`

ASSESSMENT OF INVENTORY MANAGEMENT PRACTICES FOR HHMAN IMMUNODEFFICIENCY VIRUS (HIV) DRUGS AND TEST KITS IN SELECTED PUBLIC HEALTH FACILITIES IN WEST WOLLEGA ZONE

BY: GEMECHU ASMERA

A research paper submitted to school of pharmacy, institute of health science, Jimma University: - in partial fulfillment of the requirements for master degree in pharmaceutical supply chain management

NOVEMBER, 2018

JIMMA, ETHIOPIA

JIMMA UNIVERSITY

FACULTY OF HEALTH SCIENCES

SCHOOL OF PHARMACY

ASSESSMENT OF INVENTORY MANAGEMENT PRACTICES FOR HHMAN IMMUNODEFFICIENCY VIRUS (HIV) DRUGS AND TEST KITS IN SELECTED PUBLIC HEALTH FACILITIES IN WEST WOLLEGA ZONE

BY: - GEMECHU ASMERA (B. Pharm)

ADVISOR: - TADESSE GUDETA (B. Pharm, MSc.)

NOVEMBER, 2018

JIMMA, ETHIOP

Abstract

Background: - Effective inventory management minimizes stock outs and losses due to unnecessary expiry, and other problems, and ensures that the desired medicines are available at all times in adequate quantities. However, inventory management of health facilities in Ethiopia was reportedly addressed to be deficient. The operating information system at facility level is also minimal, so that the information obtained was of little importance to support for decision-making.

Objective: - the objective of this study was to assess the inventory management practices of HIV drugs and test kits in selected public health facilities in West Wollega zone.

Methods: - facility based cross-sectional study complemented with qualitative method was conducted from April 01 to May 30, 2018 to assess HIV drugs and test kits inventory management practices in the selected public health facilities in West Welega zone.

Result: - a total of 23 health facilities (6 hospitals and 17 health centers) was selected for the study. The inventory management practices of HIV drugs and test kits in these facilities were assessed using recording and reporting accuracy, stock out rates, wastage rates etc. Accordingly, the average data transfer accuracy of RRF for the specific products was calculated to be 65.0%. From 409 bin cards assessed, 67.7% were updated from which 83.7% were filled accurately. The majority of the facility (78.3%) had faced stock out during the last six months of the study. Concerning the wastage of products, 88,539.79 ETB was lost due to poor inventory management during the last six months of the study period. Regarding storage conditions, only 26.1% of the assessed health facilities were adhered to good storage criteria. Managerial negligence, inadequate human resource, inadequate supply, supply of near expiry date and lack of training and supportive supervision were the identified inventory management challenges during the study.

Conclusion and Recommendation: - inventory management practices of HIV drugs and test kits in West Wollega zone health facilities were deprived. Report inaccuracy, poor record updating practices, frequent stock outs, resource wastages and non-adherence to good storage practices were identified in the area. Therefore, ORHB, WoHO & ZHD of W/W zone and PFSA shall solve the identified problems accordingly. (through recruiting adequate human power, training the staffs and providing supportive supervision and feedback regularly).

Keywords: - inventory management, logistics management information system, storage condition, and West wolega Zone.

Acknowledgement

First of all, I would like to thank my almighty GOD who helped me in all directions and kept me alive and healthy in this unstable and frustrating world. Next, I wish to give my special thanks to my advisor Tadesse Gudeta (B. Pharm, MSc.) for his indebted guidance and advice from the bottom of his heart. Without his real involvement through timely comment, advice and guidance, this research paper would not be really accomplished.

I would also like to thank Jimma University for giving me the chance as well as financial support to conduct the study.

Lastly but not the least, I would like to extend my gratitude to Chemonics International Inc for its financial support.

Table of content

List of table

List of figures

Acronyms and abbreviation

AA- Addis Ababa

AACA- Addis Ababa City Administration

AIDS- Acquired immune deficiency syndrome

ART- Antiretroviral treatment

ARV- Antiretroviral

FEFO- First expired first out

GPSP- Good Pharmacy Storage Practice

HC- Health center

HFs-health facilities

HIV- Human Immunodeficiency virus

HOSP- Hospital

IFRR- Inter-facility reporting and resupply form

IPLS-Integrated Pharmaceuticals Information System

LIAT-Logistics indicator assessment tool

LMIS-logistics management information system

Mgt- Management

MOH- Ministry of Health

OHB- Oromia health bureau

PFSA-Pharmaceuticals Fund and Supply Agency

QM- Quality monitoring

RRF- Reporting and resupply form

SOP- Standard Operating Procedure

UNAID- United States Aid for International Development

WWZHD- West Welega zone health department

WoHOs- Woreda health offices

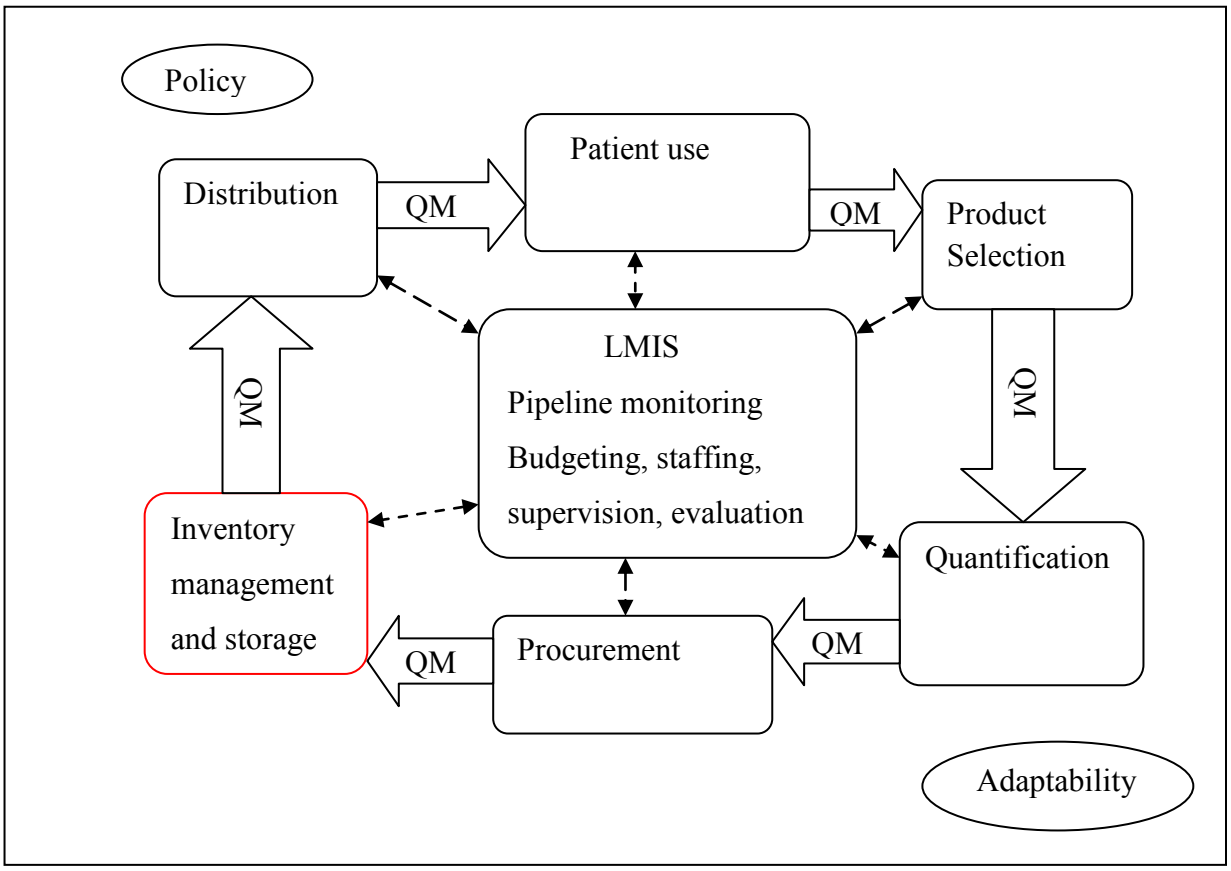
ZHD- zonal health department

1. Introduction

1 .1.Background

HIV remains a major global public health challenge by affecting the economically productive age groups (1). However, it is possible to ensure the healthiness and productivity of HIV infected people through efficient inventory management of HIV/AIDS drugs and test kits. Inventory management is important to guard the healthcare delivery towards any type of disturbance (2). Inventory management involves all activities put in place to ensure that customer have the needed product or service. However, problems might be occurred when inventory is not tracked properly. Supplies get lost, left unchecked, stock outs occur, critical equipment locations are uncertain, supplies are used without being associated to patient's record, and on-hand inventory can get bigger unnecessarily. All of these problems leads to inefficiency and additional costs (3). Inventory management activities are crucial where there is storage of products that can be at suppliers, intermediaries, and service delivery points (4).

Pharmacy management systems can assist in maintaining the balance between stocking appropriate quantities to satisfy patient requirements and minimizing excess inventory. Inventory management is one of the components of logistics management cycle aimed to deliver quality products when needed. As it illustrated in figure below, the logistics cycle is circular indicating the repetitive nature of the elements in the cycle and the activities at each step depends on one another.The overall logistics system is governed by health policy and designed to adapt to situations or changes if happened. The general goal of the health care system is to serve the customers and relieve their suffering from any pain or discomfort. Health care workers or teams are there for nothing but to serve and satisfy customer needs. However, this customer satisfaction is achieved only through effective performance of inventory activities. The logistics activities start with customer services followed by product selection which is a critical step in the cycle. The selection of a product is critical since customer needs, disease pattern and resource availability guides the process. Unless due attention is given to product selection, either the live of the patients will be in danger or resources will be wasted (5, 6 &7).



Key: QM = Quality Monitoring

◄- -► = shows the flow of information

Inventory management & storage were our focus area in this study

Figure 1: Logistics cycle

Source: Logistics Handbook: USAID | DELIVER PROJECT, Task Order 1. 2001. 2nd edition.

Once products are selected, appropriate quantification and procurement will follow to ensure an uninterrupted supply of the product. Quantification of products to be procured helps program managers to plan for budget and procurement schedule. The procurement of HIV infection related products is complex due to patents, changing treatment regimes and the need to ensure quality related issues. The product procured and received need to be stored according to appropriate storage guidelines to prevent damage and wastages as well as distributed appropriately to reach the customer. Inventory management is one of the systems designed to minimize/avoid wastage of products through theft, expiry and obsolesce. The other important component in logistics cycle is information- which is the heart of the logistics system that drives

the whole logistics cycle. Therefore, without information, the logistics system would not run smoothly(5).

Achieving commodity security for HIV/AIDS programs is challenging in low income countries due to weak inventory management. An effective and efficient logistics management requires effective service delivery(6).

1.2. Statement of the problem

The first evidence of HIV epidemic in Ethiopia was detected in 1984G.C. Since then, human immunodeficiency virus (HIV) remains the leading cause of morbidity and mortality throughout the world. Around 76.1 million people have become infected and 35 million people have died from AIDS related illnesses worldwide since its emergence as epidemics. Sub-Saharan Africa contributed 76% of the total HIV-infected people and 75% of the total HIV/AIDS deaths in 2015. Since the first case report of HIV infection in Ethiopia, almost 1.93 million people have been infected with HIV and about 1.3 million have died of AIDS-related causes. In Ethiopia, HIV infection is characterized by a low-intensity, mixed epidemic and self-sustaining transmission with a prevalence of 1.1% (7). Effective prevention and treatment program were reported to reduce the incidence of HIV infection through early diagnosis, treatment and care. Antiretroviral Therapy (ART) began in Ethiopia in 2003 and free ARV service was launched in January 2005 and public hospitals start providing free ARVs in March 2005. However, HIV remains a public health problem and surging again in Ethiopia currently which might be due to frequent stock outs of HIV test kits resulted from poor inventory management at health facilities and weakened other programmatic interventions (8).

To combat HIV/AIDS, uninterrupted supply of HIV drugs and test kits together with effective inventory management and other programmatic interventions are a pre-requisite. However, inventory management systems for HIV medicines and test kits in resource-constrained countries are challenging, and are the cause of ruptures of the supply management systems (8). One of the primary challenges to achieving a reliable, cost-effective, and secured supply of HIV/AIDS commodities has been the high cost of the commodities (9). According to world medicine situation report, the value of ARVs for the national ART program was increased from $60 million per year in 2011 to $100 million in 2015. Poor inventory management in public health institutions results in wasting of these precious financial resources; leads to poor availability of medicines, stock outs, stock losses and consequently, failure to improve patients' health outcomes(10) . In Nigeria, a total cost of 51,369.02USD was lost due to expiry of HIV drugs and test kits(11). In sub-Saharan Africa alone, there is a need of delivering about 30 containers of medicines across Africa each day to respond to the demand of over 28 million people on ART. This huge increase in ARV demand requires proper inventory management system. However, the

inventory management in low income countries has always been challenging and weak characterized by stock outs and wastage of resources (12). Product overstocking increases inventory holding cost, budget tie-up and wastage of resources due to expiration while under stocking leads to emergency order and stock out resulting in either treatment interruption or shifting between regimens. Treatment interruption increases the chance of emergence of resistant viral strains while shifting between regimens increases treatment cost. Majority of studies conducted in developing countries revealed interruption of supplies and ARVs due to stock outs resulted from poor inventory management. According to some studies, one in five health facilities of developing countries reported a stock-out of antiretroviral putting the lives of patients in danger. The duration and frequency of stock outs vary widely across health facility. A study conducted in Tanzania showed that the stock out of ARVs and HIV test kits have occurred twice and lasted 1week to 3months (13). A national survey of integrated pharmaceuticals logistics system conducted in Ethiopia also revealed inadequate supply of quality and affordable pharmaceuticals, poor storage conditions and weak stock management-resulted in high levels of waste and stock outs(14).

