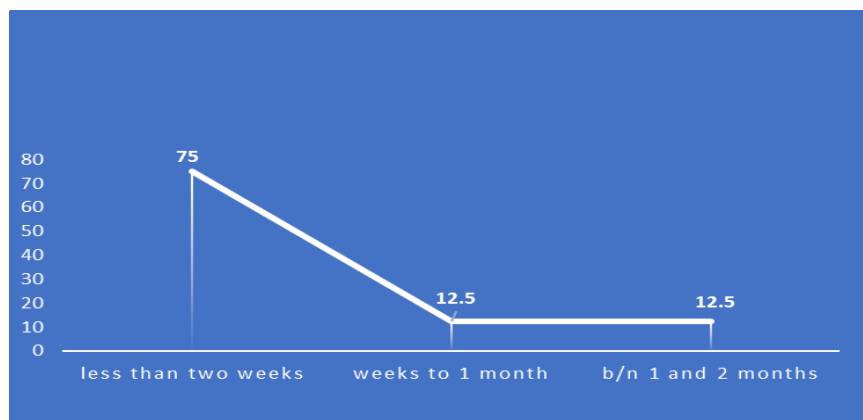
Variables	Number(n)	Percent (%)
Health facilities		
Public (Federal specialized) hospitals	2	25%
Public (Regional) hospitals	2	25%
Private hospitals	4	50%
Total	8	100%

4.1.2 Logistic system performance

4.1.2.1 The length of resupply/ on time arrival of orders

The direct or most common source of supply for ARV/TB pharmaceuticals and related commodities for all hospitals was PFSA, on average a normal order takes less than two weeks in 75% of the facilities. All private hospitals take their order within two weeks period. According to the assessment finding remaining public hospital i.e 12.5% hospitals are refilled weeks to one month and 12.5% of the hospitals between one month to two months.

Figure 1 Resupply period length



62.5% of the hospitals usually get the quantity of the products ordered from PFSA unless the resupply point was stocked out and the rest 37.5% didn't get ordered quantities. The reason for they didn't get the ordered quantity was that the order quantity changed at the resupply point.

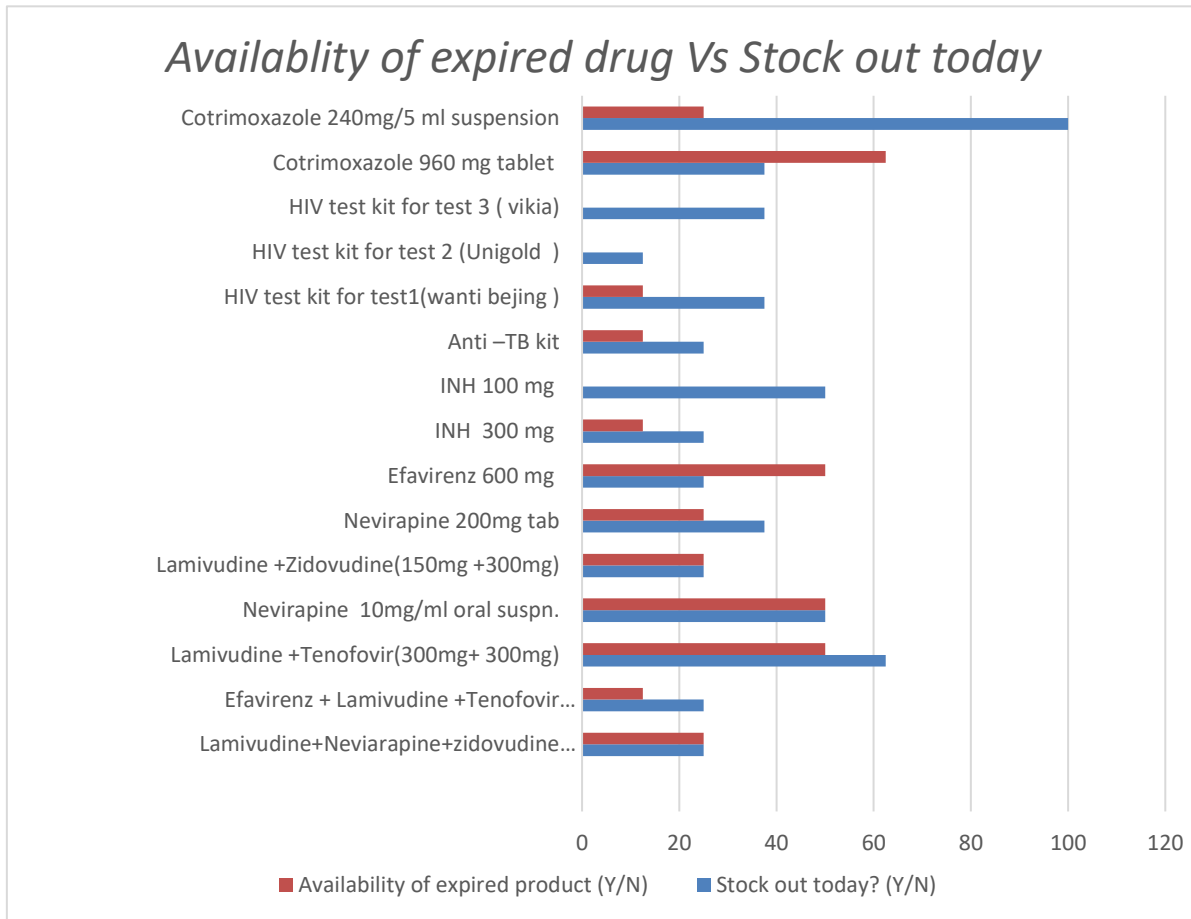
4.1.2.2 tracer product availability and stock out status at the day of visit

In the survey it is observed that stock out rate is high for cotrimoxazole 240mg/5 ml suspension followed by Lamivudine +Tenofovir (300 mg+300mg) tablet. Stock out is also high for nevirapine 10mg/5ml suspension and INH pediatric dose. All ARV products and Anti TB drugs including HIV test kits and INH was given to all hospital for free from PFSA but OI commodities like Cotrimoxazole tablet and suspension was not given for free in most private hospitals.

4.1.2.3. Availability of expired items at the day of visit

During the visit it is observed that out of the 15-tracer products expiry is high among ARV drugs handled by the Hospital, three types namely Efavirenz 600 mg caps, Lamivudine + Tenofovir 300mg + 300mg and Nevirapine 10mg/ml oral suspension are found to be expired as per the above table. These three products are expired in 50% of the hospitals and Cotrimoxazole 960 mg tablet was expired in 62.5% of hospitals.

