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ASSESSMENT OF PHARMACEUTICAL INVENTORY MANAGEMENT PERFORMANCE AT HEALTH FACILITIES:

THE CASE OF PUBLIC HEALTH FACILITIES FOUND IN SOUTH WOLLO ZONE, AMHARA REGION

By

Tariku Mahammed

Advisor: Dr. Berhanu Denu

Date: May 2018

Addis Ababa, Ethiopia

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A thesis summited to the department of logistics & supply chain management in Addis Ababa University, School of Commerce as Partial fulfillment for the requirements of Master of Arts in Logistics and supply Chain Management (MA)

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DECLARATION

I, Tariku Mahammed, hereby declare that this dissertation is my own work towards the Execution of Masters of Art in Logistics and supply chain management and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgment has been made in the text.

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List of Acronyms and Abbreviations

ART	Antiretro Viral Therapy
FEFO	First Expiry First Out
GHSC-PSM	Global Health Supply Chain-Procurement and Supply Management
GPP	Good Pharmacy Practice
HSDP	Health Sector Development Program
ICS	Inventory Control System
IMAT	Inventory Management Assessment Tool
IPLS	Integrated Pharmaceuticals Logistics System
LMIS	Logistics Management Information System
MSH	Management Science for Health
PFSA	Pharmaceutical Fund and Supply Agency
RDF	Revolving Drug Fund
SDP	Service Delivery Point

ABSTRACT

The purpose of this study was to assess the pharmaceutical inventory management performance at health facilities found in South Wollo zone, Amhara region. The specific objective of the study are to measure how accurate is the stock-keeping records, to determine the significance of the record-keeping errors, to find out how much of the pharmaceutical stock is maintained, to determine the average stock out duration of pharmaceuticals, to identify the pharmaceutical storage conditions in health facilities of South Wollo zone. The study was a cross-sectional survey that involved nine health facilities of south Wollo zone, Amhara region. The research adopted descriptive study design. A stratified random sampling technique was applied to the study. The researcher used a sample size of 30% of the target population to act as the sample size. The researcher used inventory management assessment tool and storage condition observation checklist to collect data for the research. The collected data were quantitatively analyzed using statistical methods to produce frequency tables and graphs for effective interpretation. The key findings from the study revealed that all health facilities visited had stock out of a number of tracer products in the past 100 days. The study found that the average percent of time out of stock was 14%, the average percent of products available on the day of assessment was 76% in the surveyed public health facilities found in South Wollo Zone, The study has found that the average percentage of stock keeping records that were accurate is 62%, health facilities had on average 27% of records greater than physical counts, health facilities had on average 12% of records were lesser than physical counts and the average ratio of inventory variation to total stock is 11%. The study also revealed that majority of the public health facilities (55.6%) practiced unacceptable storage condition. This study demonstrated poor inventory management with respect to the general quality of record keeping, space allocation and general organization of the pharmaceutical storeroom. The researcher recommended that health facilities should design a mechanism for making timely entries and recording issues on logistics tools to keep up to date inventory records and management information system. Frequent monitoring of stock status is suggested, to avoid discrepancies and to keep it to adequate levels. Regular supervision by the district pharmacist is needed to monitor this. Government should strive to introduce use of computer in inventory control in all health facilities and South Wollo zone should take efforts and work with stakeholders to ensure that health facilities have "standard" store for pharmaceutical.

Key words: Inventory management systems, stock out, tracer products, pharmaceutical, stock status.

CHAPTER ONE - INTRODUCTION

1.1 Background of the study

The availability of drugs and medical supplies is critical to the success of any healthcare program. Drugs and medical supplies are part of the final link between patients and health services. They play a key role in prevention, treatment and care programs, and in order to sustain these services, availability of medical commodities is required. A reliable and consistent supply of drugs and medical supplies to health facilities at all levels of the health system determines the success of nationwide health programs (Raja & Mohammad, 2005)

Health commodities are expensive and valuable resources in any healthcare program. They must be managed effectively and efficiently in all levels of the supply chain to ensure availability of quality health commodities at all times. Effective and efficient drug supply management is critical to ensure the cost-effective distribution of health commodities given that the cost of medicines is often high and mismanagement results in wastage, stock out and pilferage. Therefore, there is a need for efficient management of the drug supply cycle to prevent stock out and all types of wastage, including shrinkage and expiries (Nakyanzi, et al., 2010).

A health facilities supply system should ensure adequate stock of all the required items to maintain uninterrupted supply. This necessitates the effective and efficient inventory management of pharmacy store by keeping a close supervision on important drugs, prevention of pilferage, and priority setting in purchase and distribution of drugs. Poor inventory management in health institutions, especially the public health facilities, results in wastage of financial resources, poor availability of some essential medicines, stock outs, and stock losses. This has been experienced in many countries and has contributed to failure to attain better health outcomes (MSH., 2012).

Pharmaceutical are important integral part of a quality health care service delivery. The provision of complete health care necessitates the availability of safe, effective and affordable drugs and related supplies of the required quality. Cognizant of the pivotal role of pharmaceutical in achieving the goal and objectives of the health program and policy of the country, the Government of Ethiopia outlines its commitment to ensuring availability and accessibility of medicines which are effective, affordable, safe and of good quality in all sectors of the health care system and hence,

established an agency called Pharmaceutical Fund and Supply Agency (PFSA) that is responsible for the supply of pharmaceutical in the country (PFSA, 2015).

Since its establishment in 2007, Pharmaceutical Fund and Supply Agency (PFSA), the lead organization managing the health care supply chain of the country, has been working to ensure the availability, accessibility, and affordability of essential medicines with appropriate quality, safety, and efficacy. To achieve these goals, PFSA developed and began implementing the Integrated Pharmaceuticals Logistics System (IPLS) (PFSA, 2015).

Poor inventory management can be inferred from inaccurate stock records, inadequate and unsystematic monitoring of medical stock, stock out, inadequate storage space and storage condition, and indefinite procedures in terms of frequency and quantity. These incidences can be traced to inadequate know-how of inventory management and its actual management (MSH., 2012). (Lloyd, et al., 2008)revealed that despite initiatives to increase the availability and access to ARV's in East African countries through the Global Fund to Fight AIDS, the medical supply management in the region's countries was found to be deficient. This was attributed to inadequate capacity to quantify needs, place orders and adequately keep records.

The national survey conducted in January 2014 on IPLS to measure system performance at public health facilities (hospitals, health centers, and health posts) indicated that the system has enabled to significantly improve the availability of essential pharmaceuticals at health facilities. Routine monitoring reports show that IPLS is improving information recording and reporting, storage and distribution systems, as well as the availability of essential commodities at service delivery points. The average availability of essential tracer medicines at health facilities on the day of visit was 89%. The Agency's target was to increase the availability of essential pharmaceuticals from 65% to 100%. Average availability of the tracer pharmaceuticals during six months prior to the study was 78.1%. This is an indication of the improvement in the availability of essential pharmaceuticals at public health facilities providing primary and secondary level of care. (PFSA, 2015)

On the other hand, assessment made in 17 Federal and Addis Ababa City Government hospitals, which are supposed to give tertiary level of care, revealed that the availability of key medicines varies significantly among hospitals. The availability of key medicines at the dispensaries of these

hospitals at the time of visit ranged from 33.3% to 100%. This shows the need to work hard to ensure the continuous availability of pharmaceuticals at health facilities.

With the aim of improving the continuous availability of health commodities at an affordable price in a sustainable manner, the sector's capacity in procuring and distributing pharmaceuticals, medical supplies, laboratory reagents, and equipment through various programs has increased significantly. Various capacity building activities have been undertaken to enable health facilities to forecast their pharmaceuticals demand. Though this is enabling the Agency to base its procurement on health facilities demand, there are still problems in record-keeping, forecasted data quality, timely requisition and consumption reporting (Federal Democratic Republic of Ethiopia, Ministry of Health, August 2015).

Even though unreserved support and reasonable budget allocation have been provided by the government to improve the pharmaceuticals supply chain management, there is complaints on pharmaceuticals shortage and wastage in the country, which might probably be due to poor implementation of the inventory control system. (PFSA., 2007)

The principal goal of inventory management involves having to balance the conflicting economics of not wanting to hold too much stock. In fact, inventory management can bring out significant improvement not only on patient care but also in the optimal use of resources (Kagashe & Massawe, 2012).

Therefore, inventory management is a key measure in ensuring a continuous and consistent supply of drugs in a health facility set-up. It is crucial to know the levels of medicines in a pharmaceutical set-up in order to maintain the availability of essential drugs, to avoid stock outs, overstocking and expiries. Hence, health care organizations need to assess and improve inventory management to attain optimization of the pharmaceutical supply system in terms of its efficiency. This can be supported through linking product selection decisions to patient need; basing financing and procurement decisions on established quantification methodology; and improving information system that provides feedback for tracking stock movements (Kagashe & Massawe, 2012).

1.2 Statement of the Problem

Pharmaceuticals represent a large portion of the costs in the healthcare system. They account for 20–60% of health spending in developing and transitional countries (Cameron A, et al., 2009). As pharmaceuticals are an essential and indispensable resource element in health facilities, they need to be managed efficiently in order to prevent shortage, stock out and all types of wastage including pilferage and expiry. Inventory management is a key step in ensuring a continuous supply of pharmaceutical. It is crucial to know the levels of medicines in the store in order to maintain availability, to avoid stock outs, overstocking and expiries (Coyle, et al., 2003).

In many countries, poor inventory management in public health institutions results in wastage of financial resources, poor availability of some essential medicines, stock outs, and consequently, failure to ameliorate patients' health outcomes. Stock shortages and stock outs of pharmaceuticals are among salient features of a poorly performing pharmaceutical inventory management system. These problems significantly compromise the quality of healthcare service delivery to patients (MSH., 2012).

Poor availability of Essential Drugs is the key barrier to access to medicine especially in public sector where generic medicines availability is less than 60% across WHO regions, ranging from 32% in the Eastern Mediterranean Region to 58% in the European Region. In the poorest countries of Africa and Asia, as much as 50% of the population lacks such access. While some 10 million lives a year could be saved by improving access to essential medicines and vaccines – 4 million in Africa and South-East Asia alone (WHO, 2011).

In Ethiopia, there are frequent drug shortages in public health facilities. A national survey estimated that only 70% of essential medicines were available in the public sector (FMOH, 2003). Majority of the common leading causes of morbidity and mortality can be substantially reduced if pharmaceuticals are available and appropriately used (FMHACA, 2013). In this regard, efforts have been made to increase the accessibility of Essential Drugs such as increasing budget allocation by government and adoption of the pull system. due to the immense effort provided in the infancy implementation age of the new pharmaceutical supply chain management system, availability of drugs in government health facilities were reached 77% from below 50%, even though the target is to reach 100% (Deesie PFSA branch., 2014,) but researches showed that

availability Essential Drugs in public health facilities in various part of the country is still a challenge (Abiye. Z, et al., 2013).

Lack of effective pharmaceutical inventory management system not only affects the availability of EDs, but also significantly affects efficiency. Deficiencies in selection, quantification, storage, as well as high prices, poor quality, theft, expiration of drugs, irrational prescribing, and incorrect use of medicines by patients cause losses totaling 70% of the original expenditure (MSH, 2011).

In Ethiopia, studies on pharmaceutical inventory management is very limited (Daniel G, et al., 2012). One research assessed the management of pharmaceuticals in Addis Ababa government hospitals as part of the whole quality of pharmaceutical care. The only research that can be mentioned for involving the pharmaceutical logistics assessment in HCs is the nationwide survey made to assess the pharmaceutical sector 12 years ago (FMOH, 2003). Overall, studies dedicated to assess pharmaceutical inventory management performance in health facilities found in South Wollo zone are limited.

Bearing the aforementioned facts in mind, this study, therefore, aimed to assess the performance of pharmaceutical inventory management at health facilities found in south Wollo zone, Amhara region. This study envisages to provide an empirical snapshot of the current pharmaceutical inventory management performance at health facilities found in south Wollo zone, and to provide baseline information to track changes and improvements in pharmaceutical inventory management performance over time.

1.3 Research Question

The following research questions triggered the idea to conduct the study.

1. what percentage of products are available in stock at the time of the assessment in the public health facilities found in south Wollo zone?
2. What is the average stock out duration of pharmaceuticals in public health facilities of south Wollo zone?
3. How accurate are the stock keeping records at public health facilities found in south Wollo zone?
4. How much is the ratio of inventory variation to total stock at public health facilities found in south Wollo zone?

5. How acceptable is the pharmaceutical storage conditions in the public health facilities with respect to good storage practice?

1.4 Research Objectives

1.4.1 Overall Objective

The general objective of this study is to assess and examine the pharmaceutical inventory management performance at public health facilities found in south wollo zone.

1.4.2 Specific Objectives

1. To assess availability of pharmaceutical in south Wollo zone public health facilities.
2. To identify the pharmaceutical stock out duration at the public health facilities of South Wollo zone.
3. To measure the stock-keeping records accuracy in the health facilities.
4. To determine ratio of inventory variation to total stock to find out the severity of record-keeping errors at the public health facilities.
5. To find out the pharmaceutical storage conditions at the public health facilities found in south Wollo zone.

1.5 Significance of the Study

Proper pharmaceuticals inventory management helps to prevent overstock, understock and expiry of products. Thus, an effective inventory management is paramount important to ensure efficient utilization of the limited resource.

This study will fill the paucity of data on the status of the performance of pharmaceutical inventory management particularly that of program drugs in health facilities of South Wollo zone.

The research findings would add insight to the body of knowledge in the area of inventory management for pharmaceutical which would help researchers & scholars and be a basis for reference.

