Assessment of Performance and Challenges of Pharmaceuticals Inventory Management of the Public Health Facilities in West Shewa Zone, Oromia Region, Ethiopia.

By

Juhar Bekele (B. Pharm)

A thesis Submitted to Addis Ababa University, College of Health Science, School of Pharmacy, Department of Pharmaceutics and Social Pharmacy Graduate Program presented in partial fulfillment of the requirements for the Degree of Master of Science in Health Supply Chain Management.

Advisor: Tariku Jebena (Ph.D.)

June, 2020
Addis Ababa, Ethiopia

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This is to certify that the thesis prepared by Juhar Bekele, entitled: "Assessment of Performance and Challenges of Pharmaceuticals Inventory Management of the Public Health Facilities in West Shewa Zone, Oromia Region, Ethiopia." and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Health Supply Chain Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university, and that all the resources and materials used for the thesis, have been fully acknowledged.

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Signature: _____

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June, 2020

Abstract

Background*: As high as 40 percent of the health care budget was expended on pharmaceuticals in developing countries, however significant proportions of the population do not get access to even the most essential medicines. Weak pharmaceutical inventory management is one of the factors that may contribute to the problem as it can result in irrational utilization of drugs, blockade of financial resources and/or stockout of essential medicines.* ***The objective*** *of this study was to assess the performance and challenges of the pharmaceuticals inventory management of public health facilities in West Shewa Zone, Oromia Region, Ethiopia.* ***Generally****, the methods used in this thesis have been guided by the recommendations of the Logistics Indicator Assessment Tool (LIAT) developed by USAID/DELIVER Project. Accordingly, facility-based cross-sectional descriptive study design was followed. Among 98 total health facilities, 17 of them were chosen by simple random sampling technique. Both qualitative and quantitative data were collected. Qualitative data were collected from 10 participants through key informant interview method by using a semi-structured interview guide and analyzed using a qualitative analysis technique (reviewing the interview thoroughly, categorizing thematically, summarizing and finally writing down the information by stating the finding), while quantitative data were collected using a data abstraction forms and observation checklist and analyzed using descriptive statistics. The data collection period was from May to June 2019.* ***The average*** *shelf life of the selected medicines was 62.22%. None of the selected medicines were stocked per the plan in all the facilities. An average inventory accuracy rate was 39.23%. The wastage rate in studied facilities was 7.08%. The average order lead time was 31.10 days. The inventory turnover rate was 8.21 and the average percentage fulfillment of a storage condition was 70.88%. Some of the major challenges identified include the inability to dispose of a large quantity of expired medicine, inadequate storage space, interrupted supply and inadequate manpower.* ***The inventory*** *management performance of the study facilities were poor which was shown by lower inventory accuracy rate, higher wastage rate and lower storage condition. Applying feasible medicine disposal method, fulfilling the required manpower and sharing near expiry medicines with other facilities are recommended.*

Keywords: *Challenges, Essential, Facilities, Health, Inventory, Management and Medicines*

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Table of Contents

Acronyms and Abbreviations vi

CHAPTER I – INTRODUCTION 1

1.1 Background of the Study 1

1.2 Statement of the problem 3

1.3 Research Question 4

1.4 Objective of the Study 5

1.4.1 General objective 5

1.4.2 Specific objectives 5

1.5 Significance of the Study 5

1.6 Scope of the Study 6

1.7 Operational definitions of Terms and Concepts 6

CHAPTER II – RELATED LITERATURE REVIEW 7

2.1 Theoretical Literature Review 7

2.1.1 Inventory Management 7

2.1.2 Storage Conditions of Essential Medicines 13

2.2 Empirical Literature Review 14

2.2.1 Inventory Management 14

2.2.2 Storage Conditions of Essential Medicines 16

2.3 Challenges Related to Inventory Management 17

2.4 Conceptual Framework of the Study 18

CHAPTER III - RESEARCH METHODS 20

3.1 Description of the Study Area 20

3.2 Study Approach 22

3.3 Study Design 22

3.4 Population of the Study 22

3.5 Sampling Design 22
3.6 Data Types, Sources & Collection Methods 23
3.7 Data Quality Assurance 24
3.8 Data Analysis 25
3.9 Ethical Considerations 26
CHAPTER IV - RESULTS AND DISCUSSIONS 27
4.1 Results 27
4.1.1 Inventory Management Performance: A Quantitative Observation 27
4.1.1.1 Quality Indicators 29
4.1.1.2 Response Time Indicators 32
4.1.1.3 Cost/Financial Indicators 33
4.1.1.4 Productivity Indicators. 35
4.1.2 Challenges of Inventory Management Performance: A Qualitative Observations 39
4.1.2.1 Quantification and Procurement/Obtaining/ Related Challenges 40
4.1.2.2 Stock Management Related Challenges 43
4.1.2.3 Storage Condition Related Challenges 44
4.2 Discussions 46
CHAPTER V - CONCLUSION AND RECOMMENDATIONS 50
6.1 Conclusion 50
6.2 Recommendations 51
CHAPTER VI - LIMITATIONS OF THE STUDY 52
References 53
Annexes i
Assessment Tools i
Section I: Quantitative Data Collection Formats i
Section II: Qualitative Data Collection Format xv

List of Tables

Table 4.1. Inventory Management Practices of Selected Health Facilities in West-Shewa Zone, Oromia Region, Ethiopia on the Day of the Visit. 28
Table 4.2 Value of Stock Wasted as a result of Wastage in Selected Health Facilities in West Shewa Zone, Oromia Region, Ethiopia from July 2017 to June 2018. 34
Table 4.3 Average % of the Storage Condition of each Selected Health Facilities in West Shewa Zone, Oromia Region, Ethiopia on the Day of the Visit 36
Table 4.4 Average Percentage of an Individual Standard Criterion used to Measure the Storage Condition of the Selected Health Facilities in West Shewa Zone, Oromia Region, Ethiopia on the Day of the Visit. 37
Table 4.5 Socio-Demographic Characteristics of the Key Informants Working in the Selected Health Facilities in West Shewa Zone, Oromia Region, Ethiopia on the Day of the Visit 39

List of Figures

Figure 2.1 The Logistics Cycle 8
Figure 4.1. Average Percentage Shelf Life of each Studied Medicines of the Selected Public Health Facilities in West Shewa Zone, Oromia Region, Ethiopia on the Day of the Visit. 29
Figure 4.2 Percentage of each of those Essential Medicines Stocked According to the Plan of the Selected Public Health Facilities in West Shewa Zone, Oromia Region, Ethiopia on the day of the Visit. 30
Figure 4.3 Inventory Accuracy Rate of the Individual Selected Public Health Facilities in West Shewa Zone, Oromia Region, Ethiopia on the Day of the Visit. 31
Figure 4.4 Stock Wastage Rate of each Studied Medicines of the Selected Health Facilities in West Shewa Zone, Oromia Region, Ethiopia from July 2017 to June 2018. 32
Figure 4.5 Order Lead Time of the Selected Health Facilities in West Shewa Zone, Oromia Region, Ethiopia from January 2018 to June 2018. 33
Figure 4.6 Inventory Turnover Rate of each Studied Medicine of the Selected Health Facilities in West Shewa Zone, Oromia Region, Ethiopia from July 2017 to June 2018. 35

Acronyms and Abbreviations

AAU	Addis Ababa University
ABC	Always, Better, Control
ART	Anti-Retroviral Therapy
CEO	Chief Executive Officer
CMS	Central Medical Stores
DHIS	District Health Information System
DTC	Drug and Therapeutic Committee
EFDA	Ethiopian Food and Drug Administration
EOQ	Economic Order Quantity
ETB	Ethiopian Birr
FEFO	First Expire First Out
FMOH	Federal Ministry of Health
HC	Health Centre
HIV/ AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
HSDP	Health Sector Development Program
Hsp	Hospital
KPI	Key Performance Indicator
LIAT	Logistic Indicator Assessment Tool
MOH	Ministry of Health
MoHSWT	Ministry of Health and Social Welfare of Tanzania
MSH	Management Science for Health
NLSM	National Level Management of Store
PFSA	Pharmaceutical Fund and Supply Agency
RRF	Recording and Reporting Format
SOP	Standard Operation Procedure
TB	Tuberculosis
TDF + 3TC + EFV	Tenofovir + Lamivudine + Efavirenz
USAID	U.S. Agency for International Development
VEN	Vital, Essential & Non-essential
WHO	World Health Organization

CHAPTER I – INTRODUCTION

In this chapter of the study Background, Statement of the Problem, Research Questions, Objective of the Study, Significance of the Study, Scope of the Study and Operational definitions of Terms and Concepts were discussed.

1.1 Background of the Study

Medicines have a unique value in health care system; they save lives and improve health as the major top causes of morbidity, mortality and disability in developing countries can be prevented, treated, or improved with cost-effective essential medicines. Medicines also promote confidence and involvement in health care services (MSH, 2012; PFSA 2015).

The provision of complete health care delivery requires the availability of safe, effective and affordable medicines and related supplies of the required quality, inadequate quantity, at the required place and at all times (MSH, 2012; PFSA 2015).

The World Health Organization (WHO) estimates that about one-third of the world's population have no consistent access to essential medicines (USAID|DELIVER Project, 2013).

The Federal Ministry of Health (FMOH) has been working to make sure that an efficient and effective healthcare supply chain that realizes impartial access to reasonably priced medicines for all Ethiopians (PFSA, 2015). Although recently a great progress has been made, the Ethiopian facility still had several problems that are required to be solved so as to achieve the six rights. To resolve these problems in public health facilities, Pharmaceuticals Fund and Supply Agency (PFSA) was established in 2007. The Agency is mandated to avail reasonably priced and quality pharmaceuticals sustainably to all public health facilities and safeguard their rational use. So as to accomplish its mandate in the area of pharmaceuticals supply in an efficient and effective manner, integrated pharmaceuticals logistics system (IPLS) has been developed and implemented since 2010 (PFSA, 2015).

In health care industry inventory refers to the stockpile of pharmaceutical products kept to meet forthcoming demand. Inventory signifies the largest current asset, and

also liquid assets in pharmacy practices and its worth continues to increase owing to growth in diversity and cost of health care industry products (Dwivedi, Kumar & Kothiyal, 2012).

As discussed in a just-in-time inventory control system, inventory is considered waste. However, there are some of the most important reasons for obtaining and holding inventory. This include: Fluctuations in demand: A stock on hand is a protection: As it's difficult to know how much is likely needed at any given time, but it's still needed to satisfy customer demand on time. Therefore, adequate inventory allows the system to deal with demand fluctuations (Muller, 2003; MSH, 2012).

Unreliability of supply: Inventory protects you from unreliable suppliers or in a situation when an item is rare and it is hard to ensure a stable supply. Whenever possible unreliable suppliers should be rehabilitated through discussions or they should be replaced (Desselle and Zgarrick, 2009).

To maintain confidence in the system: If stockouts happen frequently, patients and staff lose will trust in the system (MSH, 2012). Price protection: Buying adequate amounts of products at proper time protects from the impact of cost inflation (Desselle and Zgarrick, 2009).

To decrease unit cost of the medicines: Ordering medicines in a large quantity allows quantity discounts, and also lowers the shipping and port clearing costs (MSH, 2012).

Lower ordering costs: buying a larger amount of an item less often lowers the ordering costs compared to buying smaller amount frequently (Muller, 2003).

On the other hand there are also costs associated with having inventory: acquisition costs, procurement costs, carrying costs, and stock-out costs.

i. The acquisition cost is the price we pay to acquire the product.
ii. Procurement costs are all the costs related to procuring the product: checking the inventory, placing orders, receiving orders, stocking the product, and paying the invoices (Desselle and Zgarrick, 2009).
iii. Carrying costs refer to the storage, handling, insurance, cost of capital to finance the inventory, and opportunity costs. Another carrying cost is the cost of loss through theft, deterioration, and damage (Muller, 2003).
iv. The fourth cost is the stock-out cost, which is the cost of not having a product on the shelf when a patient needs or wants it (Desselle and Zgarrick, 2009).

Inventory Management is the process of maintaining stock properly at each levels of a supply chain and at all times (PFSA, 2017).

1.2 Statement of the problem

Despite the difference in size of the health institution, pharmaceuticals are the very important and indispensable component of a health care system. To ensure better accessibility, an adequate quantity of medicines in the needed dosage and strength have to be stocked. All pharmaceuticals have a limited shelf life and many require suitable storage facilities (USAID|Deliver Project, 2013). In order to better utilize these pharmaceuticals, a balance needs to be kept between the service level and the stock level as the concept of essential medicines (Kokilam et al., 2015).

Utilization of a scientific way of running the pharmaceuticals inventory management in health care handles all the matters related to the stocking of pharmaceutical products, thereby ensuring efficacy, safety, stability, availability, and keeping medicine quality to deliver improved healthcare provisions (Kokilam et al., 2015).

However, the application of a strong inventory control system for a pharmaceutical supply is a difficult task; a weak inventory management in a public pharmaceutical supply can result in irrational utilization of medicines, wastage or tied-up of money, stocking out or overstocking of essential medicines that lead to expiration, rise in holding cost, poor enterprise's flexibility and reduced quality of healthcare service (MSH, 2012). Furthermore, this excess or surplus products will lead to a decrease in the number of medicines ready to serve the patients and due to that, the quality of healthcare would be compromised (Kagashe & Massawe, 2012).

In addition to that, even though there are several challenges in this area, researches done in the field of the supply chain, concentrate more on optimizing the supply chain system itself for its efficiency and competitiveness in the market. Only limited studies focus on the idea of inventory management in the supply chain. An effective inventory management system plays a significant role in reducing the associated costs across different stages of the supply chain system (MSH, 2012).

In a study by Nahamya D. (2007) on Assessment of Essential medicine Management in the Public Health Facilities in Uganda; poor pharmaceuticals inventory management

at the health facilities and other problems are identified as major reasons for the stock-out of key medicines as high as 37.5%.

According to the Malaysian country health plan report on the 10th Malaysian plan, from 2011 – 2013 a total of 1,692,125.00 Malaysian Ringgit medicine were lost only from two hospitals due to theft and mismanagement involved medicine (Mahidin et al., 2015).

A report of the President's Malaria Initiative (PMI) to congress of the United States of America (USA) government indicated that until April 2014, the total reported theft of PMI commodities in Angola amounted to over $642,000 since January 2008 (Office of Inspector General, 2009).

The Ethiopian pharmaceutical supply chain has also several problems including non-availability, un-affordability, poor storage, weak inventory management and weak distribution system including weak fleet management (Shewarega et al., 2015).

In addition, according to a assessment done by Tadesse (2017), an average of about 7.5% of medicines were identified as wasted from 2013 – 2015.

Even if the reviewed studies have tried to assess some parts of inventory management performance from which majority of them used only quality indicators; however, none of the assessed studies had used the four types of indicators i.e. Quality Indicators, Response Time Indicators, Cost/Financial Indicators and Productivity Indicators to comprehensively assess the inventory management of the facilities they have included in their study.

Therefore, this study has tried to fill this gap by employing these four types of indicators supplemented by the qualitative method to assess the inventory management of those health facilities in detail.

1.3 Research Question

This study was conducted based on the following research questions.

- What is the performance level of the pharmaceutical inventory management of the selected health facilities?
- What are the challenges related to managing inventory at the same health facilities?

1.4 Objective of the Study

1.4.1 General objective

The general objective of this study is to assess the performance and challenges of the pharmaceuticals inventory management of public health facilities in West Shewa Zone, Oromia Region, Ethiopia.

1.4.2 Specific objectives

1. To determine the performance of the pharmaceuticals inventory management of the selected health facilities in-terms of quality.
2. To assess the response time performance of the pharmaceuticals inventory management of the studied facilities.
3. To determine cost performance of the pharmaceuticals inventory management of the studied facilities.
4. To measure the productivity performance of the pharmaceuticals inventory management of the studied facilities.
5. To identify the challenges related to managing inventory at the same health facilities.

1.5 Significance of the Study

This study is aimed to assess performance and challenges of the pharmaceuticals inventory management of public health facilities found in West Shewa Zone, Oromia Region, Ethiopia.

Accordingly, the study measured the performance level of the pharmaceuticals inventory management and identifies the key challenges that can affect the pharmaceuticals inventory management, and came up with appropriate suggestions or recommendations that can help solve or minimize those problems and challenges identified in the study so that it can easily fulfil customer need at the least possible cost and with a smallest inventory investment.

It also gives some clues to the government and non-governmental organizations working in this area to focus on the problem and be involved in an effort to improve pharmaceutical inventory management. Furthermore, the study can also help researchers to carry out more research on inventory management of the public sector.

1.6 Scope of the Study

This study assessed the public health facilities in West Shewa Zone only . The scope of this study is limited to assess only the performance and challenges of the pharmaceutical inventory management. This study assessesed the performance and challenges of the pharmaceutical inventory management between July 2017 to June 2018.