Figure 2 Availability of expired drug Vs Stock out today

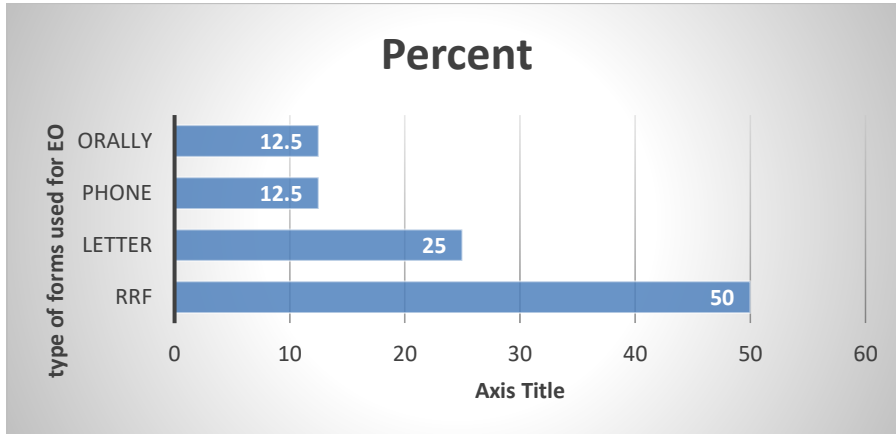


4.1.2.4 Emergency order placement

Among 8 health facilities only 12.5% of the hospitals didn't place any emergency order in the past 3 months, 25% of the hospital have placed 1 emergency order, but 62.5% of the hospitals placed 2 or more emergency orders in the past three months. All public hospitals have one or more emergency order than private hospitals

The study finding shows 50% of the hospitals placed emergency order using RRF, 25% placed emergency order using letter, 12.5% of the hospitals through phone and 12.5% of the hospital placed emergency order orally.

Figure 3 Emergency order placing and reporting mechanism



4.1.3 Logistic management information system

4.1.3.1 Logistics reporting and recording tools availability and use

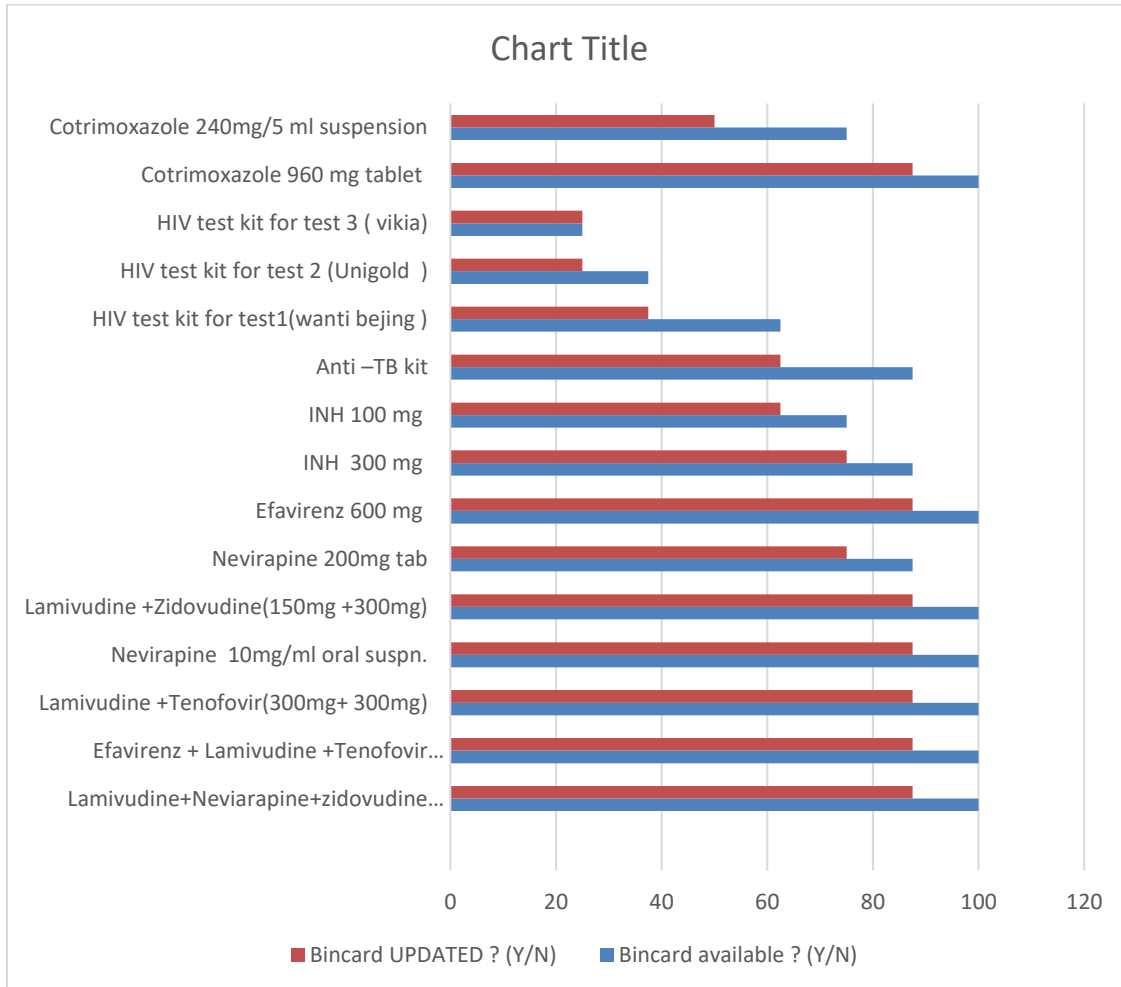
Bincards and RRF was available in all 8 hospitals but 87.5% of hospitals reported availability of IFRR. Of these, 87.5% use bincard; 50% of the hospitals one private and three public hospitals use IFRR but only 37.5% reported the existence of completed IFRR, among these none completed their IFRR. A total of 87.5% of the hospitals reported the availability of IPLS Standard Operating Procedure (SOP). All 100% of the hospitals use RRF and all compiles and sent to higher level of the supply chain.

4.1.3.2. Use of bincard for tracer products

As shown in the table tracer products bincard availability and use (updated) was assessed and the result shows that bincard is available 100% for 6 ARV pharmaceuticals out of 7, only one item scored 87.5% for availability of bincard. Anti TB kit and INH adult 87.5 % of hospitals have bincard available and 75% updated, but pediatric INH 75% availability of bincard and 62.5% updated bincard.