The research provide insight for decision makers to make possible decisions and also to chalk out programs for dealing with all facets of the country's current pharmaceutical inventory management performance. Thus, the research would become valuable with regard to providing information on the pharmaceutical inventory management performance of the public health facilities that indicates

what is happening in the pharmaceutical inventory management and what actions are needed to take. It assists the management in ensuring effective inventory management at all times as it aid with decision making to formulate strategies of combating the persistent problem of inventory management in the healthcare organizations.

The study gives insight of the situation taking place on the issues associated with pharmaceutical inventory management in public health facilities and it also assists the management in making possible intervention in ensuring proper pharmaceutical inventory management, which results in uninterrupted supply of pharmaceutical and avoid wastage which leads to prudent utilization of resources and improved health services to the citizens.

Lastly for the Researcher, the study does not only fulfill the partial requirement for the award of the Degree of Masters of Art in Logistics and Supply chain but also serve as a basis for further research in the field of pharmaceutical inventory management.

1.6 Scope of the Study/delimitations

The followings are delimitations of the study:

The study is limited to the pharmaceutical inventory management performance of public health facilities in South wollo zone, with a focus on program drugs only. It does not include revolving drug fund (RDF) pharmaceutical.

The target population of the study comprised public health facilities such as hospitals and health centers that provide ART service to the community.

Due to the large number of potential participants in the study population, the population involved in the current study does focuses only on health facilities that provide ART service within South Wollo Zone.

1.7 Limitation of the Study

Time constraints and inadequate financial and material resources were challenges that limited the depth of coverage of the research work. A longer time and enough resources would have helped to unearth more findings especially with other healthcare institutions in other regions of the country to determine how inventory management affect their service delivery level.

Due to the small/unique sample available for the study, as the study was conducted only on one geographical area (South wollo zone), results might not be generalizable beyond the specific population from which the sample is drawn. However, the researcher tried to maintain the scope and objectivity of the study.

The limitations of the study include lack of similar studies with similar setting and concentration. Unavailability and incompleteness of data, and the assumptions made might affect the finding of this study. This study did not address all components of the inventory management system performance. The findings of this study were from only health facilities perspective and did not include other stakeholders.

1.8 Organization of the Study

This study is assessing pharmaceutical inventory management performance at public health facilities of south wollo zone. The study covers the following chapters.

Chapter 1: This chapter has presented the general overview of the study including the background of the study, statement of the problem, research questions, objectives of the study, significance of the study, scope of the study, limitation of the study along with definition of the terms. The chapter ends with providing the organization of the study.

Chapter 2: This chapter contains the review of related literature and research related to the performance of pharmaceutical inventory management. It provides an extensive review of the theoretical literature review related to inventory management and the empirical review of the performance of inventory management at public Health care organizations.

Chapter 3: In this chapter, the researcher presents the description of the study area, the research design and the research approach that is applied in this study. The chapter also states the population and sampling techniques, data sources and types, the data collection procedures, data processing and analysis. The chapter ended with mentioning the ethical considerations of the study.

The analysis and discussion of the findings of the study is presented in Chapter 4. Chapter 5 discuss the summary of the study, conclusions drawn from the findings and recommendations.

1.9 Definition of Terms

The following definitions are provided to ensure uniformity and understanding of these terms throughout the study.

Stock out: Depicts a situation in which the demand or requirement for an item cannot be fulfilled from the current inventory. It is unavailability of usable stocks in the store or a balance of zero on the bin cards at store.

Essential drugs: Those drugs which the nation must have in sufficient quantities at all times for the management of the most common health problems that affects the greater number of its population.

Tracer drugs: These are drugs selected by the federal ministry health of Ethiopia to be available in all government health institutions in all the time, 24 hours a day and 365 days in a year.

Pharmaceuticals: This term is used in this document to mean medicines and other medical supplies.

Physical inventory: It is a process of counting by hand the total number of units of each item in store/warehouse at any given time.

Program drugs: those drugs that are necessary for the treatment of program specific disease such as anti-malarial drugs, antiretroviral drugs, family planning drugs, and TB-drugs, etc. those drugs are not for sell.

Service Delivery Point: It is all facilities, hospitals and health centers, that provide health care service to the community.

CHAPTER TWO – RELATED LITERATURE REVIEW

This chapter provides an extensive review of the related literature and research related to inventory management and pharmaceutical inventory management in Health care organizations. The chapter have two sections. The first section deals with the theoretical review of related literatures which discuss definition of inventory, purposes of inventory, types of inventory, inventory costs, importance of inventory, inventory management and different perspectives of inventory. The second section states about the empirical review of pharmaceutical inventory management which includes the importance of Inventory management in Health care organizations and the empirical review of pharmaceutical inventory management performance at health facilities.

2.1 Theoretical Review

2.1.1 Definition of Inventory

Inventory is defined as a stock or store of goods for fulfilling customers demand. These goods are maintained on hand at or near a business's location so that the firm may meet demand and fulfill its reason for existence. If the firm is a retail establishment, a customer may look elsewhere to have his or her need satisfied if the firm does not have the required item in stock when the customer arrives. If the firm is a manufacturer, it must maintain some inventory of raw materials and work-in-process in order to keep the factory running. In addition, it must maintain some supply of finished goods in order to meet demand (Stock and Lambert, 2001).

(Coyle, et al., 2003) defines Inventory as raw materials, work-in-progress, finished goods and supplies required for creation of a company's goods and services. The number of units and/or value of the stock of goods a company hold.

2.1.2 Purposes of inventory/Reasons for Holding Inventory

Inventory is a major use of capital and for this reason; efficient inventory management is to increase organizational profitability, to predict the impact of organizational policies on inventory levels, and to minimize the total cost of logistics activities. An organization incurs costs every time an item is handled. Since handling generally adds no value to a product or service, it should be kept to a lowest minimum. By carefully analyzing material flows, inventory management can save an organization significant amount of money (Chopra & Meindl, 2003).

(Chopra & Meindl, 2003) explained that inventory exists in an organizational operation because of the mismatch between supply and demand. Therefore, inventory's role is to increase the amount of demand that can be satisfied by having the product or service ready and available when the customer wants it. Another important role inventory plays are to reduce cost by exploiting economies of scale that may exist during production and distribution, but managers should use actions that lower the amount of inventory needed without increasing cost.

(Chopra & Meindl, 2003) suggests that since inventory plays a significant role in a supply chain's ability to support a firm's competitive strategy and that the firm's competitive strategy requires very high level of responsiveness, a company can achieve this responsiveness by locating large amounts of inventory close to the customer. Another very important role that inventory plays in an organization is to avoid stock-out costs (the costs of being out of inventory). This is very important to all organizations, especially in the healthcare delivery where delay by a few seconds can cost a life.

(Stock and Lambert, 2001), outlined five reasons for holding inventory.

The first is to enable the firm achieve economies of scale. Inventory is required if a firm is to realize economies of scale in purchasing, transportation, and manufacturing.

Secondly, it balances supply and demand. Seasonal supply and/or demand may make it necessary for a firm to hold inventory.

Thirdly, inventory enables specialization in manufacturing. Inventory makes it possible for each of a firm's plants to specialize in the products that it manufactures.

Fourthly, it provides protection from uncertainties in demand and order cycle. Inventories in excess of those required to support production can result from speculative purchases made because management expects either a future price increase or a strike.

Finally, inventory acts as a buffer between critically interfaces within the supply chain. Since members of the supply chain are separated geographically, it is necessary for inventory to be held throughout the supply chain in order to successfully achieve time and place utility. Though these reasons for holding inventory are very good and important for organizations, holding of inventory still draws some skepticism.

2.1.3 Types Of Inventory

(Stock and Lambert, 2001), categorized inventories into six main types, namely:

Cycle Stock is the inventory that results from the replenishment process and is required in order to meet demand under conditions of certainty. That is when the firm can predict demand and replenishment times (lead times) perfectly.

In-Transit Inventory (Pipeline) is the inventory that is en route from one location to another. It may be considered part of cycle stock even though it is not available for sale and or shipment until after it arrive at the destination.

Safety or Buffer Stock is the stock held in excess of cycle stock because of uncertainty in demand or lead time. The notion is that a portion of average inventory should be devoted to cover short-range variations in demand and lead time.

Speculative Stock is inventory held for reasons other than satisfying current demand. That is inventories purchased as a result of speculations of price hikes.

Seasonal Stock is a form of speculative stock that involves the accumulative of inventory before a season begins in order to maintain a stable labour force and stable production runs or in the case of agriculture products, inventory accumulated as a result of a growing season that limits availability throughout the year.

Dead (obsolete) Stock is the set of items for which no demand has been registered for some specified period of time. They are out of date, deteriorated or no longer useful as a result of advancements in technology.

2.1.4 Inventory Costs

Inventory represents an investment in the organization whether as a result of deliberate policy or not. Inventory cost are important for three major reasons. First, inventory cost represents a significant component of total logistics cost in many companies. Second, the inventory levels that a firm maintains at points in its logistic system affect the level of service the firm can provide to its customers. Third, cost trade-off decisions in logistics frequently depend upon and ultimately affect inventory carrying cost (Coyle, et al., 2003)

The categories of cost associated with inventory are: costs of holding stock (carrying costs), costs of obtaining stock (ordering cost), stock out costs, and the cost of the stock itself (Coyle, et al., 2003).

- **Costs of Holding Stock**

Costs of Holding Stock, also known as carrying cost, is the variable cost of keeping inventory on hand, and is a combination of the costs associated with opportunity costs, interest on capital invested on the stock, storage charges (rent, lighting etc.), taxes, equipment maintenance and running cost, insurance and security, shrinkage, and other variables. It represents one of the highest costs of logistics.

- **Costs of Obtaining Stock**

This cost is the expense of placing an order for additional inventory and does not include the cost or expense of the product itself. It includes the clerical and administrative costs associated with the purchasing, accounting and goods received departments; transport cost; and set up and tooling costs associated with each production run where goods are manufactured internally (Coyle, et al., 2003).

- **Stock-out Costs**

It is the cost of not having product available when a customer demands or need it. When an item is unavailable for sale, a customer may accept a back order for future availability of the needed product, or perhaps purchase (or substitute) a competitor's product, directly taking profit from the firm experiencing the stock out. According to (Coyle, et al., 2003), stock out costs include lost contribution through the lost sale caused by the stock out, loss of future sales because customers may go elsewhere, cost of production stoppages caused by stock out of work-in-progress and raw materials, and extra costs associated with urgent, often small quantity, replenishment orders.

- **Cost of the Stock**

Cost of the stock also called purchasing cost is the cost of the purchased item itself. These costs are buying in prices or the direct cost of production. These costs are needed to be considered when discount is available for bulk purchases, and when savings in production cost are possible with longer batch runs.

2.1.5 Importance Of Inventory

According to (Stock and Lambert, 2001), Inventory management is concerned with every aspect of the movement or flow of commodities in an organization. This is to be done by:

- Eliminating handling wherever possible.
- Minimizing travel distance.
- Providing uniform flow free of bottlenecks.
- Minimizing losses from waste, breakage, spoilage, and theft.

An organization incurs costs every time an item is handled. Since handling generally adds no value to a product or service, it should be kept to a lowest minimum. By carefully analyzing material flows, inventory management can save an organization significant amount of money.

Inventory is a major use of capital and for this reason; efficient inventory management is to increase organizational profitability, to predict the impact of organizational policies on inventory levels, and to minimize the total cost of logistics activities.

(Stock and Lambert, 2001), explained that, corporate profitability can be improved by increasing sales volume or cutting inventory costs. Increased sales are often possible if high levels of inventory lead to better in-stock availability and more consistent service levels. Low inventory levels can reduce fill rates on customer orders and result in lost sales.

(Stock and Lambert, 2001), further explained that, better inventory management can increase the ability to control and predict the reaction of inventory investment to changes in management policy. Therefore, inventory managers must determine how much inventory to order and when to place the order.

(Chopra & Meindl, 2003), explained that inventory exists in an organizational operation because of the mismatch between supply and demand. Therefore, inventory's role is to increase the amount of demand that can be satisfied by having the product or service ready and available when the customer wants it. Another important role inventory plays is to reduce cost by exploiting economies of scale that may exist during production and distribution, but managers should use actions that lower the amount of inventory needed without increasing cost.

(Chopra & Meindl, 2003), suggests that since inventory plays a significant role in a supply chain's ability to support a firm's competitive strategy and that the firm's competitive strategy requires very high level of responsiveness, a company can achieve this responsiveness by locating large amounts of inventory close to the customer. Another very important role that inventory plays in an organization is to avoid stock-out costs (the costs of being out of inventory). This is very important to all organizations, especially in the healthcare delivery where delay by a few seconds can cost a life.

2.1.6 Inventory Management

Inventory management is the set of policies and controls that monitor levels of inventory and determine what levels should be maintained, when stock should be replenished, and how large orders should be. Inventory management involves ordering, receiving, storing, issuing, and reordering limited items. Firms keep a supply of inventory to maintain independence of operations, meet variation in product demand, and allow flexibility in production scheduling, provide a safeguard for variation in raw material delivery time, take advantage of economic purchase order size and anticipation of price changes. In making any decision that affects inventory size, one must consider inventory holding costs which includes the costs for storage facilities, handling, insurance, pilferage, breakage, obsolescence, depreciation, taxes, and the opportunity cost of capital; Setup (or production change) costs; Ordering costs and Shortage costs (Odinga, 2007).

An inventory management system aims to assist in determining when and how much stock to order or issue. Orders that are placed timely allow drugs to be available at the right time. Successful inventory management is based on good record keeping. Paper-based record keeping is found in most drug supply systems, where stock cards or bin cards are used for that purpose. Maintaining enough stock to avoid shortages, to confront fluctuation and to avoid oversupply also constitutes the aim of successful inventory management (Odinga, 2007).