1.7 Operational definitions of Terms and Concepts

Inventory Accuracy Rate: is an indicator that measures the accuracy of stock balances recorded in a bin card, or automated system (i.e., amount on the record equals physical count) over a range of items as a percentage of stock balances reviewed for accuracy (PFSA, 2017).

Inventory management: Is the process of maintaining stock properly at all levels of the supply chain and at all times (PFSA, 2017).

Inventory Turnover Rate: is the number of inventory cycles for a given product for a defined period of time, usually calculated annually (Aronovich et al., 2010).

Order Lead Time: The time interval between when new stock is ordered and when it is delivered and ready for use (USAID|DELIVER Project, 2011b).

Percentage of Facilities Stocked According to Plan: It's a measure of the percentage of the health facilities with stock levels above the established minimum level and below the established maximum level for the product of interest at a specified point in time (PFSA,2017).

Percentage of Stock Wastage due to Expiration or Damage over a Period of one year: is the proportion of stock for an item that is useless because of expiration or damage during a period of one year to the total quantity of that item received during a year plus the quantity of that items found during the beginning period of the year. (PFSA, 2017).

Percentage Shelf Life of Key Essential Medicines: It's the percentage of remaining shelve life on date of receive divided by total shelf life (PFSA,2017).

Acceptable Storage Condition: It's the situation in which facilities or warehouses have fulfilled at least 80% of the storage condition defined in the standard criteria shown (see Annex VI) for evaluation of warehouses (PFSA, 2017).

CHAPTER II – RELATED LITERATURE REVIEW

This section covers theoretical review on, inventory management that include inventory control and inventory performance, and storage condition; along with the empirical study conducted on these areas.

2.1 Theoretical Literature Review

2.1.1 Inventory Management

Inventory management is the very crucial part of the pharmaceutical supply system; i.e. without a healthy inventory management system, the pharmaceutical supply system as a whole will not be feasible in addition to that pharmaceuticals inventory management can also bring out significant improvement in patient care as it's important in enabling to achieve the six rights. (Kokilam et al., 2015: Dwivedi, Kumar & Kothiyal, 2012). It's also is one of the major activities in the logistics cycle (see Figure 2.1) (USAID|DELIVER Project, 2011b).

Inventory management is not a separate function, we could; therefore, describe it as one of the activities that combine to form the broader function of logistics. All of these activities are so closely related that it would certainly be difficult to draw a boundary between inventory management and, say, purchasing, materials handling or warehousing. These activities are all closely related and often overlap. We should not, therefore, try to draw artificial boundaries between them, but should view them as different aspects of a single logistics function. This reinforces the point that all logistics activities have a direct impact on the stocks (Waters., 2003).

The idea of inventory management becomes clear when it is just described as the process to order, receive, store, issue and then reordering of a limited list of products. Inventory management is the function responsible for all decisions made about a stock in an organization. It makes decisions for policies, activities and procedures to make sure the right amount of each item is kept in stock at any time (MSH, 2012; Waters, 2003).

The goals of inventory management are to minimize the amount spent on inventory and the procurement and holding costs while balancing the service level and the stock level. Pharmaceuticals Inventory management is a key factor in success in a pharmacy because efficient inventory management can keep costs down improve cash flow, and

improve service. Alternatively, inventory mismanagement results in increased operating and opportunity costs (Dwivedi, Kumar & Kothiyal, 2012).

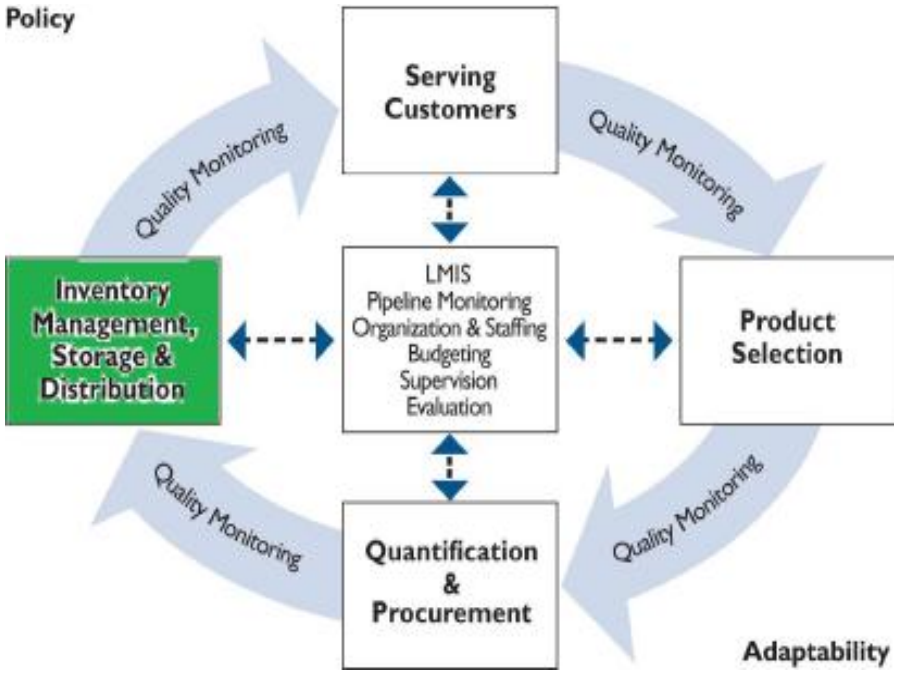

Figure 2.1 The Logistics Cycle

Source: USAID | DELIVER PROJECT, Task Order 1. 2011b.

2.1.1.1 Inventory control system

Inventory control is the method of handling inventory so as to meet customer needs at the minimum possible cost and with the lowest investment (Rachmania and Basri, 2013). Establishing and maintaining effective inventory records and procedures are the foundation for synchronizing the flow of pharmaceuticals through the distribution system and the key protection against theft and corruption. The inventory control system was intended for ordering and issuing medicines, for financial management, and for monitoring the consumption and preparing the stock balance reports important for procurement (MSH, 2012).

An inventory control system informs the supply chain managers when to order or issue, amount to request or issue, and how to keep an appropriate stock level of all products to avoid stock-out and over-supply. Therefore, it's maintained by every firm

to manage its inventories efficiently (USAID|DELIVER Project, 2011b; Rachmania and Basri, 2013).

Several objectives in inventory control such as minimize inventory investment; determine the appropriate customer service level balance supply and demand; minimize ordering cost and holding cost; also, preservation of inventory control system. It's useful in identifying the optimum level of inventories and getting solution to the problem of economic order quality, the reorder level and also safety stock (Rachmania and Basri, 2013).

It's also helpful in assisting the store managers to maintain a proper stock level to meet the patient's demand. A well planned and well-run inventory control system helps to prevent shortages, oversupply, and expiry of pharmaceuticals (PFSA, 2015).

Inventory management relates to the tracking and management of pharmaceuticals which includes the monitoring of pharmaceuticals moved into and out of stock room locations and the reconciling of the inventory balances (WHO, 2018). Some of the techniques used in managing inventories were discussed below:

Economic Order Quantity (EOQ)

This inventory control model was developed by F.W Harris in 1915 and it's the widely applied in practice. EOQ enables to determine the ideal lot size for procuring thereby lowering the overall operating cost. EOQ enables inventory managers to determine quantity of optimum items to buy. Nevertheless, the common EOQ model takes in to consideration the conditions such as uniform need/demand, fixed lead time, fixed order cost per order, immediate refill, no stock-out allowed, no demand ambiguity and quantity discounts aren't available. As the above suppositions do not show in all conditions, EOQ model should be improved to the actual inventory control system analysis (Rachmania and Basri, 2013).

Just-In-Time

Just-in-time is one among the most talked-about topics in materials planning primarily due to its tremendous success in the situation of Japanese companies. Just-in-time (or zero-inventory system) is an ideal concept of inventory management in which we are capable of supplying any kind of product that is required, anywhere and anytime required just in time with 100% supply guarantees without keeping any stock on hand (Vrat, 2014). In this study, this idea was included just simply to show the current

scientific development or what has been done in this area of study so far, even though its practical possibility in pharmacy was not yet reported.

Vendor Managed Inventory System

A vendor managed inventory system helps in minimizing the company's holding of stock and forces the distributor to maintain goods which in turn secures the level of service of the retailer (Njoroge, 2015).

This system is an initiative of partnering that encourages cooperation and the sharing of information between partners in a business. Bar codes are used in tracking items such as stock in retail, records, people and machines. Some control systems used for inventories apply this technology in order to make stock tracking automatic this improves on efficiency and thus supply chain performance (Njoroge, 2015).

ABC Analysis

In supply chain management it is known that a relatively small amount of items account for most of the value of annual consumption. The analysis of this phenomenon is more commonly known as ABC analysis also called Pareto analysis; it came in the nineteenth century when Vilfredo Pareto found that 20% of the population owned 80% of the wealth (Waters, 2003; MSH, 2012).

In ABC analysis method medicines are divided depending on their annual consumption (individual price of each item times annual consumption) to Class A items (products that are 10 to 20% of items that comprise 75 to 80% of the money used up), Class B items (those with medium usage rates), and the Class C items (most of the products that are slow moving, which constitutes 5 to 10% of the funds consumed). MSH, 2012).

In any supply system, evaluating the consumption trend and the value of total consumption for all items is useful. ABC analysis are useful to identify products that require serious attention /give priority to Class A items/ in procurement, inventory control, and port clearing. It's also used to identify those medicines that have the greatest budgetary effect if their quality is compromised (Dwivedi, Kumar & Kothiyal, 2012; MSH, 2012).

In addition, ABC analysis can also help with inventory management activities like the following:

Monitoring shelf life: Focus should be given to Type A items to minimize waste caused by the medicines expiry.

Delivery schedules: In the case when all medicines are ordered only once a year, divided deliveries of class A items can lead to optimum shelf lives.

Stock count: Cyclic stock counts should be guided by ABC analysis, with more frequent counts for the class A items.

Storage: Increasing control for the issuance as well as storage of the class A medicines at the service delivery points, like health centers and hospital can minimize pilferage, waste and organized theft of medicines MSH, 2012).

The limitation of ABC analysis is that it groups the items into three classes based on annual usage value only. It does not assume how critical the item is from the point of view of its availability (stockout cost). Additionally, if the unit purchase price or demand fluctuations are high, ABC classification needs to be updated regularly. To address this issue, the VED analysis is done based on the criticality of the availability of items (Vrat, 2014).

Maximum-Minimum Inventory Control Systems

It's another kind of inventory control system designed to ensure that the quantities in stock fall within an established range. Most successful inventory control systems used for managing health commodities are max-min systems of one type or another (USAID|DELIVER Project, 2011b).

A max-min inventory control system that are applicable to health commodity logistics systems are categorized in to three types. This includes forced-ordering, continuous review, and standard system.

The inventory control system is used to determine quantity to order or issue and when to request or issue. For each of these three types, the same formula is used to determine how much to request or issue. The main difference between the systems is the trigger for ordering or issue, i.e. when the order should be placed or an issue made.

1. In a forced-ordering system, the trigger for an order is end of the review period.
2. In a continuous review system, the trigger for an order is when the facility reaches the minimum level.
3. In a standard system, the trigger for an order is end of the review period for the commodities that are at the minimum level (MSH, 2012; USAID|DELIVER Project, 2011b).

2.1.1.2 Inventory Management Performance

Different supply chain and logistics performances are measured by several types of indicators. Accordingly, in order to measure the performance of inventory management, several indicators were developed specifically for use in public-sector pharmaceutical supply systems (MSH, 2012).

A. Types of Indicators

Selecting the type of indicator has to be done with care as it could be dangerous to simply focus attention only on one area. For instance, focusing only on productivity could improve one area but not affect the overall performance of the supply chain. According to Edward Frazelle (2001) model as adapted by Aronovich et al. (2010), there are four types of indicators: quality, time, financial, and productivity. To complete the analysis, all indicator types need to be considered, and they need to work together.

Quality Indicators: These indicators are often the simplest and widely used to implement and measure. Typically, they tell you how well you are performing a specific activity. A common indicator in this classification includes: average percentage shelf life of key essential medicines, percentage of facilities stocked according to plan (stock levels between the min and max levels, inventory accuracy rate, percentage of stock wastage due to expiration or damage over a period of one year (Aronovich et al., 2010; PFSA, 2017)

Time Indicators: These indicators measure the time it takes to complete specific activities. They show where saving time during specific activities can improve an overall supply chain performance. An order lead time is a common indicator in his category (Frazelle 2001; Aronovich et al., 2010).

Cost/Financial Indicators: These indicators enable supply chain managers to identify the supply chain cost drivers and help move toward a more efficiently managed supply chain. Some of the indicators under this classification includes: inventory holding cost, value of unusable stock as percentage of total inventory value, average response cost (Aronovich et al., 2010; PFSA, 2017).

Productivity Indicators: These indicators examine how well resources are used. For example, filling vehicles to their capacity, instead of sending out vehicles half-full,

could reduce costs and improve efficiency. A common indicator in this group was an inventory turnover rate (Frazelle 2001; Aronovich et al., 2010).

The Logistics Indicators Assessment Tool (LIAT) is the quantitative data collection tool that enables us to carry out surveys that measure health products logistics system performance as well as product availability at health facilities. The LIAT was helpful in monitoring the performance of some processes contained in the logistics management of the health commodities over a period of time, to assess certain outcomes of the logistics interventions, to conduct continuous supervision and performance monitoring, as well as to monitor products availability (USAID|DELIVER Project, 2011a).

Hence, the inventory management system of public health pharmaceutical supply chain systems can also be monitored and evaluated periodically using standard performance indicators to measure how effectively the inventory is being managed, although no standards exist yet for the acceptable range of performance (PFSA, 2017; MSH, 2012).

2.1.2 Storage Conditions of Essential Medicines

Products are stored at every facility in the pipeline; almost everyone working in the supply chain is responsible for product storage. Storage is one element of the logistics activity concerned with the physical custody of the products after they are acquired until they are issued. This looks routine if done well but can be most critical if not done well like all service functions (Vrat, 2014; USAID|DELIVER Project, 2011b).

The major task of storage is to receive the products from the supplier ensuring the quality and quantity of the products received and place it in the right location in the store to safeguard it till it is issued to lower level or customer. When the demand on the store is placed through an indent, it should efficiently locate and retrieve the item so as to issue it with the minimum of delay (Vrat, 2014)

An important goal in the storage of health products is the correct staging of health products to ensure that orders can be filled and distributed (USAID|DELIVER Project, 2011b).

Well-positioned, appropriately-constructed, correctly-arranged, and protected storage facilities are a crucial element of the pharmaceutical supply system. A properly

constructed building delivers the right environment for storing the products and helps the efficient movement of supplies. Storage facilities constructed by considering these issues will help in maintaining pharmaceutical quality and minimize operational costs. Storage facilities can be categorized into three groups: storerooms, manual warehouses and mechanized warehouses (MSH, 2012).

Regardless of storage facilities size—whether it's a small health center storeroom or a mechanized central warehouse—the key operational activities of storage are similar. The complexity of these activities will vary based on the size of products that can be managed and the storage facility size; along with the specific requirements, like cold storage (USAID|DELIVER Project, 2011b).

The appropriate storage methods, housekeeping function within the store, reducing or eliminating storage losses due to expiry, pilferage and damages during internal handling, store accounting, and physical stock verification are very important activities. Failing to do these activities properly will lead to delays, handling losses, etc. The storage area at times can indirectly show the quality of housekeeping culture in an organization (Vrat, 2014).

2.2 Empirical Literature Review

2.2.1 Inventory Management

According to the study done on pharmaceutical inventory management practices in hospital supply chains of cancer medicines in Indonesia, overstock was the major pharmaceutical inventory management problem (Rachmania and Basri, 2013).

A Study done in Malaysia on the area of the inventory management practices disclosed that inappropriate management may be due to caused by different reasons such as the level of management commitment, the costs incurred as well as the skills that the workers have (Mahidin et al., 2015).

In China, research by Jianling et al (2010) as cited by Pallangyo (2014) on the analysis of an inventory management in the China enterprises reveals that, in order for organizations to maintain competitive advantages and higher profitability, they need to pay more attention to the stocks control system. He adds that organizations need to adopt an effective inventory control method in their internal control system and implement scientific stocks control ways.

A study conducted in Uganda to assess the management of an essential medicines in the public health facilities shows that inventory management is generally poor with only 36% of the records that coincide with the physical counts of the drugs. The low percentages of correspondence between stock records and physical counts may be caused by wastage or pilferage. Shortage of staff, overload of staff with clinical work, little dedication to record-keeping and poorly trained staff in drug logistics management also contribute to this poor inventory control [Namaya, D., 2007].

In Namibia, facilities request/order products from a Central Medical Store (CMS). However, an assessment done on the CMS distribution disclosed that, the stock record are not properly maintained and physical count does not correspond with stock records (computerized records). The study identified that the regional stores as well as the health facilities have no better systems for determining what to order, how much or when to request, as a result majority of the facilities were forced to place many emergency orders during the six-week order interval, that added another workload on the already overburdened CMS. (MSH, 2012).