Bincard availability and use is minimum for HIV test kits 1 (wantibeijing), test 2(unigold) and test 3 (Vikia). Bincard availability is 62.5%, 37.5% and 25% of hospitals respectively. But bincard is updated in 37.5%, 25% and 25% of the Hospitals respectively.

Figure 4 Bincard use and availability for tracer products



4.1.3.3. LMIS Reporting and Data completeness

The survey finding shows all hospitals sent their RRF to PFSA for direct resupply. However, 50% hospitals sent their RRF bimonthly whereas 50% hospitals sent their RRF quarterly.

RRF reporting rate was assessed, accordingly 62.5% of the hospitals sent their RRF with in the last month, 25% sent their RRF 3 months ago, but 12.5% sent their RRF to PFSA more than three months ago.

Table 2 Use and completeness of reporting formats

	complete IFRR		complete RRF	
	yes	no	yes	no
hospital private	0	4	3	1
category public	3	1	4	0
Total	3	5	7	1

SPSS version 20 descriptive crosstabulation

Although RRF completeness was checked randomly that 62.5% completed all columns of the RRF properly.

This assessment shows use IFRR for regular reporting is 62.5% and 37.5% of the hospitals in ART dispensing unit and Anti-TB dispensing unit respectively. IFRR use was minimal among private hospitals than public.

In the survey hospitals was asked for what mechanism the RRF was sent to PFSA and the finding shows 75% claimed that their RRF was sent by hand carried by hospital staffs and 25% claimed send their RRF by drivers to PFSA for resupply.

Hospitals was asked for any feedback given by higher level and 75% said they have received feedback on RRF report. Feedback was received by three private and three public hospitals.

4.1.4 Inventory management

Hospitals assessed by what means they determine how much to order from PFSA, accordingly 50% of the hospitals determines the resupply quantity by themselves through calculating RRF but the rest 50% of hospital resupply quantity was determined by higher level PFSA or RHB.

Hospitals Dispensing units were assessed if they have a predefined schedule to determine when to order and how much to order from main store of the hospital 62.5% of the hospitals have resupply schedule for dispensing units to order through IFRR for internal resupply and only 50% follow the resupply schedule properly. During the assessment 100% of the facilities have engaged in inter facility overstocked item transfer, redistribution of near expiry pharmaceuticals and related health commodities.

4.1.5 Storage

Among 17 storage guidelines assessed most storage guidelines are fulfilled. Twelve guidelines are fulfilled by 75% and above of the hospitals. Four guidelines i.e commodities are protected from direct sunlight, water and humidity, visually free and protected from harmful insects and rodents and Roof is always maintained in good condition to avoid sunlight and water penetration scored 100% fulfilled in all health facilities.

Fire safety equipment is available, accessible and the current space of the store room is sufficient for existing products with reasonable expansion are fulfilled in half 50 % of the hospitals.

Separate location for expired item in store room and products stacked 10cm of the floor are fulfilled by only 62.5% of the hospitals. Only 37.5% of the hospitals are fulfilling the guideline on stacking products 30 cm away from the walls.

Table 3 Storage guidelines fulfilled

No.	Description	No.	Yes
1	ARV drugs are arranged properly and professionally in such a way that identification labels and expiry dates and/or manufacturing dates are visible	1(12.5%)	7(87.5%)
2	ARV drugs are stored, organized and arranged in a manner that is accessible for first-expire – first-out (FEFO) stock rotation method	1(12.5%)	7(87.5%)
3	Cartons and products are in good condition, not crushed, deteriorated, and spoiled due to mishandling. If cartons are open, determine if products are wet or cracked due to heat/radiation	1(12.5%)	7(87.5%)
4	There is a separate location to store/put damaged and/or expired ARV and Anti TB drugs and related commodities by removing from usable products before they get disposed using appropriate procedure.	3(37.5%)	5(62.5%)
5	Drugs including ARV and Anti TB drugs and related commodities are protected from direct sunlight and high heat at all times of the day and during all seasons	0(0%)	8(100%)
6	Cartons and drugs are protected from water and humidity during all seasons	0(0%)	8(100%)
7	Storage area is visually free and protected from harmful insects and rodents (check the storage area for traces of bats and/or (dropping or insects))	0(0%)	8(100%)
8	Storage area is well secured with a lock and key, but is accessible during normal working hours; access is limited to authorized personnel	1(12.5%)	7(87.5%)
9	Drugs are stored at the appropriate temperature during all seasons according to product temperature specifications	2(25%)	6(75%)

10	Roof is always maintained in good condition to avoid sunlight and water penetration	0(0%)	8(100%)
11	Storeroom is maintained in good condition (clean & tidy, all trash removed, sturdy shelves, well organized boxes).	2(25%)	6(75%)
12	The current space of the store room is sufficient for existing products and reasonable expansion (i.e., receipt of expected product deliveries for near future)	4(50%)	4(50%)
13	Products are stacked at least 10 cm off the floor	3(37.5%)	5(62.5%)
14	Products are stacked at least 30 cm away from the walls and other stacks	5(62.5%)	3(37.5%)
15	Products are stacked no more than 2.5 meters high.	1(12.5%)	7(87.5%)
16	Fire safety equipment is available and accessible	4(50%)	4(50%)
17	Drugs are stored separately from insecticides and chemicals	1(12.5%)	7(87.5%)

4.2 Discussion

4.2.1 Characteristics of study Health facilities and study participants

A total of 8 hospitals involved in the assessment of HIV/AIDS and TB pharmaceuticals and related commodity management were participated in this study, of these 50% were private hospitals while 50% were public hospitals. At these facilities, study participants number of years of experience in the hospital range from months to 8 years and only 50 % of them stayed in the hospital for more than 2 years. In 75% of the hospitals assigned principle person managing ART and TB pharmaceuticals and related commodities at hospital. Pharmacy unit of these hospitals were staffed by 164 pharmacy professionals under the among them 58 of them trained on IPLS. All hospitals surveyed provide ART and Anti TB service to the public for free plus their product delivery modality is directly from PFSA for most of the Items except HIV test kit.

Previously the national design for the flow of pharmaceuticals and information in the IPLS doesn't accommodate Private facilities involved in key public health services including ART and TB care and treatment as it basically designed for public setting. In addition to this existing IPLS SOP manual lacks clarity in inclusion of private health facilities in accessing program commodities and monitoring of pharmaceutical services. In May 2017 PFSA included the private facilities in IPLS SOP by preparing addendum. It is believed that this supplement for the new national approach on management of supply chain system of public health commodities has to address the need of private facilities involved in provision of public health services in a comprehensive way in order to have a complete national design for flow of pharmaceutical and information. (PFSA,2017)

So, when studying supply chain inclusion of all health facility type gives clear status of the supply chain system on product flow and information flow as well as public service availability with commodity security. Logistics system can only work if well-trained, efficient staff monitor stock levels, place orders, and provide products to clients.