Generally, an inventory management problems of ARVs put individual patient at risk of disease progression & death and failure of public health programs due to development of ARV drug resistance, difficulty in achieving progress towards universal access, and diminishes the credibility of ART programs in the eyes of patients, the community and healthcare providers (10, 17).

2. Literature review

The goal of every public health logistics system is to help ensure that there is commodity security for every customer and its availability when needed. A proper functioning logistics system together with effective logistics management is critical to ensuring commodity security. Financing, policies, and commitment are also important. Effective and efficient logistics management not only helps to ensure commodity security or customer satisfaction but also helps to determine the success or failure of any public health program. Therefore, optimization of inventory management is mandatory to avail usable products when and where needed(15). Compared to many other essential medicines, ARVs and HIV tests may require special handling or adjustments during inventory management(16). The special nature of ARVs and HIV tests will influence the design of the inventory control system, logistics management information systems and the storage and distribution networks(17).

Logistics management is part of supply chain management which encompasses all the logistics activities as operational component of the supply chain management including quantification, procurement, inventory management, transportation and fleet management, and data collection & reporting. It is the art of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods including services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements. Logistics management puts more emphasis on efficient movement and storage of products to fulfill customer requirement(18).

The challenge of national medicines policies in low income countries is the inability to ensure uninterrupted supply of essential medicines that are safe, efficacious, physically & financially accessible and used rationally. The regular availability of medicines and health commodities is the most important output of a logistics system which can be ensured through effective and efficient inventory management. However, a study conducted in Sub-Saharan African countries indicated that the medical supply systems were often unreliable and therefore do not guarantee regular supply of essential medicines(19).

Logistics management information system practices of ARVs in health facilities (LMIS)

Logistics management information system collects data about commodities which often used for activities, such as filling routine supply orders for health facilities. LMIS collects, organizes and reports data that enables people to make logistics system decisions(20). LMIS at health facilities can be manual (paper based) or partly or wholly computerized. In most of low income countries, LMIS data were recorded on store ledgers, stock control cards and requisition forms at the district and health facility level where reporting such data to the higher levels of the distribution system for better supply planning is often difficult. Effective LMIS practices at health facility should present data elements with complete and accurate information for effective decision making by program managers. However, a number of studies and assessments conducted in resource limited countries showed low utilization of LMIS tools with inaccurate and incomplete information. For example an assessment conducted in Zimbabwe on HIV/AIDS logistics system revealed that ART monthly progress report captures only services statistics without logistics data items (Stock on hand, consumption data and loss/adjustment(21). A study conducted in Addis Ababa to assess laboratory LMIS practice for HIV/AIDS also revealed that the laboratory LMIS was weak, being hampered by several systemic challenges that caused frequent stock outs of critical commodities, thus impeding continuous and quality testing for patients (22). One of the main difficulties in implementing a functional LMIS was found to be the burden for the health professional in maintaining multiple tasks (8).

Inventory management practices of ARV drugs and HIV test kits at health facility

Every facility needs an inventory management system and written procedures to deal with ordering supplies, receiving and storing stocks and recording and accounting for stocks(23). The value of antiretroviral (ARV) drugs in terms of cost, as well as life-saving potential, leads to mismanagement and pilferage if appropriate inventory control procedures are not established. The aim of inventory management at all levels is to ensuring minimum stock levels, as well as secures storage and distribution throughout the supply chain. Most successful inventory control systems are maximum–minimum inventory systems or systems that ensure that usable stock levels are maintained within an established range. Holding large quantities of stock in inventory requires more money and increased storage space and risk of pilferage, damage, and expiration

(9, 21, and 23). Inventory management practice in the health facilities can be measured by availability of usable stock on hand within established max-min range of the country as measured by stock out rate. The stock out of ARV drugs is critical as it increases the risk of treatment interruption, antiretroviral resistance, treatment failure, morbidity and mortality. An assessment of the magnitude of stock out of HIV medicines and diagnostic tests in all zonal warehouses and public facilities in Kinshasa, Democratic republic of Congo showed stock outs of the regimen in 56% of the facilities (24). The assessment of medicine stock out and inventory management problems in Dar es Salaam region hospitals, Tanzania revealed about 20% of tracer medicines were stock out and imbalances of records on stock record card also observed(25). In Ethiopia, assessment of HIV/AIDS related commodities in Addis Ababa indicated that 75% of the assessed facilities reported stock out of one or more ARV drugs on the day of visit. Another study conducted to assess inventory management of key essential medicines in health facilities of east shewa zone, revealed the mean stock out rate of 27.25%(26).

The storage condition of health facility storerooms

The storage condition for pharmaceutical products should comply with the recommended good storage practices so as to preserve the quality of the products stored. Well-located, well-built, well-organized, and secure storage facilities are essential components of pharmaceutical supply system (20). Good inventory control requires careful thought about the dimensions and design of the storage space, appropriate conditions for storage of different types of supplies, the importance of stock rotation and systematic arrangement of stock, as well as attention to cleanliness, fire prevention measures, and security within the store (17, 23, 24). However, health facilities of undeveloped countries may not comply with good storage practices (proper storage guidelines) because of their limited storage space, as well as poor capacity to manage the stores. A study result of the in-depth assessment of the medicines supply carried out in sub-Saharan African countries over four years (2007–2010) showed that only 45% of health facilities had good storage conditions on average and 6.14% of them had adequate storage areas. Storage capacity was also reported to be inadequate at all levels in the logistics system. A study conducted in Ethiopia, east shewa zone, Oromia regional state also revealed that only 25% of the assessed health facilities were adhered to good storage practice (11, 26).

Logistics management Challenges of ARV drugs and HIV test kits

A major challenge in pharmaceuticals inventory management is to maintain usable stocks and avoid wastages. Studies conducted in Zambian and Nigerian health facilities at different times identified that limited storage capacity at health facilities compromised quality of inventory management. Limited storage capacity, lack of reliable data, lack of adequate human resource and poor performance of health care workers were the challenges of inventory management of ARV drugs and HIV test kits (15, 23).

2.1. Conceptual framework

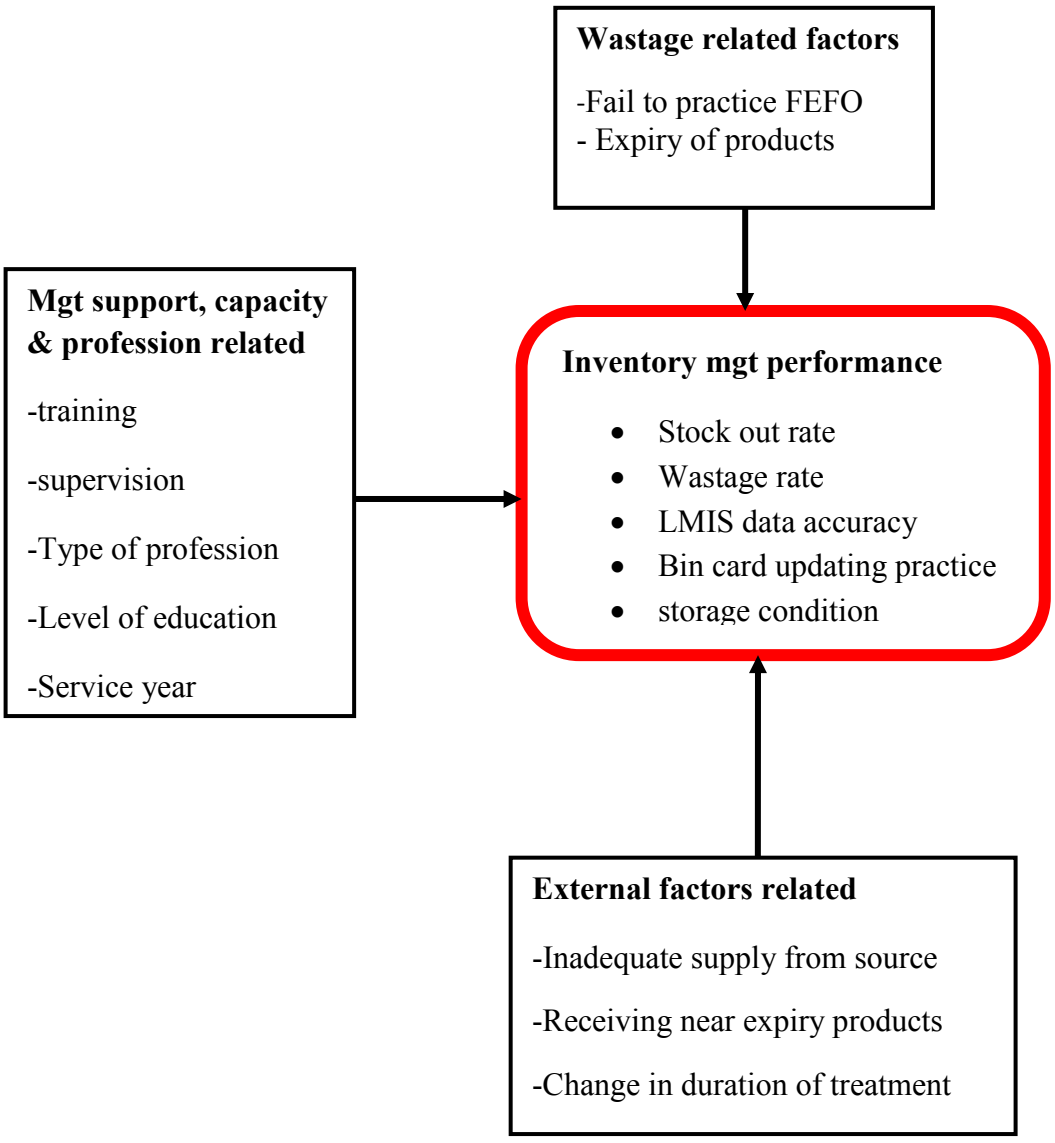


Figure 2: Conceptual framework Conceptual framework developed after review of different literatures.

2.2. Significance of the study

In many developing countries, especially sub Saharan African countries, the pharmaceutical inventory management was found to be ineffective and inefficient evidenced by frequent stock outs, wastages and unavailability of complete and accurate information. Personnel involved in medicine supply did not know methods to be used in controlling inventory. Thus inventories of medicines were mismanaged because of poor inventory management performance. Logistics tools were not filled and updated regularly and most of the facilities did not know their consumption (17). The study would provide a clue on HIV drugs and test kits inventory management practices in terms of indicators like stock out rates, inventory accuracy rates, accuracy in stock record keeping, value of unusable stock and stock wasted due to expiration. This study can also help program managers, logistics managers in the health facility, WoHO, ZHD, Oromia regional health bureau and PFSA to fill any gap that can be observed in the area.

3. Objectives

3.1. General objectives

- To assess the HIV drugs and test kits inventory management practices in selected public health facilities in west Wollega zone.

3.2. Specific objectives

- To assess the availability & utilization of logistics tools
- To evaluate LMIS data accuracy.
- To assess stock out rate of HIV drugs and test kits
- To assess wastage rate of HIV drugs and test kits
- To assess health facilities adherence to good storage condition.
- To identifyinventory management challenges related to HIV drugs & test kits

4. Methods and materials

4.1. Study area and period

4.1.1. Study area

This study was conducted in West Wollega zone public health facilities. West Wollega zone is one of the 18 zones of Oromia located in Western part of the region. Ghimbi town is the capital city of West Wollega zone which is located in the eastern part of the Zone at a distance of 441km from Finfinne, the capital city of Oromia as well as Ethiopia. West Wollega zone is located between $90^{0}10^{1} - 9^{0}17^{1}$ N latitude and $35^{0}44^{1}$-$36^{0}09^{1}$ E longitudes. West Wollega is bordered on the west by Kelam Wollega_Zone, on the north by the Benishangul-Gumuz Region, on the east by East Wollega zone, and on the southeast by Illubabor zone. The Zone covers an area of 13131 square kilometers. The total population of West Wollega was 1,211,755 approximately (27). There are nineteen (19) Weredas in the West Wollega zone. According to West Wollega zone health department, there are 561 health facilities (6 hospitals, 67 health centers and 488 health posts) excluding private clinics. Two of the six hospitals are non- governmental while the rest four are governmental hospitals. 2622 different health professionals, including 122 pharmacy professionals (49 pharmacists and 73 druggists), 85 doctors, 147 health officers, 1032 nurses, 169 (56 lab technologists and 113 laboratory technicians), 1010 health extension workers and 57 environmental health scientists are there in West Wollega zone (source: WWZHD).

4.1.2. Study period

The study was conducted from April 2018 to May 2018.

4.2. Study design

Health facility based cross-sectional study complemented with a qualitative method was used to assess HIV drugs and test kits inventory management practices in the selected public health facilities of West Wollega zone, Oromia regional state, Ethiopia.

4.3. Population

4.3.1. Source population

All health facilities of West Wollega zone, all professionals working under pharmacy units and all facility managers of those health facilities, all logistics recordings and reporting tools used in the selected health facilities and all medicines found in the selected health facilities.