The study conducted in Nigeria showed that poor planning and forecasting, insufficient information about consumption and current stock levels, funding and capacity constraints and poor infrastructure are reasons for inappropriate stock levels (Schöpperle, 2013).

In Malawi the Principal Secretary of Health Ministry et.al (2013) as cited by (Pallangyo, 2014) state that medicine stock-outs were amounting to 95%. It was noted that causes were theft, tedious and bureaucratic process of procuring medicines and parallel system to purchase medication for treatment programs. The identified causes of stock-outs, in this case, are within the stocks control system and they are revealing the weakness of the system.

A study by Silumbe (2011) as cited by (Pallangyo, 2014) state that in Dar Es Salaam, Tanzania, shows that, regardless of the government efforts to ensure availability of medicines, there is a large stockout time as a result of weak pharmaceutical management of anti-malarial medicines in the public health facilities.

A study done by Desale et al. (2013) showed that 50% of the eight assessed hospitals as well as 54% of the 24 health centers were now using stock cards or bin cards for the entire HIV/AIDS and TB laboratory commodities in the main pharmacy store, out of

these records only 25 % and 20.8% were updated their bin-card with accurate information corresponding with the actual physical count conducted during visit at health centers and hospitals respectively.

2.2.2 Storage Conditions of Essential Medicines

According to the study by Tanzania's Ministry of Health and Social Welfare (2008) from the assessed health facilities, only 33% of the health facilities had adequate storage space.

In another study carried out on public health facility found in Uganda by country's Ministry of Health (2008) has identified that the adequacy of storage practices and handling of medicines in dispensaries and warehouses were 63.6%.

A study in Nigeria disclosed that, among the National Level Medical Stores, eight of them have moisture, leaking roofs/ceilings, drains and/or taps, inadequate cold storage capacity and absence of assigned areas for reception, delivery, and quarantined products. Stock management is done manually with stock holding cards and follows the first-expired-first-out (FEFO) strategy (Schöpperle, 2013).

Assessment of pharmaceutical and commodity management of ART, PMTCT, VCT and programs in Ethiopia, Namibia, and Rwanda showed that Warehousing and distribution systems for PMTCT products at the central level were lacking in Ethiopia. Moreover, pharmaceutical and laboratory structures at the facility level were limited in terms of space, storage, and handling capacity, thereby compromising product security and safety and patient confidentiality (MSH, 2012).

A study done on store management of pharmaceutical products in woreda health offices of the West Hararghe Zone, Ethiopia showed that among the assessed health facilities 80% of them have no adequate storage space for different warehouse activities. (Kassie et al., 2014).

Regarding storage condition, a study by PFSA in collaboration with USAID|DELIVER Project; on average, slightly more than half (55 percent) of the health facilities met acceptable storage conditions (80 percent of the criteria or more) (Shewarega et al., 2015).

The reviewed literatures have tried to assess some aspects of inventory management performance as part of the logistics activities in the supply chain and showed that an

efficient inventory management was important for health facilities to achieve their establishment objective.

From assessed studies, none of them had used the four types of indicators i.e. Quality Indicators, Response Time Indicators, Cost/Financial Indicators and Productivity Indicators to broadly assess the performance of the inventory management in the facilities they have studied.

Numerous kinds of indicators were developed to measure different supply chain as well as logistics activities. Selecting only one type of indicator to assess can lower the confidence, and it might be risky to focus on only one area. For instance, giving emphasis only on cost control might improve certain area but have no effect on the general performance of a supply chain (Aronovich et al., 2010).

Therefore, the aim of this study was to fill this gap by applying these four types of indicators along with the qualitative method to assess the inventory management of those health facilities in detail.

2.3 Challenges Related to Inventory Management

Though it varies from one facility to another, challenges that face managing inventory exists in all cases. Below are some of the studies done in this area.

An indicator based assessment of medicine storage and inventory management practices in various public hospitals in India revealed that, inadequate storage space, inadequate availability of storage equipments and lack of human resource are among the major challenges identified (Iqbal et al., 2015).

According to the study by Nahamya D. (2007) poor record keeping observed in public health facilities was mainly attributed to inadequate training of the staff in the drug logistic management, as the survey revealed that the majority of the staff (80%) was in the category of nurse/midwife and study results indicate that only 20% of the staff was formally trained in logistic management.

In Ghana an assessment of health commodities management practices in selected hospitals in Ashanti region showed that counterfeit and/or substandard commodities, irrational/incorrect use, delays in approving medicines and non-medicines, undermined distribution, transportation, lack of adequate storage facilities,

unavailability of skilled labour, internal bureaucracy, lack of funding, and logistical problems are the main challenges that face managing inventories (Adzimah et al., 2014).

In study by Tadesse (2017) provision of pharmaceuticals without needs and requisition, lack of an automated stock management tool, absence of functional DTC, poor communication between the PFSA and facilities, insufficient pharmacy personnel and weak monitoring and evaluation system were some of the major factors that contributed to wastage of pharmaceuticals in the facilities.

In another study by Legese (2018) it's disclosed that max-min inventory control management was not properly practiced in the hospital assessed, and there was no specific time to order, quantity to order or how much stock to hold. This study identified that inadequacy of storage space, limited capacity of PFSA to supply the quantity requested in the required time, shortage of staff and lack of commitment as well as initiation by the staffs.

2.4 Conceptual Framework of the Study

The framework consist of independent variables like remained shelf life, record accuracy, stock wastage, lead time and standard storage criteria, and performance of inventory management as an outcome variable; in addition it also included the challenges. It shows how the independent variables and challenges affect the an outcome variable which is performance of an inventory management.

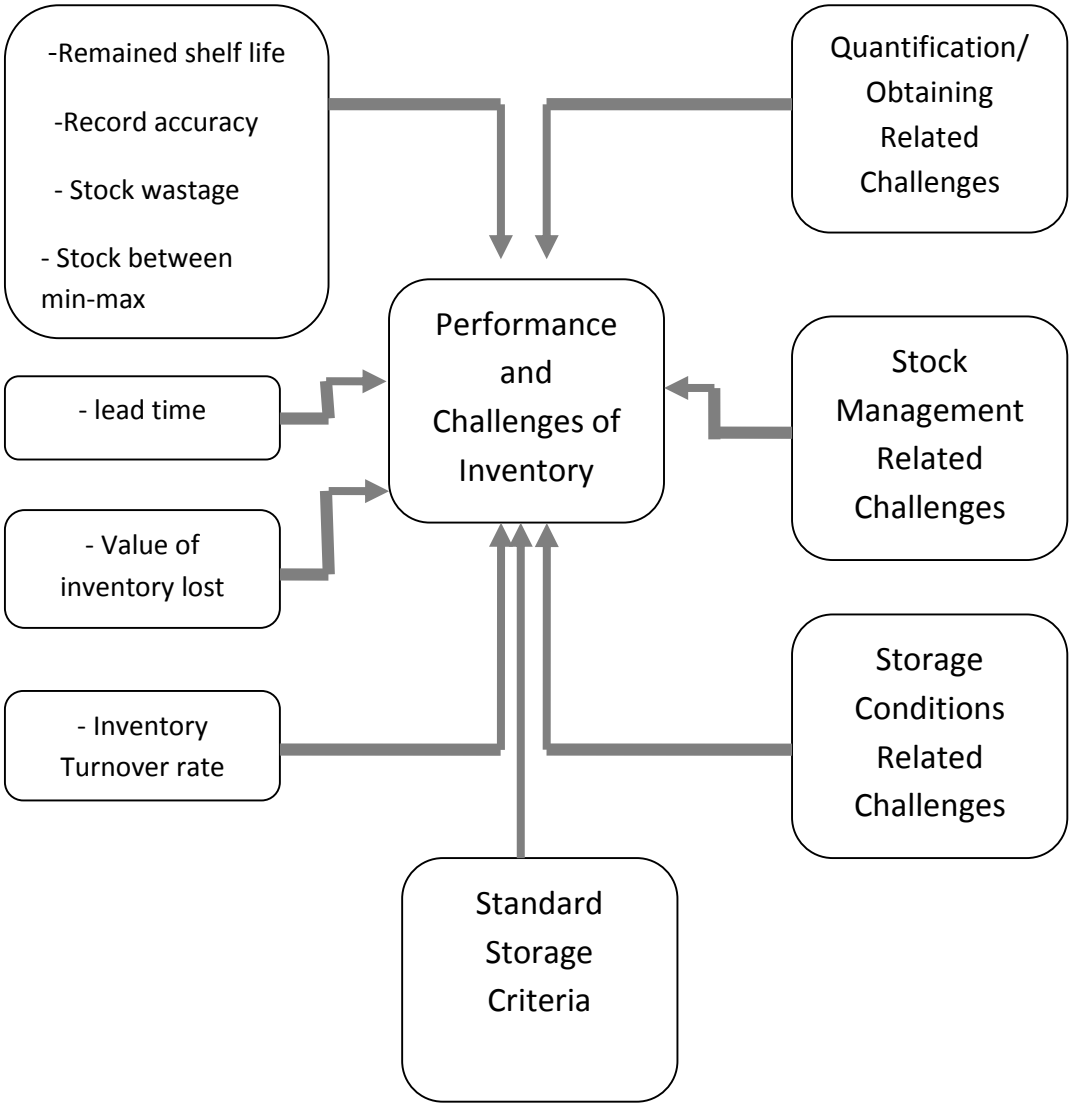

Figure 2.2 Conceptual Framework of the Performance and Challenges of Pharmaceutical Inventory Management

CHAPTER III - RESEARCH METHODS

3.1 Description of the Study Area

This study was done in selected public health facilities located in West Shewa Zone, Oromia Region, Ethiopia. West Shewa is one of the 20 different zones of Oromia regional state. This zone covers an area of 14,921.19 square kilometers. West Shewa is bordered on the North by the Amhara Region, on the North-West by Horo Guduru Wellega, on the North-East by North Shewa zone, on the South by South-West Shewa Zone and the Southern Nations, Nationalities and Peoples Region, on the south-west by Jimma, on the East by Oromia Special Zone Surrounding Finfinne and on the West by East Wellega (See Annex X) (Girma et al., 2018; Wikipedia, 2018).

Ambo, the capital town of the zone, is located 114 Km west of Addis Ababa. Based on the Central Statistics Agency 2007 census projection this zone has 2,652,781 populations. It is divided in to 22 different woredas (Abuna-Gindeberet, Ada'a-Berga, Ambo, Bako-Tibe, Chelia, Chobi, Dire-Enchini, Dano, Dendi, Ejersa-Lafo, Ejere, Elfata, Elu-Galan, Gindeberet, Jaldu, Jibat, Liban-Jawi, Meta-Robi, Meta-Walkite, Mida-kegn, Nono, Toke-Kutaye) with varying number of population and kebeles. It has 520 Health Post, 90 Health Centre, 06 Primary Hospitals and 01 General Hospital and 01 Referral Hospital with a total of 1,959 health professionals and 821 supportive staff according to information obtained from West Shewa Zonal Health Department (2018).

In addition to that, there are 2 Other Governmental Organizations health centers, 05 Non-Governmental Organization clinics, 01 specialty dental clinic, 25 medium clinics, 178 primary clinics, 34 drug stores and 18 rural drug vendors as stated by West Shewa Zonal Health Department (2018).

These health facilities were providing different medical services under the management of the Oromia health bureau, and the referral hospital under Ambo University.

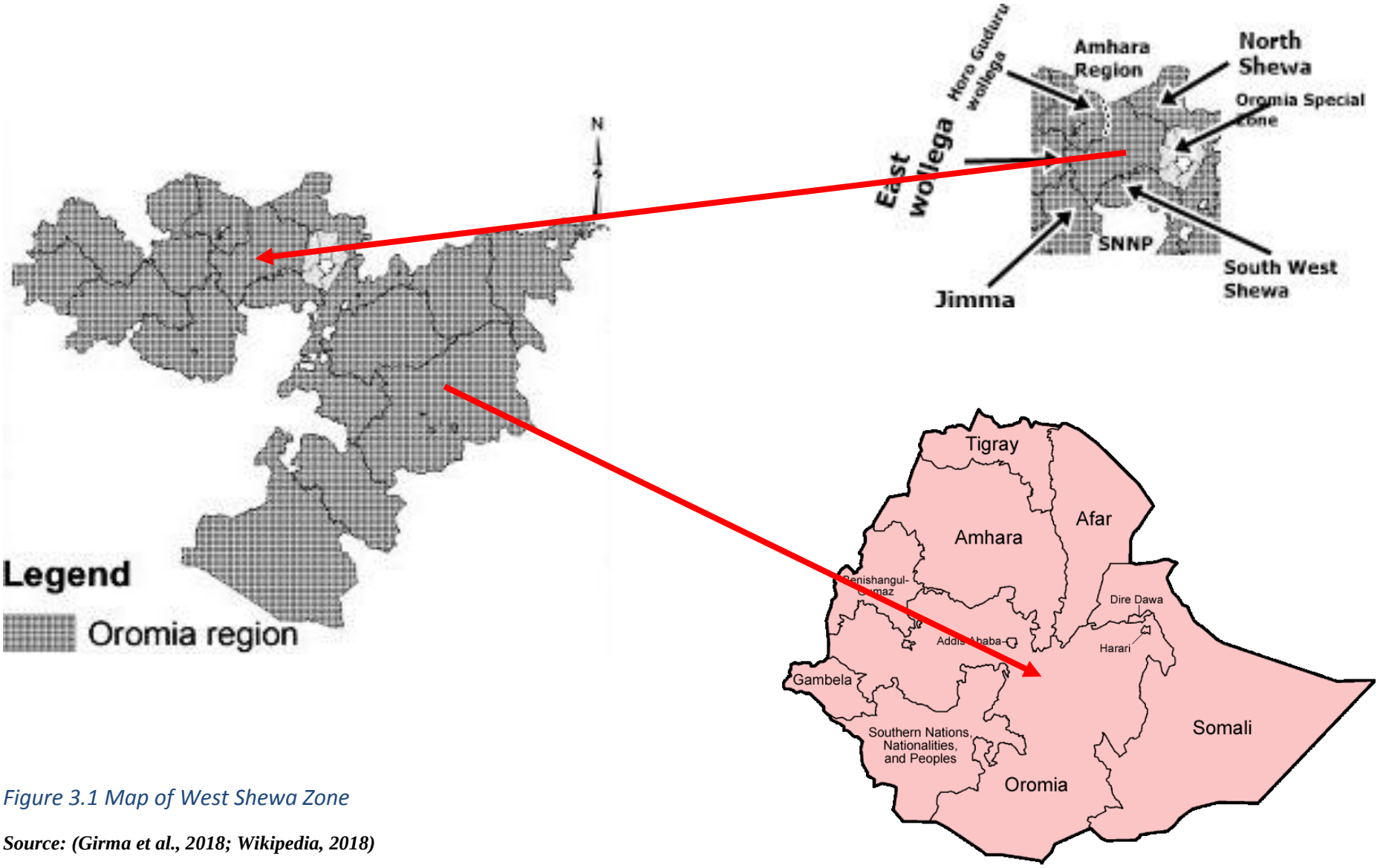

Figure 3.1 Map of West Shewa Zone

Source: (Girma et al., 2018; Wikipedia, 2018)

3.2 Study Approach

In order to meet the study's objective, both the qualitative and quantitative approaches were employed in this study. The quantitative approach was used to assess the inventory management performance by using the different standard operating procedures and key performance indicators, whereas qualitative approach was used to capture the information that cannot be gathered by quantitative method, and to strengthen/support the quantitative data.

3.3 Study Design

A facility-based cross-sectional descriptive study was followed to assess the performance and challenges of the pharmaceuticals inventory management of public health facilities in West Shewa Zone, Oromia Region, Ethiopia.

3.4 Population of the Study

All public health facilities that own separate and centralized pharmaceutical storeroom (Hospitals and health centers excluding health posts), which are 98.

Of those public health facilities that are functional for at least one year (from July 2017 to June 2018) and above are included in order to obtain full-year pharmaceuticals transaction data that are utilized to calculate the indicators.

All health professionals working in those public health facilities that are involved in medicine supply management activities are included for the qualitative study.

3.5 Sampling Design

The determination of the sample size of the health facilities was undertaken as per the USAID|DELIVER Project's Logistics Indicator Assessment Tool (LIAT) recommendation where a minimum of 15% of the total health facilities was suggested (USAID|DELIVER Project, 2008).

As a result, 17 public health facilities which are beyond the minimum requirement (i.e. 15) were sampled from a total of 98 public health facilities. A simple random sampling method /Lottery method/ was used to select those health facilities.

Regarding the qualitative data 10 participants were selected from the 17 health facilities identified (as it's determined that the information has been saturated). This includes four store-managers, three pharmacy department heads, one facility head of

the health center, one chief executive officer (CEO) of the hospital and one storage and distribution officer from PFSA. The purposive sampling method was applied in selecting the study participants for their ability to generate rich information; as they have a good experience in this area.