4.2.2 Logistic system performance

4.2.2.1 The length of resupply period / on time arrival of orders

The direct or most common source of supply for ARV/TB pharmaceuticals and related commodities for all hospitals was PFSA, on average a normal order takes less than two weeks in 75% of the facilities. All private hospitals take their order within two weeks period.

Similar studies in Black Lion Hospital the length of the resupply period for a normal order, it will take, approximately greater than two weeks between sending an order and receiving products from the main supply point which is PFSA hub. (Sisay A 2017)

In Zimbabwe public health facilities, the lead time for antiretroviral drugs (ARVs) and prevention of mother-to-child transmission (PMTCT) commodities was often less than one month. (Jabulani N, et al ,2005)

In this assessment, out of the total hospitals studied 62.5% of the hospitals usually get the quantity of the products ordered from PFSA unless the resupply point was stocked out and the rest 37.5% didn't get ordered quantities. The reason for they didn't get the ordered quantity was that the order quantity changed at the resupply point.

The result obtained from the respondent interview in black lion hospital showed that the two reasons for not having the exact type and amount of items requested by the hospital are absence of adequate stock at the resupplying PFSA hub and stock out of items during the resupply period at the resupplying PFSA hub. (Sisay A 2017)

In the IPLS it is well defined that when the three essential data items are properly recorded and reported through RRF, the system it self determine how much to order and the data are visible up to the higher level of the supply chain. Each Facilities review period as resupply schedule is every two months till the 10Th day.

4.2.2.2 Tracer product availability and stock out status at the day of visit

In the survey it is observed that stock out rate is high for cotrimoxazole 240mg/5 ml suspension followed by Lamivudine +Tenofovir (300 mg+300mg) tablet. Stock out is also high for Nevirapine 10mg/5ml suspension and INH pediatric dose. All ARV products and Anti TB drugs including HIV test kits and INH was given to all hospital for free from PFSA. But OI commodities like Cotrimoxazole tablet and suspension was not given for free in most private hospitals.

Similar study in lesetho, most facilities were found to have over 80 percent of basic ARVs in stock. (Pharasi B,2007)

A national survey in Rwanda showed that 39% and 42% of the laboratory were stock-outs of HIV test kits & reagents respectively during the past six months of before surveyed, and experienced frequent shortages because of bureaucratic procedures. (Lijdsman C, et al.,2003)

But a study in the Cape Metropole in western Cape town shows the variation between stock records and physical counts for the ARV drugs assessed was 51.6% and no historical data on stock

outs also monthly usage (monthly consumption) could be retrieved in any of the CHCs, although there were no actual stock outs on the day of the fieldwork. (Mahoro A ,2015)

Simliarly In Zimbabwe logistic system assessment, found a high stock out rate for all HIV & AIDS commodities, including antiretroviral (ARV)drugs. However, there was 100 percent availability of complete first-line ARV regimen on the day of visit. A significant number of facilities were stocked out of Nevirapine and rapid HIV test kits, on the day of the visit. Expired stocks of Nevirapine were also found at some facilities on the day of visit. The team also found a very high stockout rate of cotrimoxazole during the period under review and on the day of visit. .(Jabulani N, et al ,2005)

A study in south Sudan 89% of studied facilities had all tracer medicines in stock, 11 of health facilities had expired tracer medicines, 25 % of the health facilities had stock levels that ensures near term product availability and 27 % of the health facilities showed stock outs of one or more drug at the time of visit (Dick, Farai and Joseph , 2011)

In Ghana 60% of the facilities were fully stocked on the day of the visit. (Kwei N, et al.,2006)

Key ART monitoring laboratory commodities were stock out at many facilities at the day of visit and during the past six months. (Adino D, et al.,2013)

A study in blacklion hospital Out of the 17 types of ARV drugs, two drugs namely Lopinavir + Ritonavir 200mg + 50mg and Nevirapine 10mg/ml oral suspn) i.e 11.8% are out of stock from the hospital main store. Even though these drugs were out of stock in the store room they are found available in the dispensary. (Sisay A 2017)

A study conducted in public health facilities of Addis Ababa 75% of the hospitals faced stock out of one or more ARV drugs on the day of visit. Stock out was high for NVP 200 mg in hospital 50%.Whereas, all of the hospitals were stock out one or more test kits on the day of visit. (Birhanemeskel E, 2014)

If a logistics system is *effective*, it will produce the results that are needed: products will be available when and where customers/Hospital Clients need them.

4.2.2.3. Availability of expired items at the day of visit

During the visit it is observed that out of the 15-tracer products expiry is high among ARV drugs handled by the Hospital, three types namely Efavirenz 600 mg caps, Lamivudine + Tenofovir 300mg + 300mg and Nevirapine 10mg/ml oral suspension are found to be expired as per the above table. These three products are expired in 50% of the hospitals and Cotrimoxazole 960 mg tablet was expired in 62.5% of hospitals.

A study in Blacklion Hospital also assessed the availability of expired items at the time of visit. Accordingly, out of the 17 types of ARV drugs handled by the Hospital, four drugs are found to be expired with significant quantities. (Sisay A, 2017)

In a study on the assessment of pharmaceutical logistic system in South Sudan, it is reported that among the total of facilities included in the study, it is reported that 11 of health facilities had expired tracer medicines. (Dick, Farai and Joseph, 2011)

One of the major goals of a well established supply chain is to enable health facilities to have adequate (reasonable quantity) of stocks any time so that overstock, wastage due to expiry, understock and stock outs can be avoided any time so that health commodity resources can be used efficiently and effectively and quality and satisfactory health service can be provided to clients any time.

4.2.2.4 Emergency order placement

Among 8 health facilities only 12.5% of the hospitals didn't place any emergency order in the past 3 months, 25% of the hospitals have placed 1 emergency order, but 62.5% of the hospitals placed 2 or more emergency orders in the past three months. All public hospitals have one or more emergency orders than private hospitals.

The study finding shows 50% of the hospitals placed emergency order using RRF, 25% placed Emergency order using letter, 12.5% of the hospitals through phone and 12.5% of the hospital placed emergency order orally.