Poor inventory management can be inferred from inaccurate stock records, inadequate and unsystematic monitoring of medical stock, and indefinite procedures in terms of frequency and quantity. These incidences can be traced to inadequate know-how of inventory management and its actual management (MSH., 2012).

Inventory control is one of the elements underpinning inventory management; a failure to monitor stock levels regularly could have fatal consequences; disruption of or delay in a course of treatment

which may worsen a patient's condition and lead to death if a lifesaving medicine is out of stock. The lack of a standardized inventory control system with procedures for monitoring and managing stock levels of drugs is a challenge to emerging logistic systems; as is the case in Lesotho where stock levels were not monitored, resulting in stock out and over-stocking of certain medicines (Clark & Barraclough, 2010).

Inventory control deals with the physical control of product quantities in the store to ensure a balance on hand. It helps to decide what, when and how much to keep in the store to avoid shortages and pilferages and to minimize ineffective stock. Matching the stock on hand with stock-keeping records by physically counting the number of each type of product in the store at a given time is required for functioning inventory management (Odinga, 2007).

In inventory management, records serve as the basis of the information needed in ordering new stocks of medicines and other supplies, and provide an audit trail. Records are crucial in inventory management as they help in ensuring balanced levels of stock and are the basis for decision-making. They also constitute an important source of data used to compile various reports. Documenting all activities in inventory management is critical. Creating accurate records reduces the likelihood of discrepancies that may occur in many activities that take place in the store room (MSH., 2012).

2.1.7 Different Perspectives Of Inventory Management

Inventory management is primarily about specifying the size and placement of stocked goods. It is required at different locations within a facility or within multiple locations of a supply network to protect the regular and planned course of production against the random disturbance of running out of materials or goods (Lysons & Gillingham, 2003).

(Lysons & Gillingham, 2003), identified three main aims of inventory management as:

- To provide both internal and external customers with the required service levels in terms of quantity and order rate fill.
- To ascertain present and future requirements for all types of inventory to avoid both overstocking and bottlenecks in production.
- To keep costs to a minimum by variety reduction, economical lot sizes and analysis of costs incurred in obtaining and carrying inventories.

(Stock and Lambert, 2001), states that the objectives of inventory management are to increase corporate profitability, to predict the impact of corporate policies on inventory levels, and to minimize the total cost of logistics activities.

(James, 1998), highlights that distributors carry Ten to Thirty percent (10-30%) of additional inventory that is unnecessary. These cause unnecessary carrying cost, loss of customers, loss of sales, and loss of profit due to sloppy and inefficient inventory management. He further points out that there is the need to set out procedures to control physical inventory, to determine the true cost of managing inventory.

He therefore argues that the purpose of inventory management is to facilitate shop operation by reducing the amount of time that goods are kept on the shelf (rack time), thus increasing gross profit.

The relevance of these theories to this study is that it reveals that holding unnecessary stock of commodities adds to the operational cost of any organization and therefore reduces profit. Organizations should therefore adopt efficient inventory management techniques and procedures to ensure that the right quantity and quality of commodities are available when and where they are needed.

2.2 Empirical Review

2.2.1 Importance of Inventory management in Health facilities

Inventory management plays a crucial role in providing efficient healthcare in relation to three vital aspects of medical supplies used in the health facilities; availability, safety, and affordability. Quality care cannot be provided on time unless required pharmaceutical is available in adequate quality. The availability of pharmaceutical is the most important quality indicator of healthcare as medicines play a key role as a final link between patients and health services. Sustained supply contributes to improving the therapeutic outcomes of patients. In the current scenario of increasing health care costs, systems inventory must be optimized without sacrificing the level of service provided (Clark & Barraclough, 2010).

Although the amounts and dollar values of the inventories carried by different types of health care providers vary widely, in a typical hospital's budget 25 to 30 percent goes for medical supplies and their handling. On the national scene, health care supplies constitute 8 to 9 percent of health

care expenditures. Clearly, medical supplies require significant attention in health care budgeting. Health care managers must be able to manage the inventory of medical supplies effectively (Clark & Barraclough, 2010).

Inventory management systems obtain and move supplies and equipment to places where they are needed in a timely manner and at an optimum cost. Supplies and equipment usually cannot go directly from their source to the end user. They must be held in the warehouse at different level along the way. In view of this warehouse of supplies maintained and inventory of supplies and equipment are held at all levels in the Ethiopian pharmaceutical supply chain (John snow Inc., 2010).

Drugs have a special importance and need to be available for the following reasons:

a. Save lives and improve health outcomes,
b. Promote trust and participation of the people in health services,
c. provide a direct low-cost response for many diseases

Considering these brief reasons for the importance of the availability of drugs, it is imperative that the pharmaceutical supply management follows a stringent process and implementing efficient pharmaceuticals supply management is indispensable, because it improves the pharmaceuticals logistics activities which in turn have quantifiable benefits. Well-functioning supply chain benefits public health programs by increasing program impact, enhancing quality of care and improving cost effectiveness and efficiency (John snow Inc., 2010).

The ultimate purpose of effective pharmaceuticals logistics activities is to ensure that patients always get pharmaceuticals they need, and to be successful, the system must fulfil the six rights of supply chain management by ensuring the right products, in the right quantity, of the right quality, at the right place, at the right time and for the right cost (PFSA., 2007).

2.2.2 Pharmaceutical Inventory Management performance

Inventory management is the heart of pharmaceutical supply system. Inventory management for pharmaceutical supply sounds easy, all that must be done is to order, receive, store, issue and reorder limited list of items. But in reality, the task is difficult and in many countries poor inventory management in public drug supply system lead to financial wastage, shortage of essential drugs, decreased in quality of patient care and increased the inventory cost. Lack of accurate stock cards,

and systematic performance procedures and rules to guide staff, lack of understanding of basic issue of proper inventory management system are directly related to ineffective management (WHO, 2003).

Medicines play an important role in public health care programs, saving lives and drawing people to health facilities, where they can also receive preventive treatment. Medicines can also help keep health care costs down. Despite this important role of medicines in the health care delivery system, access to essential medicines has remained a big challenge to many populations around the world. Survey by WHO/HAI estimates that in about 40 developing countries, availability of medicines in the public sector is only one third (Report, MDG Gap Task Force, 2008).

A well-organized pharmaceutical logistics system ensures the continuous availability of all pharmaceuticals that are required for patient care. At the same time, an effective pharmaceutical logistics system should be able to respond to sudden increases in drug demand, ensuring that adequate supplies are available to deal with any emergencies that arise. Stock availability is the ultimate measure of the other components of the logistics system and it also gives an idea of the overall effectiveness and efficiency of the system, from forecasting and procurement to distribution, storage and inventory management (John snow Inc., 2010).

Measuring the availability of EDs at health facilities is one of the core components of the assessment of readiness of facilities to deliver quality services. The health facility assessments, however, employ a wide variety of tools and approaches to measure availability of EDs. For example, rapid assessments employ the reported availability by respondents without verification as a measurement of availability of EDs, while in-depth facility assessment methods validate the reported response by observing the medicines, verifying the expiration dates and collecting further data on stock-out over an extended period.

An assessment that was done in Afghanistan to REACH grantee NGOs found that for the surveyed warehouses, on average 81% of the tracer medicines were in stock on the day of the visit and in surveyed HFs, on average 86% of the tracer medicines were in stock on the day of visit (USAID, 2006.).

Study conducted in Indonesia on Pharmaceuticals Inventory management issues found that there is inefficient inventory management of pharmaceuticals in hospital due to less management

awareness and this leads to increased inventory cost (Ilma Nurul Rachmania, 2013). A study done to assess pharmacy and inventory control in ministry of health hospitals in Jordan showed that medication quantification requirements are not estimated according to actual hospital need and standard procedures related to poor inventory system. In addition, there were improper stock recording practices in some hospitals due to poor skills (Godeliver A.B, et al., 2012).

Study in Tanzania on Medicine stock out and inventory management in hospitals showed logistics skills levels of professionals who involved in supply chain was poor and pharmaceuticals inventories management was not effective and in turn it affects the availability of essential medicine (Godeliver A.B, et al., 2012). Studies in South Africa and Kenya showed due to the inventory management system is by inappropriate professionals and lack of management ownership, difficulties in getting accurate records of information and product flow, low availability of essential drugs were resulted and challenges to implement FEFO with expiration of huge stocks resulted. Poor inventory management greatly interrelated with poor skill level of professionals, lack of management follow up, allocation of inappropriate type of professionals (MSH, 2006).

Other literatures also evidenced that due to lack of appropriate skill, training gaps on the system and failed to deploy the required quantity of pharmacy professionals, appropriate data on drug consumption and stock position had not been collected regularly from the service center, which resulted serious consequence on the rational use of medicine, quantification and availability of medicine at health facilities of developing countries.

Essential medicine programs place a high priority on improving inventory control to ensure the reliable supply of essential medicines and other item at health facility. To achieve this aim, staffs need to be trained in inventory control, storage and ordering procedure, system monitoring should be in place, management ownership on the system should be improved; appropriate staff should be recruited (MSH, 2006).

The purpose of inventory management system at health facility level is to inform when to order or issue, how much to order or issue, and how to maintain appropriate stock level of all product to avoid shortage and over supply (WHO, 2003). In other way, the purpose help to prepare orders, maintain sufficient safety stock, maintain records accurately, adjust inventory level to new health problems and changes, provide appropriate, safe and secure storage, prevent expiry of medicine

which demands management follow up, trained and committed pharmacy professional for the system implementation (MSH, 2006).

The management of inventory depends on information systems that provide feedback for tracking the storage and movement of goods at every level within the supply system and storage of medication ready for use in health facilities, ensuring proper stock rotation and medicine with dates so that items of earliest expiry dates are used first, as well as enabling managers to know the total amounts of drugs that are within the supply and where they are located thus allowing the possibility of redistribution and inventory records should be regularly updated to confirm that items are being used correctly and not diverted and misused (FMHO., 2003).

For these reasons, it is very important to control and manage the building up of inventory, Pharmaceuticals should be controlled by inventory management systems, items on shelves should be tagged with bin cards, the necessary information's on the bin cards should be filled and update, the stock record cards should also show an up-to-date stock balance for received and issue items, there by resulting good inventory control which makes pharmaceutical supply management effective and efficient.

Researches done in Sub-Saharan countries showed that availability of Essential Drugs has been improved, but still far from the WHO recommended target of 100% (WHO, 1993). In Ghana, the availability of key Essential Drugs selected for the country in public health facilities was 80%; and length of stock out duration 29.9 days (Ministry of Health of Ghana, 2009). In Tanzania, Uganda and Kenya, all of them East African countries, the availability of key Essential Drugs was 88.9%, 45.7% and 82.6%, respectively ((MOHSW, 2008); (Ministry of Health of Uganda, 2008); (WHO, 2009). Though the availability of Essential Drugs seems high in the health facilities of Tanzania, the same facilities also presented a considerable number of stock out days. Some medicines were out of stock for 4 months with the median number of stock-out 135.6 (MOHSW, 2008). In Uganda, the length of stock-out duration in public health facility pharmacy was 72.9 days (Ministry of Health of Uganda, 2008). A cross-sectional study conducted in health centers of Western Ethiopia showed that only 55.6% of the assessed drugs were available (Abiye. Z, et al., 2013).

Accuracy of stock records is very critical for proper inventory management. The study that was done in Afghanistan found that 20% to 25% of the warehouses did not have up to date stock cards, did not mark dates of stock outs and did not keep the stock card with the items (USAID, 2006.). A

study done in Tanah Papua to assess HIV/AIDS commodities showed that in general inventory management was poor, stock record keeping and subsequent data quality was poor and management of expiry dates was weak (SCMS, 2008). The survey in Jordan also found that the average percentage of stock records that corresponds with physical count was 38.4% (Talafha, 2006). In Kenya, an assessment that was done in 2006 to assess stock status and logistics system for various vertical programs found that, in general there was inadequate availability of recording and LMIS tools and poor quality of records and reporting (Bunde, et al., 2007).

Essential Drugs require specific procedures and conditions for safe storage that protect their integrity and effectiveness, maximize their shelf life, and make them readily available for distribution. The procedures should include about the dimensions and design of the storage space, appropriate conditions for storage of drugs, and the importance of stock rotation and systematic arrangement of stock, as well as attention to cleanliness, fire prevention measures, and security within the store. A drug product must retain its properties within specified limits in order to be useful. When Essential Drugs are stored appropriately, clients can be assured that they receive a high-quality product. The stability of a drug product depends on the active ingredient, which can be affected by its formulation and packaging. Inadequate storage and distribution can lead to physical deterioration and chemical decomposition, and reduced potency (MSH, 2011).

The availability of quality medicines and medical supplies at health units contributes significantly to health service utilisation and to the overall public health outcomes. Given the limited resources, especially in developing countries it is important to minimise resource wastage by ensuring that procured medicines and medical supplies are appropriately received, stored and distributed while maintaining their quality. This contributes to the timely access to health services by those in need (Kagashe & Massawe, 2012).

It is vital that the storage of medicines is managed efficiently and effectively to ensure that medicines are kept properly, as the shelf life of medicines depends on their storage conditions. The storage area must be dry and well-ventilated, out of direct sunlight and maintained within acceptable temperature limits. The presence of an air conditioner is necessary to allow the correct temperature. The inventory must be protected from excessive humidity according to product specifications, and the presence of sufficient lighting is necessary. Fire safety equipment must be

available and the staff should be trained to use it. Furthermore, the storage must meet physical dimension standards (MSH., 2012).

The inventory must be well labeled and arranged in an accessible manner for counting and general management (Raja & Mohammad, 2005). A good store management system is built in a way that allows the tracking of medicine movement in the store and ensures proper stock rotation so as to allow medicines with the earliest date to be used first (Clark & Barraclough, 2010).