With regard to the type and number of medicines included, they were selected based on the ten top morbidities of the West Shewa Zone. Accordingly, 20 essential medicines (See Annex VII) were selected that include first-line medicines of the ten top morbidities in accordance with a national standard treatment guideline third edition (FMHACA, 2014).

3.6 Data Types, Sources & Collection Methods

Both the quantitative as well as qualitative data types were collected in this study.

The data source for the quantitative data that are necessary to calculate KPI's to assess the actual inventory management performance like the day order placed, received date, quantity issued, stock balance, list of annual inventories, list of expired medicines was obtained by record reviews (i.e. VEN List, Bin cards, RRF formats, pharmaceuticals recorded on 19/22 Models and other records) and data like stock status, manufactured date, expiry date, physical count and storage condition were collected by observation.

The quantitative data were collected by three trained druggist data collectors. The standardized data collection tool from LIAT (USAID|DELIVER Project, 2008) and Aronovich et al. (2010) was adapted to the health facilities context and used in collecting the data. This includes data abstraction formats and observation checklist (see Annex I to VI) It's collected through document review by recording selected pharmaceuticals information like record accuracy (the correspondence between stock records and the actual physical count), stock status, expiry or damage and costs of those pharmaceuticals on the data abstraction form, and filling the checklist containing standard criteria used to measure storage condition through observation (see Annex VI). Data during the visit point and the last year's data (from July 2017 to June 2018) was captured in order to calculate the indicators.

Whereas, the data source for the qualitative part was key informants interview. Important data that help to understand the root causes of weak inventory

management performance that cannot be collected by the quantitative method was collected by this method.

An interview guide for key informants interview was initially prepared in English and later translated into Afan Oromo by an official translator to be used for gathering the qualitative data (see Annex VIII and IX). The interview was carried out by the principal investigator, and it lasts for an average of 35 minutes. The voice recorder was also used for the key informant interview. The key informants interview that was conducted in Afan Oromo was then transcribed and translated back into English.

The study's data collection process (both qualitative and quantitative data) was carried out from *May to June 2019.*

3.7 Data Quality Assurance

An adapted data collection tool from a standardized data collection tool LIAT (USAID|DELIVER Project, 2008) and Aronovich et al. (2010) was used to gather the data. In addition, data collection tool validation method called face validity was employed by using two experts working in this area.

Face Validity is the method in which people who have deep knowledge or understanding of the topic (i.e. experts) read through the data abstraction formats, observation checklist and interview guide, and evaluate if the points included successfully capture the area under investigation (Colling ridge, 2014).

Once the data collection tools were developed it was pretested in two health centers which are not involved in the study. The testing of the tools was conducted to confirm the suitability of the tool for the intended purpose. It was also helped in modifying better and estimating the time needed to collect and process the data effectively.

For the quantitative study, data collectors were provided training for one day on the data collection instruments and processes before the data collection starts. Data was reviewed and crosschecked by the main investigator for the consistency and completeness and inconsistencies found was amended on time.

Concerning the qualitative part, the semi-structured interview guide was tested for its validity by the same two experts working on this area. In addition, it's also pretested in the two health centers which are not involved in the study along with the

quantitative data collection tools. All interviews conducted were audio-recorded. The records were listened for several times and transcribed to ensure quality transcription.

3.8 Data Analysis

The quantitative data were analyzed by using Microsoft Excel 2016 to calculate descriptive statistics like an average and percentage of inventory management key performance indicators, and also to calculate the formulas that are used to determine an individual indicators.

The following Key performance indicators were analyzed in this study using the data collected, and the results were summarized and presented by using the tables and graphs.

i. **Average Percentage Shelf Life of Key Essential Medicines**

$$= \frac{\textit{Remaining shelve life on date of receive}}{\textit{Total Shelf life}} X100$$

ii. **Percentage of Facilities Stocked According to Plan (Stock Levels between the Min and Max Levels**

$$\frac{\textit{Number of storage facilities with stock levels between the established max/min levels}}{\textit{Total number of facilities visited}} \times 100$$

iii. **Inventory Accuracy Rate**

$$= \frac{\text{Number of items where stock record count equals physical stock count}}{\text{Total number of items counted}} X\ 100$$

iv. **Percentage of Stock Wastage due to Expiration or Damage over a Period of one year**

$$= \frac{\textit{Unusable stock of an item during a period of one year}}{\textit{Beginning stock plus quantity received of the item during one year period}} * 100$$

v. **Order lead time**

= day order is received by facility – day order is placed by facility to the supplier

vi. **Value of Medicines Lost as a Result of Wastage as Percentage of Total Inventory Value**

$$= \frac{\text{Value of Unusable Stock}}{\text{Total Inventory Value}} * 100$$

vii. **Inventory turnover rate**

$$= \frac{\text{Total value of items distributed}}{\text{Average value of inventory}}$$

viii. **Storage Condition**

$$\text{\% fulfillment of the storage conditions for each facility} = \frac{\text{No. of 'yes' responses}}{\text{Total number of storage conditions considered}} * 100$$

In qualitative part of the study, all interviews conducted were audio-recorded. The records were first transcribed and translated to English. A transcript of the interview was analyzed using the qualitative analysis technique (reviewing the interview thoroughly, categorizing thematically, summarizing and finally writing down the information by stating the finding). As a result 03 themes and 13 codes were emerged from the qualitative data collection. In addition, relevant quotations were used to support the themes in the presentation of study findings.

3.9 Ethical Considerations

The study was first approved by an Ethical Review Board of the School of Pharmacy, Addis Ababa University. Then by the Research and Ethical Committee of Oromia Regional Health Bureau before the study was commenced. Following that a letter informing the facility administrators and West Shewa Zone Health Department was written from the Regional Health Bureau (see annex X and XI).

Oral consent of the subject was asked before the interview for the qualitative part of the study. There was a high degree of confidentiality throughout data collection, and the name of those health facilities involved as well as individual subjects participated were not stated in the result, instead the code representing the facility and cumulative result of studied facilities and summary results of key informant interviews was stated.

CHAPTER IV - RESULTS AND DISCUSSIONS

4.1 Results

In this section of the study both qualitative and quantitative results of pharmaceutical inventory management performance and challenges of the selected 17 health facilities of West Shewa zone were displayed.

4.1.1 Inventory Management Performance: A Quantitative Observation

The availability of different logistic forms like bin cards, RRF and IFRR is fulfilled in almost all facilities assessed even if consistent utilization of bin card has some problem. Though majority of the facilities 12 (70.5%) have prepared their facility based Essential drug list (EDL), only 3(17.64%) facilities have updated it.

Regarding classification of the products based on VEN and/or ABC method 7(41.17%) of the facilities have categorized their products accordingly from which only 3(17.64%) facilities have been regularly updating it.

Even though many of the facilities claim that they have established DTC, but only 3(17.64%) facilities have functional DTC who regularly meet (i.e recorded in minute) , have a plan and execute their job according to the plan.

From the assessed health facilities only 7(41.17%) of the facilities have been using the automated records (software) to manage their pharmaceutical transaction. Regarding the pharmacy professional's manpower, none of the facilities have fulfilled the required manpower as per the Public Service Bureau standard (table 4.1).

Table 4.1. Inventory Management Practices of Selected Health Facilities in West-Shewa Zone, Oromia Region, Ethiopia on the Day of the Visit.

PRATICES ASSESSED	Number of Facilities Response Type	
Availability of logistic Forms	Yes (%)	No (%)
○ Bin Card	15(88.24%)	2(11.76%)
○ IFRR	17(100%)	0
○ RRF	17(100%)	0
Utilization of logistic Forms		
○ Bin Card	16(94.12%)	1(5.88%)
○ IFRR	17(100%)	0
○ RRF	17(100%)	0
Availability of EDL	12(70.59%)	5(29.41%)
Updated EDL	3(17.65%)	14(82.35%)
Availability of SOP Manual	15(88.24%)	2(11.76%)
Products classified VEN /ABC method	7(41.18%)	10(58.82%)
Updated VEN and/or ABC classification	3(17.65%)	14(82.35%)
Functional DTC	3(17.65%)	14(82.35%)
Availability of Automated record	7(41.18%)	10(58.82%)
Availability of pharmacy staff man power against Public Service Bureau Standard	%tage	
▪ Pharmacy Professionals	43%	
Last supportive supervision obtained	Last month	11(64.7%)
	b/n 1-3 month	3(17.65%)
	This year	2(11.76%)
Capacity building trainings provided to pharmacy staff	**IPLS**	89.22%
	DTC	22.19%

The results of this study are organized under the four types of indicators. This includes Quality Indicators, Response Time Indicators, Cost/Financial Indicators and Productivity Indicators.

4.1.1.1 Quality Indicators

i. Average Percentage Shelf Life of Key Essential Medicines

It's an indicator used to track the shelf life of products when they reach facilities, indicating if there are problems with the supplier/donor; as these problems could lead to expiries and wastage.

Accordingly, an average percentage shelf life of key essential medicines ranges from 28.59% to 81.56% with an overall average percentage shelf life of the selected medicines was calculated to be 62.22%. Among the assessed medicines Zinc tablet (Dispersible) has an average percentage shelf life of 28.59% whereas Enalapril tablet, Paracetamol tablet, Ciprofloxacin tablets have an average percentage shelf life of 81.56%, 80.28%, 78.78% respectively. Average percentage shelf life of key essential medicines is depicted in figure 4.1

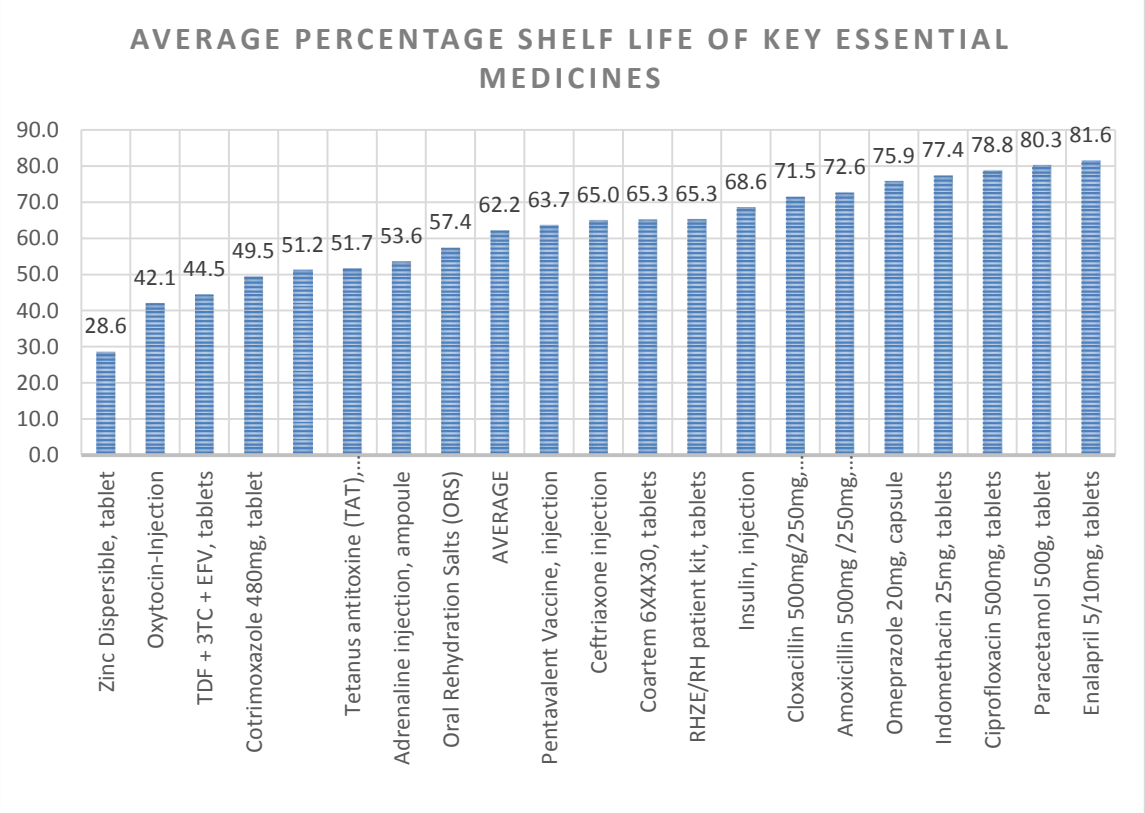

Figure 4.1. Average percentage shelf life of each studied medicines of the selected public health facilities in west shewa zone, oromia region, ethiopia on the day of the visit.

ii. Percentage of Facilities Stocked According to Plan (Stock Levels between the Min and Max Levels

This indicator helps in determining whether stock levels of the products are adequate (between the Min and Max) at some point in time. It enables one to know an overstock situation that might lead to expiry and wastage of product, as well as stockouts or rationing resulting fom low stock levels.

From the assessed health facilities, none of those essential medicines were stocked according to the plan in all health facilities studied. From those essential medicines studied Zinc tablet (Dispersible) followed by Albendazole tablets and Indomethacin tablets have relatively higher values with average stocked according to the plan of 52.94%, 35.29% and 35.29% respectively. Whereas, TDF + 3TC + EFV, tablet was not stocked between the Minimum and Maximum Levels in all of the facilities assessed (Figure 4.2).

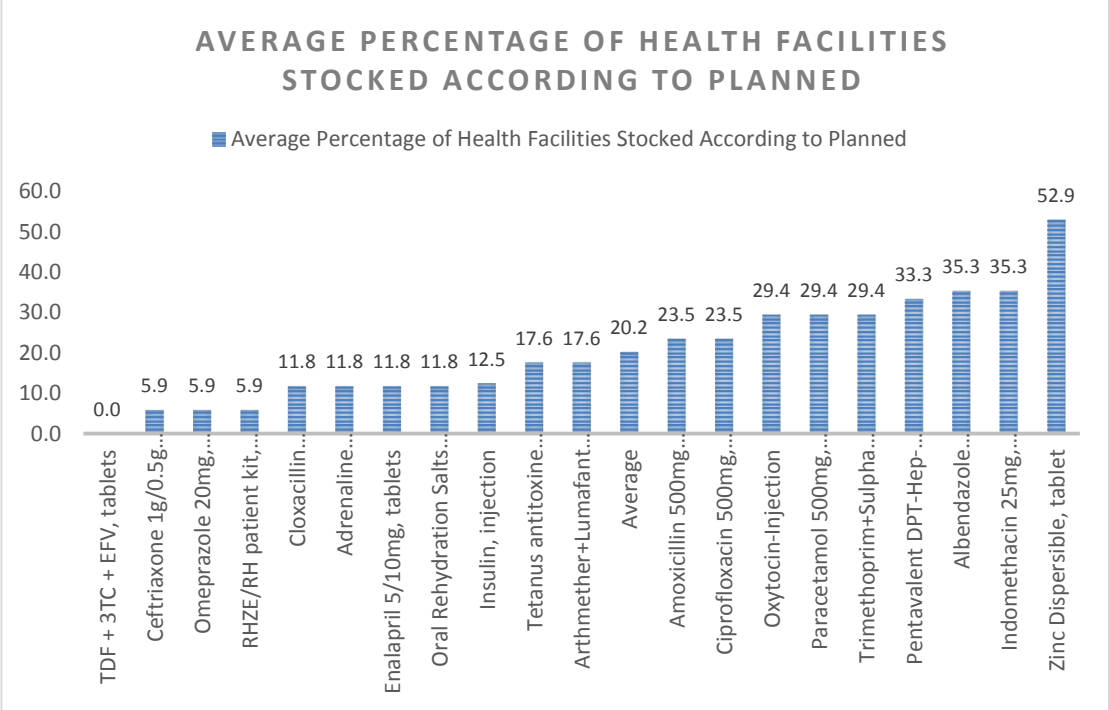

Figure 4.2 Percentage of each of those essential medicines stocked according to the plan of the selected public health facilities in west shewa zone, oromia region, ethiopia on the day of the visit.

iii. Inventory Accuracy Rate

This indicator measures the ability of a facility to accurately record the stock balance for all items over a given period of time. Having accurate stock-on-hand values is very

important during forecasting and procurement as well as for proper picking and distribution.

An average inventory accuracy rate was 39.23% that ranges from 0% for Health Facility 6 to 75% for Health Facility 12. An average inventory accuracy rate of individual health facilities was shown in figure 4.3.