Similar studies conducted in Botswana showed that the current laboratory system is the consistent interruption of testing services resulting from unplanned activities, reagents stock outs and expiries, excessive emergency order situations that interrupts the supply plan and lack of documented procedures was also identified, the occurrences of stock-outs is an important indicator of poor inventory management, stock outs of reagents and supplies translate into the inability of a laboratory to perform tests . (Andersson and Marasi, 2009)

The study on HIV/AIDS related commodities supply chain management in public health facilities of Addis Ababa revealed while all of hospitals had emergency order more than 3 times within 6 months prior to the study. All of the hospitals had an emergency order of test kits more than 3 times in the past 6 months. There was high mean percentage difference between quantity ordered and received for 3TC300/TDF300 (69.6%) in hospitals and 51.7% in HCs). (Birhanemeskel E, 2014)

The findings of another study in Black Lion Hospital shows in addition to using the RRF and IFRR, the Hospital places emergency orders through phone or orally for the resupply of items. For the last three months the hospital made two emergency orders of ARV drugs from the PFSA supplying hub. (Sisay A, 2017)

An emergency order should be just that an order placed only when a realistic possibility of stocking out exists. Emergency situations are not normal; rather, they are the exception. When a max-min system experiences frequent emergency orders, the system design and stock levels should be reviewed and probably reset.

4.2.3 Logistic management information system

4.2.3.1 Logistics reporting and recording tools availability and use

Bincards and RRF was available in all 8 hospitals but 87.5% of hospitals reported availability of IFRR. Of these, 87.5% use bincard; 50% of the hospitals one private and three public hospitals use IFRR but only 37.5% reported the existence of completed IFRR of these none completed their IFRR. A total of 87.5% of the hospitals reported the availability of IPLS Standard Operating Procedure (SOP). All 100% of the hospitals use RRF and all compiles and sent to higher level of the supply chain.

A study on the assessment of pharmaceutical logistic system in south Sudan 39% of the health facilities had LMIS tools such as logistic formats and 27 % of them experienced accurate logistics records (Dick, Farai and Joseph, 2011). A study in Ethiopia Even though there exists a well -designed laboratory LMIS, keeping quality stock/bin cards and LMIS reports were very low. (Adino D, et al., 2013)

4.2.3.2. Use of bincard for tracer products

As shown in the table tracer products bincard availability and use (updated) was assessed and the result shows that bincard is available 100% for 6 ARV pharmaceuticals out of 7, only one item scored 87.5% for availability of bincard. Anti TB kit and INH adult 87.5 % of hospitals have bincard available and 75% updated, but pediatric INH 75% availability of bincard and 62.5% updated bincard.

Bincard availability and use is minimum for HIV test kits 1 (wantibejing), test 2 (unigold) and test 3 (Vikia). Bincard availability is 62.5%, 37.5% and 25% of hospitals respectively. But bincard is updated in 37.5%, 25% and 25% of the Hospitals respectively.

4.2.3.3. LMIS Reporting and Data completeness

The survey finding shows all hospitals sent their RRF to PFSA for direct resupply. However, 50% hospitals sent their RRF bimonthly whereas 50% hospitals sent their RRF quarterly.

RRF reporting rate was assessed, accordingly 62.5% of the hospitals sent their RRF with in the last month, 25% sent their RRF 3 months ago, but 12.5% sent their RRF to PFSA more than three months ago. Only one private hospital send their RRF with in the last month ,the rest three Private hospitals send their RRF before three months or more than that. Although RRF completeness was checked randomly that 62.5% completed all columns of the RRF properly.

This assessment shows use IFRR for regular reporting is 62.5% and 37.5% of the hospitals in ART dispensing unit and Anti-TB dispensing unit respectively. IFRR use was minimal among private hospitals than public.

In the survey hospitals was asked for what mechanism the RRF was sent to PFSA and the finding shows 75% claimed that their RRF was sent by hand carried by hospital staffs and 25% claimed send their RRF by drivers to PFSA for resupply.

Hospitals was asked for any feedback given by higher level and 75% said they have received feedback on RRF report. Feedback was received by three private and three public hospitals.

Similar study in public health facilities of Addis Ababa shows the reporting and receiving system of ARV drugs were more organized compared to HIV test kits. It was also noted that in majority of the cases the professionals were unable to handle the computerized LMIS, as desired. (Birhanemeskel E., 2014)

Another study conducted in Nigeria reveal reporting rates of 81% for ARVs, and 79% for RTKs reagents reports. The reviewed report and requisition for ARVs revealed faults with quality of data ranging from wrong reporting units to incomplete data capturing of the essential report elements such as dispensed data, SoH, quantity to order, etc. Among all the health facilities providing TB

services are expected to submit quarterly LMIS report, 84% submitted their LMIS reports for the quarter under review. The remaining 16% of these facilities did not submit any report. The quarterly LMIS reports of TB commodities reviewed are of good and acceptable quality with minimal errors. (Gulma et al., 2015)

But a study in lesto Logistics is a serious problem in the laboratory services, with no logistics management information system (LMIS) in place and few of the laboratories using stock cards. (Pharasi B, 2007)

The placing of orders was found to be erratic and inconsistent and less than 50 percent of the laboratories sent stock reports to the district or central levels. (Pharasi B, 2007)

The study on HIV/AIDS related commodities supply chain management in public health facilities of Addis Ababa revealed majority of the hospitals 75% were able to submit the requisition and report of ARV drugs to PFSA according to the schedule. (Birhanemeskel E, 2014)

According to the findings of Black Lion Hospital, out of the 17 ARV drugs, for 14 items (82.4%), the data reported on the RRF is different to that recorded on the bin card which shows a very poor LMIS data quality. (Sisay A, 2017)

Advantage of linking reporting to ordering is that reporting rates often improve because when a report is tied to an order, it usually encourages timely submission of reports. Facilities are more likely to submit their reports when they receive something (resupply) in return. Program and logistics managers collect data to make decisions. When they receive data they know are incorrect, they need to communicate with the facility that sent the data. Managers can also use data they receive to congratulate facilities for moving toward program goals.

4.2.4 Inventory management

Hospitals assessed by what means they determine how much to order from PFSA, accordingly 50% of the hospitals determine the resupply quantity by themselves through calculating RRF but the rest 50% of hospital resupply quantity was determined by higher level PFSA or RHB.

Hospitals Dispensing units were assessed if they have a predefined schedule to determine when to order and how much to order from main store of the hospital 62.5% of the hospitals have resupply schedule for dispensing units to order through IFRR for internal resupply and only 50% follow the resupply schedule properly. During the assessment 100% of the facilities have engaged in inter facility overstocked item transfer, redistribution of near expiry pharmaceuticals and related health commodities.