4.3.2. Study population

A total of twenty-three health facilities (Six hospitals and seventeen health centers) from 17 districts of West Wollega zone, logistics recording and reporting tools used in the last 6 months of the study period (69 RRFs, 409 bin cards, 23 model 20 & 23 model 19), eight pharmacy store managers, two pharmacy heads, two facility heads, all HIV drugs and test kits in the selected health facilities were the study populations.

4.4. Inclusion and Exclusion criteria

4.4.1. Inclusion criteria

All hospitals and health centers established before November 2017 and providing HIV test and ART services were included in the study. Bin cards of all HIV drugs and test kits, RRFs and model19 used in the last six months of the study period and HCMIS tool (where available) were included in the study.

4.4.2. Exclusion criteria

Health posts were excluded since they do not provide HIV/AIDS care and treatment services. Two health centers situated in two Weredas were excluded from this study since they were not providing HIV/AIDS care and treatment services. This is due to that the two Weredas were established recently and on the way to fulfill the requirements for each sectors managed under it.

4.5. Sample size determination and sampling procedures

4.5.1. Sample size determination

There were 73 public health facilities (6 hospitals & 67 health centers) excluding health posts

from which 23 were selected. The 23 health facilities were determined by using the logistic indicators assessment tool assumption that suggests to take a minimum of 15% of the facilities (28)**.** Accordingly, the sample size for the present study was calculated as;

X = Z * 15%.....where, X represents sample size and Z represents population size

X = 73*0.15= 10.95 =~11. However, 11+12 = 23 public health facilities were included in the study based on available resource and time. All RRFs used between October 01, 2017 to March 30, 2018 and all bin cards of HIV drugs & test kits managed at the facility were taken.

4.5.2. Sampling procedures

The list of health facilities providing HIV/AIDS care and treatment services was taken from WWZHD. The health facilities were stratified as health centers and hospitals. Hospitals were again stratified administratively as NGO and government. However, only 23 health facilities (6 hospitals & 17 health centers) found in West Wollega zone were providing ART services. Only health centers that were situated in district towns and hospitals were providing ART services. Two Weredas were established recently thus the health centers situated in them were not providing ART service (Source: WWZHD). Therefore, 19 Weredas minus 2 Weredas = 17 Weredas were there in which ART service was available. Thus, all hospitals and health centers providing ART services and situated in different Weredas were assessed in this study.

Concerning medicines, all HIV drugs and test kits that had been managed in the 23 public health facilities in W/Wollega zone were assessed (29).

For RRF, IFRR and bin card

According to integrated pharmaceuticals logistics system SOP of Ethiopia, hospitals and health centers were expected to send RRF report every two months to the next higher level (30). So, three RRF reports from each facility (RRF from April 01, 2017 to May 30, 2018) were considered. Thus, 3*23= 69 RRFs were obtained for retrospective review. Regarding logistics recording tools, all bin cards of HIV drugs and test kits managed in the facility were considered. Thus, 20 bin cards* 23HFs= 409 bin cards were assessed in this study.

It is difficult to assess the accuracy and timeliness of IFRR since the IFRRs are filled by

estimation rather than counting and filling the stock on hand at the dispensary. Most of the dispensing units also do not use bin cards. The report submission time for the IFRR to the respective store was also not consistent. Thus, IFRR was checked only for their utilization.

For qualitative study

Twelve health professionals from different disciplines (nurses, pharmacy and facility heads) working on pharmacy related activities were selected for in-depth face to face interview. Eight store managers, two pharmacy heads and two facility heads with work experience of greater than one year were involved in the interview. The sample size of the interviewee was determined based on our data needs, time and resource available.

4.6.1. Dependent variables

- Inventory management practices
    - Stock out rate
    - Wastage rate
    - LMIS data accuracy
    - Bin card updating practice
    - Storage condition

4.6.2. Independent variables

Personnel, management support and storage conditions related

- Type of profession
- Level of education
- Service year
- Training
- Supervision

Wastage related

- Fail to practice FEFO
- Expiry

External factors relater

- Receiving near expiry product
- Inadequate supply from source
- Change in duration of treatment

4.6.3 Key performance indicators for logistics management of HIV drugs and test kits

It was difficult to measure inventory management performances at health facility directly. Logistics indicator assessment tool developed by USAID | DELIVER PROJECT was adapted to measure the inventory management performances at health facility since it is difficult to measure the performance of inventory management directly (8).

- **For LMIS performance:**
  - Accuracy in transferring information to the LMIS reporting
  - Timeliness of LMIS report
  - Completeness of LMIS Reports
  - Facility LMIS reporting Rates
  - Logistics record keeping practice
  - Inventory accuracy rate
- **Inventory management related:**
  - Stock out Rates
  - Ordering and receiving time
  - Emergency order rate
  - Stock wastage due to expiration
  - Value of unusable stock
- **Storage condition related:**
  - Thirteen measuring indicators were used to measure health facility's storage conditions in this study. Accordingly, facilities that fulfilled 80% of the storage condition were considered to have good storage condition (16).

4.7. Data collection procedures

Structured and semi-structured questionnaire was developed through adapting the USAID deliver tools and modified it to our country situation. Then, data were gathered from health facility stores using the structured and semi-structured questionnaire. All relevant documents used within the six months duration were also reviewed from logistics records. Physical count of the products was also performed to check bin card accuracy. For qualitative data, semi-structured questionnaire was developed by the principal investigator after reviewing LIAT and relevant

literatures. Then, the data were collected from key informants through note taking using the face to face in-depth interview technique to explore the challenges associated with HIV drugs and test kits logistics management performance. Each interview lasted a range of 25 to 30 minutes. The interview was made using the native language spoken in the zone, which is Afaan Oromoo.

4.8. Data processing and analysis

The collected data were checked for completeness and consistency of information. Then, quantitative data were coded and entered into Statistical package for Social Science (SPSS) version 20. After analysis, the results of the quantitative data were presented in tables and graphs. A chi - square test was employed to determine the association between dependent and independent variables. Then, variables with critical value $P<0.05$ were considered as statistically significant at 95% confidence interval. Qualitative data were analyzed using a thematic analysis approach. According to this approach, the information obtained from key informants through in-depth face to face interview was grouped into different topics after reading the note taken several times. Then, the main points of the notes taken were summarized and coded with numbers. Then, the codes with similar idea were collected together under similar topics. Finally, the points under each topic were written in detail, summarized carefully and presented with narration.

4.9. Data quality assurance

The data collectors (pharmacy professionals) were trained on data collection tools. The training was emphasized on how to collect valid data. During data collection, supervision and discussion were made by the PI on a regular basis and the collected data were reviewed for completeness and summarized on the same day of the data collection. Qualitative data were collected by PI to increase the consistency of the information.

4.10. Ethical consideration

The ethical approval letter was obtained from institutional review board of Jimma University and submitted to West Welega zone health department (WWZHD). Then, by filing the original letter of the institutional review board of Jimma University, WWZHD provided another letter to contact with the respective hospitals and Wereda health offices. Then, the letter from WWZHD was submitted to the respective hospitals and Woreda health offices of the zone. From the Woreda health offices, another letter was obtained and submitted to the respective health centers.

Then, the hospital and health center managers directed the letters to pharmacy store managers. Verbal consent was also obtained from all respondents before enrolling them in the study. During the consent process, the respondents were provided information regarding the purpose of the study and why they were enrolled in the study.

4.11. Operational definitions

- ARVs – in this study, ARVs refers to drugs used in hospitals and health centers for viral load suppression in an infected person's blood.
- Inventory management practices- in this study refer to the practices of an inventory management in the public health facilities.
- Bin card accuracy- is the similarity of stock balance on a bin card with stock on hand obtained during physical count.
- RRF accuracy- is the similarity of stock balance reported in the RRF with the stock balance on the bin card on the date that RRF was completed.
- Accurate- means there is no discrepancy between the recorded amount and the stock on hand obtained through physical count as well as between the records on bin card and RRF.
- Near accurate- means equal to plus/minus ten percent discrepancy between the records on bin card and RRF as well as between the balance on bin card and physical count (i.e. the discrepancy ranges from 90% to 110%).
- Not accurate- refers to greater than/less than ten percent discrepancy between the records on bin card and RRF as well as between the balance on bin card and physical count (i.e. the discrepancy is > 110% or < 90%).
- Completeness-means that all the columns are filled for each product recorded on RRF.
- Timeliness- means until the 5^{th} day of the reporting period every two months.
- HIV test kits- refers to diagnostic test kit 1&2RTK, wantai Beijing and uni-gold test kits used for screening of HIV infection.
- Utilization-using RRF & IFRR for reporting and requision purpose.

4.12. Limitation of the study

- Other stake holders such as PFSA, wereda health offices, and zonal health departments were not involved in the study because of time and budget constraints.

5. Results

Regarding logistics reporting forms, a total of 69 RRFs were to be evaluated, but only 60 were found. Nine RRFs were missed since 3 health centers never prepared the RRF within the last six months of the study. For the qualitative most part; 12 key informants (8 pharmacy store managers, 2 pharmacy heads and 2 facility managers) were participating in the in-depth face to face interview.

5.1. Socio-demographic characteristics of professionals working under pharmacy

A total of 78 different health professionals was working under pharmacy units of the selected health facilities. From the total staffs working under pharmacy units, 50 (64.1%) were pharmacy professionals while 28 (35.9%) were other health professionals (nurses and clinical officer). Forty (51.3%) of the total professionals were degree holders and 38 (48.7%) were diploma holders. Twenty-three (29.5%) of the professionals were working as store managers. Of these, 18 (78.3%) were diploma holders, while 5 (21.7%) were degree holders. Majority 61 (78.2%) of the total staffs had an experience of more than two years whereas 16(69.6) of the store managers had >2years of service (Table 1).

Table 1:Socio-demographic characteristics of the study participants in selected public health facilities in West Wollega zone, April to May 2018.

Socio-demography			
variables		**Total # of professionals under phar. unit (N=78), (%)**	**Store personnel (N=23-), 29.5 % of total prof. under pharmacy units (%)**
Type of education	Phar. professional	50 (64.1)	16 (69.6)
	others (N+CL.O)	28 (35.9)	7 (30.4)
Level of education	degree	40 (51.3)	5 (21.7)
	diploma	38 (48.7)	18 (78.3)
Service year	<2years	17 (21.8)	7 (30.4)
	>2years	61 (78.2)	16(69.6)

N= nurse, CL.O= clinical officer, Phar.= pharmacy

A majority of the staff working at pharmacy stores 15 (65.2%) had not trained on integrated pharmaceutical logistics system (IPLS) while 11 (47.8%) of them had received on the job training like comprehensive antiretroviral therapy training and plump nut supplement as well as laboratory commodity management. Only few staffs 2 (8.7%) have trained on health commodity management information system and drug& therapeutics committee trainings. Most of the health facilities 18 (78.3) had not received supervision within the last six months before the study period. However, 5 (21.7%) of health facilities have received supervision in the past 6 months (Table2).

Table 2:Training and supportive supervision received by store personnel in selected health facilities in the West Wollega zone, April to May 2018. (N=23)

Variables		Frequency (%)	Total (%)
IPLS training	Received	8(34.8)	23(100)
	Not received	15(65.2)	
On job training like	Received	11(47.8)	23(100)
(ART, plump nut,	Not received	12(52.2)	
Lab. Commodity Mgt)			
Other (HCMIS, DTC)	Receive	2(8.7)	23(100)
	Not received	21(91.3)	
Supervision received by stores	1-3month ago	2 (8.7)	23(100)
	3-6month ago	3(13)	
	>6month	18(78.3)	

5.2. Logistics management information system practices in health facilities

5.2.1. Availability and utilization of logistics tools recording and reporting formats

Blank logistics recording and reporting formats such as bin cards, RRF and IFRR were available 23 (100%) in all assessed health facilities. Automated records (computers for HCMIS) were available in all hospitals and 13 (76.5%) health centers. As indicated in the table below, utilization of the logistics tools was varied from facility to facility. RRF &IFRR utilization was 23 (100%) in hospitals, while the utilization was 23 (100%) for RRF & 14 (82.4%) for IFRR in

health centers. The utilization of bin card was 5 (83.3%) in hospital and 11 (64.7%) in the health center. Automated records were utilized only in 2 (33.3%) of hospitals (Table 3).

Table 3:Logistic tools availability and utilization in selected public health facilities in West Wollega zone, April to May 2018.

Type of LMIS records		Hosp, N (6)	HC, N (17)	Aggregates
		Frequency %	Frequency %	Frequency %
Bin card	Available	6(100)	17(100)	23(100)
	Utilized	5(83.3)	11(64.7)	16(69.6)
RRF	Available	6(100)	17(100)	23(100)
	Utilized	6(100)	17(100)	23(100)
IFRR	Available	6(100)	17(100)	23(100)
	Utilized	6(100)	14(82.4)	20(87)
Automated record	Available	6(100)	13(76.5)	19(82.6)
	Utilized	2(33.3)	0(0)	2(33.3)

5.2.2. Data quality of logistics tools

5.2.2.1. Accuracy of RRF for specific products

The average data transfer accuracy of RRF for specific products was calculated to be 65.0% on aggregates. As indicated in the table below, the average data transfer accuracy of the specific products was found to be 70% in hospitals and 62.3% in health centers. The result of the assessment revealed variation in the data transfer accuracy of the specific products. For instance, wantai Beijing HIV test was reported to be 66.7% accurate in hospitals, while it was reported to be 95.2% accurate in health centers. The reported information accuracy was 50% for TDF/3TC 300/300 mg &NVP 200mg while it was 88.9% for both 3TC 150mg & NVP 200mg/ml in hospitals (Table 4).