The use of the FEFO (first expiry, first out) system is one of the techniques of inventory management, where the products with the closest date of expiry are the first to be issued, despite the order in which they were received. This helps in preventing loss through expiries. The manufacturer labels products with an expiry date to indicate the date until which the quality and efficacy of the medicine is still guaranteed (WHO, 2003).

Records are produced and maintained in the context of professional responsibilities that are necessary to the running of business activities. Records are documents that arise from the activities, process and transactions of an organization and that constitute facts upon which to base future decisions. In inventory management they serve as the basis of the information needed in ordering new stocks of medicines and other supplies, and provide an audit trail. They are crucial in inventory management as they help in ensuring balanced levels of stock and are the basis for decision-making. They also constitute an important source of data used to compile various reports (MSH., 2012).

Difficulties of complying with record-keeping practices have been identified in many PHC facilities in Lesotho; challenges pinpointed in ART scale up included scarce reliable records, characterised by poor record-keeping practices and late reporting of consumption data. The staff were not sufficiently trained and motivated at every level to use the LMIS (Logistic Management Information System), a tool used in order to prevent stock-outs (Raja & Mohammad, 2005). In Jordan, the lack of proper stock-recording practice in some hospitals contributed to information inaccuracy during the quantification of the hospital needs (Talafha, 2006).

Documenting all activities in inventory management is critical. Creating accurate records reduces the likelihood of discrepancies that may occur in many activities that take place in the store room. In this way, the pharmacy staff and the administration have information necessary for decision

making. Access to quality data is also necessary for the forecasting and quantification process, the outcome of which is used by the facility and the provincial health information system. A proper information system allows for the identification of bottlenecks in the facility system (Kagashe & Massawe, 2012). (Kagashe & Massawe, 2012) identified discrepancies in records during a study carried out in Tanzanian public hospitals: at one hospital (Temeke), records showed that recorded balances were greater than physical count, indicating that the recording of issuing of supplies was very poor. One of the contributing factors was that there were many record books to be filled out, in such a way that a person issuing the medicines does not record directly on the bin card. Some tracer items at the aforementioned hospital had no bin cards (Kagashe & Massawe, 2012).

In Sub-Saharan countries like Uganda, and South Sudan, only 63.6% and 35% of the surveyed health facilities had adequate storage practices respectively (Ministry of Health of Uganda, 2008); (GhTech, 2011). In Kenya, adequacy of storage space and condition in public health facilities was only 60% (WHO, 2009). A study done in Tanzania showed the situation of storage practice of pharmaceuticals in detail. The study revealed that most health facilities (71%) had a main storage place, but the storage space for forecasted quantities of medicines and medical supplies was inadequate and this was affirmed by 56% of facilities surveyed. The study reported that expired stocks did have a separate storage space in only 41% of the health facility pharmacies. With regard to products requiring cold storage, only 52% of the health facilities had fulfilled the requirement and had the equipment (MOHSW, 2008).

Knowledge on pharmaceutical inventory management is one of the key factors for ensuring proper inventory management of pharmaceutical. Knowledge of those managing the “last mile” of the supply chain, that is, from district or zonal warehouse to the health facility to the patients is critical for the essential pharmaceuticals to the patients (MSH, 2010). However, some studies have shown the knowledge of some of individuals involved in the pharmaceutical supply logistics is low. An assessment in Uganda showed that one of the factors that led to poor availability of pharmaceuticals health facilities was lack of training in pharmaceutical quantification and the system that was used to supply the pharmaceutical (Tumwine, et al., 2010).

A survey that was done in Dar es salaam hospitals on medicine stock out and inventory management problems in public hospitals found that, sixty five percent (65%) of the interviewed

pharmaceutical health workers were unable to mention the methods used in inventory control. Sixty five percent (65%) were unable to mention the method they were using to estimate the quantities of pharmaceuticals required annually, and about twenty two percent (22%) mentioned the consumption method while twenty seven percent (27%) said they quantified the amounts of medicines depending on the funds available (Kagashe & Massawe, 2012).

In the last five years, the inventory management across the Ethiopia pharmaceutical supply chain has showed significant improvement. As part of major interventions to improve pharmaceutical inventory management in the country, the Integrated Pharmaceuticals Logistics System (IPLS) has been implemented in more than 2500 health facilities. Since August 2011, it has been started to directly deliver program commodities to many health facilities ─ all hospitals and accessible health centers which creates a three level distribution levels i.e. PFSA center, PFSA Hubs and Health facilities (PFSA, 2016).

The national IPLS survey indicated that wastage of pharmaceuticals due to expiry, theft, damage, etc, is known to be decreasing from time to time as a result of the implementation of IPLS at health facilities. But, it was not possible to get clear evidence on the current status of wastage rate at health facilities due to lack of proper recording and documentation of unfit for use pharmaceuticals at health facilities. The average annual wastage rate in value for pharmaceuticals at the Agency level (both at central and branch warehouses) was 1.60% and 1.19% in 2006 and 2007 budget years respectively. The rapid assessment conducted on 17 federal and Addis Abeba administration hospitals in 2006 revealed that the estimated average wastage rate of 8 hospitals was about 4.8% (PFSA, 2015).

Even though there are astonishing achievements in the last five years, there are challenges which still remain to be addressed to create well established inventory management system at all levels of the country supply chain. On/off implementation of IPLS particularly at referral hospitals and smaller health centers hampered the inventory control system (PFSA, 2015).

According to the national IPLS survey, sustainable availability of formats and the quality of record keeping is a challenge so as to use data for decision making. Only 49 percent of hospitals have an accurate balance on their bin cards. The exact accuracy of RRF data was found to be between 40 and 50 percent for most of the products; with the average of 46 percent. The survey results also showed that the storage condition for significant proportion of health facilities did not meet the

standard criteria. On average, slightly more than half (55 percent) of the facilities met 80% of the acceptable storage conditions. The aforementioned challenges overtly signify the pressing need to intensify efforts to coordinate activities, scale up best practices to strengthen inventory management at all levels (PFSA, 2015).

The above cited studies provide evidence that pharmaceutical logistics systems in many countries globally and specifically in the developing world are facing some problems in their operations. Problems of unavailability of pharmaceuticals, poor record keeping practices and therefore poor quality of data and reports are some of the problems that were evident in the cited studies. Ethiopia, therefore, being in the developing country, is no wonder that its pharmaceutical logistics system might be facing similar challenges as those in other developing countries.

Summarizing the literatures, inventory serve as an insurance policy against the unexpected break through, delay and other disturbances that could disrupt ongoing activities. According to the review; lack of commitment, poor stock recording and updating, workload in the health facilities, less management ownerships on system ownership and gap on professional's skills are some of the factors that limit effective inventory management and it is important to have proper inventory management of pharmaceutical at health facilities as it helps in preventing stock out, overstocking, deterioration, obsolescence and high currying cost. Therefore, a sound inventory management is vital for logistics decision making. Effective inventory management system is important to health facilities to ensure availability of pharmaceutical for the provision of services to the public.

2.3 Conceptual Framework

The conceptual framework includes independent variables identified as accuracy of stock record, inventory variation, product availability, stock out days and storage condition & pharmaceutical inventory management performance as dependent variable. The problem under investigation is performance of pharmaceutical inventory management as it is affected by the identified independent variables. Pharmaceutical Inventory management performance is shown on the right side while the independent variables are shown on the left hand side in figure 2.1.

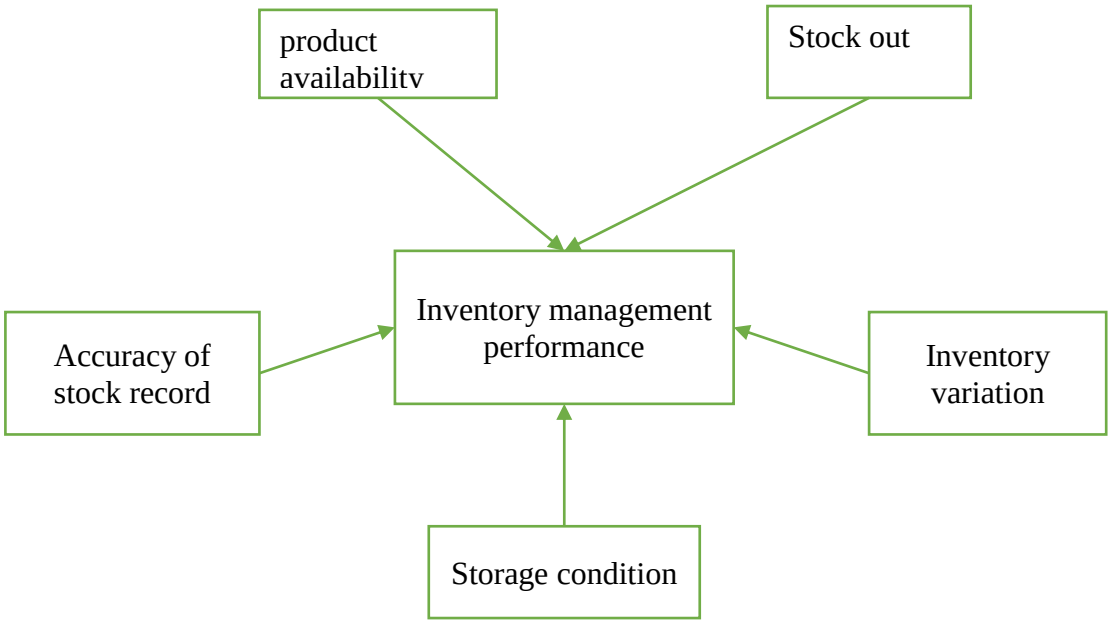

Figure 2. 1: A conceptual framework of inventory management performance

Source: Adopted from (Rogers, 2011)

CHAPTER THREE – RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter describe the research design and methodology that is used in carrying out the research. It state the description of the study area, the research approach, the research design, the population and sampling of the study. Furthermore, it deals with the data source and type, the data collection procedures, validity of instrument, reliability, ethical consideration and data analysis.

3.2 Description of the Study Area

The study is conducted in East Amhara region of South Wollo zone . South Wollo, is one of 10 Zones in the Amhara Region of Ethiopia. There are 21 districts found in the zone. It is bordered on the south by Semien Shewa and the Oromia Region, on the west by Mirab Gojjam, on the northwest by Debub Gondar, on the north by Semien Wollo, on the northeast by Afar Region, and on the east by the Oromia Zone and Argobba special woreda (Deesie PFSA branch., 2014,).

The Zone has a total population of 2,518,862, an increase of 18.60% over the 1994 census, of whom 1,248,698 are men and 1,270,164 women; with an area of 17,067.45 square kilometers, South Wollo has a population density of 147.58. While 301,638 or 11.98% are urban inhabitants, a further 3 individuals were reported to be pastoralists (Deesie PFSA branch., 2014,). Dessie town is the capital of the zone which is 401 km far from the capital of Ethiopia (Addis Ababa).

There are 132 public health facilities found in the zone, 2 hospitals and 130 health centers. Out of the 132 health facilities, 31 of the health facilities are ART service provider and 101 of the health facilities are not providing ART service. (GHSC-PSM Ethiopia , 2017).

3.3 Research Approach

The research approach of this study is quantitative method of data collection as it involves the generation of data in quantitative form which is subjected to rigorous quantitative analysis in a formal and rigid fashion. This study forms a data base from which to infer characteristics or

relationships of population where sample of the population to be studied is observed and its characteristics then be determined, and it is inferred that the population has similar characteristics.

3.4 Research Design

Descriptive study is conducted to assess and describe the pharmaceutical inventory management performance at public health facilities found in south wollo zone.

Descriptive studies is used to collect information without changing the environment and to provide description of the state of affairs as it exists at present. The researcher has no control over the variables; the researcher can only report what has happened or what is happening..

The study is carried out Cross-sectional study for it is to estimate the prevalence of an outcome of interest for a given population, providing a snapshot of the outcome and characteristics associated with it, in this case the pharmaceutical inventory management performance at public health facilities, at a specific point in time or over a short period.

In this study, the researcher reviewed a retrospective data record using an observational method to check for stock availability, stock out rate, stock record accuracy, stock level (stock according to the plan) and store management at public health facilities at one specific point in time. However, the cross-sectional design gives no indication of the sequence of events and does not allow for inferring causality.

In this study, the researcher applied quantitative method of data collection and the data is collected using facility storage condition observation checklist and Inventory Management Assessment Tool. The Storage observation checklist is used to collect data on general pharmaceutical storage condition. Inventory Management Assessment Tool is used to review the pharmaceutical Inventory records (retrospective inventory record) and examine stock records and historical stock outs. An observational method is applied on physical stock of the inventory and the inventory record at the day of visit to check for stock availability, stock discrepancies (inventory accuracy), inventory level, stock out.

3.5 Population and sampling

3.5.1 Population of the study

The study is conducted on these public health facilities (both Hospitals and Health centers) in South wollo zone that provide ART service, since these health facilities are providing high volume of service for the community. These ART service providing health facilities found with in south wollo zone, 2 hospitals and 29 health centers, is part of this study, and the personnel in charge of the pharmaceutical inventory management on the day of the visit at each facility is also part of the study to provide qualitative information that supplemented the quantitative data.

3.5.2 Sample size and sampling technique

The sample size of the study is 30% of the target population in proportion to the size of the stratum, since it has been confirmed that such a sample size is adequate for a descriptive survey study (Paton, 2002).

The target population are 31 health facilities of south Wollo zone that provide ART service. Therefore, out of the 31 health facilities found in the target population, 9 of the health facilities, which is 30% of the target population, is included in the study.

The sampling procedure that is adopted in this study is random sampling method, which provides each member of the target group with equal non-zero probability for being selected in the sample. The main factor considered in determining the sample size is to keep it manageable enough and also to enable the researcher to derive detail data at an affordable cost in terms of time, finances and human resource (Mugenda & Mugenda, 2003).