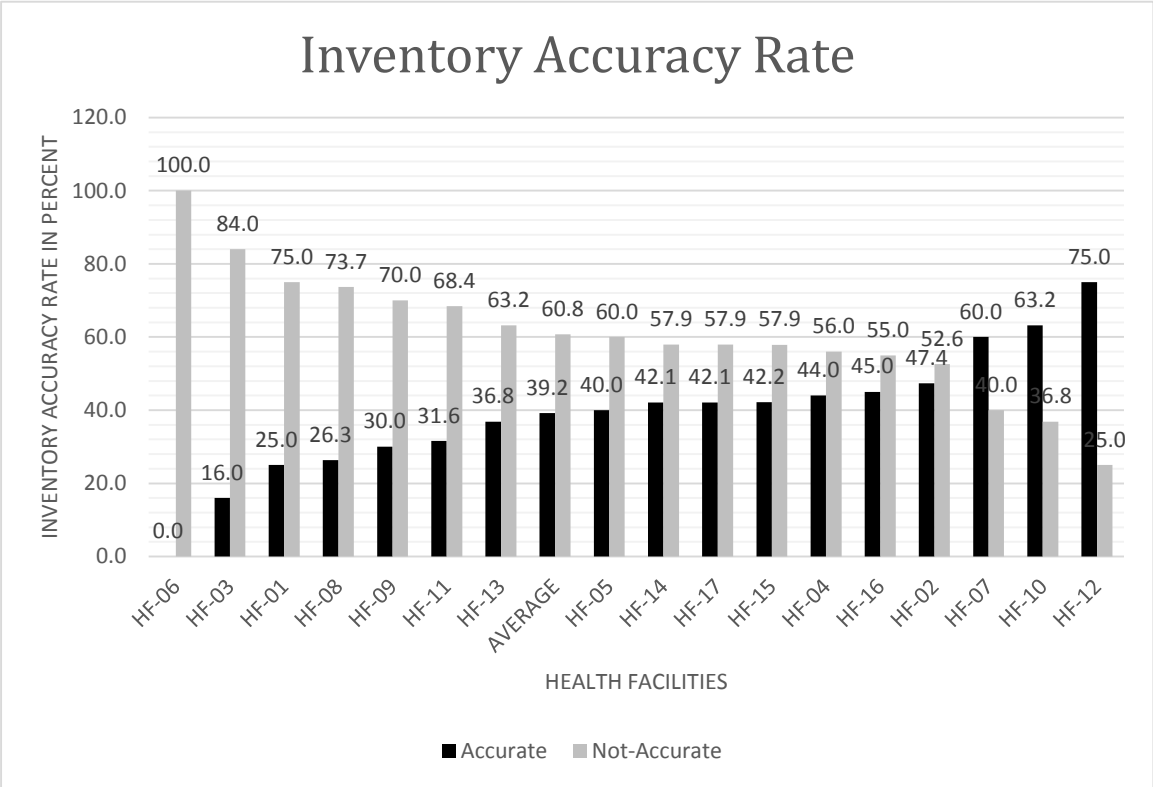

Figure 4.3 Inventory accuracy rate of the individual selected public health facilities in west shewa zone, oromia region, ethiopia on the day of the visit.

iv. Percentage of Stock Wastage due to Expiration or Damage over a Period of one year

Beginning stock balance plus the quantity of an item received from July 2017 to June 2018 and un-usable stock of an item during the same year were taken to calculate the stock wastage rate.

Hence, an averagely 7.08% of the studied medicines were found to be wasted in those health facilities. An average stock wastage rate of the individual medicines was shown in figure 4.4. As depicted in the figure, while medicines like Adrenaline and Artemether + Lumefantrine contribute as much as 42.47% and 39.16% respectively; medicines like

Cloxacillin, insulin and omeprazole contribute only 0.01%, 0.03%, 0.19% to an overall wastage rate respectively.

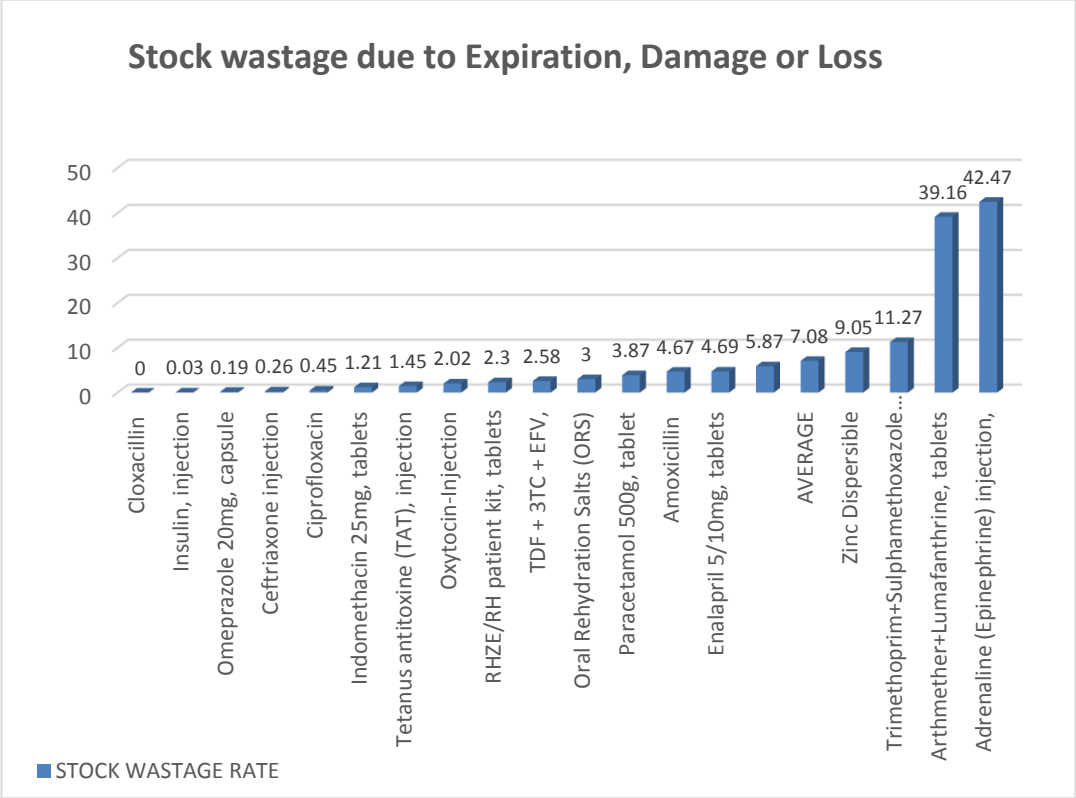

Figure 4.4 Stock wastage rate of each studied medicines of the selected health facilities in west shewa zone, oromia region, ethiopia from july 2017 to june 2018.

4.1.1.2 Response Time Indicators

v. Order lead time

It's the time interval needed to finish the procurement cycle. It starts when the need for new stock is known and ends when that stock is delivered and available for an issue (MSH, 2012). During lead time calculation, it is to include all the time up to when the stock is ready to use. The stock that has been received, but not inspected, recorded, and put on the shelf, is not ready to be issued and is not available to be used. To improve the client's response time, the stock must be available for the customer when they request or need it (USAID|DELIVER Project, 2011b).

The overall average order lead time of the past six months (from January 2018 to June 2018) in those health facilities was calculated to be 33.10 days (figure 4.5). It ranges

from as short as 19.67 days for Health Facility 05 to as long as 50 days for health facility 11.

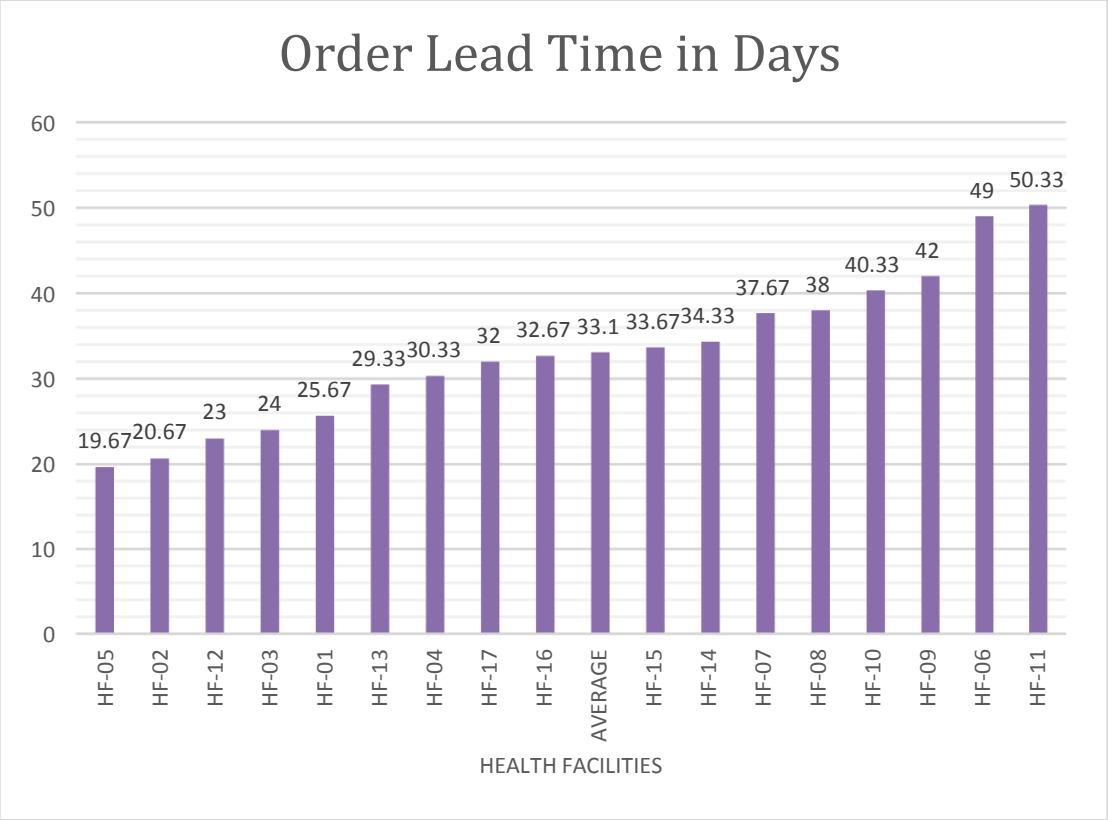

Figure 4.5 Order lead time of the selected health facilities in west shewa zone, oromia region, ethiopia from january 2018 to june 2018.

4.1.1.3 Cost/Financial Indicators

vi. Value of Medicines Lost as a Result of Wastage as Percentage of Total Inventory Value

This indicator is preferable to be calculated for the unusable stock within one budget year.

Where the total inventory value includes the value of the items found during the beginning period of the year plus the value of the items received during the year in review.

The value of money lost as a result of medicine expiry in all health facilities assessed from July 2017 to June 2018 was calculated to be 321,546.11 Ethiopian Birr (ETB). As shown in table 4.2 from the total money lost due to the expiry of these selected key essential medicine TDF + 3TC + EFV takes the lead by contributing more than half (i.e. 51.17%) of the total wasted. However, medicines like Cloxacillin capsules,

Indomethacin, tablets and Omeprazole, capsule contributed only as small as 0.02%, 0.20%, 0.29% from the total amounts of medicines wasted.

Table 4.2 Value of stock wasted as a result of wastage in selected health facilities in west shewa zone, oromia region, ethiopia from july 2017 to june 2018.

S. No	Item List	Unit	Total Quantity	Total Cost	%tage from the total value
1	Albendazole 400mg/200mg, tablets	10X12	58.00	5018.51	1.56%
2	Amoxicillin 500mg /250mg, capsule.	50X10	60.46	25604.69	7.96%
3	Ciprofloxacin 500mg, tablets	10X10	100.00	7656.67	2.38%
4	Ceftriaxone 1gm/0.5gm injection	1	758.00	9964.67	3.10%
5	Cloxacillin 500mg/250mg, capsules	50X10	0.13	68.92	0.02%
6	Adrenaline 1mg/ml inj., ampoule	100	8.29	2543.69	0.79%
7	Indomethacin 25mg, tablets	10X10	14.30	648.56	0.20%
8	Enalapril 5/10mg, tablets	10X10	75.50	4283.27	1.33%
9	Omeprazole 20mg, capsule	10X10	26.00	930.02	0.29%
10	Oral Rehydration Salts (ORS)	1	1013.00	2293.23	0.71%
11	Oxytocin 10units/ml -Injection	1	216.00	1572.00	0.49%
12	Paracetamol 500mg, tablet	100X10	16.00	2658.98	0.83%
13	Pentavalent DPT-Hep-Hib Vaccine	1	0.00	NA	NA
14	Tetanus anti-toxin (TAT), 1500IU inj.	1	464.00	27628.42	8.59%
15	Trimethoprim + Sulphamethoxazole 960mg/480mg, tablet	100X10	37.36	12607.28	3.92%
16	Zinc Acetate 20mg, tablet (Dispersible)	10X10	188.00	6382.22	1.98%
17	TDF + 3TC + EFV, tablets	30	888.00	164549.95	51.17%
18	Insulin Zinc/ (30/70), 100IU/ml, inj.	1	51.00	4267.04	1.33%
19	RHZE/RH patient kit, tablets	Kit	38.00	26140.43	8.13%
20	Artemether + Lumefantrine (20/120mg), tablets	6X4	29.20	16727.57	5.20%
	TOTAL		321546.11		100%

4.1.1.4 Productivity Indicators.

vii. Inventory turnover rate

This indicator determines a number of times the health facilities inventory was sold/distributed/ and replaced (i.e. turned over) in a specific period. The Average Inventory turnover rate of the selected key essential medicines was calculated by dividing a total value of items distributed last year and an average value of inventory. Accordingly, an average inventory turnover rate assessed from July 2017 to June 2018 was 8.21 (figure 4.6). As shown in the figure below medicines like Ceftriaxone injection has a relatively higher inventory turnover rate of 13.80 followed by RHZE/RH patient kit, whereas Artemether + Lumefantrine and Adrenaline (Epinephrine) injection have a lower turnover rate.

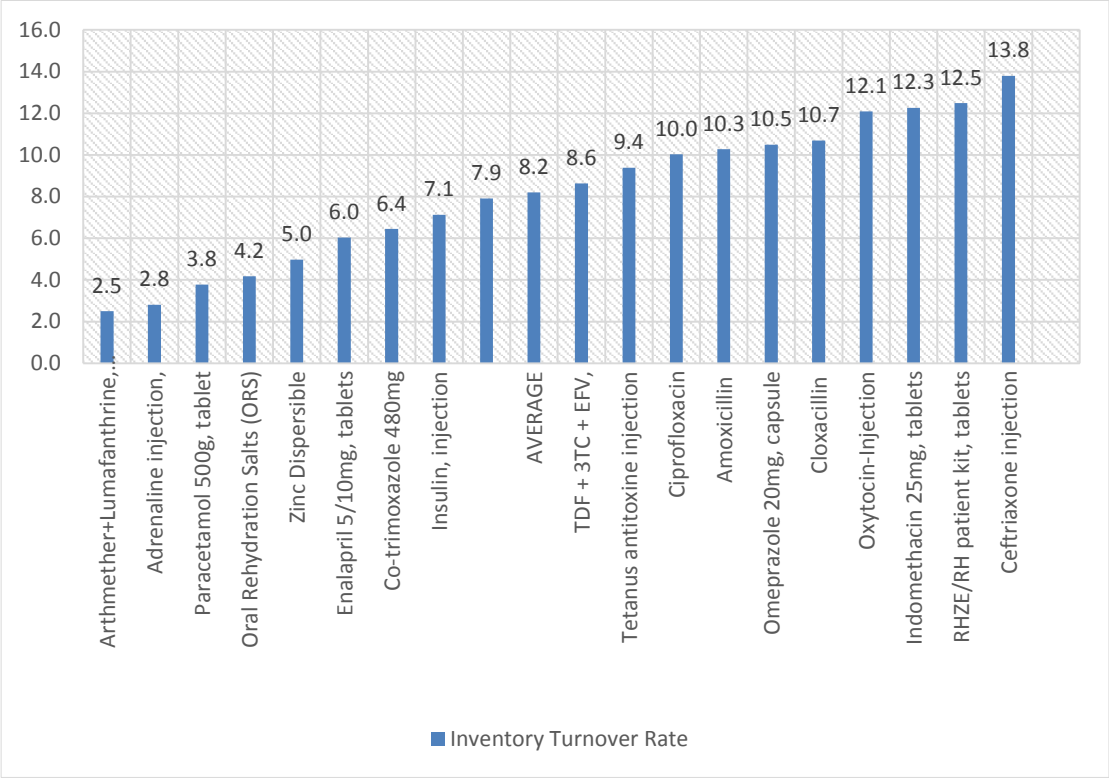

Figure 4.6 Inventory turnover rate of each studied medicine of the selected health facilities in west shewa zone, oromia region, ethiopia from july 2017 to june 2018.

viii. Storage Condition

In order to supply products of optimum quality to our clients, an individual health facility must have an acceptable storage condition (i.e. safe, protected, and well-organized storage areas) that will avoid or minimize the quality problem of the product. To assess the storage conditions of health facilities, Logistic Indicator

Assessment Tool /LIAT/standard criteria were used (Shewarega et al., 2015). Physical observations were also used to measure whether these health facility stores were following these criteria.