A well functioned inventory control system can be realized by maintaining adequate stock levels of each items by analyzing timely collected and good quality LMIS data. In addition to preventing stock outs (ensuring stock availability), preventing expiry, over stock and wastage of pharmaceuticals, a well-functioning inventory control system will reduce frequent emergency orders that would happen due to understock of items below the expected minimum levels of stock. (PFSA 2015, & Sisay A,2017)

4.2.5 Storage

Among 17 storage guidelines assessed most storage guidelines are fulfilled. Twelve guidelines are fulfilled by 75% and above of the hospitals. Four guidelines i.e commodities are protected from direct sunlight, water and humidity, visually free and protected from harmful insects and rodents and Roof is always maintained in good condition to avoid sunlight and water penetration scored 100% fulfilled in all health facilities.

Fire safety equipment is available, accessible and the current space of the store room is sufficient for existing products with reasonable expansion are fulfilled in half 50 % of the hospitals.

Separate location for expired item in store room and products stacked 10cm of the floor are fulfilled by only 62.5% of the hospitals. Only 37.5% of the hospitals are fulfilling the guideline on stacking products 30 cm away from the walls.

In Ghana 83.3% the facility store follows first-to-expire, first-out (FEFO) principles and Expired products were typically separated from usable supplies. (Kwei N, et al.,2006) In south sudan 35 %

of the health facilities maintained acceptable storage condition and practice. (Dick, Farai and Joseph, 2011)

In Lesotho none of the facilities had a practice of separating damaged or expired items from usable ones which is one of a sign of poor storage management. (Pharasi B,2007),

Similarly, a study in black lion hospital assessing the storage condition of the Hospital, it is observed that among the 17 standard criteria set to measure compliance of the storeroom with acceptable standard condition, it is observed that the store room fulfilled 12 of them (70.6%). Hence, since this figure is less than 80%, which is a minimum requirement for having acceptable storage condition for Pharmaceuticals, the Hospital store is considered that it doesn't fulfil normal storage condition for pharmaceuticals storage as per the storage guideline.(Sisay A 2017)

Poor storage condition will affect the quality of pharmaceuticals being stored i.e if the recommended storage condition by the manufacturer is not kept drugs and supplies may expire before the meant expiry date printed. Rooms that are too hot, stacks of carton that are too high, and other poor storage condition can cause damage or deterioration of the pharmaceutical product that would contribute for reduction of shelf life. A well-organized store will keep items safe, help simplify the facility's work and reduces time wastage in trying to find needed items. Health facility pharmacy store improvement is one of the IPLS related pharmaceuticals management initiatives which includes having a well-organized and well spacious store room that contains all the required storage facilities and adhering to the good pharmaceutical storage guidelines & practices.(MSH,2015 & USAID ,2006)

CHAPTER FIVE.

5. Summary, Conclusions and Recommendations

This chapter provides the summary of major findings, conclusions, and recommendation of the study.

5.1 Summary of findings

A total of 8 hospitals involved in the assessment of these 50% were private hospitals and 4 50% were public hospitals. At these facilities, study participants number of years of experience range from months to 8 years, only 50 % of them stayed in the hospital for more than 2 years. Staff turn over is high in the private than public ,75% staffs in private hospital stay less than 2 years and 50 % of staffs in public hospital have less than two years experience. Among 164 staffs only 35% of them trained on IPLS. More pharmacy staff in public hospital than in private hospitals. All provide ART and Anti TB service to the public for free and their product delivery modality is directly from PFSA.

On average a normal order takes less than two weeks in 75% of the facilities. Stock out rate is high for cotrimoxazole 240mg/5 ml suspension followed by Lamivudine +Tenofovir (300 mg+300mg) tablet. It is also observed that stock out is high for Nevirapine 10mg/5ml suspension and INH pediatric dose. All ARV products anti TB drugs, HIV test kits and INH was given to all hospital for free from PFSA but OI commodities like Cotrimoxazole tablet and suspension was not given for free in most private hospitals, some get OI commodities and some not and difficult to justify the reason behind it.

Expiry is high among ARV drugs handled by the Hospital, three types namely Efavirenz 600 mg caps, Lamivudine + Tenofovir 300mg + 300mg and Nevirapine 10mg/ml oral suspn. These three products are expired in 4 (50%) of the hospitals and Cotrimoxazole 960 mg tablet was expired in 62.5% of hospitals.

Among the assessed hospitals 75 % have placed emergency order 1 or more time and 50% of them are through RRF.

Availability of bincards and RRF was confirmed in all hospitals but 87.5% of hospitals reported availability of IFRR. Of these, 50% sent their RRF quarterly, only 62.5% completed all columns of the RRF properly. But only 62.5% and 37.5% use IFRR for regular reporting in ART dispensing unit and Anti-TB dispensing unit respectively. IFRR use was minimal among private hospital than public.

All the facilities have engaged in inter facility overstocked item transfer, redistribution of near expiry pharmaceuticals and related health commodities. Most storage guidelines are fulfilled, among 17 storage guidelines assessed 12 guidelines are fulfilled by 75% and above of the hospitals.

5.2 Conclusion

Based on the major findings presented above and the framework utilized to guide the study, the following conclusions may be drawn.

- ❖ The overall result of this study provides an important information that can be used to measure and conclude on supply chain status of the Hospitals on HIV /AIDS and Anti TB pharmaceuticals and related commodities availability and program success.
- ❖ The result clearly shows that, public hospitals are more staffed than public hospitals.
- ❖ Availability of bincard and RRF was great but IFRR availability needs improvement. Half of the studied hospitals sent their RRF quarterly, and all columns of the RRF are partially completed which affect the data quality of the report as well as the resupply system. IFRR usage is very minimal in TB dispensing unit than ART plus IFRR use was minimal among private hospital than public.
- ❖ Stock out rate is high for cotrimoxazole 240mg/5 ml suspension followed by Lamivudine +Tenofovir (300 mg+300mg) tablet. Additionally, stock out is high for Nevirapine 10mg/5ml suspension and INH pediatric dose.

