



**ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**INVENTORY MANAGEMENT PRACTISES FOR PHARMACEUTICALS
ITEMS AT HEALTH FACILITIES IN ADDIS ABABA**

**BY
Ermiyas Semu Wodajo
SGS/0207/2009A**

**June, 2018
ADDIS ABEBA, ETHIOPIA**

**INVENTORY MANAGEMENT PRACTISES FOR PHARMACEUTICALS
ITEMS AT HEALTH FACILITIES IN ADDIS ABABA**

BY

Ermias Semu Wodajo

SGS/0207/2009A

**A THESIS SUBMITTED TO ST. MARY'S UNIVERSITY, SCHOOL OF
GRADUATE STUDIES, IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF GENERAL
MANAGMENT**

June, 2018

ADDIS ABEBA, ETHIOPIA

ST. MARY'S UNIVERSITY
SCHOOL OF GRADUATE STUDIES FACULTY OF BUSINESS

INVENTORY MANAGEMENT PRACTISES FOR PHARMACEUTICALS
ITEMS AT HEALTH FACILITIES IN ADDIS ABABA

BY

Ermias Semu Wodajo

SGS/0207/2009A

APPROVED BY BOARD OF EXAMINERS

_____	_____	_____
Dean, Graduate Studies	Signature	Date
_____	_____	_____
Research Advisor	Signature	Date
_____	_____	_____
External Examiner	Signature	Date
_____	_____	_____
Internal Examiner	Signature	Date

DECLARATION

I, the under signed, declare that this thesis is my original work, prepared under the guidance of Tilaye Kassahun (PhD, Associate Professor). All sources of material used while working on this thesis have been duly acknowledged. I further confirm that the thesis has not been submitted either in part or in full to any other higher learning institution for the purpose of earning any type of degree.

Ermias Semu Wodajo

Name

Signature and Date

ENDORSEMENT

This thesis has been submitted to St. Mary's University College, School of Graduate Studies for examination with my approval as a university advisor.

Advisor

Signature

ACKNOWLEDGEMENTS

I am grateful to Almighty God for giving me strength, health and knowledge to accomplish this research paper successfully. His grace and sufficiency has brought me this far and I really appreciate the life and successes he has helped me. Then I would like to express my special thanks of gratitude to my Advisor Tilaye Kassahun (PhD, Associate Professor.) I would also like to acknowledge all pharmacists and store keepers those participate in this study.

Thanks to the entire academic staff of St.Mary's university school of graduate for their contribution in one way or another.

Finally, I would like to thank my family, friends and colleagues for their support and cooperation till the end of this project.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	i
TABLE OF CONTENTS	ii
LIST OF TABLES	v
LIST OF ABBREVIATIONS/ACRONYMS	vi
ABSTRACT	vii
CHAPTER ONE: INTRODUCTION	1
1.1. Background of the Study	1
1.1.1 Hospitals Being Studied.....	2
1.2. Statement of the Problem.....	2
1.3. Research Question	4
1.4. Objective of the Study	4
1.5. Significance of the Study	5
1.6. Scope and the limitation of the study.....	5
1.7. Definition of Terms.....	6
1.8. Organization of the Research.....	7
CHAPTER TWO: REVIEW OF LITERATURE.....	8
2.1. Introduction.....	8
2.2. Theoretical Literature Review	8
2.2.1. Introduction to Pharmaceutical Inventory Management.....	8
2.2.2. Pharmaceutical Store Management.....	11
2.2.3. Benefits of Successful Inventory Control System at Health Facility	13
2.2.4. Problems due to Poor Inventory Control System at Health Facility.....	14
2.2.5. Challenges Confronting Management of Pharmaceutical Items at Health Facility	15
2.2.6. Pharmaceutical Inventory Control System	16
2.2.7. Pharmaceutical Inventory Control Techniques.....	19
2.2.7.1. Economic Order Quantity (EOQ) Model.....	20
2.2.7.2. ABC Analysis	21
2.2.7.3. VED Analysis	21
2.2.7.4. ABC-VED Analysis (ABC-VED Matrix)	23

2.2.8. The Role of Information Technology in Pharmaceutical Inventory Control.....	23
2.3. Empirical Literature Review.....	25
2.4. Conceptual Framework.....	27
CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY	28
3.1. Research Approach.....	28
3.2. Research Design.....	28
3.3. Population and Sampling Techniques.....	28
3.4. Source of Data and Data Collection Tools	29
3.5. Procedure of Data Collection.....	30
3.6. Method of Data Analysis	31
3.7. Instrument Validity	31
3.8. Instrument Reliability	32
3.8.1. Reliability Analysis of Questionnaires	33
3.9. Ethical Consideration.....	33
CHAPTER FOUR: RESULTS AND DISCUSSION.....	34
4.1 Introduction.....	34
4.2 General Information.....	34
4.2.1. Demographic Characteristics	35
4.2.2. Duration of Operation of the Organization.....	37
4.3 Result and Discussion on Inventory Management Practice for Pharmaceutical Items at Health Facilities in Addis Ababa.	37
4.3.1 Inventory Control Techniques Used by Hospitals	37
4.3.2 Pharmaceutical Store Management Practice at Hospitals.....	39
4.3.3 Use of Technology in Inventory Control at Hospitals	41
4.3.4 Challenges Confronting Management Pharmaceutical Items at Hospitals.....	43
4.3.5 Consequences of Poor Inventory Control at Hospitals.....	45
CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS.....	48
5.1. Introduction.....	48
5.2. Summary of Findings.....	48
5.3. Conclusions.....	50

5.4. Recommendations.....	51
5.5. Suggestions for Further Research	52
REFERENCES	53
Appendix A: Individual Consent Form.....	59
Appendix B: Questionnaires	60
Appendix C: Researcher observation check list	66
Appendix D: Interview questions	67
Appendix E: List of Hospitals included in the studied	68
Appendix F: Reference for questionnaire	69

LIST OF TABLES

Table 3.1: Reliability Statistics	33
Table 4.1: Socio-demographic Characteristics of Respondents	35
Table 4.2: Descriptive Statistics for inventory control techniques	38
Table 4.3: Descriptive Statistics for pharmaceutical store management practice	40
Table 4.4: Status of use of technology in inventory control	42
Table 4.5: Descriptive Statistics for Challenges of inventory management	44
Table 4.6: Descriptive Statistics for consequence of poor inventory control	46

LIST OF ABBREVIATIONS/ACRONYMS

ABC	Always Better Control
ADE	Annual Drug Expenditure
EFMHACA	Ethiopian Food, Medicine and Healthcare Administration and Control Authority
EOQ	Economic order quantity
FEFO	First expire first out
FPC	Finite Population Correction
FSN	Fast-Slow-Non-moving
GSP	Good Storage Practice
HML	High-Medium-Low Cost
HSDP	Health Sector Development Program
ICT	Information Communication Technology
ICT's	Inventory Control Techniques
LIAT	Logistics Indicators Assessment Tool
LSAT	Logistics System Assessment Tool
MHGU	Ministry of health government of Uganda
NDP	National Drug Policy
NEML	National Essential Medicine List
PFSA	Pharmaceutical Fund and Supply Agency
RFIDS	Radio Frequency Identification System
SDE	Scarce-Difficult-Easy to procure
SOPs	Standard operation Procedure
VED	Vital, Essential and Desirable
VEN	Vital, Essential & Non essential
WHO	World Health Organization

ABSTRACT

Managing stock effectively is important for any organization. Managing pharmaceutical products and materials up to their point of use in health facilities is an important task in order to provide quality healthcare. Without adequate pharmacy inventory management practices, hospitals run the risk of not being able to provide patients with the most appropriate medication when it is most needed. The General objective of the study was to assess Inventory management practices for pharmaceutical items at health facilities in Addis Ababa. The study population comprised of both government and private hospitals in Addis Ababa. Simple random sampling techniques were applied to select a sample size of 30 hospitals where inventory management was mostly carried out and purposive sampling to select head pharmacist and store keeper those involved directly on inventory management at the facility. The study used both primary data and secondary data that were collected through a semi-structured questionnaire, observation check list & interview for quantitative and qualitative analysis. Out of the 60 questionnaires that were distributed 53 questionnaires were filled and returned successfully. This represents a response rate of 88.4% percent. Data was analyzed using descriptive statistics. The study found that majority of hospitals are not effective in practicing the major inventory control techniques such as having essential medicine list, using established formula to determine facility resupply, establishing optimized stock level techniques such as Maximum, Minimum, safety stock and reorder level, ABC analysis and VEN analysis. Finally from the study it can be concluded that the main challenges of the hospital in managing inventory are: sufficient storage area to store all the needed products, lack of technology in inventory control and lack of proper training of inventory management and supply chain is the main challenge that almost all facility faced. In general, stock out of essential medicine and expiration is a result of poor inventory control as a consequence. Based on these findings, the study recommends that implementation of scientific inventory control techniques, use of technologies and training for better management of inventories as these reduced associated cost related to wastage and improve quality health care delivery.

Key words: Pharmaceutical product, Pharmaceutical inventory control, Medicine, Store

CHAPTER ONE: INTRODUCTION

1.1. Background of the Study

Access to health care, which includes access to essential drugs, is part of the fulfillment of the fundamental human right to health. The provision of complete healthcare service by health facilities necessitates the availability of safe, effective and affordable medicines and related supplies of the required quality, inadequate quantity at all times (EFMHACA NEML, 2015). Today, as nations strive to make medicines available and affordable to all citizens, countries have adopted a national drug strategy. These strategies specify the goals set by government for the pharmaceutical sector, their relative importance and the main action needed for attaining them.