For table 4 bellow, RRF line for Hosp. N= 18x20 =360, RRF line for HC.N=42x17=714; N is 42 for HCs because 3 HCs failed to prepare RRF report in the last 6months of the study.

Table 4:RRF data transfer accuracy of the product line in selected public health facilities in the West Wollega zone, April to May 2018.

List of products	Hospital			Health center		
	Accurate (%)	Near accurate (±10%)	Not accurate (±10%)	Accurate (%)	Near accurate (±10%)	Not accurate (±10%)
ABC 300mg	13(72.2)	2(11.1)	3(16.7)	27(64.3)	8(19)	7(16.7)
ATZ/r 300/100mg	16(88.9)	2 (11.1)	0(0)	0(0)	0(0)	0(0)
EFV 200mg cap	15(83.3)	3(16.7)	0(0)	23(54.8)	13(31)	6(14.3)
EFV 50mg	12(66.7)	0(0)	6(33.3)	18(42.9)	20(47.6)	4(9.5)
EFV 600mg	11(61.1)	5(27.8)	2(11.1)	27(64.3)	12(28.6)	3(7.1)
TDF/3TC/EFV300/300/600	10(55.6)	1(5.5)	7(38.9)	30 (71.4)	9(21.4)	3(7.1)
AZT/3TC/NVP300/150/200	12(66.7)	1(5.5)	5(27.8)	27(64.3)	6(14.3)	9(21.4)
AZT/3TC/NVP60/30/50	12(66.7)	4(22.2)	2(11.1)	25(59.5)	14(33.3)	3(7.1)
LPV/r (80+20)mg/5ml	12(66.7)	4 (22.2)	2 (11.1)	0(0)	0(0)	0(0)
LPV/r 250+50)mg tab	13(72.2)	5 (27.8)	0(0)	0(0)	0(0)	0(0)
TDF/3TC300/300	9(50)	6(33.3)	3(16.7)	17(40.5)	10(23.8)	15(35.7)
3TC 150	16(88.9)	2(11.1)	0(0)	28(66.7)	10(23.8)	4(9.5)
AZT/3TC300/150	13(72.2)	3(16.7)	2(11.1)	23(54.8)	10(23.8)	9(21.4)
AZT/3+C60/30	11(61.1)	7(38.9)	0(0)	19(45.2)	17(40.5)	6(14.3)
ABC/3TC60/30	10(55.6)	6(33.3)	2(11.1)	22(52.4)	8(19)	12(28.6)
NVP200	9(50)	7(38.9)	2(11.1)	20(47.6)	5(11.9)	17(40.5)
NVP200mg/ml	16(88.9)	2(11.1)	0(0)	37(88.1)	5(11.9)	0(0)
Diagnostic test kit 1&2RTK	15(83.3)	3(16.7)	0(0)	24(57.1)	18(42.9)	0(0)
Beijing wantai HIV test	12(66.7)	6(33.3)	0(0)	40(95.2)	2(4.8)	0(0)
Uni-gold 20 tests	15(83.3)	2(11.1)	1(5.6)	38(90.5)	3(7.1)	1(2.4)
Subtotal	**252(70)**	**71(19.7)**	**37(10.3)**	**445(63.8)**	**170(23.2)**	**98(13.0)**

The association of RRF accuracy and its contributing factors was analyzed statistically using a chi - square test. Accordingly, RRF accuracy had a significant association with type of profession, X^2 (1, N=23) = 16.1, p=0.001; level of education, X^2 (1, N=23) = 67.6, p=0.009 and

training, X^2 (1, N=23) = 52.7, p=0.022. However, the RRF accuracy was not significantly associated with supervision and service year in this study (Table 5).

Table 5:The association of RRF accuracy and its contributing factors in selected public health facilities in West Wollega zone April to May 2018.

Variables	RRF accuracy		
	Likelihood Ratio		
	Value	Df	Asymp. Sig. (2-sided)
Type of profession	16.050	1	0.000
Supervision	0.032	1	0.859
Level of education	6.762	1	0.009
Service year	3.821	1	0.051
Training	5.274	1	0.022

5.2.2.2. Completeness and timeliness of RRF Report

The completeness of RRF was found to be 14 (77.8%) and 24 (57.1%) in hospitals and health centers respectively making the aggregated result 38 (63.3%). Twelve (66.7%) of the RRF were completed on time in hospitals, while 30 (71.4%) of the RRF were completed on time in health centers. The aggregated result of timelines of completing the report was found to be 42 (70%) (Figure 3).

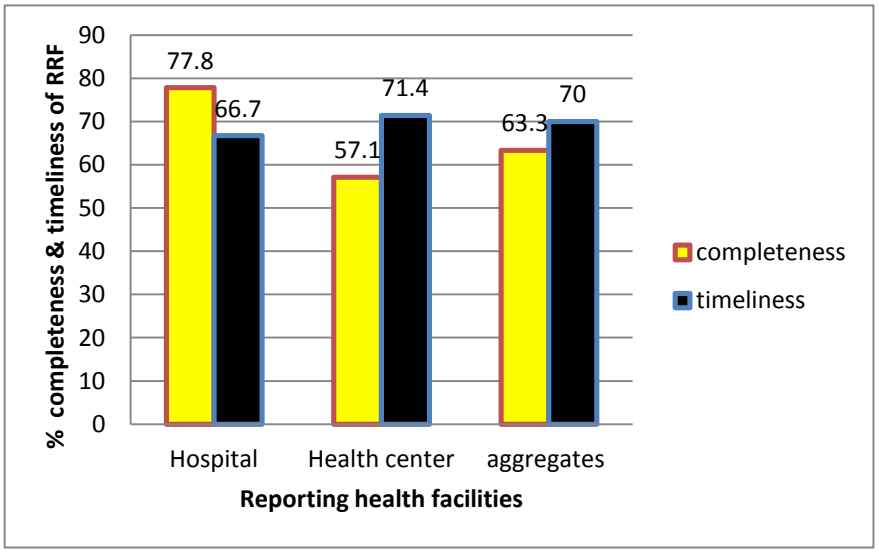


Figure 3: The completeness and timeliness of RRF in selected public health facilities in West Wollega Zone, April to May 2018. (N=18 for Hosp, N=42 for HC)

5.2.2.3. Bin card updating practices in the selected public health facilities

A total of 409 bin cards (120 from hospitals and 289 from health centers) were evaluated in the selected health facilities. Accordingly, 88 (73.3%) of the bin cards were updated in hospitals. In health centers, 189 (65.4%) of the bin cards were also updated. The overall updated bin cards in hospitals and health centers were 277 (67.7%). The bin card updating practices of specific products was also indicated in the table below (Table 6).

Table 6:Bin card updating practice frequency in selected public health facilities in the West Wollega zone, April to May 2018.

List of products	Hospital (N=6)		Health center (N=17)	
	Updated (%)	Not updated (%)	Updated (%)	Not updated (%)
ABC 300mg	4(66.7)	2(33.3)	12(70.6)	5(29.4)
ATZ/r 300/100 mg	5 (83.3)	1 (16.7)	0(0)	0(0)
EFV 200mg	4(66.7)	2(33.3)	14(82.4)	3(17.6)
EFV 50mg	3(50)	3(50)	10(58.8)	7(41.2)
EFV 600mg	4(66.7)	2(33.3)	8(47.1)	9(52.9)
TDF/3TC/EFV300/300/600	5(83.3)	1(16.7)	11(64.7)	6(35.3)
AZT/3TC/NVP300/150/200	6(100)	0(0)	10(58.8)	7(41.2)
AZT/3TC/NVP60/30/50	5(83.3)	1(16.7)	11(64.7)	6(35.3)
LPV/r (80+20)mg/5ml	6(100)	0(0)	0(0)	0(0)
LPV/r 250/50 mg tab	4(66.7)	2(33.3)	0(0)	0(0)
TDF/3TC300/300	3(50)	3(50)	9(52.9)	8(47.1)
3TC 150	5(83.3)	1(16.7)	13(76.5)	4(23.5)
AZT/3TC300/150	4(66.7)	2(33.3)	9(52.9)	8(47.1)
AZT/3TC60/30	3(50)	3(50)	10(58.8)	7(41.2)
ABC/3TC60/30	4(66.7)	2(33.3)	11(64.7)	6(35.3)
NVP200	4(66.7)	2(33.3)	12(70.6)	5(29.4)
NVP200mg/ml	6(100)	0 (0)	14(76.5)	3(23.5)
Diagnostic test kit 1&2RTK	4(66.7)	2(33.3)	8(47.1)	9(52.9)
Beijing wantai HIV test	6(100)	0(0)	14(76.5)	3(23.5)
Uni-gold 20 tests	3 (50)	3(50)	13(76.5)	4(23.5)
Grand total	**88(73.3)**	**32(26.7)**	**189(65.4%)**	**100(34.6)**

The association of bin card updating practices and its contributing factors was tested statistically using a chi - square test. As a result, bin card updating practice had a significant association with type of profession, X^2 (1, N=23) = 59.02, p=0. 015; and level of education, X^2 (1, N=23) = 49.90, p=0. 026. (Table 7)

Table 7:The association between bin card updating practice and its contributing factors in selected public health facilities in west Wollega zone, April to May 2018.

Variables	Bin card updating practice		
	Likelihood Ratio		
	Value	Df	Asymp. Sig. (2-sided)
Type of profession	5.902	1	0.015
Level of education	4.990	1	0.026
Service year	2.048	1	0.152
Training	2.964	1	0.085
Supervision	0.076	1	0.783

5.2.2.4. Accuracy of bin card data in the selected public health facilities

The average accuracy of bin cards in the hospitals was calculated to be 76(63.3%), while it was 156(54%) in health centers) making the aggregates 83.7%. The accuracy ranges from 33.3 for EFV 50mg & 600mg to 83.3 for TDF/3TC/EFV 300/300/600mg, 3TC 150mg, NVP200mg, ATZ/r 300/100mg and diagnostic test kit. In health centers, the average accuracy of the bin cards was 54 with the range of 29.4 for AZT/3TC/NVP60/30/50 to 82.4 for NVP 200mg/ml. The overall aggregated bin card accuracy in the selected health facilities was 219 (56.7%) (Table 8).

Table 8:Bin card data transfer accuracy in selected public health facilities in West Wollega zone, April to May 2018. (N=409)

List of products	Accuracy of bin card updating					
	Hospital (n=6)			Health center (n=17)		
	Accurate	Near accurate (±10%)	Not accurate (±10%)	Accurate	Near accurate (±10%)	Not accurate (±10%)
ABC 300mg	5(83.3)	1(16.7)	0(0)	9(52.9)	5(29.4)	3(17.6)
ATZ/r 300/100mg	5(83.3)	1(16.7)	0(0)	0(0)	0(0)	0(0)
EFV 200mg	4(66.7)	1(16.7)	1(16.7)	7(41.2)	6(35.3)	4(23.5)
EFV 50mg	4(66.7)	1(16.7)	1(16.7)	8(47.1)	7(41.2)	2(11.7)
EFV 600mg	2(33.3)	4(66.7)	0(0)	11(64.7)	6(35.3)	0(0)
TDF/3TC/EFV300/300/600	2(33.3)	4(66.7)	0(0)	7(41.2)	10(58.8)	0(0)
AZT/3TC/NVP300/150/200	2(33.3)	3(50)	1(16.7)	12(70.6)	4(23.5)	1(5.9)
AZT/3TC/NVP60/30/50	5(83.3)	1(16.7)	0(0)	5(29.4)	8(47.1)	4(23.5)
TDF/3TC300/300	5(83.3)	1(16.7)	0(0)	11(64.7)	4(23.5)	2(11.7)
3TC 150	5(83.3)	1(16)	0(0)	13(76.5)	2(11.7)	2(11.7)
AZT/3TC300/150	4(66.7)	2 (33.3)	0(0)	10(58.7)	5(29.4)	2(11.7)
AZT/3TC60/30	3(50)	3(50)	0(0)	9(52.9)	7(41.2)	1(5.9)
ABC/3TC60/30	2(33.3)	3(50)	1(16.7)	8(47.1)	6(35.3)	3(17.6)
LPV/r (80+20)mg/5ml	6(100)	0(0)	0(0)	0(0)	0(0)	0(0)
LPV/r (250+50)mg tab	5(83.3)	1(16.7)	0(0)	0(0)	0(0)	0(0)
NVP200	3(50)	3(50)	0(0)	10(58.7)	5(29.4)	2(11.7)
NVP200mg/ml	5(83.3)	1(16.7)	0(0)	14(82.4)	3(17.3)	0(0)
Diagnostic test kit 1&2RTK	2(33.3)	4(66.7)	0(0)	10(58.7)	7(41.2)	0(0)
Beijing wantai HIV test	2(33.3)	3(50)	1(16.7)	12(70.6)	5(294)	0(0)
Uni-gold 20 tests	5(83.3)	1(16.7)	0(0)	9(52.9)	8(47.1)	0(0)
Grand total	**76(63.3)**	**39**	**5**	**156(54)**	**98**	**35**

5.3. Inventory management practices of ARVs and HIV test kits

5.3.1. The stock out rate of HIV drugs and test kits and its contributing factors (N=23)

From HIV drugs and test kits assessed, 8 (40%) of them were stocked out at least once within the last six months with a different duration of times. Twenty one (91.3%) of health facilities had stock outs of Beijing wantai on the day of visit. Six (26.1%) of health facilities had also stocked out of TDF/3TC/EFV, NVP200tab and diagnostic test kit 1&2RTK on the day of the visit. During the last six months of the study period, 9 (39.1%) of facilities had stock outs of EFV 600mg, NVP200 and Diagnostic test kits with mean stock out duration of 45, 60 and 67.5 days respectively. Eighteen (78.3%) of the health facilities had also stocked out of wanting Beijing to mean stock out frequency of 2.2 and mean stock out duration of 47.9 days within the last 6months of the study period. ABC/3TC was staked out in 9 (39.1%) of the health facilities with mean stock out duration of 49 days while AZT/3TC was stocked out in 7 (30.4%) of health facilities with mean stock out duration of 52.1 days. The overall mean stock out frequency of the products during the last 6months of the study period was 9.95. In more than half of the health facilities; 18 (78.3%) inadequate supply from resupplying facility was the cause of stock out in Beijing wantai during the last 6months of the study period. Expiry was also the cause of stock out in AZT/3TC 60/30, AZT/3TC/NVP300/150/200 and ABC/3TC60/30. Change in duration of treatment was the cause of stock outs in AZT/3TC60/30, EFV600 & NVP200mg (Table9).