The sample size was obtained randomly based on lottery sampling technique. The technique was used to obtain the nine health facilities from the zone. And all personnel who were available in the facilities on the day of assessment were included in the study.

3.6 Data Sources and Types

3.6.1 Data Source

In this study, the sources of data is reviewed of records mainly bin cards of pharmaceuticals in the health facilities store and observation of the health facilities storage conditions as well as stock availability of pharmaceutical.

The data collection tools that is used in this study are:

1. Inventory Management assessment tool
2. Storage condition observation checklist

1. **Inventory Management assessment tool:** Inventory Management Assessment Tool (IMAT) that is used in this study is developed by Management Sciences for Health. It is used to collect quantitative data on pharmaceutical inventory management considering information on both manual and electronic logistics tools) (MSH , 1995) (Appendix 2). The tool is used to assess and measure inventory management performance, the effectiveness of record-keeping and stock management in a warehouse based on four indicators. Two of the indicators measure effectiveness of record-keeping and the remaining two indicators measure the effectiveness of stock level monitoring systems.
2. **Storage condition observation checklist:** the checklist is used to collect data on the general pharmaceutical storage condition in the health facilities. It is adopted from standards of Good Pharmacy Practice (GPP) (SAPC, 2010). Seventeen aspects of storage condition is verified, inter alia security of the storage room, protection of medicines, the arrangement of medicines as well as the storage itself. The details of the checklist can be seen in Appendix 3.

3.7 Data collection procedure

The steps and processes that is used by the researcher while collecting data using the data collection instruments is as stated below. All data is collected by the principal investigator.

Data on accuracy of stock record is collected by reviewing of store ledger and/or bin card and comparing it with the physical counts on the day of visit.

Data on ratio of inventory variation to total stock is collected by reviewing the available stock level of products in the store and comparing it with difference on the recorded stock level of the product.

Data on product availability is collected based on physical count of the products in the store on the day of visit.

Data on days out of stock is collected by counting the number of days each product was out of stock within the assessment period (the last 100 calendar days). For each product, the researcher

reviewed the transactions on the stock card during the last 100 days. For each stock-out during the 100 days period, the number of days the product had a 0 balance is add up.

Data on storage condition is collected though observing the general storage condition in the facilities store area and marking against the specific storage criterion on the check list.

Table 3. 1: list of indicators and data source

	Indicators	**Data Source**
1	Percentage of products in stock	inventory count
2	Average percentage of time that products are out of stock	Records and respondent
3	Percentage of accuracy of stock record	Comparison of bin card balance and physical
4	Ratio of inventory variation to total stock	Comparison of bin card balance and physical
5	the storage conditions	Visual observation
	Indicators	Data Source

3.8 Validity of Instruments

To ensure data validity, the data collection tools is subjected to the following validity test. The data collection tools is pretested prior to commencing the study for its content, and any ambiguity of the tools. Pretesting was carried out at 3 public health facilities in South wollo zone. Data entry is made the same day as data collection to avoid errors. Busy days at the facility is also excluded from days of data collection to avoid errors due to unrecorded data as a result of high workload.

3.9 Reliability

To ensure reliability or generalizability of the study, clearly defined measurements and a detailed observation checklist is used. Use of adapted data collection tool does also improves reliability. Only one researcher is used for data collection and entry to improve reproducibility since inter-researcher variability is nullified.

3.10 Ethical consideration

Before commencing the data collection, the researcher seek ethical approval or permission to carry out the study is obtained from the Ethics Review Committee of the School of commerce, Addis Ababa University. Then, the study is conducted in the selected health facilities after permission

from the health facility in-charge obtained. Participants of the study is asked for consent before participating in the study. During the consent process, they are provided with information regarding the purpose of the study, why and how they are selected to be involved in the study, and what is expected of them and that they can withdraw from the study at any time. Participants is also assured about confidentiality of the information obtained in the course of the study by not using personal identifiers.

3.11 Data analysis

Data analysis refers to deriving meaning from the data that is collected in the study. An appropriate system is applied for sorting the data and facilitating subsequent processing and analysis. The data is checked in the field to ensure that all the information has been properly collected and recorded. Before and during data processing, the information is checked again for completeness and internal consistency. Data cleaning is done and the data collected is transformed into a form appropriate for manipulation and analysis. Data collected is checked for completeness daily after field visit. Data collected using forms and checklists is entered in to excel. The excel sheet is used to make the required analysis and calculation.

Analysis of the data involved the production and interpretation of frequencies, tables, graphs, etc., that describe the data.

Indicators for the inventory management is calculated based on the formulas developed by the Management Sciences for Health (MSH , 1995). Stock out of pharmaceutical (tracer drugs) is assessed based on average percentage of time that products were out of stock for the past 100 days and percentage of availability of products in stock is based on the stock available on the day of the assessment.

Indicator 1: Percentage of products in stock: It Measures the system's effectiveness in maintaining a range of products in stock (at the time of the assessment). first, facility specific percentage of tracer products available on the day of assessment, using the following formula:

$$\frac{\text{the total products in stock}}{\text{Total number of products in the study}} \text{ x100}$$

Then, the average percentage of products available on the day of visit for the facility sample is obtained as follows:

$$\frac{\text{Sum of \% of products in stock on the day of assessment for each facility}}{\text{Total number of facilities in the sample}} \text{ x100}$$

Indicator 2: Average percentage of time that products are out of stock: It Indicates the system's capacity to maintain a constant supply of products over time by minimizing the duration of stock outs. It is assessed based on average percentage of time that products were out of stock for the past 100 days. The first step is to obtain facility specific average percentage of time out of stock of the tracer products, using the following formulas:

$$\frac{\text{Total number of days out of stock within the last 100 days}}{\text{Total number of products in the study x 100days}} \text{ x100}$$

Then after, the average percent of time out of stock of the tracer products for the facility sample is obtained using the following formula:

$$\frac{\text{Sum of average \% of time that products were out of stock for each facility}}{\text{Total number of facilities in the sample}} \text{ x100}$$

Indicator 3: Percentage of stock records that is accurate: It Indicates the quality of the record-keeping system by identifying the proportion of records that is accurate. The first step is to obtain facility specific percentage of stock records of tracer drugs that is accurate corresponding with physical counts is obtained, using the following formulas:

$$\frac{\text{Count of records that are accurate}}{\text{Total number of products in the study}} \text{ x100}$$

Thereafter, the average percent of stock records that is accurate for the tracer products for the facility sample is obtained using the following formula:

$$\frac{\text{Sum of average \% for each facility}}{\text{Total number of facilities in the sample}} \text{ x100}$$

Indicator 4: Ratio of inventory variation to total stock: It Indicates the severity of record-keeping errors. first, facility specific ratio of inventory variation to total stock is obtained as follows:

$$\frac{\text{Total sum of Absolute value of the difference between recorded and physical values}}{\text{the total sum of Physical quantity (based on actual count)}} \text{ x100}$$

Then, the average ratio of inventory variation to total stock for the facility sample is obtained as follows;

$$\frac{\text{Sum of average ratio of inventory variation for each facility}}{\text{Total number of facilities in the sample}} \text{ x100}$$

Indicator 5: General pharmaceutical storage condition: facilities is categorized based on total scores they obtained in the storage condition checklist. Those scored 90%-100% were categorized as excellent, 70%-89% acceptable and below 70% as unacceptable group.

Finally, the findings of the study is presented using tables, bar charts and where applicable statements is used. From the findings of the research, appropriate summary, conclusions and recommendations is made.

CHAPTER FOUR – ANALYSIS AND DISCUSSION

In this chapter the findings of the study are described. This chapter presents research findings of the study which have been discussed under thematic sections in line with the study objectives. It presents the data analysis, interpretation and discussion of the findings. The findings are interpreted following the interpretation scheme developed in the methodology section. The findings are based on data collected by the use of two data collecting tools so as to evaluate inventory management performance of public health facilities found in south Wollo zone. The analysis and discussion is performed with respect to the five objectives of this study.

The survey was conducted from April 16-27, 2018. Permission was received to conduct the study at 9 out of the 9 eligible sites and hence research was conducted in all the sampled health facilities which is 100% response rate.

4.1 Pharmaceutical availability in public health facilities

In this study, stock level monitoring was assessed to determine the health facilities system's capacity to maintain a range of products in stock. stock level monitoring was assessed based on stock out duration during the last 100 days and pharmaceutical availability on the day of assessment. The survey collected data on stock from stock record ledger and physical count, stock outs on the day of visit and stock outs during the last 100 days.

Accordingly, stock out is measured as average percentage of time that products are out of stock which indicates the system's capacity to maintain a constant supply of products over time by minimizing the duration of stock outs. Product availability is measured as Percentage of products in stock which measures the system's effectiveness in maintaining a range of products in stock (at the time of the assessment).

The first objective of the study was to determine the percentage of pharmaceutical available at stock at the day of the assessment and to find out how much of the pharmaceutical stock is maintained in public health facilities of South Wollo zone.

Percentage of tracer products available on the day of assessment:

Availability of products on the day of assessment was expressed as the percentage of tracer products available on the day of assessment in a particular facility. The study has found that all the health facilities (100%) visited don't have a stock of one or more number of tracer products on the day of assessment. Figure 4.1 shows the average percentage of tracer products that were in stock on the day of assessment in the surveyed health facilities.

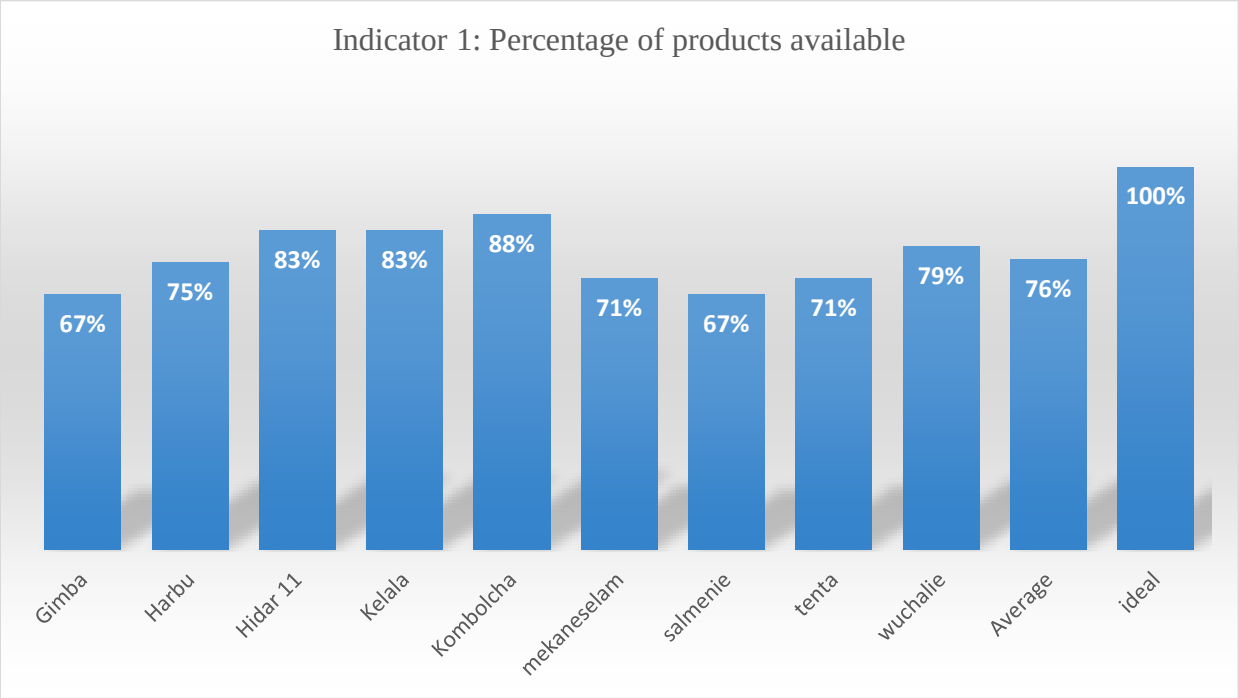

Figure 4. 1 Average percentage of tracer products available on the day of assessment

The results show that the average percent of products available on the day of assessment was 76% in the surveyed health facilities. In ideal situation we expect 100 % of tracer products to be available in all health facilities at all time. The highest percentage of tracer products available is 88% which is in Kombolcha health center. The lowest percentage of tracer products available is 67% which is in Gimba and Salmenie health centers.

The average percentage of time that tracer products that are out of stock.

Stock out within the last 100 days was expressed as the average percentage of time that products were out of stock in a particular facility. The study has found that all facilities (100%) visited had experienced stock out of a number of tracer products within the last 100 days. Figure 4.2 shows the average percentage of time that tracer products were out of stock in the visited facilities.