In Ethiopia the health system is guided by the National Health Policy issued in 1993 and the Health Sector Development Program (HSDP). Accordingly the government of Ethiopia has developed the National Drug Policy (NDP), which is part and parcel of the health policy with the objective to meet the country's demand for essential drugs and to systematize its supply, distribution and use and to ensure the safety, efficacy and quality of drugs. The policy outlines its commitment to provide and determine the types of drugs to be used in the health services on the basis of the country's health problems and capability (NDP, 1993).

According to Ethiopian good storage practice Pharmaceutical products can be defined as “any product intended for human use, presented in its finished dosage form, which is subject to control by pharmaceutical legislation in either the exporting or the importing state and includes products for which a prescription is required, products that may be sold to patients without a prescription, biological and vaccines” (EFMHACA GSP, 2015 p.no 6). Pharmaceutical products (drugs) are the prime crucial and indispensable resource element of a healthcare system, irrespective of varying size of the health institution. To ensure better accessibility and availability of adequate quantity of drugs in the required dosage and strength, they need to be stocked (Kokilam, Joshi and Kamath, 2015).

Managing stock effectively is important for any organization. Management of basic health commodities concept is growing as it is very important in various countries. Managing pharmaceutical products and materials up to their point of use in health facilities is an important

task in order to provide quality healthcare. Running a hospital is no exception because without enough stock, health services to patients will come to a halt. Without adequate pharmacy inventory management practices, hospitals run the risk of not being able to provide patients with the most appropriate medication when it is most needed (Wijayawickrama & Woo-Miles, 2009).

1.1.1 Hospitals Being Studied

The Ethiopian Health Policy (EHP) indicates that the government under the federal ministry of health (FMOH) works closely with public hospital with the participation of the private sector and non-governmental organization as well in the health care service. The national Health Policy (NHP) outlines its commitment, assurance of accessibility of health care with the provision of safe, effective, quality and affordable essential medicine for all segment of the population (NHP, 1993).

The Ethiopian health service is structured into a three tier system. These levels are: The primary care level which has three kinds of service points health posts, health centers and primary hospitals; The secondary care level which is comprised of General Hospitals and The tertiary care level which is comprised of Specialized Hospitals (FMOH, HSDP IV). This study is conducted in general and Tertiary care hospitals from both government and private sector where inventory management was mostly carried out. The reasons why the researcher want to select these sector is based on the researcher extensive work experience and have good knowledge on the pharmaceutical sector. In addition to that the issue of managing pharmaceutical item is the vital issue in healthcare facility in Ethiopia. The hospitals that were included in the study are listed in the Appendix E.

1.2. Statement of the Problem

In the clinical practice setting, be it in a hospital or a primary health care facility, managing pharmaceutical items are a challenging task on a daily basis. This entails wide varieties of activities which include ordering, receiving, storing, issuing and reordering drug supplies and dealing with expired medicines.

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, numerous medical commodities are required. A reliable and consistent supply of these commodities to health facilities at all levels of the health system will determine the success of these nationwide programs (Esther, 2015). Effective supply management has the potential to make a powerful contribution to the reliable availability of essential medicines, which are a crucial part of the delivery of high quality health care services. Good supply management is also crucial to the cost-effectiveness of providing medicines (Management Science for health, 2010).

In Ethiopia many health facilities faces various challenges like an inadequate supply of quality and affordable essential pharmaceuticals, poor storage conditions and weak stock management resulted in high levels of waste and stock outs (Shewarega, Abiy, Dowling, Necho, Sami, and Yared, 2015). A “sick” inventory arise due to individual decision making on frequency of reordering and quantity to be ordered, ad-hoc structuring, inaccurate stock recording, lack of transparency, increase in complexity, and absence of systematic monitoring. These problems mainly arise due to lack of awareness or knowledge about of scientific stock keeping and warehouse practices. In developing countries like Ethiopia, where budget is tight overstocking of certain pharmaceutical items may block a substantial portion of the medicine budget, resulting in insufficient funds for procuring other more important perhaps life saving medicine. For this reason, it is important to implement or upgrade an inventory control system in health facilities pharmaceutical supply to maintain a steady supply of medicine to the public. This ensures good health to all while minimizing the costs associated with inventory holding, lowering order processing, procurement or delivery costs, controlling stock levels and minimizing stock out conditions (Kokilam et al, 2015).

Health facilities in order to provide complete health care service with the provision of appropriate essential medicine; they need to keep stocks of certain pharmaceutical items. Inadequate controls of stock can result in both overstocking and under stocking of pharmaceutical items which can lead to expiration and shortage of essential medicine respectively. So that the supply of medicines needs to be managed efficiently in order to prevent shortage of medicine and all types of wastage including overstocking, pilferage and expiry. This wastage reduces the quantity of medicines available to patients and therefore the quality of health care they receive (Kagashe & Massawe, 2012).

This is one of the many problems encountered when there is no effective pharmaceuticals item management in health facilities. The management of pharmaceuticals inventory at health facilities has not been subjected to a wide research so far. The purpose of this study was the assessment of inventory management practice for pharmaceutical items at selected health facilities in Addis Ababa with the objectives of providing appropriate information related to pharmaceutical inventory control techniques and challenges confronting management of pharmaceutical items for decision making of relevant authorities.

1.3. Research Question

The study sought to answer the following research questions:

1. What inventory management practices are used in managing pharmaceutical items at selected health facilities?
2. What pharmaceutical store management practices are applied at selected health facilities?
3. What is the role of technology in managing pharmaceutical items at selected health facilities?
4. What are the specific challenges confronting management of pharmaceutical items at selected health facilities?
5. What are the consequence of poor inventory management of pharmaceutical items on the availability of essential medicine and quality of health care service?

1.4. Objective of the Study

From the stated problem, the study sought to examine inventory managing practice for pharmaceutical items at health facilities in Addis Ababa.

The study had the following objectives:

- 1.To identify inventory control techniques used in managing pharmaceutical items at selected health facilities.
- 2.To assess the pharmaceutical store management practice at selected health facilities.
- 3.To determine use of technology in inventory management at selected health facilities.
4. To determine challenges confronting management pharmaceutical items at selected health facilities.
- 5.To determine problems related to poor inventory management of pharmaceutical items in health facilities and to find out suitable solution to overcome them.

1.5. Significance of the Study

This study is designed to address pharmaceuticals inventory management practice at health facilities. It will find out the main problem and factors that affect the healthcare facilities in the provision of essential medicine and quality healthcare service in the demand of the clients due to managing pharmaceutical items.

The findings of the study might help the regulatory body to review the current inventory management policy and the management team and stakeholder of the health facilities the current inventory control systems to implement in order to reduce costs associated with drugs inventories of the hospital without reducing the service level while improving efficiencies at the same time.

The researcher hopes that the findings of this research will enlighten the inventory management practitioners in health facilities on the effect of inventory management and its importance in improving the institution performance and also help the inventory managers in decision making concerning the suitable level of inventory to be kept in the hospital so as to ensure the patients are accorded appropriate service level while ensuring overall efficiencies in the hospital is maintained.

The study can also be used as basic information by pharmacy department and inventory control staff to develop policies and procedures for purchasing drugs and controlling their levels as well as it will form the basis on which future researchers could be built in the area of inventory. Therefore, the main objective of this study is to forward the information regarding the various bottlenecks related to pharmaceuticals inventory management practices in the present system that will cater policy makers and service provider to put forth certain measures for betterment.

1.6. Scope and the limitation of the study

Inventory control system varies from one organization to another. The nature of the firm as well the nature of items determines types of the system to adopt. This study focuses on the practices and problems of pharmaceutical items management at selected hospitals in Addis Ababa. The hospital has been chosen because of they manage large number of inventories as compared to health centers and health posts. The management of medicines and other pharmaceutical

products were covered by this study. The data were gathered from Pharmacy professionals and Store keepers with specific focus on those responsible for pharmaceutical stock control function in the hospital.

However, due to time and other constraints, the scope of the study was delimited by geographically, conceptually and methodologically. Geographically; the study was limited only selected public and private sector hospital in Addis Ababa, Conceptually; the study was used limited variables to assess the inventory control practice applied and methodologically; the study was limited on descriptive statistics techniques only to analyze the data.

1.7. Definition of Terms

In pharmacy operations, inventory is referred to the stock of pharmaceutical products retained to meet future demand.

Inventory Management: Are the methods that are used for organizing, holding and replenishment of stock.

Inventory Control: Is the operational aspect of inventory management. It involves managing the inventory that is already in the stock room or store.

Pharmaceutical product: Is any product intended for human use and presented in its finished dosage form, which is subject to control by pharmaceutical legislation.

Medicine: Is a substance or preparation used in the prevention, alleviation, or cure of disease.

Essential Medicine: Are those pharmaceutical products that satisfy the priority healthcare needs of the population and need to be available at all times in adequate amount, in the appropriate dosage form and a price the community can afford

Expiry date: The date given on the individual container of a pharmaceutical product up to and including the date on which the product is expected to remain within specifications, if stored correctly.

Stock Outs: A situation where the demand of an item cannot be fulfilled because the item is not in the current inventory.

Lead time: the time between initiation of a purchase order and receipt at store.

First expiry, first out (FEFO): A method of inventory management in which pharmaceutical products with the earliest expiry date are the first product to be issued, regardless of the order in which they are received.