Table 9:HIV drugs and test kits stock outs and the reasons for stock outs in selected public health facilities in West Wollega zone, April to May 2018,(N=23).

List of products	Stock out status				Reason for stock out		
	No of facilities SO on the day of visit	No of facilities SO for the past 6month (%)	Mean SO freq in past 6mnths	Mean Duration of SO in the past6mn	Expiry (%)	Inadequate resupply (%)	Changed duration of Rx (%)
EFV 600mg	4(17.4)	3(13)	1	45	8.7	0	4.3
TDF/3TC/EFV300/300/600	2(8.7)	5(21.7)	1	34.4	8.7	13	0
AZT/3TC/NVP300/150/200	5(21.7)	1(0.04)	1	45	4.3	0	0
AZT/3TC60/30	7(30.4)	7(30.4)	1.5	52.1	21.7	0	8.7

ABC/3TC60/30	9(39.1)	9(39.1)	1.25	49.6	13	26	0
NVP200	2(8.7)	3(13)	1	60	8.7	0	4.3
Diagnostic test kit 1&2RTK	2(8.7)	3(13)	1	67.5	8.7	4.3	0
Beijing wantai HIV test	21(91.3)	18(78.3)	2.2	47.9	0	78.3	0

Note: SO= stock out; Rx= treatment.

The association of stock outs and its contributing factors was analyzed statistically using chi-square tests. Accordingly, stock outs of products had a significant association with inadequate supply from source, X^2 (1, N=23) = 74.1, p=0.006; expiry of products, X^2 (1, N=23) = 13.73, p=0.001 and change in duration of treatment, X^2 (1, N=23) = 44.19, p=0.036 (Table 10).

Table 10:The association between stock outs and its contributing factors in selected public health facilities in west Wollega zone, April to May 2018.

Variables	**Stock out rate**		
	Likelihood ratio		
	Value	Df	Asymp. Sig. (2-sided)
Inadequate supply from source	7.409	1	0.006
Expiry of product	13.73	1	0.000
Change in duration of treatment	4.419	1	0.036

Fifty percent of the hospitals and 5 (29.4%) of the health centers had placed an emergency order to PFSA at least once in the last 6months of the study period. Two (33.3%) of the hospitals had also placed an emergency order three times within the past 6 months prior to the study (Figure4).

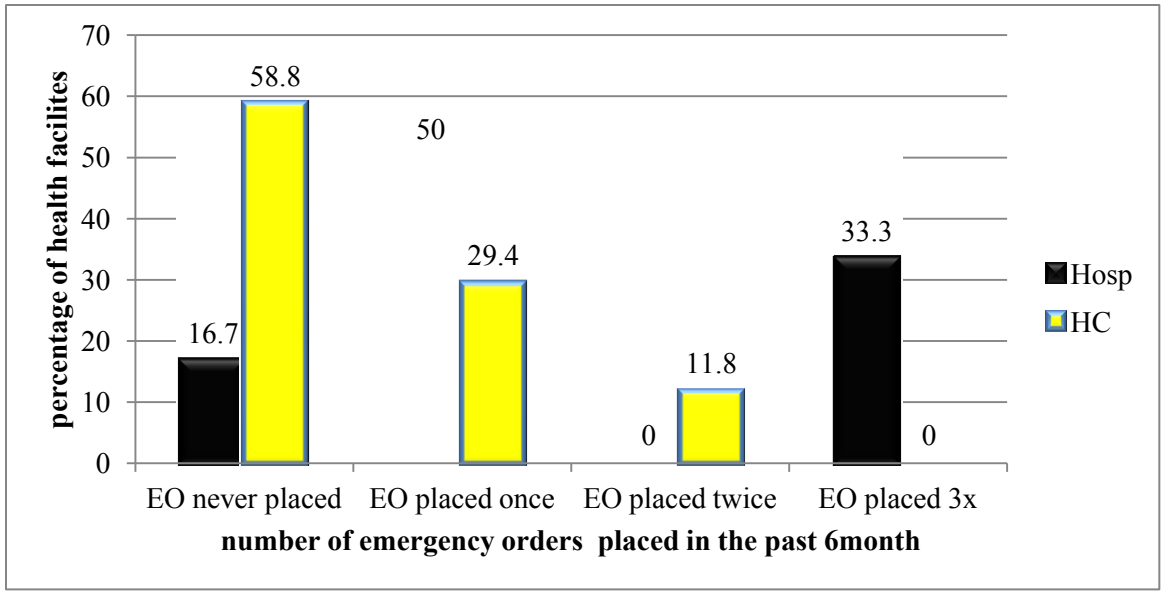


Figure 4: Frequency of Health facilities placed emergency orders in the last 6months of the study period in selected public health facilities in west Wollega zone, April to May 2018

5.3.2. Ordering and receiving

From the assessed health facilities, 4 (66.7%) of the hospitals and Ten (58.8%) of health centers had received their requested product within two weeks to one month period while 2 (33.3%) of hospitals and 2 (11.8%) of the health centers had received within less than two weeks. Five (29.4%) of the health centers had received the requested product within one month to two months (Fig 5).

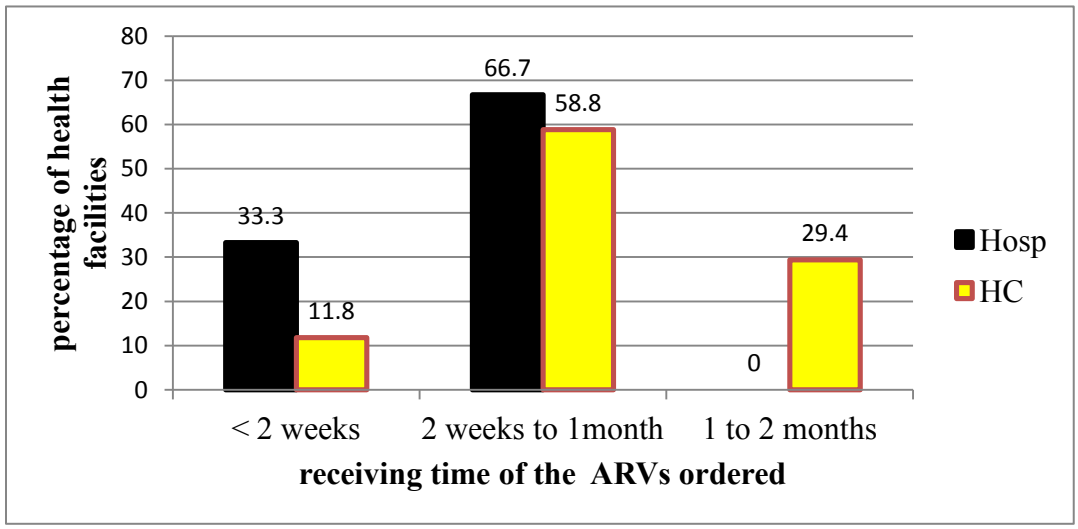


Figure 5: Percentage of hospitals and health centers received the ARV drugs they ordered in selected public health facilities of west Wollega zone, April to May 2018.

5.3.3. ARVs Wastages in the selected health facilities

The amounts of ARV drugs received and wasted within the last 6months of the study period were taken to determine the wastage rates. Accordingly, 527(12%) and 560(15.6%) of ARVs were found to be wasted on average in hospitals and health centers respectively. On aggregates, 1177(13.7%) of ARVs were wasted in the health facilities (Table11).

Table 11: Wasted ARVs in selected public health facilities in West Wollega zone, April to May 2018.

List of products	Hospital (n=6)				Health center (n=17)			
	unusable	Usable	unusable + usable	%wasted	Unusable	Usable	unusable+ usable	%wasted
EFV200	44	327	371	11.9	55	438	493	11.2
EFV50	37	266	303	12.2	50	370	420	12
EFV600	55	670	725	7.6	28	488	516	5.4
AZT/3TC/NVP300/150/200	63	685	748	8.4	86	540	626	13.7
AZT/3TC/NVP60/30/50	130	779	909	14.3	171	492	663	25.8
NVP200	132	474	606	21.8	207	653	860	24.1
NVP200mg/ml	10	41	51	19.6	16	58	74	21.6
TDF/3TC300/300	56	640	696	8	37	470	507	7.3
Total	**527**	**3882**	**4409**		**650**	**3509**	**4159**	

The reasons for wastages of the ARVs was explored and found to be expiry, receiving of near expiry product and fail to practice FEFO. In 15 (65.2%) of health facilities, wastages of EFV50 and NVP200 was occurred due to expiry. In Eleven (47.8%) of the facilities, wastage of EFV600mg was occurred due to receiving near expiry products while wastages of EFV600 and TDF/3TC300/300 in 7 (30.4%) of the facilities was due to fail to practice FEFO procedure (Table12).

Table 12: Reasons for wastage of ARV drugs in selected health facilities in west Wollega zone April to May 2018, (N=23)

List of products	Reasons for wastage		
	Expiry (%)	Receiving of near expiry products (%)	Fail to practice FEFO (%)
EFV200	13(56.5)	4(17.4)	6(26.1)
EFV50	15(65.2)	3(13)	5(21.7)
EFV600	8(34.8)	11(47.8)	4(17.4)
AZT/3TC/NVP300/150/200	12(52.2)	4(17.40	7(30.4)
AZT/3TC/NVP60/30/50	17(73.9)	2(8.7)	4(17.4)
NVP200	15(65.2)	2(8.7)	6(26.1)
NVP200mg/ml	14(60.9)	7(30.4)	2(8.7)
TDF/3TC300/300	13(56.5)	3(13)	7(30.4)

The association of wastages of ARVs and its contributing factors was analyzed statistically using chi-square tests. Accordingly, wastages of ARVs had a significant association with fail to practice FEFO, X^2 (1, N=23) = 57.85, p=0.016; receiving of near expiry products, X^2 (1, N=23) = 49.30, p=0.026 and expiry of products, X^2 (1, N=23) = 97.67, p=0.002 (Table 13).

Table 13:The association of wastages of ARVs and its contributing factors in selected public health facilities in west Wollega zone, April to May 2018.

Variables	Wastage of ARVs		
	Likelihood ratio		
	Value	Df	Asymp. Sig. (2-sided)
Fail to practice FEFO	5.785	1	0.016
Receiving of near expiry products	4.930	1	0.026

Expiry of products	9.767	1	0.002

5.3.4. The value of wasted or unusable ARVs

The value of the wasted ARVs was calculated based on the unit cost obtained from model 19 (receiving voucher) of the health facilities within the past six months during the study period. Accordingly, a total of 40722.28 ETB was lost in hospitals due to wastage while the loss was 47817.51 ETB in health centers. The wasted value was found to be high with NVP200 5896.44 (29.2%) followed by NVP200mg/ml 780.5 (26.3%), TDF/3TC 5044.48 (25.3%) and so on in hospitals. In health centers, the wasted value was high TDF/3TC 3332.96 (37.3%) followed by AZT/3TC/NVP60/30/50 12040.11 (36.6%), NVP200mg/ml 1248.8 (34%) and others. From the total received values in the past six months, 40722.28 **(**12.6%) and 47817.51 (17.8%) were wasted at hospitals and health centers respectively. On aggregate, 885339.79 (15%) of the total received value was wasted during the past 6month (Tables14).

Table 14:The values of wasted ARVs in selected public health facilities in West Wollega zone, April to May2018.

Description of wasted ARVs	Hospital (n=6)						Health center (n=17)			
	Unit	Unit cost (ETB)	Wasted Quantity	Total cost Wasted (ETB)	Total cost received in last 6month (ETB)	% of wasted cost(ETB)	Wasted Quantity	Total cost Wasted (ETB)	Total cost received in last 6month (ETB)	% of wasted cost (ETB)
EFV200	90	85.55	44	3764.2	27376	13.8	55	4705.25	35931	13.1
EFV50	30	26.21	37	969.77	6762.18	14.3	50	1310.5	9253.13	14.2
EFV600	30	99.79	55	5488.45	64364.55	8.5	28	2794.12	46302.6	6
AZT/3TC/NVP300/150/200	60	152.78	63	9625.14	100070.9	9.6	86	13139.1	79751.2	16.5
AZT/3TC/NVP60/30/50	60	70.41	130	9153.30	53511.6	17.1	171	12040.1	32881.5	36.6
NVP200	60	44.67	132	5896.44	20190.84	29.2	207	9246.69	28142.1	32.9
NVP200mg/ml	240ml	78.05	10	780.5	2965.9	26.3	16	1248.8	3668.35	34
TDF/3TC300/300	30	90.08	56	5044.48	47562.24	25.3	37	3332.96	33059.4	37.3
Total cost (ETB)				**40722.28**	**322804.21**			**47817**	**268989.3**	

5.4. Health facilities adherenc to storage conditions

Hundred percent of the health facilities assessed had secured their storerooms from water penetration. Five (83.3%) of hospitals had stored supplies and other latex products away from fluorescent lights, old files and maintained cold storage. Four (66.7%) of hospitals had stored products by FEFO, cleaned storerooms regularly and separated expired stocks without delay. Two of the assessed hospitals had arranged products by expiry and manufacturing dates to ensure visibility of the labels.