An average percentage fulfillment of a storage condition was found to be 70.88% as identified by observation using the observation checklist (Table 4.4). Only 6(35.29%) of the facilities fulfill the acceptable storage condition which is ≥ 80% (Table 4.3). Securing the storage area with a lock and key but accessing during normal working hours, storage area accessibility limitation to only authorized personnel, storage area's roof condition to avoid sunlight and water penetration and absence of evidence of foods and drinks in the store has the highest average percentage of each 100%. In contrary to this, adequacy of storage space for the existing products as well as storing products on a sturdy shelves, and organizing boxes neatly have the lowest average percentage of 35% and 41% respectively (Table 4.4).

Table 4.3 Average % of the storage condition of each selected health facilities in west shewa zone, oromia region, ethiopia on the day of the visit.

S. No	Health Facility	Average % of storage condition	Acceptable ≥ 80%	Not Acceptable <80%	Remark
1	Health Facility-01	75%		√	
2	Health Facility-02	90%	√		
3	Health Facility-03	45%		√	
4	Health Facility-04	75%		√	
5	Health Facility-05	85%	√		
6	Health Facility-06	45%		√	
7	Health Facility-07	85%	√		
8	Health Facility-08	75%		√	
9	Health Facility-09	55%		√	
10	Health Facility-10	95%	√		
11	Health Facility-11	85%	√		
12	Health Facility-12	95%	√		
13	Health Facility-13	70%		√	
14	Health Facility-14	60%		√	
15	Health Facility-15	50%		√	
16	Health Facility-16	75%		√	
17	Health Facility-17	45%		√	
	AVERAGE	**70.88%**	**06(35.29%)**	**11(64.71%)**	

Table 4.4 Average percentage of an individual standard criterion used to measure the storage condition of the selected health facilities in west shewa zone, oromia region, ethiopia on the day of the visit.

S. No	Description	Yes No. (%)	No No. (%)	Remark
1	Pharmaceuticals are arranged and organized according to a logical categorization.	12(70.6)	5(29.4)	
2	Products are organized on shelves with arrows pointing up	11(64.7)	6(35.3)	
3	Products are organized on shelves with identification labels, expiry dates, and manufacturing dates clearly visible.	10(58.8)	7(41.2)	
4	Products are stored and organized according to FEFO procedures and are accessible for counting and general stock management.	8(47.1)	9(52.9)	
5	Outer cartons are in good condition (not crushed, perforated, stained, or otherwise visibly damaged).	15(88.2)	2(11.8)	
6	There is a separate store for expired and damaged products	12(70.6)	5(29.4)	
7	Damaged and expired products were segregated from usable products in the storeroom.	15(88.2)	2(11.8)	
8	Products are stored in a dry, well-lit, well-ventilated storeroom. (Visually inspect roof, walls, and floor of storeroom.)	7(41.2)	10(58.8)	
9	Cartons and products are protected from direct sunlight	14(82.4)	3(17.6)	
10	There is no evidence of rodents in the storage area. (Visually inspect)	12(70.6)	5(29.4)	
11	There is no evidence of insects in the storage area. (Visually inspect)	12(70.6)	5(29.4)	
12	The storage area is secured with a lock and key but is accessible during normal working hours.	17(100)	0	
13	Storage area access is limited only to the authorized personnel.	17(100)	0	

14	The roof is maintained in good condition to avoid sunlight and water penetration.	17(100)	0
15	The floor is maintained in good condition so it is easy to move products from one place to another by trolley and it is easy to clean	11(64.7)	6(35.3)
16	The storeroom is clean, with all trash removed.	13(76.5)	4(23.5)
17	There is no evidence of food and drinks in the store	17(100)	0
18	Products are stored on sturdy shelves/bins, and boxes organized neatly.	7(41.2)	10(58.8)
19	The current storage space is sufficient for existing products.	6(35.3)	11(64.7)
20	Bin cards are used and updated regularly	8(47.1)	9(52.9)
	Average	**70.88%**	

4.1.2 Challenges of Inventory Management Performance: A Qualitative Observations

The qualitative data was collected by a key informant interview of key informants. These interviews were held with Head of Facility/CEO, heads of pharmacy, store managers working in those selected health facilities and storage and distribution officer from PFSA based on the reason specified in the methodology part. All of our key informants were males, the majority of them were between 31 to 40 years the age group, are pharmacy professionals and also have bachelor degrees. In addition, their work experience ranges from 3 to 10 years (Table 4.5).

The data obtained by interviewing key informants were transcribed immediately after the interviews, then thoroughly analyzed and categorized into three thematic areas based on the nature of the data. Quantification and Procurement/Obtaining/ Related Problem, Stock Management Related Problems and Storage Condition Related Problems.

Table 4.5 Socio-demographic characteristics of the key informants working in the selected health facilities in west shewa zone, oromia region, ethiopia on the day of the visit

Sociodemographic Characteristics		**Frequency**	**%**
Age	21-30 years	2	20%
	31-40 years	7	70%
	+41years	1	10%
Sex	Male	10	100%
	Female	0	0
Education	Master's degree	2	20%
	Degree	6	60%
	Diploma	2	20%
	Certificate	0	0
Profession	Pharmacy Profession	7	70%
	Nurse/Health officer	2	20%
	Other	1	10%
Work Position	Store manager	4	40%
	Pharmacy head	3	30%
	Medical Director	0	0
	Facility head/CEO/PFSA	3	30%
Work experience	Less than 1 years	0	0
	1-3 years	2	20%
	4-6 years	3	30%
	7-9 years	4	40%
	10 years and above	1	10%

4.1.2.1 Quantification and Procurement/Obtaining/ Related Challenges

Some of the Key Informants (KI) complain frequent stockout, overstocking and medicine expiry due to improper quantification during medicine procurement as it was done with the rush and without passing through the necessary steps like involving Drug and Therapeutic Committee (DTC). This may be primarily due to the lack of commitment of the staff and a little emphasis given to the quantification science by the management of the health facility. This can be demonstrated by one of KI saying that:

"as our health facility has a very high patient burden, the quantification was done swiftly without taking time to calculate the correct amount needed. Instead, it was conducted by depending only on personal judgment with a few or no utilization of past consumption data generated and also without involving the DTC that exposed us to frequent stockout, overstocking and medicine expiry." (Pharm.06)

Even though some of the KIs put quantification as the problem, others do not agree with it by saying even if quantification have some limitation with it, but when compared to other challenges like long lead time, unavailability of the product from the market, receiving near expiry medicine, receiving medicine that you did not requested or receiving medicine above you ordered; it's very minimal. For instance, one respondent said;

"even-though DTC members do not attend the quantification process regularly and contribute their share in producing a good quantification, we actually use the past consumption data and other relevant data generated at our health facility during quantification." (Pharm.03)

The majority of the health facilities criticize that the lead time of the pharmaceuticals under Program Medicines that are supplied by PFSA and budget medicines that are supplied by Biftu Adugna Supplier was longer even when compared to their promised date of delivery. This delay causes them to be exposed to different pharmaceuticals inventory management problems. In addition to that, regarding budget medicines, because the date of delivery was unknown: these health facilities will not be able to conduct their planned procurement by their internal Health Care Finance (HCF)

budget as they fear being overstocked if the same pharmaceuticals are delivered by this supplier before consuming the earlier stock. In explaining this problem one of the key informants said:

"regarding the pharmaceuticals supplied by Biftu Adugna supplier, let alone receiving the exact amount and type of pharmaceuticals we have ordered we don't even know the time these pharmaceuticals will come: they may come at the second quarter or half of the fiscal year even there is a situation in which some pharmaceutical came at the end of the year." (Pharm.03)

Another one added that

"frequently pharmaceuticals supplied by PFSA under Program medicines especially ART medicines was delivered a long time after the promised day of delivery, this may cause our stock level to fall below emergency level even sometimes lead to stockout."(Mngr.04)

The key informant from PFSA admits the delay in delivery by saying that:

"*Even though our commitment was to deliver products 15 days after the RRF was submitted by the facilities, we are delivering the products after the promised date in most of the cases. This problem was mainly due to delay report from the facilities, inadequate number of vehicles, frequent vehicle breakdown due to poor road condition and our fleet management problem." (Pharm.10)*

Another challenge that most KI's agreed upon regarding pharmaceuticals that are procured from PFSA and/or private suppliers is the frequent unavailability of required pharmaceuticals from the market, reducing the quantity ordered and filling in the lesser amount by the PFSA and subsequent increase in medicine price through a period of time. These challenges cause the facilities to run out of stock for the missing items for a longer period of time and also expose them to budget insufficiency due to repeated inflation of pharmaceuticals costs. In explaining this one KI said:

"because of procuring from the private supplier was too costly and have a very lengthy procurement process compared to PFSA, there was a case when we have returned to PFSA two to three times in case those previously stocked out medicines were available." (Pharm.06)

Even if the key informant from the PFSA admits the complaint raised from the facilities but he responded that both of them have contributed to the occurrences of the problem by saying that:

"while erroneous consumption report of the facilities to PFSA, procuring too much quantity of products due to their longer review period and others are from the facilities side; inaccurate adjustment made at our level and problem with our storage and inventory management have contributed to these problems." (Pharm.10)

In addition, the key informant said that PFSA reduce the ordered quantity when products stock status was lower, and a challenge related to shortage of hard currency also contributed to the stockout.

When asked about the challenges associated with the program medicines almost all of the key informants said that PFSA omits some medicines from their order and also supplies them with medicines that have a shorter shelf life. Moreover, it also supplies them the quantity above they ordered, and even what they did not order in the form of a rationing system. One respondent mentioned that

"PFSA sometimes misses or brought very important pharmaceuticals in a smaller quantity which frequently leads us to stock out. Furthermore, they brought products that have shorter shelf life by merging their receipt with other very crucial pharmaceuticals that force us to receive all the pharmaceuticals." (Pharm.08)

The key informant from PFSA explained this by categorizing the products that was directly donated from the partners and products that was procured by the money donated from the partners. He said most of the problem happened in the case when the products are directly donated from the partner, as the they supply products that are closer to their expiry date. Regarding the oversupply and delivering without their request he said that this was happened in the situation where the facilities have reported their morbidity or service report to the Ministry of health but they have not placed formal request (for the products that are not integrated) and when the epidemic outbreak was suspected in that areas these medicines will be supplied.

4.1.2.2 Stock Management Related Challenges

Concerning the utilization of bin-cards in the dispensing units, most of the key informants said that majority of their dispensing units do not use bin cards, and also came to store at the irregular times to fill their pharmaceuticals. The problem affects the health facilities' attempt to determine their accurate consumption data. This problem happens mainly as a result of lack of focus, the wrong attitude that pushes doing this activity is the job of pharmacy and lack of commitment from the staff and the management of the facility. One of the key informants replied:

"To speak frankly the majority of our dispensing units do not use bin cards and almost all of our dispensing units do not update their bin cards regularly. When they want to refill their pharmaceuticals from the store, they just put simply certain numbers on IFRR and request the quantity they need. We inform the head of the facility most often in order to solve the problem. However, as we don't have the power to force them to keep such records accordingly; we just give them what they have asked." (Pharm.07)

As a result of the lack of adequate human resources, skilled staff turnover and lack of practical training in this area; most of the key informants said that the classification of medicines based on VEN analysis was done almost in all of the health facilities. However, they neither update it over a past successive period of time nor prioritize medicines based on ABC classification method. One of the respondents said that

"after taking the training in the 2006 EC we have prepared VEN list of the pharmaceuticals we are using in our facility since then we didn't update it."(Pharm.03)

Despite most of the key informants have the same opinion on the problem, some of them argue that they have classified the medicines based on ABC and VEN. In addition, they also claim that they are regularly updating.

With regard to other stock management problems, owing to the shortage of manpower the pharmacists/druggists/ work in other places besides the position they were assigned. For this reason, they have no adequate time to update bin cards regularly, monitor if the stock level is between min-max and trigger order accordingly. One key informant explained that:

"even though our health facility needs five pharmacy professionals, currently only two pharmacy professionals were working. For example, I am the store manager but I also work as OPD pharmacy dispensary and/or ART Pharmacy dispensary. Hence, I don't have adequate time to conduct real-time update of all stock on bin card as well as computer, monitor stock level regularly and other important store activities" (Pharm.07)

4.1.2.3 Storage Condition Related Challenges

The inadequacy of the storage space was the main challenge stated by almost all key informants. Due to lack of adequate storage space medicines were kept in inappropriate places and conditions like piling of a large number of medicines without leaving adequate space in between, keeping them on the floor especially during medicines were received until those on the shelves are consumed and the like. On top of that, some of the key informants said that because of inadequate storage area expired medicines were kept in unsuitable rooms and conditions. This problem may be because of a lack of adequate resources and also not giving due focus by the higher body that administers those health facilities. One of the respondents described as:

"due to inadequacy of storage space and lack of different storeroom equipments like pallets and shelves, medicines were stored inappropriately. Hence, it is very difficult to move easily in the store to perform different storeroom activities. In addition to that, we also store the expired medicines in the room that is not convenient and also near the toilet room." (Pharm.06)

Some of the KI's said that from the beginning the storeroom was built for another purpose, i.e. not intended for the store, it's through time that it was changed to the storeroom in search of a wider area. Therefore, they lack some features of the storeroom like the standard height of the roof, smooth and strong floor, adequate light, enough ventilation and the like.

The other said that because due attention was not given by the managers, the wall of the storeroom was cracked, and the medicines were exposed to insects and rodents. Because of budget constraints and lack of attention given to the store by the managers that administer those health facilities; the storeroom has no or inadequate shelves, pallets, refrigerators, wall thermometers and the other was another problem

identified by the key informants. These types of equipment are very important tools that enhance the quality of the storage condition of the pharmaceuticals. These problems were elaborated by one of the respondents who said:

"our storeroom has no refrigerator, so I put all heat sensitive products in dispensary pharmacy in bulk amount this exposes me to risk of medicine loss and also overstock the refrigerator." (Pharm.07)

Accumulation of expired medicines in the storeroom was the other commonly raised challenges by the respondents. Due to the Ethiopian Food and Drug Administration (EFDA) proclamation which prohibits the routine removal of expired pharmaceuticals through open field burning methods, very large quantities of pharmaceuticals are stored and occupied most of the storeroom space. The method prescribed by EFDA was very costly and beyond the capacity of the health facilities to implement. Some of the methods include: return of medicines waste to supplier, highly engineered sanitary landfill, medium-temperature incineration (850-1000^{0}C) and high-temperature incineration >1200^{0}C (FMHACA, 2011).

Almost all of the key informants complain that since there is no public service structure for the laborer there are no daily laborers that help in unloading, storing, picking and arranging the pharmaceuticals during receiving and issuing of the products.

Furthermore, the majority of the key informant's stated that in the facilities that use HCMIS software there is shortage of IT professionals that help in maintaining the PC as well as feeding data into the PC.

4.2 Discussions

The final aim of pharmaceuticals inventory management was maintaining high level of service and minimizing cost of ordering as well as maintaining inventory that enables us to meet the customer's need by efficient utilization of the limited resource we have. So as to achieve this, inventory management performance should be monitored and evaluated regularly so that factors that affect inventory management performance can be easily identified and solved.

The findings of this study focused on inventory management performance was also organized and discussed under the four types of indicators.

Regarding the average percentage shelf life of the selected medicines, there is no suggested remaining shelf life of pharmaceutical products at the time of delivery was set nationally. But according to the WHO recommendation, the finding of this study indicated that among the assessed medicines Zinc tablet (Dispersible), Albendazole tablets and Cloxacillin capsules have not had an acceptable remaining shelf life as per the WHO recommendation at the time of delivery in 16, 10 and 8 health facilities supplied respectively; whereas medicines like Amoxicillin capsule, Artemether + Lumefantrine, tablet and Indomethacin tablet were delivered at acceptable remaining shelf life as per the WHO in 16, 16 and 15 health facilities assessed respectively.
As it's revealed in a key informant interview there are many factors that contributed to this problem. Some of them include the absence of very important medicines that have got longer shelf life, some medicines that have shorter shelf life come by the push system and others.

Concerning medicines stocked according to the plan, from the assessed health facilities, none of those key essential medicines were stocked according to the plan in all of the health facilities studied.

A key informant interview identified that inability to accurately determine their consumption, interruption in the supply of medicines, oversupplying some medicines for fear of the outbreak, shortage of manpower that work full time in the store and also lack of commitment of the staff are some of the major contributors.

In addition, when it comes to non-program medicines, setting a minimum and maximum stock level for every product is not mainstreamed and is not being monitored along with program medicines for their implementation.

With respect to inventory accuracy, this indicator is taken the basis for inventory management. It enables supply chain managers to know how much they have in stock at any given point in time and lets them know when a new order must be placed to replenish stock. This inconsistency analysis can help managers know storage locations that are having problems with inventory management; the analysis can lead to opportunities for improvement.

The study revealed that an average inventory accuracy rate was 39.23% that is higher than a study performed in Ugandan public health facilities which was found to be 36% (Namaya, D., 2007) but it's lower than the study performed in South Wollo Zone that was 62% (Mohammed, T., 2018).