ABC Analysis: A method by which pharmaceutical items are categorized based on the volume and value of consumption during a specific period of time.

VEN Analysis: A system of prioritizing pharmaceutical items and the amount to have in stock according to their therapeutic importance. It divides the pharmaceutical items in to vital, essential and non-essential category

1.8. Organization of the Research

The research is organized into five chapters. The first chapter will provides brief introduction to the study, explains the research problem, research questions, discusses objectives of the study, significance of the study, the scope of the study and limitations and finally, identifies definition of terms. The second chapter reviewed theories and previous researches done around on the management of pharmaceutical items and its effect in the performance of the quality of healthcare service and availability of essential medicine. Chapter three will presents the design of the research-methodology adopted in the study which covers the research design, population and sampling technique, data source and data collection techniques, and methods of data analysis techniques. Chapter four will summarizes the results/findings of the study, and discusses the findings linked with the literature review as well as summary. Finally the last chapter which is Chapter five will includes the conclusions and recommendations of the study.

CHAPTER TWO: REVIEW OF LITERATURE

2.1. Introduction

This chapter reviews the literature of the study that are related to the subject of this study in order to gain an understanding of pharmaceuticals inventory and its management in healthcare service delivery. Literature was reviewed in line with the stated study objectives. The review was relay greatly on data obtained from published reference materials such as books and journals. It is organized under the following parts: theoretical literature review, empirical literature review and conceptual framework.

2.2. Theoretical Literature Review

2.2.1. Introduction to Pharmaceutical Inventory Management

American Production and Inventory Control Society (APICS) define inventory management as the branch of business management concerned with planning and controlling inventories. The major aims of hospital inventory management and healthcare supply chains research is to reduce healthcare cost without sacrificing the quality of service to the patient by improving efficiency and productivity of healthcare system (Rachmania & Basri, 2013). Specifically, the process aims at reducing procurement and carrying costs, while maintaining an effective stock of products to satisfy customer and prescriber demands. Managing pharmaceutical products in that process is an integral part of the business model for all pharmacy settings, especially community and hospital practices. On the other hand, inventory mismanagement causes unnecessary rise in procurement and carrying costs and an imbalance in the supply and demand equation (Ali, 2011).

One of the most important institutions that provide community healthcare is hospital. Hospitals should keep their services at the highest level in order to meet expectations of patients (Goren & Dagdeviren, 2017). The entire system of the hospital are dependent on the materials and without materials availability the patient care function of the hospital can come to stand still. Even common medicines are out of stock and remain so for a considerable period. Of the various explanations for non-availability of even simple medicines in the third world countries, a large number are related to materials management. Hence it is of great importance that materials of right quality are supplied to all users in right quantity at the right time and place. Inventory is

one of the methods, which helps in achieving this goal. The inventory control is one of the important elements in materials management and an effective measure for containing cost of materials. Hence the control of the inventory is essential for efficient and effective supply management, which is vital to the patient care function (Khurana, Chhillar and Kumar, 2013).

All organizations hold stocks. These are the stores of materials they keep until needed. Stock consists of all the goods and materials that are stored by an organization. Without stocks most operations are simply impossible (Waters, 2003). Inventories have several functions; among the most important are to: A) meet anticipated patient demand for medical supplies; B) to protect against stock outs; C) to take advantage of order cycles; D) to permit a health care organization's operations to continue (Ozcan, 2005).

The hospital pharmacy plays a vital role in patient care. It focuses on ensuring that the prescribed medication is precisely and timely dispensed to the intended patient. Thus hospital pharmacy must purchase, store and distribute medicines (Romero, 2013). The pharmacy is one of the most extensively used therapeutic facilities of the hospital and one of the few areas where a large amount of money is spent on buying pharmaceutical items. In pharmacy operations, inventory is referred to the stock of pharmaceutical products retained to meet future demand (Dwivedi, kumar and kothiyal). The expenditure on health care delivery is increasing disproportionately as compared to the resources available. Although the amounts and values of the inventories carried by different types of health care providers vary widely. Studies revealed that in a typical hospital's budget 25 to 30 percent goes for purchasing the drugs and medical supplies and their handling (Ozcan, 2005). So as the resources are limited, there is need to utilize the existing resources appropriately and there is a need to organize and manage the pharmacy store in such a way which gives efficient clinical and administrative services (Vishavdeep, Harwinder & Sukhjeet, 2015).

The supply of medicines need to be managed efficiently in order to prevent both overstocking and under stocking. Effective inventory management in a supply chain can play a vital role in cutting inventory holding costs across the different stages of the supply chain which include selection, quantification, procurement, storage, distribution and use. In a health facility overstocking of certain items may tie up a substantial portion of the medicine budget, leaving insufficient funds for other important perhaps life saving medicines. In addition to cost holding,

excess inventory can lead to obsolescence and reduce an enterprise's flexibility. In case of a health facility excess inventory may lead to expiry of some medicines (Kagashe & Massawe, 2012). For this reason, health facilities are required to effectively manage inventories in order to ensure that customer have the needed product and to protect the regular course of medicine stock out and wastage by expiration (Oballah, Waiganjo & Wachiuri, 2015). Hospital 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 (Dwivedi et al, 2012). The goal of hospital pharmacy management is to maintain uninterrupted supply of all essential medicines throughout the time. More number of patients can be served with improved drug management in case of rational drug (Vishavdeep et al, 2015).

Inventory Management is the core of pharmaceutical supply management. Inadequate controls of inventories can result in both under and overstocking of items. An effective inventory management system plays an important role in reducing the associated costs across different stages of the supply chain system. One goal of inventory management is to achieve a reasonable balance between holding costs, on the one hand and purchasing and shortage costs, on the other. Proper stock management and drug control are vital for the successful management of the health care facility as a whole. Stock management involves various levels and aspects, including the ordering of stock, receiving and storage of stock in the health care facilities, issuing of the stock, and the reordering thereof, according to the specific levels used for inventory management. If stock is managed inadequately it could lead to wastage of essential drugs and financial resources, as well as a decrease in the quality of care rendered to the patient (Management science for health, 2012).

All facilities needs an inventory management system and written procedure to deal with ordering supplies, receiving and storing stocks and recording and accounting for stocks (Management science for health 2012). Pharmacy inventory management is a complex but critical process within the healthcare delivery system. Thus, inventory system should be developed in a cost effective manner (Montoni et al, 2014). These control mechanisms can provide a basis for consistent quality, better financial performance and improved regulatory compliance when

implemented appropriately and adhered to during day-to-day operations (Wijayawickrama & Woo-Miles, 2009). The hospital pharmacist should be an expert on medicines who advice on prescribing, administering, and monitoring as well as a supply manager who ensures that medicines are available through procurement, storage, distribution, inventory control and quality assurance (Management science for health, 2012).

2.2.2. Pharmaceutical Store Management

In any health facility medicines constitute an essential and indispensable resource element. Since almost all finished pharmaceuticals have a defined shelf-life, a specific period of time during which they should be used many of them require compliance with precise storage condition (Gizat and Samson, 2014). The shelf-life is indicated by the date of manufacture and expiry on the items label. It indicates the time that the item can be used safely or the length of time that product can be stored without affecting its usability, safety, purity, or potency if it has been stored under the manufacturer's recommended storage conditions (MHGU, 2012). Drugs and other health commodities require appropriate storage conditions as these influence their shelf-life, safety, and efficacy. Because storage condition of drugs and dosage forms can significantly influence their physico-chemical properties, due care should be taken to preserve drugs so that they remain physically, chemically, and microbiologically stable (Hawkins, Tsige & Lassooy, 2009). Storage ensures the physical integrity and safety of products and their packaging, throughout the various storage facilities, until they are dispensed to clients (USAID| DELIVER PROJECT, 2011).

Poor storage condition may result in obsolescence, deterioration, spoilage, pilferage, breakage stock due to excessive over stocking and even the development of poisonous degradation products that can be hazardous to the patient. Medical supplies should always be kept in a secured, designated storage space because medical supplies are expensive and very marketable. These items need proper care or they may deteriorate, resulting in loss of potency or development of poisonous degradation products that might harm patients. To store medicines and supplies properly, health facilities need a store that is in good physical condition, can be secured, and has shelving (MHGU, 2012; Ozcan, 2005).

Proper storage facility for drugs ensures the effectiveness, safety, strength, and quality of drugs. Unless the drugs are segregated from other non-pharmaceutical items and stored properly, long shelf life of the drugs are not guaranteed. Medicines need to be stored to maintain the intended quality and prevent damages while handling until it reaches the consumer (Kokilam et al 2015). Proper environmental controls like proper temperature, light, humidity conditions of sanitation, ventilation and segregation must be maintained wherever drugs and supplies are stored. It is extremely important to have warehouses with sufficient storage space. An effective and dedicated storage space provides the correct environment for the storage of medicines and commodities and assists the efficient flow of supplies (Iqbal, Ishaq & Dar, 2017). The potency of any drug will be greatly compromised when it is stored in structures with poor ventilation, dust, heat, rickety shelves, and lack of inventory handling equipment (Ofori-Ayeh, 2016).

Receiving and storage procedures must be followed to ensure that the items are of the desired quality when they are received and will remain so until they are used. National and international healthcare organizations and government have defined several standards for the distribution, storage, preparation and administration of medical products and materials (Romero, 2013).