Fourteen (82.4%) of the health centers have stored condoms and other latex products away from fluorescent lights, and maintained cold storages for products that require it. Only 5 (29.4%) of the health centers have separated expired products from usable stock without delay. As indicated in the table bellow, 6 (26.1%) of the health facilities assessed were adhered to good storage conditions (standards) which recommends >80% positive responses to the predefined standards. Majority of health facilities 17 (73.1 %) were poorly adhered to good storage conditions which means less than 80% (Table 15).

Table 15:Public health facilities adherence to good storage conditions in west Wollega zone, April 2018.

Storage Guidelines	hosp(n=6)	HCs(n=17)
	# of Yes	# of Yes
Clean and disinfect storeroom regularly	4(66.7%)	8(47.1%)
Store supplies in a dry and well-ventilated storeroom, out of direct sunlight	4(66.7%)	11(64.7%)
Secure the storeroom from water penetration	6(100%)	17(100%)
Fire safety equipment is available and accessible, and that personnel are trained to use it	2(33.3%)	3(17.6%)
Store condoms and other latex products away from electric motors and fluorescent lights	5(83.3%)	14(82.4%)
Maintain cold storage, including a cold chain, for products that require it	4(66.7%)	14 (82.4%)
Keep high value, narcotics and other controlled substances in a locked place	5 (83.3%)	9(52.9)
Store flammable products separately using appropriate safety precautions	3(50%)	6(35.3%)
Stack cartons at least 10 cm off the floor, 30 cm away from the walls and other stacks, and no more than 2.5 m high	4(66.7%)	8(47.1%)
Store medical supplies separately, away from insecticides, old files, chemicals, office supplies and other materials	3(50%)	11(64.7%)
Arrange the cartons so that the arrows point up, and ensure that identification labels, expiry dates, and manufacturing dates are visible	2(33.3%)	6(35.3%)
Store supplies in a manner accessible by FEFO, counting and general management	4(66.7%)	8(47.1%)
Separation of damaged or expired products without delay.	4(66.7%)	(29.4%)

The association of health facility's adherence to good storage practice and its contributing factors was also analyzed statistically using a chi-square test. Accordingly, health facility's adherence to good storage practice had a significant association with type of profession, X^2 (1, N=23) = 52.32, p=0.022; level of education, X^2 (1, N=23) = 88.40, p=0.003, service year, X^2 (1, N=23) = 206.61, p=0.001 and training, X^2 (1, N=23) = 84.69, p=0.004 (Table 16).

Table 16:The association of public HFs adherence to good storage condition and its contributing factors in west Wollega zone, April 2018.

Variables	Storage guidelines		
	Likelihood ratio		
	Value	Df	Asymp. Sig. (2-sided)
Type of profession	5.232	1	0.022
Level of education	8.840	1	0.003
Service year	20.661	1	0.000
Training	8.469	1	0.004
Supervision	3.452	1	0.063

5. 5. Qualitative result

Data for qualitative result was obtained from key informants (store managers, pharmacy heads and facility heads) using in-depth face to face interview to explore information about the importance of logistics management, the challenges related to inventory management and possible solutions to the challenges. Then, the data were reviewed carefully and categorized into three parts using a thematic approach. Finally, the information obtained was summarized and presented with narration.

5.5.1. Importance of inventory management of health facilities

Information about the importance of inventory management was explored to assess the knowledge of professionals involved in pharmacy service related jobs. The majority of the key respondents have an understanding of inventory management even though they failed to implement it in their facility. They indicated that inventory management system improves storage space utilization and reduce stock wastages.

Importance of HCMIS

Health facilities need to equip their stores with HCMIS tools to reduce workload on staffs and generate reliable reports on time. HCMIS minimizes the time required for computing logistics data. If data was filled into HCMIS carefully, the accuracy of information obtained will be increased. With HCMIS, stock status and near expiry products can be traced easily.

"… Carefully implemented logistics management system using HCMIS secures product availability through facilitating demand based on time delivery as a report can be generated easily."

5.5.2. Challenges in inventory management practices

The main challenges identified in inventory management activities at health facilities were found to be a scarcity of human resource, budget limitation to employ professionals, lack of staff commitment in implementing inventory management activities, lack of capacity building, lack of supportive supervision, absence of shelves & adequate storage space, and assigning non pharmacy professionals on pharmacy service units.

Personnel related challenges

The number of staffs and their commitment are important for the successfulness of an institution. For every activity in an institution, adequate qualified personnel are required. The failure of a program is also inevitable unless an adequate number of personnel were assigned for its implementation. The public health facilities of West Welega zone were suffering from absence of pharmacy professionals as reported by the key informants. The key informants pointed that absence of adequate human power and unscheduled requests from dispensing units increased workload on the store managers.

"..... We suffer from work burden because we work as store person and dispenser in pharmacy units. On the top of that, the dispensing units bring their requests to store as an emergency order out of their schedule. Thus we do not have time for recording and reporting activities, leading to rupture of inventory management activities."

Capacity building related challenges

On-job training, training on IPLS, supportive supervision and experience sharing with good performing institutions are the methods of building the capacity of staffs and motivating them to increase their commitment, responsibility and accountability towards their profession. *"..... I am the only druggist working in our facility where the inventory management performances are weak. I do not know how to compute the reporting formats. I believe training in such activities will improve this knowledge gap, but our facility manager is not willing to send us for training, because of absence of professionals to cover the job."*

Another respondent stated that "…. I have been trying to complete my report using an electronic recording tool (HCMIS) but the computer was down (stopped working) and nobody is there to maintain it. The other respondent added our HCMIS is functional, but I do not know how to work with it."

Infrastructures related problems

The fulfillment of infrastructures is a must in order to have good pharmaceuticals inventory management performances. However, most of the facilities assessed were lack adequate storage space, shelves and racks. Most of the store rooms were office standards to store products according to the requirements. In most of the storerooms, the products were stored on the floor in congested storerooms.

"..... Here as you see, one of the KI is pointing me, our store is too small and congested; no shelves and racks are available thus we stored the products on floor."

Budget and managerial related challenges

The success or failure of a program depends on managerial activities in addition to availability of budget. Most of the assessed health facility managers were complained of budget scarcity to employee pharmacy professionals. However, it was understood from key informants that weak inventory management activities existed at health facilities because of running pharmaceutical activities by non-pharmacy professionals. Facility managers assigned non-pharmacy professionals to work as a store manager or dispense rather than taking actions to recruit pharmacy professionals. Most of the non-pharmacy professionals face difficulties in

understanding the terminologies of pharmaceuticals and to compute some calculations in reporting and recording tools.

"…. I am a clinical officer working in injection room and assigned here as a store man in addition to the injection activities because of the absence of pharmacy professionals. I have no time to complete the reporting and recording activities. I want to work with my profession, not as a pharmacist. On the top of that I do not know how to compute the RRF reports."

5.5.3. Possible solutions of the inventory management challenge in health facility

The possible solutions for the identified inventory management challenges were also explored during the in-depth face to face interview. Most of the key informants believe that the inventory management problems would be solved by the top managers. The top managers are responsible to recruit professionals and make decisive actions for malpractices under their leadership. Accordingly, the key informants stressed that top managers at every level of the health care system should recognize and believe in the importance of pharmacy service. Recruiting the required number of pharmacy professionals is also mandatory if an effective logistics management activity has to be existed at the health facilities. Training and supportive supervisions are also important to improve inventory management performances.

6. DISCUSSIONS

The ultimate goal of every logistics management in public health facility is to help ensure that there is commodity security for every customer and its availability when needed (11). In this study, the performance of the logistics system in its ability to ensure a continuous supply of quality commodities was assessed using indicators such as stock status, rate of stock outs, accuracy and completion of recording and reporting, wastage rates and affecting factors of logistics management performance.

The availability and utilization of logistics tools is critical in logistics system to capture critical logistics data which are used for crucial decision-making at all level of logistics management. - This study revealed that the availability of logistics reporting tools (RRF &IFRR) was 100% in both hospitals and health centers while the utilization varies between hospitals and health centers. The information obtained from the interviewee supported this result that it is a must to use RRF as PFSA will not deliver products unless RRF report was placed every two months. The finding is also in line with similar study conducted in East Shewa zone where the availability of logistics recording and reporting formats was 100% (26).

The availability of recording tool (bin card) was also 100%, while its utilization was assessed and found to be 83.3% in hospitals and 64.7% in health centers. This result indicates poor utilization of bin cards at health facilities. During the in-depth face to face interview, the reason for poor utilization was explored and found to be the work burden to store person as multiple tasks were performed by one person and staff commitment. However, the hospital finding of the present study is better than the finding of the study conducted in Ethiopia to assess IPLS implementation where the utilization of bin cards was 33.5% in hospital, while the finding in health center is lower than the same research where the utilization of bin cards was 76.5% in health centers(20). The difference might be due to the commitment of an individual working as higher level logistics manager in different regions to avail the required tools and follow its utilization. The finding of this study showed that there are variations in utilization of reporting and recording tools across health facilities.

According to our study, the availability of automated recording tools (computer) was 100% in hospitals and 76.5% in health centers while its utilization was only 33.3% in hospitals and none at health centers. The 100% availability of automated recording tools in this study is because of

the delivery of at least one computer for the purpose of the HCMIS program by the US aided DELIVER project. It was understood during in depth interview that the utilization was very poor due to lack of computer skills and inability to maintain the disabled computers as reported. Lack of trained human power was one of the challenges identified in this study where 91.3% of the staffs working under pharmacy units were not received training on HCMIS. Our finding of the automated recording tool availability is better than the finding of the aforementioned study conducted in east shewa zone where the availability of automated record was observed in 20% of health facilities (26). The difference might be due to the source from where the computers were found in the respective programs.

The present study also revealed that the average data transfer accuracy of RRF for the specific productin hospitals was 70%, while it was 62.4% in health centers. On aggregates, the average data transfer accuracy of the specific products was 65.0%. Our study result is better than that of the national IPLS survey conducted by PFSA where the accuracy was 46%. The difference could be due to the number of drugs and facilities involved in the study as well the different study area. The national survey considered all programs and tracer medicines within 266 health facilities from each region while our study considered only seventeen medicines in 23 health facilities of one zone. The aggregated result of completeness was found to be 63.3%, while it was 70% for timeliness in both hospitals and health centers. This finding is lower than that of the ILPS national survey where the completeness and rate of report were 85% & 90% respectively (14). The difference might be due to the study period where the previous study was conducted during IPLS active implementation followed by active training programs and supervision.

Generally, the accuracy, completeness and timeliness of the RRF reports were shown to be very low in the present study. According to this study, West Wollega zone public health facilities couldn't achieve the minimum standard for accuracy (i.e. 90%) and completeness (i.e. 80%). Inaccurate data generates false conclusions that affect decision making and planning process by program managers. If accurate and complete reports are not available when needed, product security cannot be achieved. The accuracy and completeness of the RRF report were known to be affected by type of professionals, level of education and commitment of the staff as explored qualitatively. Most of the assessed public health facilities were complaining about the shortage of

human power related to pharmacy profession, lack of training on LMIS and lack of commitment because of managerial negligence of the pharmacy units.

The finding of the present study also showed that 67% of the assessed bin cards were updated with an average accuracy rate of 83.7%. Our finding is greater than the study conducted in South Africa where the variation between stock records and physical counts for the ARV drugs assessed was 51.6%(31). The finding is also greater than the finding of a research done in Addis Ababa to assess LMIS practice for HIV/AIDS commodities where the overall accuracy rate was 38.9%. Our finding is also similar with a study done by Jabulani to assess HIV/AIDS logistics system in Zimbabwe where the accuracy rate for the bin card was 60% (21). The differences might be due to the number of clients served that increases workload indirectly on supply managers to update the records on time in the previous studies.

Logistics tool record updating and its accuracy is an important indicator in the management of pharmaceuticals. Logistics records (bin cards) need to be updated in order to convey reliable information about the stock status in the store. The accuracy of bin card is also important as unreliable information on bin card can be the cause of either stock outs or overstock. Lack of accuracy in stock-record keeping at the health facility's store will contribute to information, inaccuracy during decision making for resupply of program drugs. Good inventory management assures the updating of all bin cards for the products managed with no discrepancy between physical count and record on bin card. However, the finding of this study indicated poor record keeping practices in the assessed health facilities evidenced by inaccurate records. In most of the bin cards, the recorded balances were greater than physical count, indicating that the issued quantity was not recorded properly. On the other hand, the recorded balances were less than physical count, indicating that the received quantities were not recorded properly. These imbalances might be due to loss of attention and the carelessness of staffs. Some key informants stated that they do not care about the activities in the pharmaceutical store as it is not their profession (31).

Lack of supervision and high work load might be other contributing factors affecting bin card updating practice and record accuracy. According to the present study, only 30.4% of the selected health facilities were received supervision within the last six month of the study period; which is lower than the findings of similar study in Addis Ababa where 70% of facilities were received supervision (20).