The difference may be due to difference in the number and type of facilities assessed, difference in the number of human resource and infrastructure that facilities may have.

Concerning stock wastage because of expiration or damage over a period of time, averagely 7.08% of the studied medicines were found to be expired in those health facilities from July 2017 to June 2018. This finding was close to the result found by the study performed by Tadesse (2017) where the average presence of expired medicines in health facilities was 7.5%.

In addition, the result was above a national target which is set to be below 2% as stated on HSDP IV (FMOH, 2010).

This difference may be due to difference in type and number of the facilities involved and type of medicines assessed.The key informant interview disclosed that delivery of medicines without their request/order, delivery of near expiry medicines by the push system, inappropriate quantification, shortage of manpower, inadequate storage space and equipment, inability to communicate and share near expiry medicines with other facilities where they are needed and others as factors that contribute to the expiry of medicines. In this study stock wastage rate of adrenaline and Artemether + Lumefantrine was higher when compared to others, and it's 42.7% and 39.16% respectively. This was due to slow comsuption rate of Adrenaline and overstocking of

Artemether + Lumefantrine by push system due to fear of malaria outbreak in that area as revealed by key informant interview.

This study revealed that an overall average order lead time in the past six months (from January 2018 to June 2018) in those health facilities was about 33.10 days. Though there is no maximum lead time set nationally, the result was good as the health facilities were supposed to maintain a minimum stock level of two months when placing the order. Moreover, this finding was shorter when compared with the study carried out in Uganda by the country's ministry of health where an average lead time of 41 days was discovered (Ugandan MoH, 2016). In this study order lead time for HF 06 and HF 11 was 49 and 50.33 days respectively, which is relatively higher than others. This was due to weak on time reporting system of those facilities and inadequate suppliers vehicle as well as frequent breakdown of those vehicles.

This study showed that the total money lost because of medicine expiry in all health facilities involved from July 2017 to June 2018 was calculated to be 321,546.11 Ethiopian Birr (ETB). Of this value TDF + 3TC + EFV contributes about 164,549.95 ETB which is 51.17% of the total money lost. The result obtained in this study was higher than the study performed by Tadesse (2017) in ten health facilities where he found 152,617.80 ETB (for the 2007 Ethiopian fiscal year i.e from July 2006 to June 2007). This disparity might occur because of the difference in the number of health facilities involved in the study. In this study, data were gathered from 17 health facilities while in the study carried-out by Tadesse only 10 health facilities were involved. The other possible reason could be the difference in the price of the medicines expired as the type of medicines expired vary.

With regard to inventory turnover rate, as it calculates number of inventory cycles in a given time period; the higher the inventory turnover rates, the lower the average inventory level/or insufficient stock levels/ and average holding cost. This insufficient stock levels could eventually lead to stock-outs. On the other hand, lower inventory turnover rates might indicate that the product has been overstocked and/or slow-moving. And this overstocking leads to unnecessary tied up of capital, higher inventory holding costs and medicine expiry and damage. The finding of this study showed that an average inventory turnover rate of the assessed health facilities (from July 2017 to June 2018) was about 8.21. This result was in line with a national acceptable range

stated on PFSA's Manual which specify the values calculated for this indicator should range anywhere from 6 to 12 (PFSA, 2017).

Storage conditions can affect the quality and safety of pharmaceutical products being stored. Rooms that are inadequately ventilated, allow direct sunlight, too hot, stack of cartons that are too high, and other poor storage conditions may reduce the safety and quality of the pharmaceutical. A well-organized storeroom will streamline its different activities; warehouse performance, as well as storage conditions will also be improved (PFSA, 2015).

With regard to storage conditions, this study specified that not a single health facility has fulfilled all the standard criteria used to measure storage conditions, and an overall average percentage fulfillment of the storage condition was 70.88%. About 58.8% of the facilities' storeroom does not get enough light and well ventilated. A key informant interview made it clear that even though some of the storerooms have windows, the store managers won't open small windows that are designed for inlet of air due to fear of security. In other health facilities storeroom, there are no windows designed for ventilation, hence the storeroom gets adequate ventilation only when the store manager was in the store.

In addition, 64.7% of the facilities did not have sufficient storage space for existing products that makes difficult to streamline different warehouse activities. This result slightly lower than a study performed in Tanzania by the country's Ministry of Health and Social Welfare (2008) in which about 67% of the health facilities have no adequate storage space, and study done in five woreda health office stores of West-Hararghe where about 80% facilities have inadequate storage space (Kassie et al., 2014). This variation could be because of the difference in the type and number of the health facilities involved in the study.

Only about 35.29% of the facilities meet acceptable storage conditions this result is somewhat lower than the study carried out by PFSA in collaboration with USAID | DELIVER Project in which the facilities that meet acceptable storage conditions was 55% (Shewarega et al., 2015). This difference could be due to the difference in the number and type of health facilities involved in the study.

CHAPTER V - CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

In the third world countries like Ethiopia where the resource allocated for health care delivery was very limited, it's very crucial to adhere to inventory management principles to efficiently use the inadequate resource we have without compromising the customer response/availability/ so that the saved resources from wastage can be used for other health care purposes.

Based on the results obtained it can be concluded that; the pharmaceutical inventory management performance of those health facilities was found to be poor. This can be exemplified by lower percentage of health facilities that were stocked according to the plan, poor inventory accuracy rate of the facilities, higher wastage rate of these facilities compared to the target set nationally and small percentage of the facilities that have fulfilled good pharmacy practice standards for the storage of pharmaceutical set by USAID /DELIVER /LIAT tool which is ≥ 80%.

With respect to identifying challenges related to managing inventory, some of them include: inability to dispose large quantities of expired pharmaceuticals that have occupied significant portion of storage space, inadequacy of storage space as well as equipment, inadequate manpower, lack of commitment of the staff, failing to give due attention to this area by the managers and lack of job satisfaction as identified by the key informants interview.

In general, although much is done to improve pharmaceutical supply chain management in the past, several challenges and poor results identified in this study need to be tackled in order to best utilize the scarce resource we have.

6.2 Recommendations

Based on the finding of this study the following recommendations have been made:

- It might be better if the DTC was re-strengthened and actively participated in all supply chain activities.
- Strengthening of the health facilities method of sharing information about their stock status and exchanging medicines that are excess (or slow moving) and are likely to be expired in one facility but stockout in another facility may reduce the medicines wastage.
- Reanalyzing the human resource required in the pharmacy unit and fulfill the pharmacy workforce accordingly by the regional health bureau could improve many inventory management activities that occurred due to lack of adequate man power dedicated to manage the facilities storeroom.
- Arranging the relevant capacity building training and regularly monitoring its outcome by the regional health bureau in cooperation with the partners.
- Improving the storeroom conditions by renovating and expanding the storeroom, and also fulfilling different types of equipment that are required in the store by the federal ministry of health and regional health bureau along with the partners.
- Modifying or changing the current medicine disposal method in effect by other feasible methods by discussing with the Ethiopian Food and Drug Authority (EFDA) so that most store room's space will be freed for use.
- Fulfilling the pharmaceuticals inventory management software in all health facilities by the regional health bureau in collaboration with the partners might ease the management of the pharmaceuticals in the storeroom.

CHAPTER VI - LIMITATIONS OF THE STUDY

- Missing of data of registered expired and damaged medicines in some facilities.
- Only data from the main store was included.
- Interruption in use of bin card in some facilities.
- Association between the independent variables and the inventory management performance outcome variables was not done.

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Annexes

Assessment Tools

Section I: Quantitative Data Collection Formats

Instruction: Being guided by the store manager, review and take data from the facility pharmaceutical records; such as bin cards, RRF, Model 19 documents and delivery notes.

A. Data collection sheet for Inventory Performance Indicators calculation of (2017/2018).

Annex I: Average Percentage Shelf Life of Key Essential Medicines

KPI	Procedure
Average percentage Shelve life of TDs = Sum of percentage shelf life of TDs/ Total number of TDs	Use the list of randomly selected TDs to check for their applicability in the warehouse Record the manufacturing, Expiry and product receive date from the package and from STVs (for date product was received) for TDs managed by the warehouse (applicable one) in months Subtract manufacturing date from the expiry date to determine the shelve life of TDs in months Subtract received date from the expiry date to determine the remaining shelve life of TDs in months on the date of receiving Divide number of months remained to get expired by the total shelve life in months for each TD to determine the percentage shelve life Add the percentage shelve life of each applicable TD and divide it by the total number of Applicable drugs to determine the average percentage shelve life of TDs

Data collection tool

S.No	List of TDs	Applic Mark "√"	Batch no.	If Applicable; Date (DDD/MMM/YYY)			Total Shelf life (D=B-A) (m)	Remaining shelve life on date of receive (E=B-C) (m)	% shelve life remaining on the date of receive (F=E/D*100)	Remark (Pro./RDF)
				Manuf. (A)	Expiry (B)	Received (C)				
1	Albendazole 400mg/200mg, tablets									
2	Amoxicillin 500mg /250mg, capsule.									
3	Ciprofloxacin 500mg, tablets									

4	Ceftriaxone 1g/0.5g injection, Vials									
5	Cloxacillin 500mg/250mg, capsules									
6	Adrenaline 1mg/ml, inj. ampoules									
7	Indomethacin 25mg, tablets									
8	Enalapril 5/10mg, tablets									
9	Omeprazole 20mg, capsule									
10	Oral Rehydration Salts (ORS), Sachet									
11	Oxytocin 10units/ml -Injection									
12	Paracetamol 500mg, tablet									
13	Pentavalent DPT-Hep-Hib Vaccine, inj.									
14	Tetanus anti-toxin (TAT), 1500IU inj.									
15	Trimethoprim+Sulphamethoxazole 960mg/480mg, tablet									
16	Zinc Acetate 20mg, tablet (Dispersible)									
17	TDF + 3TC + EFV, tablets									
18	Insulin Zinc/ (30/70), 100IU/ml, inj.									
19	RHZE/RH patient kit, tablets									
20	Artemether + Lumefantrine(20/120mg), tab									
Total		**___(G)**							**_____ (H)**	
Average percentage shelve life of TDs (I=H/G)			**_____%**							

Annex II: Stocked According to Plan

KPI	Procedure
Stocked according to plan =	- Use the list of TDs to check for their applicability in the warehouse
Number of TDs with stock levels between the established Max-Min levels/ Total number of TDs	- Ask the store manager whether or not they managed the product in their warehouse
	- Record the Min/Max level of each TD managed by the warehouse from stock record card (Bin card/HCMIS) or by asking the store manager
	- Conduct physical count and record the number of each TD available within the warehouse then reconcile it with the established min/max level for each
	- Divide the number of TDs with stock level between the established min/max by the total number of TDs managed by the warehouse

Data collection tool

S.No	List of TDs	Applicable for this warehouse	If they are applicable for the warehouse			TDs with stock level between established min/max	Remark
		Mark "√"	Established stock level		Physical count	Mark "√"	
			Minimum	Maximum			
1	Albendazole 400mg/200mg, tablets						
2	Amoxicillin 500mg /250mg, capsule.						
3	Ciprofloxacin 500mg, tablets						
4	Ceftriaxone 1g/0.5g injection						
5	Cloxacillin 500mg/250mg, capsules						

6	Adrenaline 1mg/ml, injection, ampoule						
7	Indomethacin 25mg, tablets						
8	Enalapril 5/10mg, tablets						
9	Omeprazole 20mg, capsule						
10	Oral Rehydration Salts (ORS)						
11	Oxytocin 10units/ml -Injection						
12	Paracetamol 500mg, tablet						
13	Pentavalent DPT-Hep-Hib Vaccine, injection						
14	Tetanus anti-toxin (TAT), 1500IU inj.						
15	Trimethoprim+Sulphamethoxazole 960mg/480mg, tablet						
16	Zinc Acetate 20mg, tablet (Dispersible)						
17	TDF + 3TC + EFV, tablets						
18	Insulin Zinc/ (30/70), 100IU/ml, inj.						
19	RHZE/RH patient kit, tablets						
20	Artemether + Lumefantrine(20/120mg), tablets						
	Total	**_____(A)**				**_____ (B)**	
	Stocked according to plan (C= B/A*100)	**_____%**					

Annex III: Inventory Accuracy Rate

Inventory accuracy rate = Number of TDs where stock record count equals physical stock count/ Total number of TDs		Use the list of TDs to check for their applicability in the warehouse							
		Ask the store manager whether or not they managed the product in their warehouse							
		Record the count of each TD managed by the warehouse from stock record card (Bin card/HCMIS)							
		Conduct physical count and record the number of each TD available and reconcile it with the record from the stock record card (bin card/HCMIS)							
		Divide the number of TDs where the stock record equals physical stock count by the total number of TD managed by the warehouse							
	List of TDs	**Applicability** **Mark "√"**	**Unit**	**Batch No.**	**If applicable;** **Stock record quantity**	**Physical count**	**TDs having an equal stock record and physical count** **Make a "√" Mark**	**Remark (Pro./RDF)**	**Reason for Discrepancy**
1	Albendazole 400mg/200mg, tablets								
2	Amoxicillin 500mg /250mg, capsule.								
3	Ciprofloxacin 500mg, tablets								
4	Ceftriaxone 1g/0.5mg injection								

5	Cloxacillin 500mg/250mg, capsules								
6	Adrenaline 1mg/ml, injection, ampoules								
7	Indomethacin 25mg, tablets								
8	Enalapril 5/10mg, tablets								
9	Omeprazole 20mg, capsule								
10	Oral Rehydration Salts (ORS)								
11	Oxytocin 10units/ml -Injection								
12	Paracetamol 500mg, tablet								
13	Pentavalent DPT-Hep-Hib Vaccine, inject.								
14	Tetanus anti-toxin (TAT), 1500IU inj.								
15	Trimethoprim+Sulphamethoxazole 960mg/480mg, tablet								
16	Zinc Acetate 20mg, tablet (Dispersible)								
17	TDF + 3TC + EFV, tablets								
18	Insulin Zinc/ (30/70), 100IU/ml, inj.								
19	RHZE/RH patient kit, tablets								
20	Artemether + Lumefantrine(20/120mg), tab								
Total		**____ (A)**					**_____ (B)**		
Inventory accuracy rate (C=B/A*100)		**_____%**							

Annex IV: Stock Wastage due to Expiration or Damage over a Period, Value of Unusable Stock as a % of Total Inventory Value and Inventory Turnover Rate

S.N	Product	unit	Last Year's Unusable Stock of an Item		Unusable Stock of an Item counted now		usable stock counted now		Last Year's Beginning Balance of an Item		Quantity Received Last Year		Total Value of item distributed L.Year	Last Year's Ending B		S.Wastage over a period	S.Wastage at point	value of unusable stock as a % TIV	Inventory turnover rate
			(A)	(B)	(C)		(D)		(E)	(F)	(G)	(H)		(J)	(K)				
			Qty	Price	Qty	Price	Qty	Price	Qty	Price	Qty	Price	(I)	Qty	Price	A /(E+G)	C /(C+D)	B/(F+H)	I/(F+K)/2
1	Albendazole 400mg/200mg, tablets																		
2	Amoxicillin 500mg /250mg, capsule.																		
3	Ciprofloxacin 500mg, tablets																		
4	Ceftriaxone 1g/0.5mg injection																		
5	Cloxacillin 500mg/250mg, capsules																		
6	Adrenaline 1mg/ml, inj., ampoule																		
7	Indomethacin 25mg, tablets																		
8	Enalapril 5/10mg, tablets																		
9	Omeprazole 20mg, capsule																		
10	Oral Rehydration Salts (ORS)																		

11	Oxytocin 10units/ml - Injection																		
12	Paracetamol 500mg, tablet																		
13	Pentavalent DPT-Hep-Hib Vaccine, inject.																		
14	Tetanus anti-toxin (TAT), 1500IU inj.																		
15	Trimethoprim+Sulphamethoxazole 960mg/480mg, tablet																		
16	Zinc Acetate 20mg, tablet (Dispersible)																		
17	TDF + 3TC + EFV, tablets																		
18	Insulin Zinc/ (30/70), 100IU/ml, inj.																		
19	RHZE/RH patient kit, tablets																		
20	Artemether + Lumefantrine(20/120mg), tablets																		

Annex V: Order Lead Time

KPI	Procedure
Average order lead time = Sum of the number of days between when orders were placed and when orders were received/ Total number of orders placed	- Ask the Pharmacy Head to provide you the last three RRF that the HF send to the PFSA hub.
	- Ask the respective STV (it can be one or more than one) that the PFSA send to the HF for each RRF
	- Record the date for each RRF and respective STV
	- Then calculate the difference between the date that RRF and STV produced
	- Sum up all the differences and divide it by total number of RRFs

Data collection tool

S.No	RRF	Date of RRF (A)	STV	Date of STVs (B)	Difference (C=B-A)	Remark (Pro./RDF)
	RRF-1		STV -1			
			STV -2			
			STV -3			
			STV -4			
			STV -5			
			STV -6			
			STV -7			
			STV -8			
			STV -9			
			STV -10			

	RRF-2		STV -1			
			STV -2			
			STV -3			
			STV -4			
			STV -5			
			STV -6			
			STV -7			
			STV -8			
			STV -9			
			STV -10			
	RRF-3		STV -1			
			STV -2			
			STV -3			
			STV -4			
			STV -5			
			STV -6			
			STV -7			
			STV -8			
			STV -9			
			STV -10			
Total	**_____(D)**		**_____ (E)**		**_____(F)**	
	Order lead time (G=F/D)					

Annex VI: Storage Condition

S. N	Description	Yes No. (%)	No No. (%)	Remark
1	Pharmaceuticals are arranged and organized according to a logical categorization.			
2	Products are arranged on shelves with arrows pointing up			
3	Products are arranged on shelves with identification labels, expiry dates, and manufacturing dates clearly visible.			
4	Products are stored and organized to FEFO procedures and are accessible for counting and general stock management.			
5	Outer cartons are in good condition (not crushed, perforated, stained, or otherwise visibly damaged).			
6	There is a separate store for expired and damaged products			
7	Damaged, expired products and non-pharmaceutical items are separated from usable products in the storeroom.			
8	Products are stored in a dry, well-lit, well-ventilated storeroom. (Visually inspect roof, walls, and floor of storeroom.)			
9	Cartons and products are protected from direct sunlight all times.			
10	There is no evidence of rodents in the storage area. (Visually inspect)			
11	There is no evidence of insects in the storage area. (Visually inspect)			
12	The storage area is secured with a lock and key but is accessible during normal working hours.			
13	Storage area access is limited to authorized personnel.			