According to Ethiopian Food, Medicine and Healthcare Administration and Control Authority guideline for good storage practice to facilities which stores pharmaceutical products and material in order to avoid safety, efficacy and quality problems caused by improper storage practice states that Materials and pharmaceutical products must be stored under conditions which minimize deterioration, contamination or damage. They must be stored under conditions compatible with their recommended storage requirements of temperature and /or humidity. Storage areas should be of sufficient capacity to allow the orderly storage of the various categories of pharmaceutical products and materials. Materials and pharmaceutical products should be stored in conditions which assure that their quality is maintained, and stock should be appropriately rotated in manner “first expired/first out” (FEFO) principle (EFMHACA GSP, 2015).

According to Khurana et al (2013), in order to prevent expiration of many drugs before they can be used medical store requires effective and efficient management. It emphasizes the need for planning, de-signing and organizing the medical stores in a manner that results in efficient clinical and administrative services (Khurana et al, 2013). The management of the store should

assist the flow of supplies from the source to the end user in the most reliable and economical way without a significant loss of quality, wastage, or larceny. It should take care of materials held in stock until they are needed. The main purpose of managing a store is to cater the needs of receiving, holding and dispatch stock (Waters, 2003). It is one of the inventory management duties which include controlling the movement of stock, controlling all storage units, controlling material handling procedures, overseeing quality and quantity control (Ofori-Ayeh, 2016).

2.2.3. Benefits of Successful Inventory Control System at Health Facility

Inventory management has two main concerns; 1) the level of service that is having the right goods in sufficient quantities, in the right place, and at the right time; 2) the costs of ordering and carrying inventories (Ozcan, 2005). The principal goal of inventory management involves having to balance the conflicting economics of not wanting to hold too much stock. The inventory management can bring out significant improvement not only in patient care but also in the optimal use of resources. Continuous management can provide the value added services to the patients (Dwivedi et al, 2012). From both financial and operational perspectives, efficient inventory management plays a great role in pharmacy practice. From financial viewpoint, efficient inventory management enhances gross profits and net profits by reducing the cost of procured pharmaceutical products and associated operational expenses. In addition, cash flow will improve upon saving on purchasing and storing less costly products. Such cash flow can be used to pay operational expenses and invest in other services. From operational viewpoint, effective inventory management ensures meeting customer and patient demands (Vishavdeep et al, 2015).

Maintaining a sufficient stock of items at health facilities has many benefits, patient receive medicines promptly, stock out can be prevented even when product deliveries are delayed, supplies can be replenished at schedule intervals and patients have confidence in the facility and seek help when they are ill (Management science for health, 2012).

One of the major benefits of employing inventory in health facilities other than preventing shortage, over supply and expiry of pharmaceutical products it helps to control the spread of disease and death (Azeb, 2017). Studies proved that effective management of pharmaceutical products in health facilities has resulted in an improved service delivery and lowers the mortality

rate as medicines are available at best quality and accessibility (Adzimah, Aikins, Awuah-Gyawu & Duah, 2014). For this and other benefits an effective pharmaceutical product management system must be in place to ensure their accessibility and effective use (Management Sciences for Health, 2012).

2.2.4. Problems due to Poor Inventory Control System at Health Facility

Inventory management and control has a significant role in the overall performance of supply chain (Rachmania and Basri, 2013). Because of inventory control is a difficult task in many countries, poor inventory management system in public health facilities lead to problem occur, a patient condition may worsen because of a delay in treatment, a patient may even die if life saving medicines is out of stock and patient may lose confidence in the facility health care service (management Science for health 2012).

Inadequate controls of inventories can result in both under and overstocking of items and leads to wastage or increased costs for holding stock.

- Over stocking of certain items may tie up a substantial portion of the pharmaceutical budget, leaving insufficient funds for other important, perhaps life saving medicines.
- Over stocking medicines often expire especially for short shelf-life.
- Under stocking might cause a patient death.

According to WHO Management science for health (2010), most leading causes of death and disability in developing countries can be prevented, treated, or alleviated with cost-effective essential medicines. Despite this fact, hundreds of millions of people do not have access to essential medicines. Essential medicines are those that satisfy the priority health care needs of the population. They are selected with due regard to public health relevance, evidence on efficacy and safety, and comparative cost effectiveness. Essential medicines are intended to be available within the context of functioning health systems at all times in adequate amounts, in the appropriate dosage forms, with assured quality and adequate information, and at a price the individual and the community can afford (EFMHCA NEML, 2015). WHO has defined essential drugs as “those that satisfy the needs of the majority of the population and therefore should be available at all times, in adequate amounts in appropriate dosage forms and at prices that an individual and the community can afford”. This is a global concept that can be applied in any country, in the private and public sectors and at different levels of the health care system (Iqbal et al, 2017).

Quality health care essentially is dependent on the availability of quality inventory at the right time. It is impossible to offer any meaningful health service to the satisfaction of patients and clients without the availability of inventory. In the absence of inventory, health service delivery is severally affected. Even though there is inventory there is shortage of basic essential medications and other basic inputs at almost all public health facilities as well as a large number of varieties of some expensive drugs go waste. This leads to a reduced customer service as a result of lack of best practices of inventory management techniques (Ofori-Ayeh, 2016). Studies revealed that poor inventory management in a public pharmaceutical supply can creep in wastage or blockade of financial resources, irrational utilization of drugs, shortage or overage of essential medicines resulting in expiration, increase in holding cost, reduction in enterprise's flexibility and decline in quality of healthcare service and Unavailability of a product when needed may cause the community pharmacy to lose a customer and predisposes inconvenience to the prescribing physician and may adversely affect patient's wellbeing in hospital pharmacy settings, especially when the product is an essential lifesaving one (Ali, 2011; Kokilam et al, 2015).

2.2.5. Challenges Confronting Management of Pharmaceutical Items at Health Facility

According to Ali (2011), Medicines management is a highly technical and professional activity that can only be achieved by suitably qualified, adequately trained, sufficiently skilled man power both at managerial and ground level. Appropriate measures need to be taken in the forms of decisions, actions particularly for proper selection, quantification, forecasting, procurement, distribution, and use of medicines to make the supply chain more robust and efficient. In reality implementation of a robust inventory system for a pharmaceutical supply is a difficult task (Kokilam et al, 2015). There is a problem in implementing inventory management practice, Health facilities fail to invest technology and infrastructure. The firm should put proper infrastructure to maintain maximum and minimum levels of inventory. This enables the firm to save holding costs, stock out costs and lead time costs (Njoroge, 2015).

Kagashe & Massawe (2012), in their study on medicine stock out and inventory management problems explains that lack of logistic skill and knowledge of personnel involved in medicine supply were poor. Medicines are not procured and quantified based on actual hospital need. When quantifying the amount of medicines required two methods are recommended, the consumption method and the morbidity method. The consumption method takes the average

amounts of medicines consumed monthly as the basis for calculations. The morbidity method requires knowledge of disease pattern of the area which the health facility is serving and from that the incidence of common diseases, the expected attendances and standard treatment patterns are considered to estimate the needs. Study conducted in Indonesia on Pharmaceuticals Inventory management issues showed lack of space in the warehouse to carry out too much inventory, unjustified demand forecasting technique and Lack of IT supports are some of the challenges on managing inventory (Rachmania and Basri, 2013).

Similar studies revealed that Problems in accuracy of record keeping practice, lack of commitment by management, fails to provide required facilities, use of outdated storage facilities, un motivated and lack of trained and competent professionals who understand the concept of inventory management is a major challenge to most organizations that seek to effectively manage their inventory (Tayob, 2012; Njoroge, 2015; Oballah et al, 2015). Study conducted in Ghana also revealed that, lack of logistical infrastructure to store drugs, improper monitoring of drug expiration times, poor procurement practices and distribution problems are some of money problems encountered while managing pharmaceutical products at the facility (Adzimah et al).

2.2.6. Pharmaceutical Inventory Control System

It is essential to maintain adequate inventory levels that ensure zero stock outs (Romero, 2013). The worst thing that can happen in a health facility is to have a stock out (i.e., health facilities run out of stock). The best way to ensure that pharmaceutical items do not out of stock in a health facility is to establish an inventory control system. An inventory control system informs the storekeeper when to order or issue, how much to order or issue, and how to maintain an appropriate stock level of all products to avoid shortages and oversupply. The most successful inventory control systems used for managing health commodities are Maximum-Minimum Inventory Control Systems. A max-min inventory control system is designed to ensure that the quantities in stock fall within an established range. Max stock level/max quantity; the max stock level is the level of stock above which inventory levels should not rise under normal conditions. The max stock level is fixed, whereas the max stock quantity varies as consumption changes. Min stock level/min quantity; is the level of stock at which actions to replenish inventory should occur under normal conditions. The min stock level is fixed, whereas the quantity varies as

consumption changes. Depending on the design of the max-min system, reaching the min may be the trigger for placing an order (often called the reorder level or reorder point). In some systems, reaching the min may be an indicator to monitor stocks carefully until the next order is placed, or the emergency order point is reached

There are three types of a max-min inventory control system that are applicable to health commodity logistics systems: forced-ordering, continuous review, and standard system. The basic difference between the systems is the trigger for ordering or issuing, i.e., when the order should be placed or an issue made.

In a Forced-ordering max-min system; the trigger for ordering is the end of each and every review period, In a Continuous review max-min system; the review period is not fixed; the trigger for ordering is when the facility reaches the minimum level. In a Standard max-min system; the trigger for ordering is the end of the review period for the commodities that are at the minimum level. The standard version of the max-min system is the most effective because it combines the decision rules of both forced-ordering and continuous review. For any max-min system, health facilities should set the max and min levels high enough to avoid stock outs, yet low enough so as to not increase the risk of expiration or damage. To achieve this, health facilities must set a min level high enough to ensure that the facility never completely runs out of stock. At the same time, it must still set the max low enough to ensure that space in the storeroom is adequate and that the stock does not expire before it can be used. The goal is to avoid stock outs of essential health products. Health facilities must determine three key components: lead time, review period, and safety stock to set its min stock level (USAID| DELIVER PROJECT, 2011).