High workload and frequent issuing cycle for unscheduled request of the dispensing units were the reasons why the store man couldn't update bin cards properly as stated by majority of the key respondents.

The present study also revealed that from 40% of HIV drugs and test kits were stocked out at least once within the last six months of the study period with different durations of time. For instance, Beijing wantai was stocked out in 91.3% of health facilities on the day of visit. It was also stocked out in 78.3% of the health facilities with an average stock out duration of 47.9 days and mean stock out frequency of 2.2 during the last six months of the study period. The finding of the present study is comparable with similar study conducted in Addis Ababa where 75% of the health facilities faced stock out of one or more ARV drugs on the day of visit and 70% of the health facilities stopped VCT service due to stock out of the test kits within six months of the study(34).Our present study finding is also similar with the study conducted in Zimbabwe where all of the studied ART facilities were stocked out of lamivudine and stavudine on the day of visit as well as 44% of the facilities were also stocked out of NVP 200mg with mean stock out duration of 29 days (21). The difference in the findings might be due to lack of inventory management skill, lack of commitment of facility staffs and upper logistics managers in the present study. The present study also identified the reasons for stock outs as expiry, inadequate supply from source, change in duration of treatment, lack of inventory management skill and poor commitment of staffs.

According to our study, health facilities were suffering from stock outs of products, especially HIV test kit which is critical for the existence of the program. One of the key respondents stated that "*….wantai Beijing is too scarce and never stored in our store almost since a year. However, the testing service was going on occasionally through borrowing from either the nearby health facility or from WoHO."*

"..... HIV drugs were stocked out due to changes in duration of treatment from 3months to 6months without adjusting the quantity to be supplied from the source (PFSA)."

Stock outs of products in any health care system indicate a critical failure of the logistics system which is believed to be the result of poor inventory management. With regular occurrence of the stock out, patients and staff's less confidence in the health care system and patient may default from both curative and preventive services. In case of ART program, unavailability of ARVs due

to stock out becomes dangerous, leading to the emergence of viral resistant strains. The stock out of HIV test kits might also increase the spread of HIV infection in the community. Therefore, it is desirable that there should no stock out of HIV drugs and test kits for effective HIV/AIDS care & treatment. However, fifty percent of the hospitals and 29.4% of the health centers had placed an emergency order to PFSA at least once in the last 6months of the study period due to stock outs. Two of the hospitals had also placed an emergency order three times within the past 6 months of the study period. Regarding the wastage of ARVs, the present study revealed that 40,722.28 ETB & 47,817.51 ETB were lost in hospitals and health centers respectively. The average wastage rate was 13% in hospitals and 15.1% in health centers. This finding is lower than the finding of aforementioned study conducted in east shewa zone on inventory management of tracer medicines where a total of 174,366.98 ETB was lost due to wastage(26). The difference of the findings could be the type of medicines studied where ARVs in present study are availed based on few numbers of ART patients with constant consumption while tracer medicines in previous study might be availed in large amount for different ailments in which consumption may be decreased and led to medicine wastage. The causes of medicine wastage in this study includes expiry, receiving of near expiry products and fail to practice FEFO. Expiry was reported as the cause for wastages in 65.2% of facilities. Receiving near expiry was reported in 47.8% of facilities and fail to practice FEFO was reported in 30.4% of facilities. Studies conducted in Ethiopia and Tanzania revealed similar reasons for wastage of medicines with different percentages (20, 25, 26).

According to this study, the wastage rate of HIV drugs in West Wollga zone is almost twice that of the national wastage rate. Wastage rate is one of the indicators that measures inventory management performance in health facilities. Poor inventory management in public health facilities results in wastage of financial resources. Because of poor inventory management, stocks becoming obsolete and expired in the store causing wastages of products. This means medicines were expired without noticed by anybody(35). Failed to follow FEFO procedures, delivery of near expiry by PFSA and shift of patient from one regimen to another were another reasons for expiry. Therefore, the supply of ARVs needs to be managed carefully in order to prevent all types of wastages including overstocking, and expiry. According to the key informant's response, expiry of ARVs resulted from delivery of short shelf life and decreased consumption of products due to treatment interruption by patients believing that they were healed through faith.

Redistribution of products from one facility to another is an important task to reduce wastage of ARVs by expiration before their use. In the case of short shelf life and limited supply, the ability to efficiently redistribute products with full accountability will save the life of patients and resources. However, none of the health facilities assessed had practiced the activities of redistribution.

The purpose of storage is to issue high-quality commodities and ensure little or no loss is caused by damage or expiry. In order to preserve the integrity of the products stored, the storage condition for pharmaceutical products should comply with the recommended good storage practices. In the present study, the storage condition of ARV drugs and HIV test kits was assessed using a predefined good pharmacy storage practices described in LIAT(36). To supply clients with high-quality products, each facility must have safe, protected, and well organized storage areas that will prevent damage. Almost all of the selected health facilities in west Wollega zone lack adequate storage space. Health centers store pharmaceuticals in office standard stores; the dispensary and store rooms were even not set separately in some facilities.

The storage condition for pharmaceutical products should comply with the recommended good storage practices. Facilities that fulfilled at least 80% of the storage condition were acceptable and considered to be complied with good storage practices. However, our study revealed that 26.1% of the assessed health facilities were fulfilled good storage criteria. This result is in line with the result of a research conducted in east shewa zone by Gurmu et al where 25% of the assessed health facilities were full filled good storage condition criteria(26). The slight difference might be due to lack of commitment of staffs working in stores in previous study.

There are different factors that can affect adherence to good storage practices. However, our study identified training and supervision as the affecting factors of adherence to good storage practice.

Usually, HIV test kits reach a service delivery point with short shelf life. Therefore, professionals working at the service delivery point should effectively manage inventory of such products using the first-to expire, first-out (FEFO) procedure.

The present study also identified possible challenges associated with inventory management performances of HIV drugs and test kits at facilities using qualitative methods. Accordingly, the

challenges were identified to be inadequate human power, lack of capacity building (training), lack of supervision, lack of staff commitment and managerial negligence. The increased professional turnover for the need of education and better opportunity also remains a bottleneck in public health facilities in the remote rural areas. In general, the absence of adequate human power under pharmacy units was the major challenge in all of the surveyed health facilities that poses the inventory management of medicines in danger and leaving the facilities bare of reliable data.

7. Conclusions

From this study, we can conclude that inventory management practices of ARV drugs and HIV test kits in health facilities were poor characterized by several factors, including report inaccuracy, poor record updating practices, frequent stock outs, resource wastages and non-adherence to good storage practices. The main causes of poor logistics management practices were shortages of human power related to pharmacy professionals that led to burden of high workload. Thus, the store men were unable to accomplish their inventory management activities timely and accurately since multiple tasks were covered by a single pharmacy professional. Absence of capacity building through on- the-job training also contributed to the poor utilization of logistics reporting and recording tools. Absence of supervision from the concerned bodies such as WoHOs, ZHD, facility managers and program managers was also contributed for the poor inventory management practices as the lower inventory managers neglect their duty in case of no supervision. Fail to followed FEFO procedure and near expiry product delivered by PFSA were led to expiry. This expiry was the cause of stock outs and wastage of resources resulted from poor inventory management practices.

8. Recommendations

- Oromia regional health bureau shall employ the required number of pharmacy professionals under pharmacy unit for effective pharmaceutical inventory management practices. The bureau should also provide on-the job training in consultation with other stakeholders such as PFSA to build the capacity of professionals working on inventory management activities of the health facilities.
- WoHOs and ZHD of the west Welega zone shall conduct supportive supervision on the inventory management activities of health facilities under their supervision.
- Pharmaceuticals fund and supply agency of Ethiopia shall not deliver near expiry products in excess amount as these products would be expire in health facilities. The agency should also improve its supply capacity as most of the health facilities reported that the cause of stock out was due to inadequate supply from PFSA.
- Health facility managers shall assign pharmacy professional to manage pharmacy store and follow the accomplishment of logistics activities.
- Store managers (supply managers) shall increase their commitment towards their profession to ensure quality product security for their customers.

8. REFERENCES

1. Wudie A. Impact of anti-retroviral therapy on the sexual behavior of people living with HIV / AIDS in Addis Ababa , Ethiopia : a qualitative study. 2011;(May).
2. Michael A, Bba N. Inventory management in the Ghana health service and its role deliverd by a thesis submitted to the Institute of Distance Learning , Kwame Nkrumah University of Science and Technology in partial fulfillment of the requirements for the degree ofcommonwealt. 2012;(Pg 4090210).
3. Oballah D, Waiganjo E. Effect of inventory management practices on organizational performance in public health institutions in Kenya : A case study of Kenyatta hospital. 2015;3(3):703–14.
4. Boxer D. Introduction to Logistics & Supply Chain Management. :1–32.
5. Raja, Sangeeta; Mohammad N. National HIV/AIDS programs : a handbook on supply chain management for HIV/AIDS medical commodities (English),2004. Washington, DC: World Bank. Available at http://documents.worldbank.org/curated/en/413721468316131387/National-HIV-AIDS-programs-a-handbook.
6. John Snow I /DELIVER. 2005. Guidelines for Managing the HIV/AIDS Supply Chain. Arlington, Va.: John Snow, Inc./DELIVER, for the U.S. Agency for International Development. USA.
7. Girum T, Wasie A, Worku A. Trend of HIV / AIDS for the last 26 years and predicting achievement of the 90 – 90-90 HIV prevention targets by 2020 in Ethiopia : a time series analysis. 2018;1–10.
8. Erik J Schouten etal. Antiretroviral drug supply challenges in the era of scaling up ART in Malawi. Journal of the International AIDS Society 2011, 14(Suppl 1):S4 http://www.jiasociety.org/content/14/S1/S4. 2015;14(June):1–8.
9. Larson C, Burn R, Minnick-sakal A, Douglas OK. Strategies to reduce risks in ARV supply chains in the developing world. 2014;2(4):395–402.
10. Prashant Yadav, Helen Lega Tata MB. The World Medicines Situation: Storage and supply chain management, WHO,Geneva 2011; 3rd Edition.
11. Aturaka etal. Logistic Challenges Associated with Supply Chain Management of HIV / AIDS Programs in Cross River State , Nigeria. 2017;5(4):114–8.

12. Reach V. Exploring New Distribution Models for Vaccines and other Health Commodities Adapted to the on the Ground Realities of the Equateur and Tshuapa Provinces , Democratic Republic of Congo. 2015;(October):1–59.
13. Nyogea DS, Said H, Mwaigomole G, Stoeckle M, Felger I, Hatz C, et al. An assessment of the supply chain management for HIV / AIDS care and treatment in Kilombero and Ulanga districts in southern Tanzania. 2015;17(2):1–9.
14. Shewarega etal. National Survey of the Integrated Pharmaceutical Logistics System.(PFSA). 2015. Ethiopia: Arlington, Va.: USAID | DELIVER PROJECT, Task Order 4, and Pharmaceuticals Fund and Supply Agency (PFSA).
15. Report A. The Global Fund ’s In -country Supply Chain Processes, GF-OIG-17-008,28 April 2017 Geneva,Switzerland Available at:http://apps.who.int/medicinedocs/documents/s17997en/s17997en.pdf. Retrieved on 12/4/2018.
16. Innocent Ibegbunam DM. “Health commodities management system: priorities and challenges”, Journal of Humanitarian Logistics and Supply Chain Management, Vol. 2 Issue: 2, pp.161-182, https://doi.org/10.1108/20426741211260741. 2012;
17. USAID | DELIVER PROJECT, Task Order 1. 2008. Building Blocks for Logistics System Design for HIV Tests and ARV Drugs: Inventory Control Systems, Logistics Management Information Systems, and Storage and Distribution. Arlington, Va.: USAID | DELIVER PROJEC.
18. Mentzer JT, Keebler JS, Nix NW, Smith CD, Zacharia ZG. Defining supply chain management;Journal of bussiness logistics. 2001;22(2):1–25.
19. Manso JF, Annan J, Anane SS. Assessment of Logistics Management in Ghana Health Service.International Journal of Business and Social Research (IJBSR), August, 2013. 3(8):75–87.
20. Tilahun A, Geleta DA, Abeshu MA, Geleta B, Taye B (2016) Assessment of Integrated Pharmaceutical Logistic System for the Management HIV/AIDS and Tuberculosis Laboratory Diagnostic Commodities in Public Health Facilities in Addis Ababa, Ethiopia. J Pharma . Vol. 3. 158 p.
21. Nyenwa etal. Zimbabwe HIV & AIDS Logistics System Assessment. Arlington, Va.: John Snow, Inc./DELIVER, for the U.S. Agency for International Development.