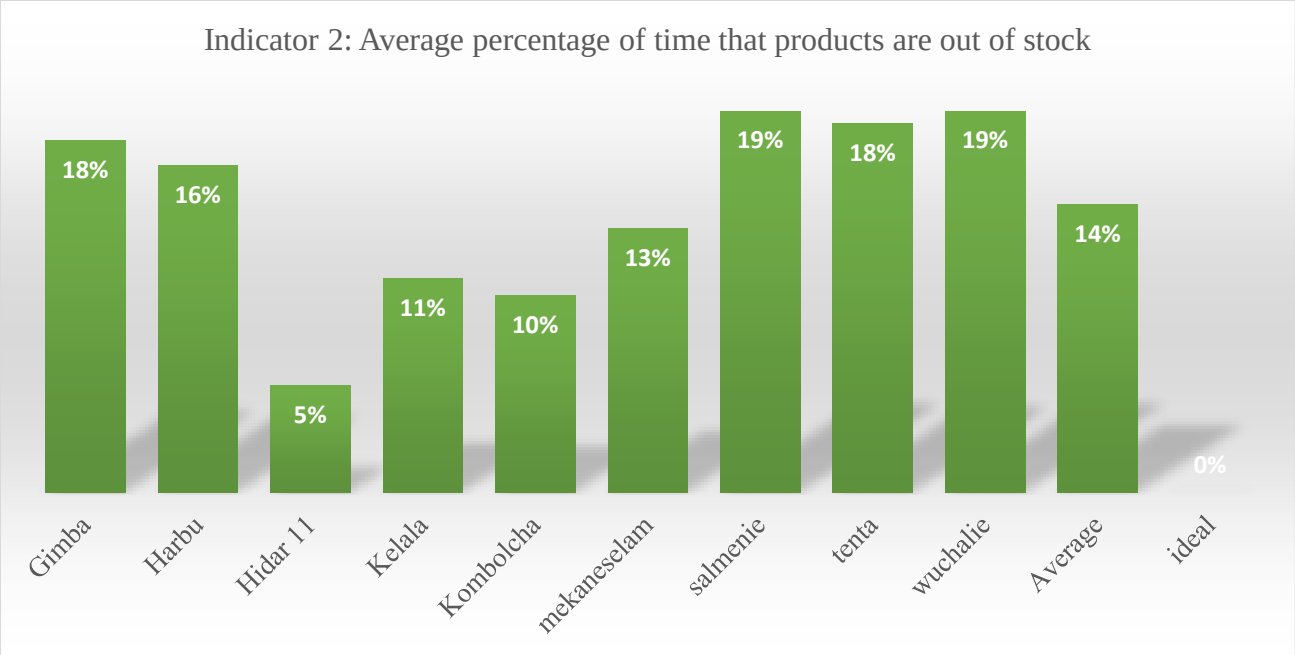

Figure 4. 2 Average percentage of time tracer products are out of stock

The study has found that all health facilities (100%) visited had stock out of a number of tracer products in the past 100 days. The study found that the average percent of time out of stock was 14% in public health facilities found in South Wollo Zone. The results also show that health facilities such as salmenie health center and wuchalie health center, have the highest stock out rate(19%) and Hidar 11 hospital have the lowest stock out rate which is 5%. In ideal situation, stock out rate is expected to be 0%.

Availability of pharmaceuticals in the surveyed facilities.

The primary reason for holding stock in a pharmaceutical supply system is to ensure availability of essential items almost all the time. Stock outs and overstocks are in any health system are important indicators of the logistics system lack of effectiveness and efficiency. Stock outs may result into unavailability of life saving medicines, disrupt course of treatment and ultimately patients and health workers may lose trust to the health system. Overstocking on the other hand puts products in increased risk of expiration or damage before they are distributed (Bunde, 2007).

This study found that all facilities visited had experienced stock out of a number of products in the past 100 days and all had stock outs of a number of products on the day of assessment. An indicator average percentage of time that products are out of stock, indicate the capacity of a system to

maintain constant supply of products over time by minimizing out of stock out duration (msh, 2010). Average percentage of time that tracer products are out of stock in the surveyed health facilities was 14%. These results show that logistics system in South Wollo Zone was not performing well. In an ideal situation this value should be zero.

An assessment for stock status and logistics conducted in 2006, in Kenya, found that average percent of time out of stock for malaria products was 51.7% in district stores, 40% in health centers and 36% in dispensaries (Bunde, 2007). Also an assessment that was done in Tanzania mainland found that average percent time out of stock of some medicines in the surveyed facilities was 33.3% (Ministry of Health and Social Welfare, , 2008). Another assessment which was done in Malawi found that the average percentage of time out of stock for medicines to manage malaria in the surveyed facilities was 33.3% (Deficient supplies of drugs for life threatening diseases in an African community., 2007). All these studies highlight the fact that performance of many pharmaceutical logistics systems especially in sub-Saharan Africa is not good.

However, the performance of the pharmaceutical logistics system for facilities can be improved and minimize the duration of out of stock. A study that was done in Jordan to assess pharmacy and inventory control in 26 Ministry of health hospitals found that the average percent of time out of stock in those hospitals was 6% (Talafha, 2006).

In this study, pharmaceutical availability was also assessed based on percent of tracer products available on the day of visit. Percentage of products available help to measure the effectiveness of the system in maintaining the full list of products that need to be in stock at the day of assessment (msh, 2010).The study found that, the average percent of tracer products available on the day of assessment for surveyed health facilities combined was 76%. These findings, again, shows that the performance of the system was not good as on average 24% of products were not available on the day of visit. For an ideal system availability on the day of visit should be 100%. A study done in Dar es Salaam Tanzania to assess stock out and inventory management problems in public hospitals found that average percent of tracer products available on the day of assessment in three district hospitals was about 80% (Kagashe & Massawe, 2012).

In this study, surveyed facilities were made of few numbers of facilities; that is, 9 health facilities. Due to the few numbers of facilities, use of statistical test to compare the average percentage of

time out of stock and average percentage of products available on the day of visit between different groups of facilities would not be able to detect difference even if the difference existed.

4.2 Accuracy of logistics data for inventory management

The study assessed the quality of record keeping system in public health facilities in South Wollo zone. In this study, Record-keeping was assessed to determine the accuracy of record-keeping system of the health facilities. Two indicators measure the accuracy of record-keeping:

1. *Percentage of stock records that is accurate:* which indicates the quality of the record-keeping system by identifying the proportion of records that is accurate. Two supplementary indicators are provided to analyze the proportion of records that is inaccurate: the first examines the proportion of recorded balances that is less than physical counts; the second examines the proportion of recorded balances that is greater than physical counts.
   1.1. *Percentage of recorded balances that is less than physical counts*: which indicates the proportion of records that under-count physical counts.
   1.2. *Percentage of recorded balances that is greater than physical counts:* which Indicates the proportion of records that over-count physical counts.
2. *Ratio of inventory variation to total stock:* which indicates the severity of record-keeping errors.

1. *Percentage of stock records that is accurate:*

A stock record was considered accurate if after adjusting for recent issues and receipts (within 7 days) the record balanced with the physical count of the stock on the day of visit. The study has found that the average percentage of stock keeping records that were accurate is 62%. Results show that, Mekaneselam hospital was doing the best in the area of record keeping, compared to other facilities, as its percentage of stock keeping records that were accurate is 83%. On the other hand health facilities such as Tenta and Wuchalie health centers, performed poorer in record keeping compared to other health facilities, as less than half (38% and 46% respectively) of the reviewed records were accurate. Figure 4.3 shows the percentage of accurate stock records in the visited facilities.

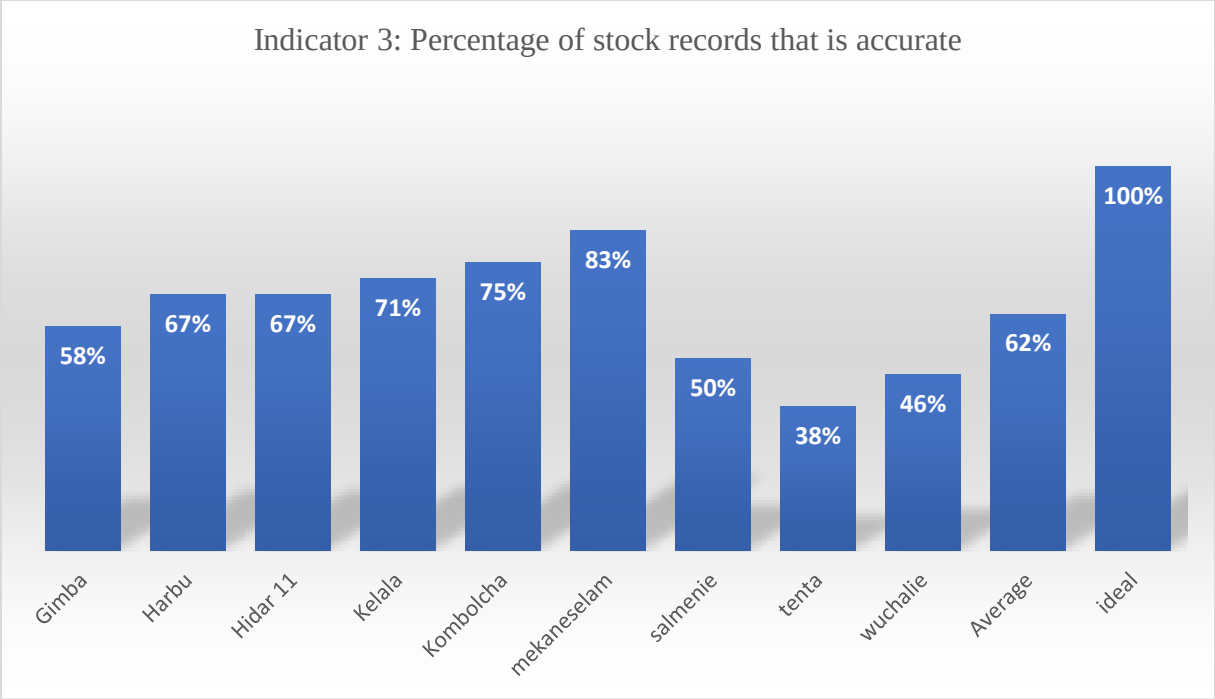

Figure 4. 3 Percentage of stock keeping records that is accurate

Percentage of stock records that is greater than physical count.

Results show that, health facilities had on average 27% of records greater than physical counts. This means that, the end balance on 27% of the reviewed records, were more than what was actually available on the shelves in these facilities on the day of assessment. Also the findings show that Gimba, Salmenie and Tenta health centers had the highest value for this indicator as compared to other facilities which is 42% and 4% is the lowest value scored by mekaneselam Hospital. Figure 4.4 shows the percent of stock records that were greater than physical counts of the stocks in the surveyed facilities.

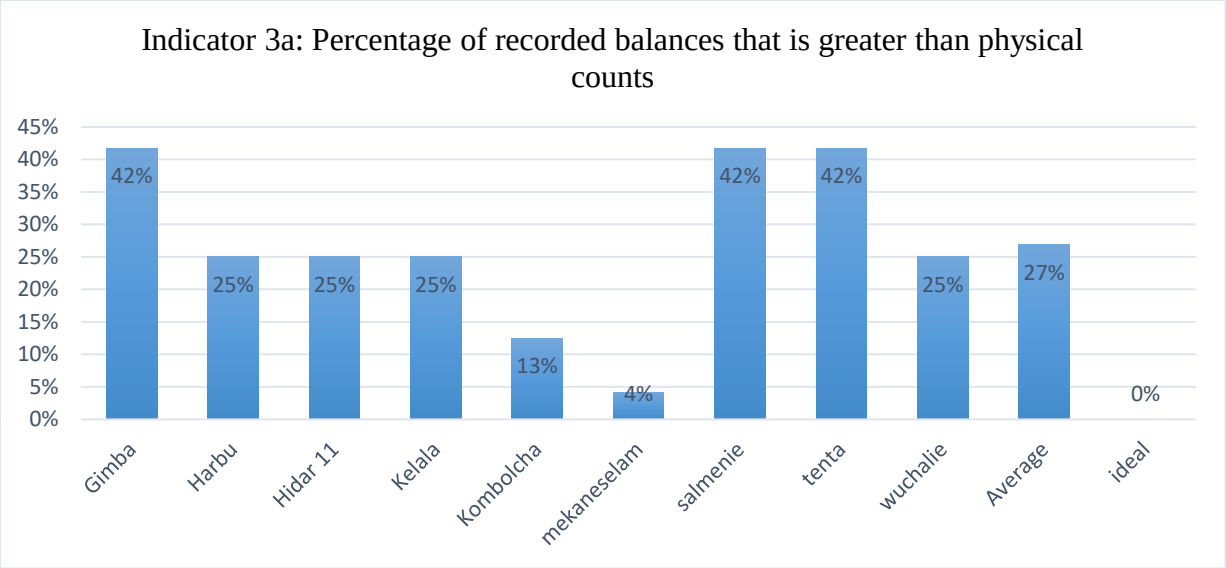

Figure 4. 4 Percent of stock keeping records greater than physical count of the stock

Percentage of stock keeping records that was less than physical count of the stock.

Results show that, health facilities had on average 12% of records were lesser than physical counts. This means that, the end balance on 12% of the reviewed records, were less than what was actually available on the shelves in these facilities on the day of assessment. Even though the ideal value for this indicator is 0%, the findings show that Wuchalie health center had the highest value for this indicator as compared to other facilities which is 29% and Gimba health center score the lowest value which is 0%. Figure 4.5 shows the percent of stock records that were less than the physical counts for the surveyed facilities.