According to Ali (2011), there are three methods used in pharmacy to manage inventory; the visual method, the periodic method, and the perpetual method. The visual method implies to visually compare the stock on hand with a listing of the amount of products that should be carried. When the stock number falls below the desired listed amount, the products are ordered. The periodic method requires counting the stock and comparing it with a listing of minimum desired level of the inventory on regular basis at predetermined periods of time. When the quantities fall below the minimum amount, the products are ordered. The perpetual inventory management method is the commonest method in industrialized countries, and it is the most

efficient method to manage pharmacy inventory. It involves a computerized system that monitors the inventory at all times on a continuous systematic basis. In this system, the inventory on hand is entered into the computer software, and the appropriate amount of products is automatically reduced from the inventory when a prescription or medication order is filled. Pharmacists can employ a hybrid of methods such as conducting annual physical count (visual and periodic methods) while maintaining a computerized system (perpetual method). This strategy enables the pharmacist to compare the quantities of products in computer with what is actually on shelves. By virtue of this approach, potential variances owing to fluctuations in supply and demand will be identified and corrected, and the accuracy of pharmacy's financial records will be evaluated and verified.

Eckert (2012) argues that the standard operating procedures (SOPs) for inventory control consists of a step-by-step process that is easy follow and understand by the employees. These steps are inventory receiving, storage and product rotation and warehouse and inventory security. These steps also serve to hold employees accountable for adhering to inventory control policy expectations. Creating and following an SOP is essential to managing inventory and controlling inventory costs. Even small organizations should not underestimate the power of an inventory control SOP (Njoroge, 2015).

According to Ozcan (2005), besides the basic responsibilities of deciding when and how much to order, Effective Inventory Management requires to establish a system for keeping track of items in inventory. These are:

1. A system to keep track of the inventory in storage and on order.
2. A reliable forecast of demand.
3. Knowledge of lead times and lead time variability.
4. Reasonable estimates of inventory holding costs, ordering costs, and shortage costs.
5. A classification system for inventory items in terms of their importance.

A good inventory system enables the facilities to become more efficient and to keep track on their inventory level as low as possible at minimum cost. Consistent system of inventory management is one of the factors to be successful as it offers information to smoothly manage the materials, fully utilize people and equipment, communicate with customers and coordinate internal activities (Kaur and Hall, 2001).

2.2.7. Pharmaceutical Inventory Control Techniques

Managing pharmaceutical items in health facilities is essential to provide the supply of medicines to the user. To achieve efficient management and patient satisfaction scientific inventory control management should be applied for the efficient management of medical stores (Santhi & Karthikeya, 2016).

Inventory control techniques are employed by the inventory control organization within the framework of one of the basic inventory models, namely fixed order quantity systems or fixed order period system. Inventory control techniques represent the operational aspect of inventory management and help realize the objectives inventory management and control (Pagare, Yadav, Mahale, Pawar, Patil & Bhadane, 2016). Maintenance of proper inventory levels using inventory control techniques (ICT's) can avoid the issues like, low inventory and high inventory turnover, excessive procurement cost, high carrying/maintaining costs, greater risks of obsolescence and higher frequency of stock outs (Malhotra, 2015).

The ICT's have been applied and followed successfully in the management of medical stores in hospitals. However an efficient and cost-effective management of pharmaceuticals items in health facilities requires the implacable knowledge and practical application of inventory control techniques. There are A number of inventory control techniques (ICT), like ABC analysis, VED (Vital-Essential-Desirable) Analysis, ABC-VED Matrix, FSN (Fast-Slow-Non-moving) Analysis, XYZ Analysis, HML (High-Medium-Low Cost) Analysis, SDE (Scarce-Difficult-Easy to procure) Analysis, have been designed, recommended and applied for the management of medical pharmacies and pharmacy stores in hospitals and associated health set-ups. Among these the ABC, VED and the ABC-VED Matrix analysis and Stock card & Bin card are the most commonly used and universally applied (Malhotra, 2015; Sefinew, Mahlet, Berhanemeskel and Workineh, 2016). In the beginning of the process, it is important to identify the drug items, and then to design a strategy for further study and identify their use pattern. The study of use pattern will help in designing suitable remedial actions (Singh, Gupta, Latika & Devnani, 2015).

2.2.7.1. Economic Order Quantity (EOQ) Model

In managing pharmaceutical items to maintain the stock level determining how much to order and when to order is the basic question. There are sophisticated methods for managing inventories and in particular for determining ‘optimal order-quantities.’ Determining the optimal order-quantity will possibly reduce the inventory management costs in managing its inventories. One basic model to determine the optimal order quantity is Economic Order Quantity model (Schwarz, 2008).

The economic order quantity (EOQ) is a model which represents the least costly number of units to order that will balance the cost of ordering to the cost of holding the said goods. The EOQ dictate the optimal balance between ordering and carrying costs by mathematically equating total ordering costs to total carrying costs. The economic order quantity (EOQ) model is frequently used to answer the question of how much to order. EOQ calculates optimal order quantity in terms of minimizing the sum of certain annual costs that vary with the order costs (Ozcan, 2005).

The economic order-quantity model considers the tradeoff between ordering cost and storage cost in choosing the quantity to use in replenishing item inventories. A larger order-quantity reduces ordering frequency, and hence ordering cost/ month, but requires holding a larger average inventory which increases storage (holding) cost/month. On the other hand, a smaller order-quantity reduces average inventory but requires more frequent ordering and higher ordering cost/month. After observing these two extremes, it should be clear that the ideal solution is an order size that avoids either a few large orders or many small orders. The cost-minimizing order-quantity is called the Economic Order Quantity (EOQ). In (EOQ) the goal is to select the order-quantity, Q, which minimizes the average inventory-management cost/time (Schwarz, 2008).

$$Q^* = \sqrt{[2 (\text{Demand}) (\text{Order Cost})] / (\text{Inventory Cost})}$$

According to (Schwarz, 2008), EOQ is a very common inventory control tool that is very easy to use. Even though the EOQ is relatively very easy to use, it relies on some assumptions:

1. Demand rate of the item is assumed to be known and constant at a rate D units/time.
2. Lead time (i.e., the time interval between placing the order and receiving the corresponding order quantity) is zero. In other words, Lead time is constant and known.

3. Unit Cost: is assumed to be fixed, regardless of the number of units ordered. In other words, Price per unit of product is constant; no discounts are given for large orders.
4. The value of Inventory-Holding Cost (h) is known and constant
5. The value of inventory-holding cost (k) is known and constant
6. All demands will be satisfied; no stock-outs are allowed.

2.2.7.2. ABC Analysis

Always Better Control (ABC) analysis is one of the most widely used tools in inventory control. It is based on Pareto's Law or "80-20 Rule". This rule, developed by Vilfredo Pareto, states that 80 % of total value is accounted by 20 % of items. ABC analysis classifies the items in inventory in three groups; Class A represents 20% of inventory items and 80% of inventory value, Class B represents 30% of inventory items and 15 % of inventory value and Class C represents 50% of inventory items and 5% of inventory value (Goren & Dagdevire, 2017).

According to ABC analysis, inventory items in Class A will be handled extensively since the most of the inventory value belongs to this group. Shortage of these items will result in high costs therefore; the inventory control of these items should be done carefully. Continuous review inventory control policies might be more appropriate for this group and safety stocks should be determined strictly. On the other hand, no strict rules should be applied for class B and C items. Low safety stock policy might be appropriate for class B items whereas class C items do not need to be controlled carefully. The limitation of ABC analysis is that it is based only on monetary value and cost of consumption of items. Some items of low monetary value are vital or life saving. Their importance cannot be overlooked simply because they are not in category A. Especially in hospital pharmacy, shortage of these items may lead to a failure in medical treatment which is very important for the illness. Therefore an additional parameter of assessment is their criticality by VED analysis (Wandalkar, Pandit and Zite, 2013).

2.2.7.3. VED Analysis

VED analysis of pharmaceuticals is based on criticality and utility for the patients. Based on their criticality, the items could be classified into three categories: vital, essential and desirable. The categories in the original system are vital (V), essential (E) and non-essential (N) (sometimes called VED-vital, essential, and desirable) (Sefinew, et al 2016).

Classification of drug based on criticality in to VED may be different from one institution to another. Different institutes have different service profiles, depending on the specialty services available and differ in their policies of classifying drugs into Vital, Essential and Desirable (Wandalkar et al 2013). Thus, the number, type and quantity of drug requirement would be different according to the type of the health facility settings (Kant et al 2015).

- **Vital (V):**

Vital pharmaceuticals can be given values based on their potential on lifesaving and crucial for health services. It is impossible without them to safely alive and prevents death or disability of the patient. They are critically needed for the survival of the patients which must be available in the hospital all the times (Pagare et al, 2016). There could be serious functional dislocation of patient care when vital drugs are not available even for a short period. Therefore, these should always be stocked in sufficient quantity to ensure their constant availability (Sefinew, et al 2016).