22. Adino Desale, Bineyam Taye&, Getachew Belay AN. Assessment of laboratory logistics management information system practice for HIV/AIDS and tuberculosis laboratory commodities in selected public health facilities in Addis Ababa, Ethiopia. Pan Afr Med J. 2013;1–8.
23. Embrey M. Management Science for Health:MDS-3 Managing Access to Medicines and Health Technologies Sterling,Va.:Kumarian Press. 2013;3(2):252–9.
24. Gils T, Bossard C, Verdonck K, Owiti P, Casteels I, Mashako M, et al. Stockouts of HIV commodities in public health facilities in Kinshasa: Barriers to end HIV. (0).
25. Nditunze L, Makuza S, Amoroso CL, Odhiambo J, Ntakirutimana E, Cedro L, et al. Assessment of Essential Medicines Stock-Outs at Health Centers in Burera District in Northern Rwanda. 2015;2(1):2013–6.
26. Gurmu TG, Ibrahim AJ. Inventory management performance of key essential medicines in health facilities of East Shewa Zone , Oromia Regional State , Ethiopia, 2017, 42(2). 277-291 p.
27. Wikipedia, the free encyclopedia,https://en.wikipedia.org/wiki/West_Wollega_Zone, Accessed on 12/2/2018.
28. USAID | DELIVER PROJECT, Task Order 1. 2009.Logistics Indicators Assessment Tool (LIAT): Antiretroviral Drugs. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.
29. Federal Ministry of Health (FMOH). National guidelines for comprehensive HIV prevention , care and treatment. 5th edition. Addis Ababa; Feb. 2017.
30. Pharmaceuticals Fund and Supply Agency (PFSA). Standard Operating Procedure Manual for the Integrated Pharmaceuticals Logistics System in Health Facilities of Ethiopia. Second Edition. Addis Ababa; August 2015.
31. Mahoro A. Examing the inventory management of antiretroviral drugs at community health centers in the Cape Metropole, western Cape.
32. Jabulani Nyenwa, David Alt, Ali Karim, Tendesayi Kufa, Jennifer Mboyane YO, Tendai Simoyi and the D project. Zimbabwe HIV & AIDS Logistics System Assessment. Arlington, Va.: John Snow, Inc./DELIVER, for the U.S. Agency for International Development. 2006;
33. Tilahun A. Assessment of Integrated Pharmaceutical Logistics System for Human

Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/ AIDS) and Tuberculosis (TB) Laboratory Diagnostic Commodities management in Public Health Facilities, Addis Ababa, Ethiopia. 2014;(June).

34. Berhanemeskel E, Beedemariam G, Fenta TG. HIV/AIDS related commodities supply chain management in public health facilities of Addis Ababa, Ethiopia: a cross-sectional survey. J Pharm Policy Pract. 2016;9:11. Published 2016 Mar 31. doi:10.1186/s40545-016-0. J Pharm Policy Pract. 2016 Mar 31;9:11.
35. Matowe L, Waako P, Adome RO, Kibwage I, Minzi O, Bienvenu E. Human Resources for Health A strategy to improve skills in pharmaceutical supply management in East Africa : the regional technical resource collaboration for pharmaceutical management. 2008;6:1–6.
36. John Snow, Inc./DELIVER. 2005. Logistics Indicators Assessment Tool (LIAT). Arlington, Va.: John Snow, Inc./ DELIVER, for the U.S. Agency for International Development.

Annexes

Annex-I- Indicators to be measured

Inventory accuracy rate= $\frac{\text{\# of items where stock record count equals physical stock count}}{\text{total number of items counted}} * 100$

Accuracy in stock record keeping=$\frac{(\text{stock record count} - \text{physical stock count})}{\text{physical stock count}} * 100$

Percentage of discrepancy of products on RRF with that of bin card =

$\frac{\text{SOH of specific product on bin card at the time of RRF report} - \text{SOHof specific product on RRF}}{\text{SOHof specific product from RRF}} \text{x } 100$

Timeliness of LMIS reports = $\frac{\text{Total Number of reports submitted on time}}{\text{Total Number of reports expected}} \text{ X } 100$

Completeness of LMIS Reports= $\frac{\text{Total Number of LMIS reports submitted}}{\text{\# of HFs expected to report X \# of reports expected from each}} \text{ X } 100$

Facility LMIS report reporting Rates= $\frac{\text{\# of HFs submitting LMIS report by a certain date}}{\text{Total number of facilities required to report}} \times 100$

Average stock-out duration in a health facility (days) = $\frac{\text{Sum of stock} - \text{out days}}{\text{Total number of tracer items}}$

Stock out Rates= $\frac{\text{\# of storage facilities assessed that experienced a stockout of pharmaceuticals}}{\text{total no.of facilities assessed}} * 100$

Percentage of facilities that maintain acceptable storage conditions=

$\frac{\text{\# of stores fulfilled 80\% of storage condition}}{\text{Total \# of stores or warehouses visited}} \text{x } 100$

% fulfillment of the storage conditions=

$\frac{\text{No.of 'yes' responses}}{\text{Total \# of storage conditions considered for each facility}} \textbf{x } 100$

Stock wastage due to expiration or damage=$\frac{\text{unusable physical stock}}{\text{usable} + unusble \text{ physical } stock\ count} * 100$

Value of unusable stock =$\frac{\text{value of wasted units per product}}{\text{value of total units received of the same product}} * 100$

Annex-II-

Questionniare

How are you everybody? Thank you for agreeing to receive us today. My name is Gemechu Asmera. My colleague is _____.I am a student in Jimma University, school of pharmacy, faculty of health sciences and doing my MSc thesis on assessing HIV/AIDS drugs and commodities supply chain management practices in selected public health facilities in the west Welega zone. As you know the number of people receiving ART continues to increase through time, so this type of research can be used to assess the current supply chain and it will provide an input for future improvement. We are visiting selected health facilities throughout West Welega zone and this facility and you were included in the assessment. I strongly tell you that this assessment will be done for educational purpose only and your name as well as the name of your health facility will not be mentioned.

Code of the facility_____

City/town: _____

Region _____

District _____

Date: _____

First ask ART coordinator and Head of the pharmacy. Then, visit the warehouse, storeroom, or other storage area where the ARV drugs and test kits are stored.

№	**A. Profession & health facility related**	Answer (code classification)	Comment
A1.	Who is the principal person responsible for managing medical supplies at this facility?	1. Nurse 2. Clinical Officer 3. Druggist 4. Pharmacist 5. Other	
A2.	What is your profession?	1. Nurse 2. Clinical Officer 3. Druggist 4. Pharmacist	
A3.	What is your education level?	1. Degree 2. Diploma 3. Certificate	
A4.	What is your position in this health facility?	1. Store manager 2. Pharmacy head 3. Facility head 4. Supply manager	
A5.	How many years you have served in this position?	Year_____ Month_____	
A6.	Who determines this facility's resupply quantity?	1. The facility itself 2. Higher-level facility	

		3. Other	
A7.	How are the facility's resupply quantities determined?	1. Formula (specify) 2. Don't know 3. Other means	
	B. Management support related		
B1.	How did you learn to complete the forms/records used at this facility?	1. Never learned 2. During a logistics workshop 3. On-the-job training 4. On-the-job (self-learning) 5. From pears	
B2.	From whom did you receive, your most recent supervision?	From _____	
B3.	When did you receive, your most recent supervision visit?	1. Never received 2. Within the last month 3. Within the last 3 months 4. Within the last 6 months 5. More than 6 months ago	
B4.	Did your supervision visit include drug management, such as	1. Stock card checked 2. Reports checked 3. Expired stock removed 4. Storage condition checked	
	C. LMIS Questions		
C1.	Is there LMIS system in your facility?	1. Yes 2. No	
C2.	If yes to ques. No 6, is it computer based or paper based?	1. Computer 2. Paper 3. Both	
C3.	Which one of the following logistics firms do you use and fill out to manage health	1. Bin card 2. Stock card	

	products?	3. Daily register	
C4.	What LMIS forms do you use for Reporting/ordering?	1. RRF 2. IFRR 3. Both	
C6.	Do LMIS reports include the following?	1. Stock on hand 2. Quantities used 3. Loss/adjustment	
C7.	How often are these LMIS reports sent to the highest level?	1. Monthly 2. Bimonthly 3. Quarterly 4. Semiannually 5. Annually	
	D. **Inventory management questions**		
D1.	When was the last time you sent an order/report for products from this facility?	1. Within the last month 2. 2 months ago 3. 3months ago 4. > 3 months ago	
D2.	How many emergency orders have you placed in the last 6 months?	1. None 2. 1 3. 2 4. 3 5. >3	
D3.	On average, approximately how long does it take between ordering and receiving products?	1. Less than 2 weeks 2. Weeks to 1 month 3. Between 1 and 2 months 4. More than 2 months	
D4.	Are there certain commodities that you always stock out before resupply?	1. Yes 2. No	If no to D4, go to no.D7.

D5.	If yes to question.C1, list the commodities you stick out of the most frequently.	1. _____ 2. _____ 3. _____	
D6.	What are the reasons for stock out?	1._____ 2._____ 3. _____	
D7.	Do you always have a surplus of certain commodities before resupply?	1. Yes 2. No	If no to D7, go to D9.
D8.	If yes to question C4, list the commodities you have a surplus of most frequently.	1. _____ 2. _____ 3. _____	
D9.	Is there expired or damaged product?	1. Yes 2. No	
D10.	What are the reasons for expiry?	1._____ 2._____ 3._____	
	E. **Storage conditions assessment questions**		
E1.	How do you arrange your products?	1. By FIFO 2. By LIFO	

(28. If you are experienced stock outs in the resent **6** months as of question noC5 above, Please specify the reasons for the stock outs)

_____

S. №	**D. Storage Guidelines**	Yes	No	Remark
D1	Clean and disinfect storeroom regularly			
D2	Store supplies in a dry and well-ventilated storeroom, out of direct sunlight			
D3	Secure the storeroom from water penetration			
D4	Fire safety equipment is available and accessible, and that personnel are trained to use it			
D5	Store condoms and other latex products away from electric motors and fluorescent lights			
D6	Maintain cold storage, including a cold chain, for products that require it			
D7	Keep high value, narcotics and other controlled substances in a locked place			
D8	Store flammable products separately using appropriate safety precautions			
D9	Stack cartons at least 10 cm off the floor, 30 cm away from the walls and other stacks, and no more than 2.5 m high			
D10	Store medical supplies separately, away from insecticides, old files, chemicals, office supplies and			

	other materials			
D11	Arrange cartons so that the arrows point up, and ensure that identification labels, expiry dates, and manufacturing dates are visible			
D12	Store supplies in a manner accessible by FEFO, counting and general management			
D13	Separation of damaged or expired products without delay.			

For any product that experienced a stock out in the last 6 months (including the day of the visit), please note reasons (by product).

Are stock cards and reports completed using the smallest unit of the count? Write Y if yes, otherwise N in the table below.

S/№	Products	Units of count	Managed at this facility?	Stock out today?	Stock card available?	Stock card updated?	Balance on stock card	Stock out most recent 6months	Number of stock outs	Total number of days stocked out	Physical count	Quantity of expired products
1	ABC 300mg											
2	ATZ/r 300/100mg											
3	EFV 200mg											
4	EFV 50mg											
5	EFV 600mg											
6	TDF/3TC/EFV300/300/600											
7	AZT/3TC/NVP300/150/200											
8	AZT/3TC/NVP60/30/50											
9	TDF/3TC300/300											
10	3TC 150											
11	AZT/3TC300/150											

12	AZT/3+C60/30											
13	LPV/r (80+20)mg/5ml											
14	LPV/r (250+50)mg											
15	ABC/3TC60/30											
16	NVP200											
17	NVP200mg/ml											
18	Diagnostic test kit 1&2RTK											
19	Beijing wantai HIV test											
20	Uni-gold 20 tests											

LMIS Data Quality: Usable Stock on Hand at Time of Most Recent LMIS Report

S/№	Product	Usable stock at hand at time of most recent LMIS report			
		Accounting to most resent LMIS report (from RRF)	Bin cards from time of LMIS report (From bin card)	% of discrepancy- $\frac{col\ 3-col\ 2}{col\ 2} * 100$	Reason for discrepancy
1	ABC 300mg				
2	ATZ/r 300/100mg				
3	EFV 200mg				
4	EFV 50mg				
5	EFV 600mg				
6	TDF/3TC/EFV300/300/600				
7	AZT/3TC/NVP300/150/200				
8	AZT/3TC/NVP60/30/50				
9	TDF/3TC300/300				
10	3TC 150				
11	AZT/3TC300/150				
12	AZT/3+C60/30				
13	LPV/r (80+20)mg/5ml				
14	LPV/r (250+50)mg				
15	ABC/3TC60/30				
16	NVP200				
17	NVP200mg/ml				

18	Diagnostic test kit 1&2RTK				
19	Beijing wantai HIV test				
20	Uni-gold 20 tests				

For qualitative data collection

Questions for in-depth interview

1. What do you think about LMIS, Inventory management and storage condition practices in your facility? Are they necessary and applicable in your facility?

   Yes, No, if yes, what do you think is their importance?

   _____

   _____

   _____

   _____

   What do you think would happen if no inventory management?

2. Did you face any problem or challenges to practice these supply chain components in your facility? Yes No (circle your answer).

   If yes to question No 2 above, what are these challenges?

   _____

   _____

   _____

   _____

   How did you determine the challenges?

3. Have you tried to solve these problems or challenges by yourself? Yes No

   If yes to question No 3, what measures do you take to solve the problems?

   _____

   _____

   _____

   _____

   How did you decide to overcome the challenges?

4. Whom do you think should solve the problems other than you?

   _____

   _____

   Why?

   _____

   _____

   _____

   _____

   Do you have any other comment

   _____

   _____

   _____

Observation checklist

Logistics management information system (LMIS)

If there is an information system, does it include?

1. Stock keeping records (e.g., inventory control cards, bin cards, stock registers) Yes No
2. Dispensed-to-user records at service delivery points? Yes No
3. Check the correctness of filling LMIS tools
4. Check fire extinguisher (fire safety equipment) availability, accessibility and functionality
5. Check availability and functionality of refrigerators (to record the actual temperature look at the internal thermometer inside the refrigerator).
6. Check availability and functionality of thermometer
7. Check availability of temperature chart, is it updated?

Damaged or expired products physically separated and removed from stock