- ❖ All ARV products Anti TB drugs, HIV test kits and INH was given to all hospital for free from PFSA but OI commodities like Cotrimoxazole 960mg and 240mg/5ml suspension was not given for free in most private hospitals.
- ❖ Expiry is high among ARV drugs handled by the Hospital. Three ARV products are expired in 50% or more of the hospitals which have great implication on the program.
- ❖ Emergency Order was placed in 75 % of the assessed hospitals for one or more time, which indicates that the inventory control system should be strengthened. Emergency order was placed are through RRF in 50% of the hospitals. So great attention should be given for minimization of expiry and to strengthen the data quality in RRF and inventory control system so that Emergency orders and Stock out should be minimized
- ❖ All the facilities have engaged in inter facility overstocked item transfer, redistribution of near expiry pharmaceuticals and related health commodities.
- ❖ Most storage guidelines are fulfilled among 17 storage guidelines assessed 12 guidelines are fulfilled by 75% and above of the hospitals.
- ❖ Supply chain findings in the hospital is encouraging only with respect to some measurements such as availability of logistics reporting and recording tools. But IFRR use, stock availability, expiry and storage condition should be given due attention.

Hence, from the above concluding points, this study concludes that even though some encouraging practices are observed filling gaps is mandatory. This study indicate that supply chain practice was encouraging both in public and private Hospitals, but Stock out should be strongly eliminated since the availability of these commodities is very crucial to the clients in need of it.

5.3 Recommendations

To address the gaps observed in supply chain assessment of public and private hospitals in Addis Ababa for the management of HIV/AIDS and Anit-TB pharmaceuticals and related commodities, the following recommendations are forwarded.

- Equally engaging private hospitals as public by providing all program products to maximize product availability and to increase program impact

- IFRR availability and use at all dispensing unit should be strengthened and monitored by hospital management, RHB, PFSA and partners supporting the supply chain system.
- Top management of the Hospitals should give due attention to fulfilling storage guideline and expansion on the pharmacy store should be done to avoid any gap with respect to the physical structure (e.g space) of the store room and fulfillment of necessary storage conditions.
- Strengthening redistribution system between facilities to minimize wastage and stock out and overstock among them. Hospitals should have to give due attention for stock outs and expiry.
- quality LMIS data should be reported by Hospital, and sufficient stock should be maintained at the supplying PFSA hub for all items always based on accurate forecast of future needs/demands. Which helps to minimize stock out as well as redundant emergency orders requested by the Hospital.
- Further research should be conducted on Program pharmaceutical management inclusive of the private sector.
- This research may show the directions for other researchers to make further investigation on this topic

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Annex I: (Data collection tool I)

Interview of key respondents using a check list and open-ended questions.

Dear sir/madam; Greetings! My name is **Seblework Teklehaymanot** and I am a post graduate student in Logistics and supply Chain management at Addis Ababa University School of commerce.

Currently I am doing my thesis work in titles, **Assessment of Supply chains of Pharmaceutical and Medical Commodities for anti TB and HIV/AIDS: in the Case of Public and Private Hospitals in Addis Ababa**. For this purpose, I am going to collect data that will help me to achieve the following objectives.

- To assess logistics system management practices within the hospital, which includes availability and use of recording and reporting formats,
 - To assess the logistic system performance by gathering information on stock status information, including stock availability, stock out, availability of product expiries, and storage conditions on the day of visit.
 - To assess inventory management system with in the hospital
 - To assess the storage condition of ARVs and Anti -TB pharmaceuticals and related commodities
- Finally, I would like to confirm that this is neither a supervisory visit nor performance evaluation of individual staff members. Rather, the findings of this research work will help to provide relevant information to make decisions and to bring improvements.

I would like to thank you so much for your great cooperation in supporting me collecting data to this research.

Using this questionnaire, I would like to ask the store manager/pharmacy to head a series of questions about the ARV and Anti TB drugs and related commodities available at the Hospital.

Do you have any questions? May I begin the questions now?

- I. The Respondent agrees to answer, Yes, you can begin your questions. Continue
- II. The respondent does not agree, Ends.

First, ask the following questions of the in-charge or pharmacy head/store manager.

Section I. Back ground characteristics of health facilities and the respondents

- 1. Type /ownership of the hospital 1. Public _____ 2. Private _____
- 2. Provides ART services: 1. Yes _____ 2. No _____
- 3. Product Delivery modality from PFSA 1. Direct _____ 2. Indirect. _____
- 4. Are you the primary person responsible for managing ARV drugs storage and distribution at this facility using IPLS system: Yes _____ No: _____
- 5. How many staff the facility has under the Pharmacy unit? No. of pharmacy staff _____
- 6. How many of them are trained in supply chain/IPLS: No. trained _____
- 7. No. of year and months you have worked at this Hospital: Years _____ Months _____

Section II. Logistic system performance

- 8. What are the direct sources of supply for ARV drugs at this Hospital? Multiple responses
 - a. PFSA
 - b. RHB
 - c. ZHD
 - d. Woreda
 - e. Health Center
 - f. Other (specify) _____
- 9. If multiple responses. What is the usual source (most common source)? Select only one answer
 - 1. PFSA _____
 - 2. RHB _____
 - 3. ZHD _____
 - 4. Woreda HO _____

- 5. Health Center ____
- 6. Other (specify)___

10. On average, for a normal order approximately how long it takes between sending an order and receiving products from main supply point?

- 1. Less than two weeks
- 2. Weeks to 1 month__
- 3. Between 1 and 2 months
- 4. More than 2 months ____

11. Does the facility usually get the quantities of products it orders?

- 1. Yes
- 2. No_____
- 3. Don't know

If Yes or don't know, go to next question

12. If no, why not? _____

The resupply point does not have adequate supply

- a. The resupply point was stocked out _
- b. Order amount changed at the resupply point
- c. Other (specify) _____

13. How many emergency orders have you placed in the last three months? If available ask for documents to verify using RRF

- a. None _____
- b. 1_____
- c. 2_____

- d. 3 _____
- e. More than 3 _____
- f. NA _____

14. What type of formats have you used to place emergency orders?

- a. Using RRF _____
- b. Using letter _____
- c Through phone _____
- d Orally _____
- e. Other(specify) _____

Section III. Logistic management information system

15. Are the following LMIS formats, Job Aids and SOPs are available at the facility?

- a. Bin cards: 1. Yes _ 2. No _____
- b. Internal Facility Report & Requisition Form (IFRR): 1. Yes __ 2. No
- c. Facility Report & requisition Form: 1. Yes __ 2. No _____
- d. Standard Operation Procedure (SOP for IPLS: 1. Yes _ 2. No

16. Do you use the following stock keeping logistics formats to manage health products in this facility?

Must be verified by checking sample completed bin cards

- a. Bin cards: 1. Yes No _____
- b. Stock cards: 1. YesNo _____
- c. Others(Specify) _____

17. What LMIS forms do you use for reporting/ordering Multiple response are possible

Must be verified with completed reports

a. IFRR: 1. Yes _____ No _____

b. RRF: 1. Yes _____ No _____

C. Other. 1. Yes _____ (Specify) _____ 2. No _____

18. The Hospital compiles and sends RRF reports to higher level?

1. Yes _____ 2. No _____

If No, go to question no. 12.