- **Essential (E):**

Essential pharmaceuticals are effective against less severe but significant illness. They are between Vital and less essential. They are lifesaving; without which patient may be in difficulty but may be somehow substituted. The shortage of essential drugs can be tolerated for a short period. If these essential drugs are not available beyond a few days or a week, the functioning of the hospital can be adversely affected. These drugs should also be controlled and monitored carefully (Wandalkar et al, 2013; Sefinew, et al 2016).

- **Desirable (D):**

Desirable/Non-essential pharmaceuticals are effective for minor illnesses and low therapeutic advantage. These items are important to patients; however, patients will not die or face a traumatic condition due to the absence of these drugs. Their absence of which will not be detrimental to the health of the patients so they are not essential. The shortage of Non-essential drugs would not adversely affect patient care or hospital functioning even if shortage is prolonged and there were no more non-essential items (Pagare et al 2016).

2.2.7.4. ABC-VED Analysis (ABC-VED Matrix)

The combination of ABC and VED analysis (ABC-VED matrix) can be gainfully employed to evolve a meaningful control over the material supplies (Santhi and Karthikeyan, 2016). The ABC-VED matrix was formulated by cross tabulating ABC and VED analysis. From the resultant combination, three categories (I, II and III) were deduced. Category I is constituted by items belonging to AV, AE, AD, BV and CV subcategories. The BE, CE and BD subcategories constituted category II, and the remaining items in the CD subcategory constituted category III. In these subcategories the first alphabet depicts its place in ABC classification & the second alphabet depicts its place in VED classification (Wandalkar et al, 2013).

Studies recommend that in a combination of ABC and VED analysis, items belonging to category I for strict and continuous managerial control as these items are both expensive and critically vital for patient's life and for greater annual drug expenditure (ADE) of the pharmacy. Category II items consumes less amount of ADE of the pharmacy and they are not as critically vital for patient's life. These need to be controlled periodically. Category III items are items that are less expensive and less critical. They do not need to be controlled periodically. Because of the greater annual drug expenditure (ADE) of hospital pharmacy store it is important to apply scientific inventory management tools for optimum management of the drug stores to set priorities in an optimum way, timely decision making in purchase of specific drugs and close supervision on drug items belonging to important categories. Thus, ABC and VED analysis can be utilized to pin point the drugs necessitating strict management control for effective & efficient utilization of hospital funds and elimination of out of stock situations in the hospital pharmacy (Singh et al, 2015; Goren & Dagdeviren, 2017).

2.2.8. The Role of Information Technology in Pharmaceutical Inventory Control

Maintaining information from health facilities is essential in order to maintain consumption, forecast pharmaceutical demand, and make other management decision. In managing pharmaceutical items stock record is the key point. Stock records are vital source of information. They contain information related to an item about reorder level, reorder interval, reorder quantity, lead time, stock on order, stock on hand, stock loss, stock balance, expiry date and estimated consumption rate. They provide detailed evidence of how products flow through the

system and can be used to identify where problem are occurring so that corrective action can be taken; therefore maintaining these records accurately and keeping them up-to-date is vital. The most important record is bin card, stock card or ledger. There for stock records (manual or computerized) must be maintained for each item in the inventory. Both manual and computerized system performs the same fundamental information processing tasks. The difference is that a computerized system enables some tasks to be accomplished more rapidly, accurately, economically, and flexibly (management science for health, 2012).

According to Awaya (2005), using computer in inventory management can work allowing analysis of drug inventory data in real time; providing real time data on products lot no, expiration of drugs, availability of essential medicine and stock on hand. Thus results easier and faster operation of the pharmacy. He revealed that in his study on automation in drug inventory management the pharmacist and technician spent less time on drug inventory, efficient in reducing inventory quantity and decreased work load, thus reducing inventory cost using computerized system.

Technology makes methods of inventory management and methods of evaluating inventory management more efficient, more precise, and more accurate. Nowadays, technology like bare code and RFID is utilized in almost all pharmacy operations; from ordering, procurement and storage to paying for products. Barcode system is utilizing hand-held scanning devices for periodic inventory control by scanning the barcodes on the product packaging or shelf labels, submitting purchasing orders electronically after inputting the scanned information into a computer via a web-based system (Ali, 2011).

Fredrick and Muturi (2016) in their studies indicated that ICT was one of the most significant factor influencing essential medicines availability because there is no manipulation of ICT to predict consumption trends and alert on when supplies are dangerously low and its efficacy in accurate stock records.

2.3. Empirical Literature Review

Stock out or lack of essential medicine is the major problems that many health facilities faced especially in developing countries. WHO estimates about one-third of the world's population is without the access to medicines they need, mostly in Asia and Africa. Studies conducted in Availability of Essential Medicines and Inventory Management Practice in Primary Public Health Facilities of Gondar Town, Ethiopia showed that even though average availability of essential medicines was good, there was long duration of stock out of essential medicines and wastage of drug due to poor inventory management practice (Somasundaram, Mulugeta, Addisie, Firehiwot, Habtam, Sintayehu, Yeheyes, Tadele & Tadesse, 2015). Studies conducted in Kenya Public Health Facilities on Factors Influencing Frequent Stock-outs of Essential Medicines states that the average availability of selected essential medicines was 57% in public sector facilities and 65.1% in private facilities and that there are large gaps in the availability of medicines in both public and private sectors, as compared to WHO requirements that essential medicine should available at all times (Fredrick & Muturi, 2016).

Study conducted in Ghana on the impact of Inventory Management Practices in Health Service Delivery reported that shortage of essential drugs and non-drug consumable resulted in prolonged sickness and in some cases death of innocent patients. The study adds that even oxygen for resuscitation account for about 15% of deaths as a result of poor inventory control techniques (Ofori-Ayeh, 2016).

In Ethiopia a study conducted at Zewditu memorial hospital on assessment of inventory management practice and challenges showed that level of personnel, weak management system, lack of proper training of inventory management, insufficient funds for procurement, lack of technology in inventory management are the main challenges faced while managing pharmaceutical products which leads to the consequence of high level of stock out which might have led to services interruptions at the Hospital (Azeb, 2017). Studies also revealed that lack of storage facilities and poor storage condition also another main challenge in the health facilities (Gizat and Samson, 2014; Adzimah et al 2014).

Similar studies conducted on the Assessment of Pharmaceuticals Inventory Management Systems Using ABC-VEN Matrix Analysis at Tikur Anbessa Specialized Hospital which is the

largest general specialized referral hospital in Ethiopia and also a teaching hospital providing pre-service and in-service trainings in various fields and specialties indicates that the hospital serves more than 818 patients per day. Majority of these patients receive a prescription containing one or more drugs. This indicates the need for proper organization of the hospital pharmacy in a manner that results in efficient and effective management of pharmaceuticals and also revealed that there are huge pharmaceuticals in TASH which need proper management and supervision to ensure the availability of various drugs round the clock as these are essential and vital for patient care (Sefinewu, 2012; Sefinewet al, 2016).

Another study conducted in India at tertiary care neuropsychiatric hospital at Delhi argue that there is a need of application of scientific inventory management tools for effective and efficient management of the medical stores and close supervision on items belonging to important categories for optimal use of funds and avoid out of stock situations in the medical stores (Khurana et al (2013).

The reviewed literatures showed that efficient pharmaceutical items inventory management is important for health facilities to achieve their establishment objectives which are provision of health services to the community.

2.4. Conceptual Framework

Jabareen (2009) explain Conceptual framework as a network or a plane of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena. The conceptual framework is a set of broad ideas used to explain the relationship between the independent variables (factors) and the dependent variables (outcome). Conceptual framework provides the link between the research title, the objectives, the study methodology and the literature review.

The conceptual framework adopted for this study shows that poor pharmaceutical store management and inadequate inventory control practice such as lack of use of scientific inventory control techniques like ABC analysis, VEN analysis and EOQ model, lack of technology, and lack of training and knowledge on inventory management and supply chain management leads to both under stocking and over stocking of medicine that results expiration, spoilage and deterioration of medicine and unavailability of essential medicines perhaps life savings which influence the quality of health service as a consequence. The conceptual framework of the study was based on key concepts of the study and literature review. In line with the reasoning above, the conceptual framework below is proposed.

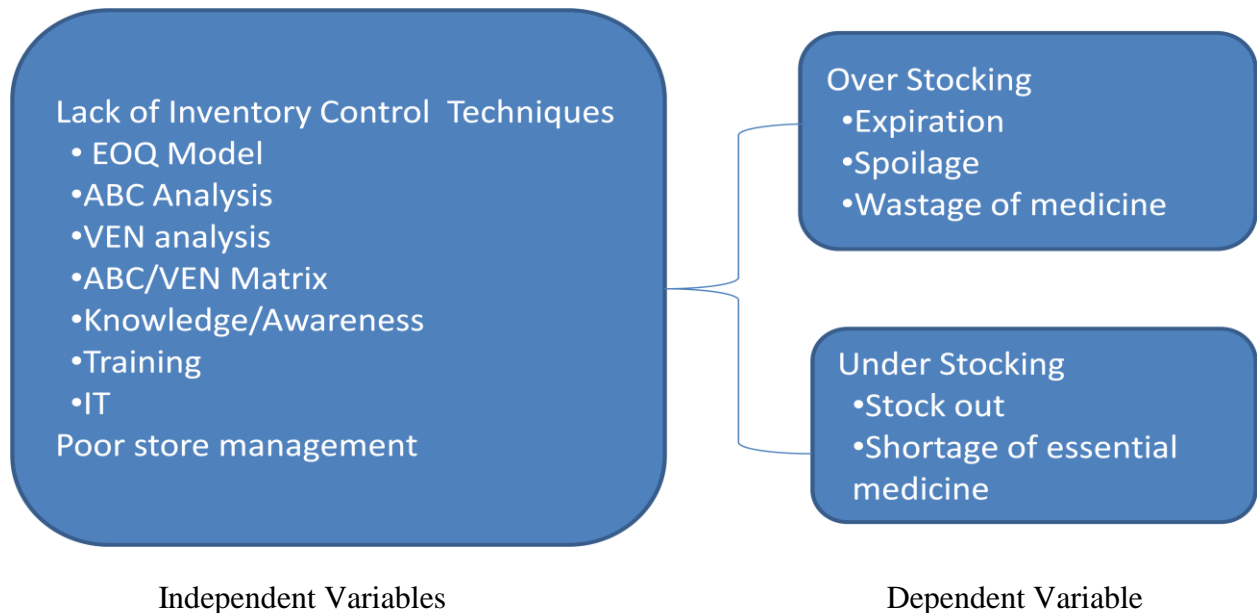


Fig 1: Conceptual framework

Source: Researcher own construct based on the literature review (2018)