14	The roof is maintained in good condition to avoid sunlight and water penetration.			
15	The floor is maintained in good condition so it is easy to move products from one place to another by trolley and it is easy to clean			
16	The storeroom is clean, with all trash removed.			
17	There is no evidence of food and drinks in the store			
18	Products are stored on sturdy shelves/bins, and boxes organized neatly.			
19	The current storage space is sufficient for existing products.			
20	Bin cards are used and updated regularly			
Average				

Annex VII: List of Key Essential Medicines

1. Albendazole 400mg/200mg
2. Amoxicillin 500mg /250mg capsule.
3. Ciprofloxacin 500mg,
4. Ceftriaxone 1g/0.5g injection
5. Cloxacillin 500mg/250mg
6. Adrenaline (Epinephrine) 1mg/ml, injection, ampoules
7. Indomethacin 25mg
8. Norfloxacin 400mg
9. Omeprazole 20mg capsule
10. Oral Rehydration Salts (ORS)
11. Oxytocin 10units/ml -Injection
12. Paracetamol 500mg tablet
13. Pentavalent DPT-Hep-Hib Vaccine
14. Tetanus anti-toxin (TAT), 1500IU inj.
15. Trimethoprim+Sulphamethoxazole 960mg/480mg tablet
16. Zinc Acetate 20mg, tablet (Dispersible)
17. TDF + 3TC + EFV
18. Insulin Zinc/ (30/70), 100IU/ml, inj.
19. RHZE/RH patient kit
20. Artemether + Lumefantrine(20/120mg), tablets

Source: (based on top ten morbidities of West Shewa Zone and tracer drug list of FMOH DHIS 2 2017/18)

Section II: Qualitative Data Collection Format

Annex VIII: Semi-Structured Guide for the Key Informant Interview English Version.

Addis Ababa University

School of Pharmacy

Department of Pharmaceutics and Social Pharmacy

Introduction

I want to thank you for taking the time to meet with me today. My name is Juhar Bekele. I came from Addis Ababa University School of Pharmacy attending a post-graduate study in Health Supply Chain Management. I am the principal investigator for the study entitled "Assessment on the Performance and Challenges of Pharmaceuticals Inventory Management in the case of Public Health Facilities in West Shewa Zone, Oromia Region, Ethiopia..". And I would like to talk with you about pharmaceutical inventory management which is very important for optimal utilization of resources and saving costs. The aim of this study is to assess the performance and challenges of the pharmaceutical inventory management of this health facility. Considering that the findings and recommendations emanated from this study will help the facility, suppliers, policymakers and other organizations to design intervention activities, you are kindly requested to participate in this study. The interview will take less than an hour. Although I will be taking some notes during the session, I can't possibly write fast enough to get it all down. Therefore, I will be taping the session because I don't want to miss any of your comments. Because we're on tape, please be sure to speak up so that I don't miss your comments. All responses will be kept confidential. This means that your interview responses will only be shared with research team members and we will ensure that any information we include in our report does not identify you as the respondent. Remember, you don't have to talk about anything you don't want to and you can stop the interview at any time.

Are you willing to participate in this interview? Yes _____ No _____

If yes, the interview will be continued

Date of interview: _____/_____/_____

Venue: _____

1. **Back ground information of the key informant**
    1. Gender: _____
    2. Age: _____
    3. Profession: _____
    4. Educational level: _____
    5. Job title: _____
    6. Work experience: _____

2. **Information about the health facility**

Study area, District Name: …… Name of Facility……,

Facility phone no…… Facility distance from Ambo……Km

3. **Guiding questions for a key informant interview**

1. What does your facility's quantification and procurement look-like?
    a. What type of quantification method do you use? Do you use data generated at the warehouse during quantification?
    b. What ORDERING method does this facility apply for the periodic replenishment of RDF Pharmaceuticals?
    c. Who is responsible for procurement & is that proper person? Why?
    d. How do you see your order lead time?
2. What does your stock management look-like?
    a. Do you encounter stock-out, over-stocking or stock wastage problems at this HF? If yes what are the main possible reasons & which type of products are prone to these problems?
    b. How often did you conduct a physical stock count? If no why? If yes how often and do you reconcile the data with stock record? If there are discrepancies, what are the possible reasons?
    c. What does the average shelf life of your products look like?
    d. Have you classified your pharmaceuticals in your warehouse in ABC or VEN or ABC-VEN Matrix analysis method? If no why?
3. What does your Storage Condition look like?
    a. How adequate is your storage space?
    b. Does the equipments required in the store-room fulfilled?

Thank you for your time!!

Annex IX: Semi-Structured Guide for Key Informant Interview Afan Oromo Version

Yunivarsiitii Addis Ababaa

Mana Barnootaa Faarmaasii

Muummee Faarmaasiiwtiksii fi Sooshaal Faarmaasii

Seensa

Yeroo keessan fudhattanii na waliin haasa'uuf hayyamamaa ta'uu keessaniif duraan dursee isin galatteeffachuun barbaada. Maqaan koo Juhaar Baqqalaan jedhama kanan dhufe Yunivarsiitii Addis Ababaa yoo ta'u, yunivarsiitii kanatti Mana Barnootaa Faarmaasii, Muummee Faarmaasiiwtiksii fi Sooshaal Faarmaasiitti sagantaa digrii lammaffaa Sirna Bulchiinsa Dhiyeessii Qorichootaa fi Meeshaalee Yaalaa hordofaan jira. Ani qorataa ol-aanaa qorannoo mata-dureen isaa "Qorannoo Raawwii fi Hudhaalee Sirna Bulchiinsa Qorichootaa fi Meeshaalee Yaalaa Dhaabbilee Fayyaa Uummataa kan Godina Shawaa Lixaa, Naannoo Oromiyaa, Itiyoophiyaa keessatti argamanii." jedhuuti. Waa'ee bulchiinsa qorichootaa fi meeshaalee yaalaa dhaabbata fayyaa keessanii irratti si waliin haasa'uun barbaadaa. Dhimmi kun qabeenya jiru qusannoon fayyadamuu fi baasii xiqqeessuuf gahee ol aanaa qaba. Kaayyoon qorannoo kanaa bulchiinsi qorichootaa fi meeshaalee yaalaa dhaabbata fayyaa keessanii qabatamaan maal akka fakkaatu gamaggamuudha. Bu'aa fi yaadni furmaataa qorannoo kanarraa argamu dhaabbata fayyaa keessan, dhiyeessitoota, seera baaftota akkasumas dhaabbilee biroo dhimma kanarratti hojjetan tarkaanfiilee barbaachisoo dhimmoota bulchiinsa qorichootaa fi meeshaalee yaalaa fooyyessan akka tolfatan akka gargaaru yaada keessa galchuudhaan qorannoo kana keessatti akka nuuf hirmaattan kabajaanan isin gaafadha. Gaaffiif deebiin kun yeroo sa'a tokkoo gadii fudhata. Sagantaa kana keessatti yaadannoo qabadhus, daddaffiin barreessee yaada hunda qabachuu hin danda'u. Dabalataan yaada keessan kamiyyu dhabuu waanan hin barbaanneef sagantaa kana sagaleen nan waraaba. Sagantaan kun waraabbii irra yeroo jiruttii yaada keessan hunda qabachuu waanan barbaaduuf sagalee keessan ol kaaftanii akka duubattan isin gaafadha. Deebiin keessan hundi iccitiin kan qabamu ta'a. Kana jechuun deebiin keessan garee qorannoo kanaa qofaaf kan qoodamu ta'ee, odeeffaannoon gabaasa keenya keessatti dabalamu kaamiyyuu eenyummaa keessan kan hin ibsine ta'uu isiniif mirkaneessuun barbaada. Hubadhaa, gaaffii deebisuu hin barbaannee kamiyyuu irra darbuu ni dandeessu dabalatan gaaffiif deebii kana sa'atii barbaaddanitti dhaabuu ni dandeessu.

Qorannoo kanarratti hirmaachuuf fedhii qabduu? Eeyyee: _____ Lakki: _____

Guyyaa geggeeffame: _____/_____/_____ Bakka: _____

1. Odeeffannoo waa'ee hirmaataa qorannichaa ragaa nuuf keennuu

a. Saala: _____
b. Umrii: _____
c. Ogummaa: _____
d. Sadarkaa barnootaa: _____
e. Gahee hojii: _____
f. Muuxannoo hojii: _____

2. Odeeffannoo dhaabbata fayyichaa

Bakka Qorannoo Maqaa Aanaa: _____

Maqaa dhaabbata fayyaa: _____ Lakkoofsa bilbilaa: _____

Fageenya Amboo irraa: _____km

3. Gaaffilee Gaaffiif Deebicha qajeelchan

1. Haalli tilmaammii fi bittaa dhiyeessii dhaabbata fayyaa kessanii maal fakkata?
   a. Mala/Malootni isin baay'ina dhiyeessii barbaachisuu shallaguuf fayyadamtan maalidha? Yeroo baay'ina dhiyeessii barbaachisuu shallagdan raga/odeeffanno kutaa kuusaa qorichaatii argamutti ni fayyadamtuu?
   b. Qorichootaa fi meeshaalee yaalaa bajataan bitaman bakka buusuu ilaalchisee tooftaan ajajuu dhaabbatni fayyaa keessan hordofu maalidha?
   c. Namni bittaa kana geggeessu eenyudha, akkasumas namni kun nama bittaa kana geggeessuf maludhaa? Maaliif?
   d. Yeroo turmaataa ajajjii keessaan irraa hanga dhiyeessin dhufutti jiru akkamitti ilaaltu?

2. Haalli bulchiinsa dhiyeessii keessanii maal fakkaataa?

   a. Rakkoon dhabamuu/dhumuu/ dhiyeessii, humnaa ol qabachuu yookaan rakkoon qisaasama dhiyeessii (Yeroon tajaajilaa irra darbuu, baduu yookaan miidhamuun tajaajilaa ala ta'uu) dhabbata fayyaa keessan ni quunnamaa? Eyyee yoo ta'e sababni rakkoo kanaa maal isinitti fakkaata, akkasumas dhiyeessii kam kam faatu yeroo hedduu rakkoo kanaaf isin saaxila?
   b. Lakkoofsa /Inventory/ dhiyeessiiwwan kunneenii yeroo meeqa geggeessitu? Lakki yoo ta'e maaliif? Eyyee yoo ta'e garagarummaa yeroo

hammamiitiin geggeeffama akkasumas ragaa lakkoofsaan argamee fi kan biin kaardii irra jiru wal simsiistuu? Garaagarummaa yoo qabaate sababni isaa maali?

c. Gidduu-galeessaan umuriin dhiyeessiiwwan / “Expiry date”n wal qabatee/ dhabbata fayyaa keessanii maal fakkaata?
d. Dhiyeessiiwwan keessan maloota ABC ykn VEN ykn ABC-VEN Matrix jedhamaniin gurmeessitanii qabduu? Lakkii yoo ta’e maaliif?

3. Haalli qabiinsa kutaa kuusaa qorichaa keessanii maal fakkaata?

a. Baldhinni kutaa kuusaa qorichaa keessanii gahaadhaa?
b. Meeshaaleen kutaa kuusaa qorichaa keessatti barbaachisan isiniif guutamaniiruu?

Yeroo nuu laattaniif baay’ee galatoomaa!!

Annex X: Ethical Clearance from SoP, AAU

በ ፋርማሲ ት/ቤት

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አዲስ አበባ ዩኒቨርሲቲ
Addis Ababa University

School of Pharmacy

Ethical Review Board

ቀን Date: April 08, 2019

ቁጥር Ref. No.: ERB/SOP/62/04/2019

To: **Juhar Bekele**
School of Pharmacy

Re: **Ethical Clearance**

It is to be recalled that you submitted a study proposal entitled ***"Assessment of inventory management practice and associated factors among public health facilities of West Shoa Zone, Oromia Region, Ethiopia"*** for ethical approval by the School's Ethical Review Board (ERB). The Board thoroughly reviewed the proposal based on its operational guidelines and found it to fulfill all ethical requirements stipulated in the guidelines. This is, therefore, to inform you that the proposal is ethically approved for implementation.

With best regards,

Arebu Issa
Chairperson, ERB

☎ 00251156 02 12 ✉ 1176 ቴሌክስ Telex: 21205 ፋክስ Fax: 00251(11)1558566 ቴሌግራም Cable: AAUNIV

Annex XI: Ethical Clearance from Oromia Health Bureau.

Biiroo Eegumsa Fayyaa Oromiyaa
Oromia Health Bureau
Saarbet (Calcalii) - Finfinnee

የኦሮሚያ ጤና ጥበቃ ቢሮ
ሳርቤት(ጨልጨሲ) - ፊንፊኔ

Lakk/Ref.NO BEFO/HRTFH/105
Guyyaa/Date 1/8/2021

Waaj/Eeg/Fay /G/Sh/Lixaa

Hospitalaa Waliigala Amboo

Hospitalaa Riferalaa "University" Amboo

Ambo

Dhimmi: **Xalayaa deeggarsaa ilaala**

Akkuma beekamu Biiroon keenya ogeeyyii, dhaabbilee akkasumas namoota qorannoo gaggeessuuf piroppoozaala dhiyeeffatan piroppoozaala isaanii madaaluun akkanumas iddoo biraatti ilaalchisanii fudhatama argatee (approved) ilaaluun "Ethical approval" ni kenna. Haaluma kanaan yeroo ammaa kana barataan digirii lammaffaa Univarsiitii "Addis Ababa" qorannoo mata duree **"ASSESSMENT OF INVENTORY MANAGEMENT PRACTICE AND ASSOCIATED FACTORS AMONG PUBLIC HEALTH FACILITIES OF WEST SHOWA ZONE, OROMIA REGION, ETHIOPIA"** jedhu irratti dursaa qoranicha kan ta'aan"**Obbo Juhaar Baqqalaa Qana'aa**" qorannoo buufataalee fayyaa fi hospitaalota godinakeessan keessa jiran irratti gaggeessuuf piroppoozaalii isaanii koree "Health Research Ethics" Biiroo keenyaatti dhiyeeffataniiru.

Haaluma kanaan koreen "Health Research Ethics" Biiroon keenyaas piroppoozaala kana ilaaluun mirkaneessee, qorannoon kun akka hojiirra oolu murteessee jira. Waan kana ta'eef hojii qorannoo kanarratti deeggarsa barbaachisaa ta'e akka gootanii fi adeemsa isaa duuka akka buutan jechaa, **"Obbo Juhaar Baqqalaa Qana'aa"** wayitii qorannoon kun qaacceffamee xumurame fiiriisaa kooppii tokko Biiroo Eegumsa Fayyaa Oromiyaatiif akka galii godhan garagalchaa xalayaa kanaatiin isaan beeksifna.

Anis,Obbo Juhaar Baqqalaa Qana'aa wayitii qorannoon kun qaacceffamee xumurame fiiriisaa kooppii tokko Biiroo Eegumsa Fayyaa Oromiyaatiif akka galii godhu mallattoo kiyyaan mirkaneessa

Nagaa wajjin

Mallattoo_____

Maqaa:Obbo Juhaar Baqqalaa Qana'aa''

Lakk. Bilbilaa:091065684

G/G

Obbo* "Obbo Juhaar Baqqalaa Qana'aa" *tiif
Bakka jiranitti

Gammachuu Guddaa
Experti Qorannoo
Qo'annoo fayyaa
Hawaasaa

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