19. If yes, to whom? Multiple responses are possible. DO NOT READ THE RESPONSES

a. PFSA

b. RHB

c. Zone Health Office

d. WoHO

e. Resupply Health Center _____

f. Don't Know

g. Other(Specify)

20. If Yes, How often are these LMIS reports (RRF reports) sent to the higher level?

Multiple responses are possible. DO NOT READ THE RESPONSES

a. Monthly. _____

b. Bimonthly (every two months) _____

c. Quarterly _____

d. Semi-annually _____

e. Annually _____

f. Other _____

21. When was the last time the Hospital sent RRF report? Must be verified with completed reports

- a) Never _____
- b) Within the last month _____
- c) months ago _____
- d) 3 months ago _____
- e) More than 3 months ago _____

22. Do all columns in RRF are completed for all medicines? Must be verified with last completed reports

- a. Yes _____
- b. No _____
- c. Completed reports not available _____

23. What is the mechanism that your Hospital sends RRF report to the higher level?

- a. Hand carried by facility's staff _____
- b. Picked up by supervisor _____
- c. Picked up by other higher level staff _____
- d. Sent via drivers _____
- e. Sent through mail _____
- f. Other(specify) _____

24. Does the ART dispensing units (DUs) use IFRR for regular reporting?

Must be verified with completed report

Yes _____ No _____ N/A _____

25. Does the Anti TB dispensing units (DUs) use IFRR for regular reporting?

Must be verified with completed report

Yes _____ No _____ N/A _____

26. Does the dispensing units (DUs) use IFRR for regular reporting?

Must be verified with completed report

Yes _____ No _____ N/A _____

Section IV. Inventory management

27. Who determines this facility resupply quantity? Multiple responses are possible

- a. The facility itself _____
- b. Higher-level facility (Health Center, PFSA/Woreda/Zone/RHB) _____
- c. Other (Specify) _____

28. Does the Hospital have a resupply schedule for dispensing units? Yes _____ No _____

If Yes, Check posted Schedule _____

If No, specify the reason _____

29. If yes, do the dispensing units follow their regular schedule? Yes No

If yes, observe filled IFRR with their schedule _____

If no reason _____

30. Does this Hospital engage in inter-facility transfer/Redistribution of excess/unwanted/near expiry drugs and supplies?

- 1. Yes
- 2. No
- 3. Don't know

Annex II. (Data collection tool II)

On top of this, I would like to actually observe the ARV and Anti TB drugs and related commodities you have at stock today and assess their general storage conditions using observation.

Section I. Tracer Product availability

Table 1. This table helps to gather data that is used to assess the stock status. Description of each column

Column 1. Name of authorized tracer products that will be counted

Column 2. Unit of count for the product

Column 3. Check if the bin card is available. Answer Y for yes and N for no.

Column 4. Check if the bin card has been updated with in the last 30 days, Answer Y for yes & N for no.

Note: if the bin card was last updated with the balance of 0 and the facility has not received any resupply, consider the bin card as updated.

Column 5. Record if the facility experiencing a stock out of the product on the day of visit, answer Y for yes or N for no. If products are available outside the store room there is no stock out. Visually verify that usable products are in stock.

Column 6. Record if the facility has expired products.

No	Ite	Units of count	Bincard available? (Y/N)	Bincard updated? (Y/N)	Stock out today? (Y/N)	Availability of expired product (Y/N)
	1	2	3	4	5	6
1	Lamivudine+Neviarapine+zidovudine (150mg+200mg+300 mg) tab	60				
2	Efavirenz+Lamivudine+Tenofovir (600mg+300mg+300mg) tab	30				
3	Lamivudine+Tenofovir (300mg+300mg)					
4	Nevirapine 10mg/ml oral suspn.	240 ml				
5	Lamivudine+Zidovudine (150mg+300mg)	60				
6	Nevirapine 200mg tab	60				
7	Efavirenz 600 mg					
8	INH 300 mg	10				
9	INH 100 mg	10				
10	Anti -TB kit	Kit				
11	HIV test kit for test1(wantibeijing)	each				
12	HIV test kit for test 2	each				
13	HIV test kit for test 3 (vikia)	each				
14	Cotrimoxazole 960 mg tablet	100*10				
15	Cotrimoxazole 240mg/5 ml suspension	bottle				

Section II. Storage conditions

This table is used as a check list to assess the storage condition of the Hospital which is used to store drugs. Place a check mark in the appropriate column based on visual inspection of the storage facility. Write any relevant observation noted in the comment's column.

N: B. to qualify as 'yes' for each criteria, the store room must meet the requirement as per described per each criteria.

No.	Description	No.	Yes	Comments
1	ARV drugs are arranged properly and professionally in such a way that identification labels and expiry dates and/or manufacturing dates are visible.			
2	ARV drugs are stored, organized and arranged in a manner that is accessible for first-expire – first-out (FEFO) stock rotation method			
3	Cartons and products are in good condition, not crushed, deteriorated, and spoiled due to mishandling. If cartons are open, determine if products are wet or cracked due to heat/radiation			
4	There is a separate location to store/put damaged and/or expired ARV and Anti TB drugs and related commodities by removing from usable products before they get disposed using appropriate procedure.			
5	Drugs including ARV and Anti TB drugs and related commodities are protected from direct sunlight and high heat at all times of the day and during all			

6	Cartons and drugs are protected from water and humidity during all seasons			
7	Storage area is visually free and protected from harmful insects and rodents (check the storage area for traces of bats and/or (dropping or insects))			
8	Storage area is well secured with a lock and key, but is accessible during normal working hours; access is limited to authorized personnel			
9	Drugs are stored at the appropriate temperature during all seasons according to product temperature			
10	Roof is always maintained in good condition to avoid sunlight and water penetration			
11	Storeroom is maintained in good condition (clean & tidy, all trash removed, sturdy shelves, well organized boxes).			
12	The current space of the store room is sufficient for existing products and reasonable expansion (i.e., receipt of expected product deliveries for foreseeable future).			
13	Products are stacked at least 10 cm off the floor			
14	Products are stacked at least 30 cm away from the walls and other stacks.			
15	Products are stacked no more than 2.5 meters high.			
16	Fire safety equipment is available and accessible			
17	Drugs are stored separately from insecticides and			