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1. Research Approach

The general objective of this research was to assess Inventory Management Practice for Pharmaceutical Items at Health Facilities. Therefore, so as to meet this objective properly a mixed approach whereby both qualitative and quantitative research approaches were employed as appropriate. The study mostly used quantitative approach to produce numerical data, but qualitative approach was also used as well to strength the quantitative data.

3.2. Research Design

The study used a descriptive research design. According to Mugenda and Mugenda (2003), descriptive research is used to obtain information concerning the current status of the phenomena to describe what exists, with respect to variables or conditions in a situation. Descriptive study design enables the researcher to collect data easily and timely by way of interviews, observation and administering of questionnaires to the selected sample. Therefore, descriptive research design is adopted in this study since the researcher was intended to assess the practice at hand thoroughly to define it, clarify it and obtain pertinent information that could be of use in management of pharmaceuticals item at health facility.

3.3. Population and Sampling Techniques

The population for this study comprised of the main public and private general hospitals found in Addis Ababa. Because of these hospitals share common characteristics and manage various pharmaceutical products they are considered as target population for the study. There are a total of 35 general hospitals at Addis Ababa under Food, Medicine and Healthcare Administration and Control Authority of Ethiopia (EFMHACA). The list of facilities that were covered in this study was attached as Appendix E.

As to the sample size determination, from among different methods, the one which was developed by USAID | DELIVER PROJECT, (2011) Guide to Conducting Supply Chain Assessments using the LSAT and LIAT provides a simplified formula to calculate a precise sample sizes. To better ensure that the results of the assessment can be considered representative and true this study assumed 5 percent margin of error (+/-2.5 percent) and a 95 percent confidence level for the equation to calculate sample size.

The general formula for calculating a sample size is:

$$n = t^2 * p (1-p) /m^2 \qquad n = 187$$

Where:

n = required sample size

t = the value of the confidence level (at 95 percent t = 1.96)

p = estimated prevalence of the indicator. (When prevalence is unknown, 0.5 should be used.)

m = margin of error (at 5 percent m = 0.05).

However, where there is a predetermined population the sample size generated from the above equation needs to be multiplied by the Finite Population Correction (FPC) factor. The formula can be expressed as:

$$New\ n = \frac{n}{1+[(n-1)/N]} \qquad New\ n = 30$$

Where:

New n = the adjusted new sample size

N = the population size

n = the sample size obtained from the general formula

Using this formula, ensuring a 5 percent margin of error and 95 percent confidence level 30 hospitals were selected in a population of 35 general hospitals where pharmaceuticals inventory management was mostly carried out. The study sample size therefore consisted of 20 general hospitals from private sector and 10 general hospitals among government. The sampling techniques used for this study were probability and non-probability sampling techniques. Probability sampling technique which is specifically simple random sampling was used to select hospitals as a population. Non-Probability sampling technique which is specifically purposive sampling techniques was used to select 30 head pharmacists and 30 storekeepers from each hospital those are directly linked to the management of pharmaceutical items at hospitals. Therefore, more specifically the sample size for the study consisted of 60 respondents.

3.4. Source of Data and Data Collection Tools

The study relied on both primary and secondary data. Primary data was collected from the pharmacists and store keepers who are responsible for the pharmacy department in all ordering, receiving and storing of pharmaceutical items in health facilities. The primary source of data for

this research semi structured questionnaire and interview. On the other side the study also used physical observation against a standard check list according to WHO standard requirements and local guideline. Secondary data was also obtained from external sources such as reference books, journal articles and research papers related to the topics. The purpose of sourcing for secondary data was to help in the formation of problems, literature review and construction of questionnaire.

This study employed three types of data collection instruments to collect primary and secondary data. The primary instrument used to collect data was questionnaire. This study majorly depends on data gathered by use of questionnaires other than interviews and observations. A questionnaire in a 5 point likert scale was used to collect data from the sample respondent. The questionnaire has 5 rating scale ranging from 1=strongly disagree, 2 = disagree, 3 = undecided (neutral), 4 = agree and 5 = strongly agree. The questionnaire was designed to meet the objectives of the study. A questionnaire which had been designed by Management Sciences for Health to assess health facilities and other used from previous works was adopted for the purposes of this study. However, the researcher structured it in such a way that it includes all relevant parts and information to clearly acquaint the respondents and to suit the objectives of the study in order to solicit answers that would meet the objectives.

3.5. Procedure of Data Collection

The procedure for the data collection was first the respondents are communicated to get their consent. Once their consent was known, the questionnaires were distributed by the researcher to each participant by appreciating their participation and devoting their precious time for the research. The researcher gave the respondents the option of filling the questionnaires at their convenient time and collected after two days for analysis. The questionnaires were collected by checking the completeness of the data. The researcher also collected data through observations in the fieldwork, visiting the pharmaceutical store and observing the operational process of activities. An interview questions were also conducted with head pharmacists of the hospital. Finally the activities were accomplished by appreciating the respondents.

3.6. Method of Data Analysis

Data processing is an important part of the whole survey operation. The data collected through questionnaires and observation was processed, summarized, edited, tabulated and coded to ensure completeness, consistency and accuracy. Descriptive analytical technique was used with the aid of Statistical Package for Social Sciences (SPSS version 20) to analyze the collected data. Descriptive data was analyzed and presented by using frequency counts, percentage, mean and standard deviation. Quantitative explanations were made of quantitative data to give meaning to them as well as explain their implications. Data from qualitative method was analyzed systematically in such a way that the major issues were identified. From these, appropriate conclusions and recommendations were made from the findings of the research.

The analysis conducted on data gathered to assess inventory management practices for pharmaceuticals item at health facilities is presented in relation to the objectives of the study. Descriptive statistics used to analyze the data in this study was based on the responses of sample respondents on their into account that numbers a five point Likert scale 1, 2, 3, 4 and 5 represents strongly disagree, disagree, undecided (neutral), agree and strongly agree respectively. The result of the study showed that the scores of disagree have been taken to represent a variable which had a mean score of less than 2.8, the score of undecided (neutral) have been taken to represent a variable which had a mean score of 2.9 to 3.2 and the score of agree have been taken to represent a variable which had a mean score of above 3.2. A standard deviation of >0.9 implies a significant difference on the impact of the variable among respondents (Scott, 1999).

3.7. Instrument Validity

To ensure validity, all questionnaires were self-administered to the right persons of respondents by the researcher and only data that was collected was analyzed. To test validity of the questionnaire, a pilot study was conducted with 4 persons from the Stores (2) and head of pharmacy (2) at two of selected hospital. The four persons were given thirty minutes to complete the questionnaire and the researcher was available to assist. Respondents were also asked to comment on the format and wording of the questionnaire. A few changes were made to the questionnaire after a pilot study. Some of the changes were related to questionnaire's terminology and repeated items. A questionnaire was needed to be tested in order to ensure that all items are clear and understandable. This happened before the main study was conducted. The

results were showed that the respondents have a good understanding of the questions and concepts of the study posed to them. In addition to this the questionnaires were adapted from Management Sciences for Health to assess health facilities and from different researchers' used. However, some modification was made in order to suit the objectives of the study. These previous works used for the development of questionnaire were attached as Appendix F.

3.8. Instrument Reliability

In this study, a reliability test was performed in order to see whether the study was given similar results if the same study is repeated. To ensure reliability of this study, a Cronbach's Alpha was performed as a measure to see if the study repeats the same results if the same study is performed again. The reliability of the instruments & data was established following a pre-test procedure of the instruments before their use with actual research respondents by Cronbach's Alpha.

Cronbach's Alpha	N of Items
.785	47

Total numbers of questions in the questionnaire were 55 testing variables and 8 items related to demographic variables, hence "N" of items in the above Cronbach's Alpha test is 47. From the analysis the Cronbach's alpha result found from the data collected from 53 respondents for Forty seven (47) questions, the overall Cronbac's alpha score is .785. The coefficient 0.7 is an acceptable reliability coefficient; since score of 0.785 is above the standard threshold level the questionnaire were reliable (Dawson, 2007).

3.8.1. Reliability Analysis of Questionnaires

To achieve reliability of the questionnaires, the Cronbach's alpha for all questions (Items) under dimension of the study objectives was calculated. The values of the reliability analysis were listed on the following Table 3.1.