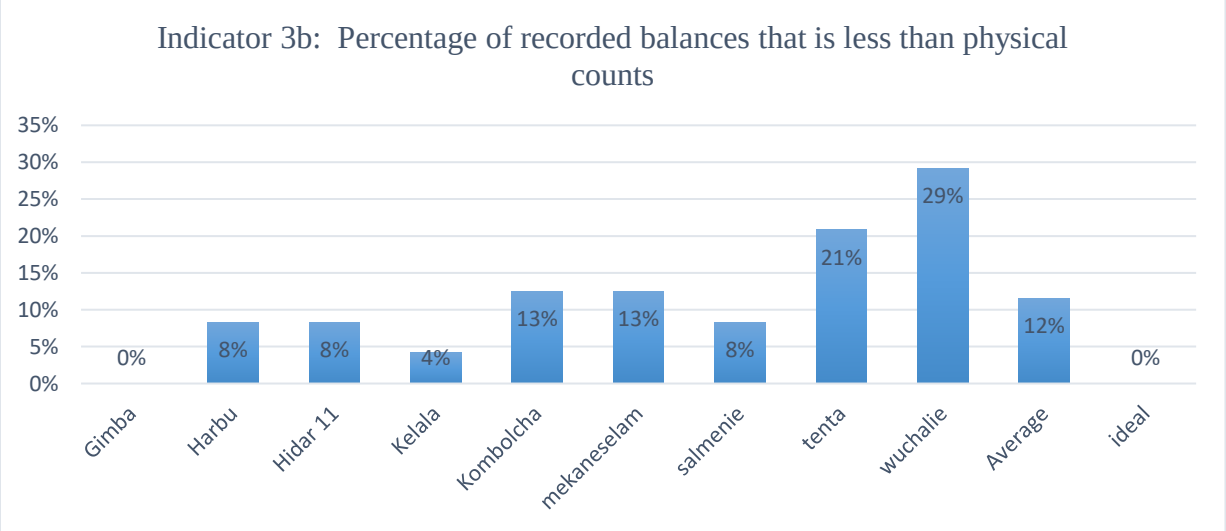

Figure 4. 5 Percent of stock keeping records less than physical count of the stock.

2. ***Ratio of inventory variation to total stock:*** **which indicates the severity of record-keeping errors.**

The study findings show the average ratio of inventory variation to total stock is 11%. Wuchalie health center had the highest score which is 22% and Kombolcha health center had the lowest value which is 2%. The more higher the value of the Ratio of inventory variation to total stock the more severe the record keeping error of facilities. Figure 4.6 shows the ratio of inventory variation to total stock in the surveyed facilities.

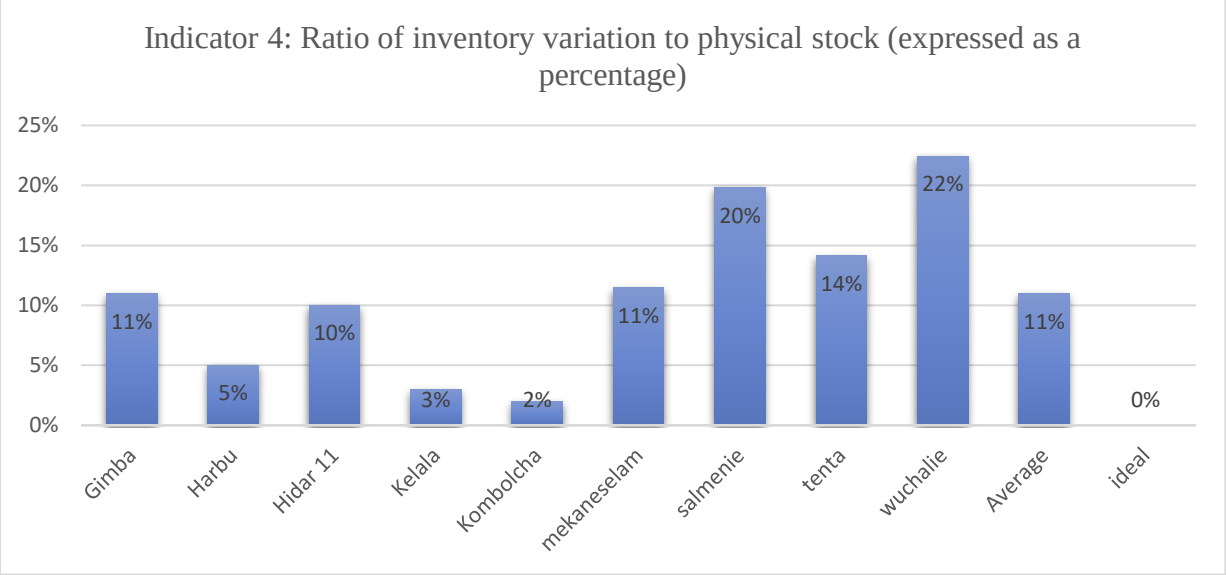

Figure 4. 6 Ratio of inventory variation to total stock in the surveyed facilities.

Accuracy of logistics data for inventory management.

Accurate inventory keeping records are essential for proper inventory management. This survey has shown that the problem of inaccurate stock keeping records is rampant to all facilities, irrespective of the facility level or facility volume. The average percentage of stock records that correspond with physical counts provides a measure of the quality of the stock record-keeping system.

This study has shown that the average accuracy of stock keeping records at the health facilities store was 62%. In health facilities, this study revealed that the problem of inaccurate stock records was also critical as it is found on average 62% of records accurate. Although the value compares

good with the international results value of 30% (Talafha, 2006), still there is much more room for improvement when we compare it from the ideal value of this indicator which is 100%.

Record keeping in most of the health facilities was purely manual and tools used were bin cards and stores ledgers. A study done in Dar es Salaam Tanzania to assess stock out and inventory management problems in public hospitals revealed that a district hospital which was doing better had 44% of accurate stock records (Kagashe & Massawe, 2012).

Stock records serve as a key source of information that is used by health facilities in estimating their needs for pharmaceuticals. Inaccurate records pose increased risk for problems of stock outs, leaks and expiry. Findings in this study about the inaccuracy of record keeping practices in health facilities, underscores the need for the Government to strengthen the record keeping system in these facilities now than ever.

In inventory management, poor information quality is an indicator of poor stock management. Proper stock recording contributes largely to the accuracy of the information on which future decisions can be based. From the results, poor record keeping was generally observed; the accuracy of records was low. A total of only 62% of the records were found to be accurate. Low level of accuracy highlights a weak inventory management; which can be associated with various factors. This results in ad hoc decisions about ordering frequency and quantities, as ordering decisions is based on weak ground information and this has cost implications.

From the results it was 27% of the recorded balances that were greater than the physical counts, meaning that the recording of supplies was very poor. Recorded balances that were less than the physical counts were 12%; this means that receipts were not correctly recorded.

The results showed that the average percentage of total variation between stock records and physical counts for the tracer products was 39%, which is relatively high compared to the international variation of 21% cited in literature (Talafha, 2006). The real status of pharmaceutical in stock is not accurately recorded and this indicates that the practice of updating records is scarce. Inaccurate record-keeping systems are of limited use for monitoring current inventory, estimating future needs and controlling the usage of pharmaceuticals.

Discrepancies can encourage thefts as losses could not be noticed. Accurate records can help to prevent this, as obvious discrepancies can raise suspicion and inspection can reveal their causes.

Concomitant use of electronic software and manual stock cards can prevent stock imbalances, by updating both sources of data and cross checking their content.

4.3 Pharmaceutical storage conditions in the surveyed health facilities.

The study assessed storage condition in storage areas in the visited facilities, examining the level of compliance with guidelines for proper storage. The public health facilities storage condition were assessed based on seventeen (17) principles. Table 4.1 shows the percentage of public health facilities that complied with the specific storage condition criterion established in the GSP manual.

For the group of public health facilities, the least satisfied conditions were; Inventory is protected from corrosive materials(0% of the surveyed health facilities complied), Inventory is appropriately labelled (0% of the surveyed health facilities complied) Inventory is within expiry date (0% of the surveyed health facilities complied), Storage site is visibly free of dirt and pests (22.22% of the surveyed health facilities complied) and Inventory is arranged in manner accessible to counting and general management (33.33% of the surveyed health facilities complied).

However, the Storage site can be securely locked, Access to storage and pharmacy is limited to authorized personnel only and Packages and containers are closed were compiled by all facilities.

Table 4. 1 Percentage of health facilities that complied with Good Storage Practice Standards for the storage of pharmaceutical (N= 9)

Description	Compliant of health facilities % (n) (N=9)
Storage room is securely locked, and access limited to authorized personnel	100.00
Storeroom is maintained in good condition: clean, all trash removed, sturdy shelves, and organized boxes	100.00
Inventory is protected from harmful temperatures according to product specifications. The room temperature is around 25 degrees Celsius and for the fridge items at 2 to 8 degrees	33.33
Inventory is protected from excessive humidity, harmful light sources and corrosive materials according to product specifications	88.89
Physical dimensions of the storage site meet appropriate standards: at least 30 cm above the floor, no medicines stored on the floor, and there is sufficient space for the stock	66.67
Sufficient inventory is present at the site, based on facility's indicated criteria	88.89

Inventory is appropriately labeled on the shelves and in the storeroom	0.00
Inventory is arranged in manner that is accessible for counting and general management	22.22
Inventory is arranged in manner that is accessible for first to expire, first out (FEFO)	55.56
Packages and containers are closed	55.56

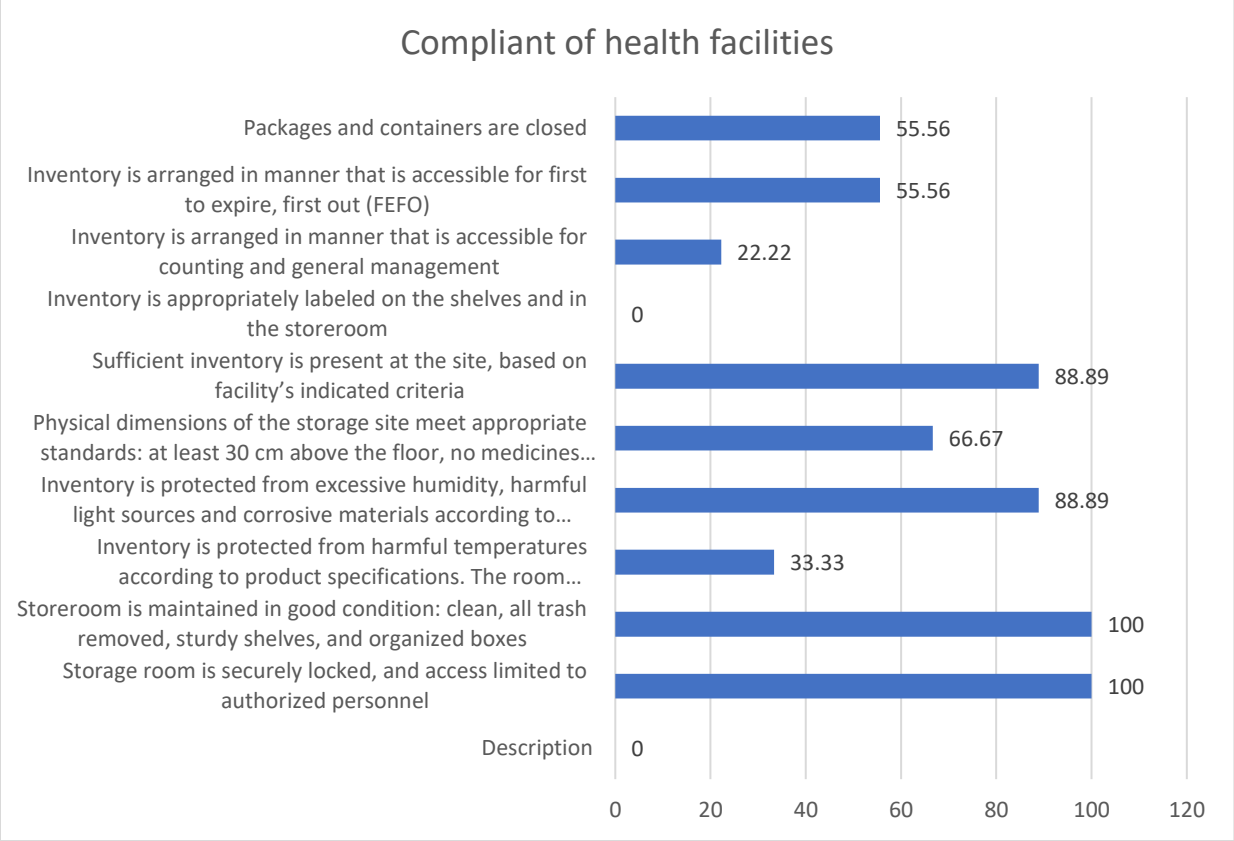

Figure 4. 7: pharmaceutical storage condition finding summary

In general, the results of this study show that majority of the public health facilities practiced unacceptable storage condition(55.6% of the health facilities) and only 44.4 % of the health facilities are acceptable storage conditions. Table 4.2 shows the number and percentage of the surveyed facilities with the acceptable, unacceptable and excellent general storage condition for pharmaceuticals.

Table 4. 2: Number/percent of facilities that had acceptable storage conditions

Facility Type	Excellent (>89%)	Acceptable (70%-89%)	Unacceptable (<70%)	Total
Health facilities	0 (0%)	4 (44.4%)	5 (55.6%)	9

General pharmaceutical storage conditions in the surveyed facilities.

Storage condition is important to maintain purity, potency, safety and effectiveness of pharmaceuticals for a longer period of time. Proper storage condition, therefore, is one of the strategies to help ensure that only high quality products reach the clients. Storage conditions for pharmaceutical are critical and it is, therefore, important to maintain the temperature at the required levels.

In the survey, storage condition of public health facilities were assessed based on security and access, conditions of storage site, availability and organization of medicines and packaging of medicines.

The findings showed that all the public health facilities complied the Security and Access criteria. Storage site were securely locked and Access to storage and pharmacy is limited to authorized personnel only. In health facilities, some were performing well while some hand unacceptable storage conditions.

Some of the health facilities only fulfill the Conditions of Storage area. Only 33.3 % of the Storeroom is maintained in good condition *(clean, all trash removed, sturdy shelves, organized boxes.).* Regarding cleanliness and tidy arrangement of store room most health facilities failed in this criterion. There were not enough pallets so cartons were put directly on the floor, boxes were not organized and there was a lot of dust in the metal shelves. There were a lot of dusts on the shelves and walls. Although shortage of space may hinder proper store arrangement, the untidiness and presence of a lot of dust on the floor, shelves and walls indicates either, shortage of housekeeping staff or failure of the management to supervise the housekeeping activities properly.

88.9% facilities Inventory is protected from harmful temperatures according to product specifications, 66.7% Inventory is protected from excessive humidity according to product specifications, 88.9% Inventory is protected from harmful light sources according to product specifications, 22.2% Storage site is visibly free of dirt and pests, 44.4 % of the public health facilities did not meet the standards for appropriate physical dimensions for pharmaceutical; rooms

were too small to hold the available inventory. Due to small size of the warehouse, it was not possible to put stack 30cm away from the walls and other stacks. In all of the health facilities Inventory is not protected from corrosive materials. 22.2%

The finding of the study shows that only some of the health facilities fulfilled the availability and Organization of Medicines criteria. 55.6% kept Sufficient inventory, only in 33.3% of the facilities Inventory is arranged in manner accessible to counting and general management, 55.6% Inventory is arranged in manner accessible for first-to expire, first out (FEFO). In all health facilities Inventory is not appropriately labelled and also the Inventory is not within expiry date. Public health facilities were storing inventory inappropriately, with missing or misplaced labels.

The finding of the study shows that most of the health facilities fulfilled Packaging of Medicines criteria. All health facilities Packages and containers are closed, 77.8 % of the facilities Packages are clean in both pharmacy and store room and 88.9% of the facilities Packages and boxes are not crushed.

CHAPTER FIVE – SUMMARY,CONCLUSION AND RECOMMENDATION

This chapter presents a summary of key data findings of the study, the conclusions drawn from the findings and the recommendations for stakeholders to ensure effective and efficient management of inventory in health facilities. The chapter is structured as follows: Summary, conclusion, recommendations, and suggestions for further research.

5.1 Summary

In order to ensure achievement of the study objectives, the summary of the study findings is presented in relation to the objectives of the study. The general purpose of the study was to assess and examine the pharmaceutical inventory management performance at public health facilities found in south wollo zone. This study had the following five objectives: To assess availability of pharmaceutical in south Wollo zone public health facilities, To identify the pharmaceutical stock out duration at the public health facilities of South Wollo zone, To measure the stock-keeping records accuracy in the health facilities, To determine ratio of inventory variation to total stock to find out the severity of record-keeping errors at the public health facilities, To find out the pharmaceutical storage conditions at the public health facilities found in south Wollo zone. The discussion of the results in the previous chapter shows the following main findings.

Pharmaceutical Availability

The first objective of the study was to assess availability of pharmaceutical in south Wollo zone public health facilities. The study revealed that the average percent of products available on the day of assessment was 76% in the surveyed health facilities. This implies that the performance of the inventory management system was not good, as on average 24% of products were not available on the day of visit.

Pharmaceutical Stock Out

The second objective of the study was to identify the pharmaceutical stock out duration at the public health facilities of South Wollo zone. The study revealed that the average percent of time pharmaceutical are out of stock was 14% in public health facilities found in South Wollo Zone.

This implies that pharmaceutical inventory management system at public health facilities found in South Wollo Zone was not performing well

Stock-Keeping Records Accuracy

The third objective of the study was to measure the stock-keeping records accuracy in the health facilities. The study revealed that the average percentage of accurate stock keeping records were 62%.. This implies that there are stock record keeping accuracy problem in the public health facilities of south wollo zone, as it is found on average only 62% of records were accurate. Low level of record accuracy highlights a weak inventory management which is limited use for making informed decision.

Ratio Of Inventory Variation

The fourth objective of the study was to determine ratio of inventory variation to total stock to find out the severity of record-keeping errors at the public health facilities. The study revealed that the average ratio of inventory variation to total stock is 11%. This implies that the accuracy error is significant and hence become less usable for making inventory related decisions.

Pharmaceutical Storage Conditions

The fifth objective of the study was to find out the pharmaceutical storage conditions at the public health facilities found in south Wollo zone. The study revealed that majority of the public health facilities practiced unacceptable storage condition(55.6% of the health facilities) and only 44.4 % of the health facilities are acceptable storage conditions. This implies that pharmaceutical are not stored in the appropriate storage conditions that enable to keep their potency optimum level and also to keep them safe.

5.2 Conclusion

The findings of this study reveal that the inventory management of pharmaceutical was poor in terms of record keeping, stock level monitoring and the storage condition.

The study has revealed that availability of pharmaceuticals in public health facilities in South Wollo Zone was not 100%. Health facilities in South Wollo Zone had faced stock outs of a number of pharmaceutical products. Stock outs being one of indicators for a pharmaceutical logistics

system performance, it therefore implied that the pharmaceutical logistics system for South Wollo Zone public health facilities was not effective.

Stock keeping records in South Wollo Zone public health facilities surveyed were not perfectly accurate. There were incidences of some stock records counts to read more than what was actually available in stock and also there were incidences of some stock records count to read less than what was actually available in stock. This practice posed increased risk for stock outs, leak and expiry of pharmaceuticals.

Poor stock management, specifically in updating and ensuring accuracy in record keeping, was found to be a major issue in pharmaceutical inventory management at the health facilities. Incorrect stock status, characterized by a lack of timely entries and issues on the logistics tools, was the key culprit in the lack of correspondence between the records and a physical stock count.

Pharmaceutical storage condition in majority of public health facilities in South Wollo Zone was below the acceptable standard. However all health facilities had put the pharmaceuticals under lock and key and entrance to store rooms was only accessible to authorized personnel. As far as storage conditions were concerned, labeling was found to be a daunting task as different labels were necessary for the same pharmaceutical.

5.3 Recommendations

In light of the findings of this study, the following recommendations are made in order to improve the pharmaceutical inventory management performance:

Government should strive to introduce use of computer in inventory control in all Health facilities. As these facilities manage relatively large number of products, use of computers in inventory management improves the efficiency and effectiveness of inventory management and record tracking.

South Wollo zone should now take efforts to ensure that Health facilities have “standard‟ store for pharmaceutical. These stores should be spacious enough to allow the health facilities to keep a stock level of four months of stock. The health facilities should carry out regular maintenance for health facilities‟ buildings so that to avoid minor problems like roof leakage.

Making timely entries and recording issues on logistics tools contribute to an upto-date inventory and management information system. After manual inventory verification, found quantities should be compared to the stock quantities in the inventory records, and the records should be updated to produce a perfect match with actual stock quantities. The need to create logistics tools for each products in the store should be emphasized.

When a delivery arrives at the health facilities, the received quantities, the date of the delivery and other relevant information should be entered immediately on the respective logistic tools to update the stock status. The same procedure should be followed when drugs are issued from the health facilities store room to different units, with the date of issue and quantity issued being recorded on the available logistics tool. Timely entries on the logistics tools that are used are essential for the availability of good and updated records, which could increase the stock management efficiency and ease data collection for reporting and monitoring purposes.

The use of manual records may have contributed largely to the discrepancies found. Human error can be reduced and data processing improved by using computer technologies, e.g. HCMIS, which should be introduced at all health facilities. Manual records should still be used where the electronic system is not fully operational.

There is a need of frequent monitoring of stock status in order to keep it at the required levels, by carring out frequent stock taking to reduce discrepancies.

Improvements in storage conditions should be promoted with regard to labeling, by creating (if space is available), a label for every brand/pack quantities and to store pharmaceutical accordingly. Physical conditions in the store should be improved at the facilities concerned by the expansion of store room.

Internal organization should be improved to allow enough time for stock monitoring.

Regular supervision by the district pharmacist is needed, regular monitoring and evaluation of all staff in order to identify training and other needs should be consolidated.

Association between predictors and outcome variables, should be explored in a longitudinal study

Finally health facilities should focus on the followings recommendations:

To improve the stock records accuracy, they are expected to:

- Use the same unit size (the smallest unit in which a product is dispensed) at all levels.
- Conduct periodic inventories and reconcile records.
- Consolidate products in one location.
- Record store location on stock cards.
- Refer to indicators 1a and 1b to determine if problems occur when receiving or distributing products.

To avoid or minimize the stock record discrepancies, health facilities shall:

- Verify that all receipts are recorded.
- Issued stock are always recorded correctly.
- Adjustments (for expired or damaged items removed from your stock) are recorded correctly.
- Establish measures to improve security.

Ratio of inventory variation to total stock is higher. There appears to be a general problem with the record-keeping system. It is possible that there are either many products with insignificant errors or a few products with large errors. Hence, health facilities shall develop procedures to ensure that:

- Stock cards are updated regularly.
- Stock cards are verified in order to reduce math and counting errors.

Average percentage of time out of stock is higher. Your system is not responsive to stockouts. Hence, health facilities shall consider the following suggestions for improving stock availability:

- Increase the minimum stock levels to account for delays in deliveries. (It may be necessary to increase your lead time estimates.)
- Try to monitor stock levels more frequently.
- Update and write minimum stock levels on stock cards and check against them with each distribution.

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Appendixes

Appendix 1. List Of Tracer Products

S/N	ITEM NAME		
1	Efavirenz-Lamivudine-Tenofovir disoproxil fumarate 600+300+300MG/tablet		
2	Atazanavir-Ritonavir 300+100MG/tablet		
3	Lamivudine-Zidovudine-Nevirapine 30+60+50MG/tablet		
4	First RTK (Wantie/Collodial Gold)		
5	Second RTK (Unigold)		
6	Tie-Breaker RTK (Vikia)		
7	Male condoms		
8	Ready-to-use therapeutic food		
9	Coartem ACT (ALu) 6X1		
10	Coartem ACT (ALu) 6X3		
11	Injectable Contraceptive (Depot Medroxy-progesterone Acetate 150 mg Vial, SR) (Depo Provera)		
12	1 rod implant (Implanon) (Etonogestrel 68 mg/rod)		
13	2 rod implant (Jadel) (Levonorgestrel 75mg/rod)		
14	Combined Oral Contraceptive (Levonorgestrel/Ethinyl Estradiol 150/30 mcg + Fe 75 mg, 28 tablets/cycle) (D-Norgestrel) (Microgynon)		
15	Copper-bearing IUDs		
16	1Emergency contraceptive (Levonorgestrel 0.75 mg tablet)		
17	Progestin Only Pill (Levonorgestrel 30 mcg 35 tablets/cycle) (D-Norgestrel –0.03mg) (Mini Pills)		
18	Oxytocin (10 IU injectable)		
19	$MgSO_4$ (50% injectable)		
20	Injectable gentamicin		
21	ORS		
22	Zinc		
23	Chlorhexidine gel (7.1% chlorhexidine gluconate, delivering 4% chlorhexidine)		
24	Amoxicillin (125mg or 250 mg dispersible tablets)		

Appendix 2. Inventory Data Collection Form

INVENTORY MANAGEMENT ASSESSMENT TOOL (IMAT)
C. DATA COLLECTION AND CALCULATION SHEET

ORGANIZATION _____

TODAY'S DATE _____

A	B	C	D	E	F	G	H
#	Name of product	Unit	# DAYS out of stock within the last 100 days. Starting date / /	Last stock balance recorded on stock cards. *Do not correct errors!*	Physical quantity (based on actual count)	Difference between recorded and physical values *(E-F)*	Absolute value of G |G| *(remove minus signs from results in column G)*
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
N=		**Totals:**					

Total number of products in the study

I Count of records that are accurate (number of zeros in column G)

J Count of records less than physical counts (numb. of negative results in column G)

K Count of records greater than physical counts (numb. positive results in column G)

L Total products in stock (total number of products present (not zero) in column F)

The maximum for L is N, the number of products in the study.

Appendix 3. Facility Storage Condition Observation Check List

Facility Name: _____ Facility type: _____

District: _____ Name of the Data Collector: _____

Date: _____

0 =no, 1 = yes				
No.	**Security and Access**	0	1	Specific comments
1	Storage site can be securely locked. *(Check both store room and pharmacy)*			
2	Access to storage and pharmacy is limited to authorized personnel only *(are there any locks on the doors, who has keys, who is allowed in and who authorises entry)*			
General comment				
0 =no, 1 = yes				
No.	**Conditions of Storage Site**	0	1	Specific comments
3	Storeroom is maintained in good condition *(clean, all trash removed, sturdy shelves, organized boxes.)*			
4	Inventory is protected from harmful temperatures according to product specifications *(is there an air conditioner in both? What temperature is it kept at? Should be around 25 degrees Celsius. For fridge items 2-8 degrees)*			
5	Inventory is protected from excessive humidity according to product specifications. (*Look for signs of dampness on boxes and walls*)			
6	Inventory is protected from harmful light sources according to product specifications. (*Must not be in direct sunlight)*			
7	Inventory is protected from corrosive materials			
8	Storage site is visibly free of dirt and pests			
9	Physical dimensions of storage site meet appropriate standards. *(Shelves must be at least 30 cm above floor, there must be no medicines stored on the floor, there must be sufficient space for stock available)*			
General comment				
0 =no, 1 = yes				

No.	**Availability and Organization of Medicines**	0	1	Specific comments
10	Sufficient inventory is present at the site, based on facility's indicated criteria *(check stock card of selected ARVs, ensure quantities are above min stock level/buffer amount)*			
11	Inventory is appropriately labelled. *(Check that medicines are labelled by generic name, are stored under correct label station. NB some medication is labelled according to name dosage and pack size)*			
12	Inventory is within expiry date. *(Check all packs under each label*			
13	Inventory is arranged in manner accessible to counting and general management *(Are medicines arranged according to generic name, alphabetically as well as dosage strength and pack size)*			
14	Inventory is arranged in manner accessible for first-to expire, first out (FEFO). *Check if medicines are arranged such that those with the shortest expiry dates are at the outermost and first to be dispensed)*			
General comment				
0 =no, 1 = yes				
No.	**Packaging of Medicines**	0	1	Specific comments
15	Packages and containers are closed *(Only check immediate packages and containers)*			
16	Packages are clean in both pharmacy and store room			
17	Packages and boxes are not crushed			
General comment				