Table 3.1: Reliability Statistics

No	Dimensions	Cronbach's Alpha	N of Items
1	Inventory Control Techniques	.718	11
2	Pharmaceutical Store Management Practice	.845	18
3	Use of technology in Inventory Control	.625	4
4	Challenges Confronting Management of Pharmaceutical Items	.802	9
5	Consequence of Poor Inventory Control	.766	5

Source: Own survey and SPSS output, June (2018)

3.9. Ethical Consideration

Ethical clearance were obtained from St. Mary's University School of Graduate Studies. Official letters of co-operation were written to who concern. In order to secure the consent of the research, the researcher had communicated the details and aims of the study. The researcher has stated to the participants that they have to participate in the research willingly. Moreover, the researcher ensured to the respondents not to disclose their names, personal information and the data obtained were treated with high confidentiality. Besides, informed the consent of the key respondents was obtained during data collection. There was the need to ensure that the study did not contravene the ethical issues. Hence, the research questions were framed such that inconvenience and embarrassment were not caused to the participants in the research.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter covers the results and discussions of the analyzed data that were obtained from the primary data which was collected using a semi-structured questionnaire, interview and physical observation. Data analysis was done in line with the objectives of the study which were: To identify inventory control techniques used in managing pharmaceuticals item, to assess pharmaceutical store management practice, to determine use of technology in inventory management, to determine challenges confronting management pharmaceutical items and to identify problems related to poor inventory management of pharmaceutical items at health facilities. The results are categorized and presented according to various pharmaceuticals inventory management issues dealt with-in this study.

A total of 60 questionnaires were distributed to 60 pharmacy professionals working in 30 hospitals. Out of these, 30 were head pharmacists and 30 were storekeepers. These groups of respondents were selected because they have relevant experience in pharmaceuticals item management at the health facilities. Finally, 53 questionnaires were returned which represents nearly 88.4% of the total sample size.

4.2 General Information

This section provides the demographic information of the respondents and the organizations with respect to their personal and general information.

4.2.1. Demographic Characteristics

Table 4.1: Socio-demographic Characteristics of Respondents

Socio-demographics	Socio-demographics Characteristics	Frequency	%
Sex	Male	20	37.7
	Female	33	62.3
Age	18-25 years	7	13.2
	26-35 years	36	67.9
	36-45 years	8	15.1
	46-55 years	2	3.8
Marital Status	Single	28	52.8
	Married	25	47.2
Education	Diploma	16	30.2
	Degree	33	62.3
	Master's degree	4	7.5
Profession	Pharmacy technician	16	30.2
	pharmacist	36	67.9
	Pharmacist and L&SCM	1	1.9
Years in current position	0-1 years	2	3.8
	1-3 years	17	32.1
	3-6 years	20	37.7
	6-10 years	12	22.6
	Above 10 years	2	3.8
Work experience	1-3 years	6	11.3
	3-6 years	23	43.4
	6-10 years	13	24.5
	Above 10 years	11	20.8
Duration of the hospital in operation	Less than 10 years	16	30.2
	Above 10 years	37	69.8

Source: Own survey and SPSS output, June (2018)

Gender Characteristics

The results as indicated in the Table 4.1 above show that the size of males was 20 (37.7%) and females 33(62.3%). Majority of the respondents were females at 62.3% while males were 37.7%, though having both gender make the study complete.

Age in years

The respondents were asked to show their age in years. Accordingly, 7 (13.2%) were between ages 18-25 years; 36(67.9%) were between 26 to 35 years of age; 8(15.1%) were between ages36-45 and 2(3.8%) were between 46 to 55 years of age. Therefore, we can say that the study have the feature of the new as well as the old generation.

Marital status

The respondents were asked to show their marital status. As Table 4.1 indicates, 28(52.8%) were single and 25(47.2%) were married.

Educational level

The respondents were asked to indicate their level of education to determine whether they understood pharmaceutical inventory management practices. From the findings in Table 4.1 above, 4 (7.5%) of the respondents were Master's degree holders, 33(62.3%) of the respondents were holders of first degree while 16 (30.2%) of the respondents had diploma. This is an indication that most of the respondents understood pharmaceuticals inventory management practices and that they were appropriate for responding to the study questions.

Profession

The respondents were asked to show their professions. The findings show that 16 (30.2%) were pharmacy technician, 36(67.9%) were pharmacist and 1 (1.9%) were pharmacist and logistics and supply chain manager (L&SCM). This indicates that all respondents are professionals in the field of pharmacy.

Years worked in the current position

The respondents were asked to indicate the period that they had served in the hospital. This was intended to determine whether the respondents had a relevant working experience in the field of pharmaceuticals item management in the hospitals.

The findings in the Table 4.1 above show that, 2 (3.8%) of the respondents worked for a period above 10 years, 12(22.6%) of the respondents worked for a period between 6-10 years, 20

(37.7%) of the respondents worked for a period between 3-6 years, 17(32.1%) of the respondents worked for a period between 1-3 years while 2 (3.8%) of the respondents worked for a period of less than 1 years. This is an indication that most of the respondents who responded had a relevant experience in pharmaceuticals item management practices in both government and private hospitals in Addis Ababa.

Work experience

The respondents were asked to show their work experience. From the findings in table 4.1 above, it was found that 6 (11.3%) of the respondents were between 1 to 3 years experience, 23(43.4%) of the respondents were between 3 to 6 years experience, 13(24.5%) of the respondents were between 6 to 10 years experience and 11 (20.8%) of the respondents have experience of more than 10 years. This means that majority of those working in the facilities had experience and gained rich information. Therefore, they were appropriate for responding to the study questions.

4.2.2. Duration of Operation of the Organization

Furthermore, the study sought to determine the duration which the health facility had been in operation to find out whether it was long enough for the facility to have adequately used inventory management practices.

From the findings, as indicated in Table 4.1 above, 37(69.8%) of the respondents indicated that most hospitals had been in operation for a period of more than ten years while 16(30.2%) of the respondents indicated that the hospitals had been in operation for less than 10 years. From the findings, it can be concluded that most of hospitals in Addis Ababa had been in operation for a period of more than 10 years. This implies that most hospitals used inventory management practices for a long period time.

4.3 Result and Discussion on Inventory Management Practice for Pharmaceutical Items at Health Facilities in Addis Ababa.

4.3.1 Inventory Control Techniques Used by Hospitals

The study sought to determine the first objective of the study which was to identify inventory control techniques used in managing pharmaceutical items in selected health facilities at Addis Ababa. The respondents were asked to indicate the extent to which inventory control techniques was used. The findings are presented in the table 4.2 below.

Table 4.2: Descriptive Statistics for inventory control techniques

No	Items	N	Mean	Std. Deviation
1	The hospital has standard list of stock items	53	4.30	.87
2	There is essential medicine list to be kept always in the store	53	2.38	.81
3	The hospital has a policy or written procedure to control inventory	53	3.66	1.16
4	The hospital uses Established formula to determine facility resupply need	53	2.26	.88
5	The hospital has Optimized stock level (max, min, safety stock and reorder level)	53	2.26	.98
6	The Hospital is Effective in practicing ABC Analysis, VEN Analysis and EOQ model	53	1.47	.61
7	The hospital Uses VEN analysis to prioritize and ensure availability	53	2.43	1.15
8	The hospital Uses Bin card and Stock card to manage inventories	53	4.36	.79
9	The hospital is Effective in regularly updating bin and stock card	53	2.30	.89
10	The hospital conducts Physical inventory at least once a year	53	4.75	.62
11	Inventory records Reconcile at the end of physical count	53	4.21	.95
	Valid N (listwise)	53		
	Aggregate mean and Average standard deviation		3.13	0.89
Note: Values 1, 2, 3, 4 and 5 represent strongly disagree, disagree, neutral, agree and strongly agree, respectively.				
Where: Less than 2.8 = Disagree, 2.9-3.2 = Neutral, Above 3.2 = Agree				

Source: Own survey and SPSS output, June (2018)

As it can be seen from Table 4.2 above, the average mean and standard deviation of the total item of inventory control techniques represents 3.13 and 0.89 respectively, which shows that inventory control technique neither applied below nor above or neutral and standard deviation indicating that it is a small value thus respondents were agreeing to the same idea. However, having standard list of stock items, having policy or written procedure to control inventory, use of bin card and stock card to manage inventory, conducting physical inventory at least once and

reconciling and explaining differences at the end of physical count with mean score above 3.2, indicated that agreement to be applied at health facilities. On the other hand having essential medicine list, use of established formula to determine facility resupply need, maintaining optimum stock level (maximum, minimum, safety and reorder level), effective in practicing inventory management techniques such as ABC analysis, VEN analysis and Economic order quantity, use of VEN analysis to classify items in order to ensure their availability and effectiveness in record keeping and updating bin card and stock card regularly with mean score below 2.8, shows that disagreement to be used at health facilities.

As observed in this study all hospitals were applied for inventory management practices required maximum and minimum level of inventory but not effective in maintaining optimum stock level (maximum, minimum, safety and reorder level). The researcher couldn't see anything regarding to the maximum and minimum level of inventory items. Bin cards and stock cards are used to document the stock movement in the health facility but it was observed that no established formulas are used to calculate optimum stock level. In addition to that found in this study by interview, even if policy or written procedure to control inventory are available, majority of interviewee are not well trained of these procedure to follow. Majority of respondents are not aware of the scientific approach in controlling inventory and quantification of pharmaceutical products as well.

4.3.2 Pharmaceutical Store Management Practice at Hospitals

The second objective of the study was to assess pharmaceutical store management practice at selected health facilities in Addis Ababa. The respondents were asked to indicate their levels of agreement on which pharmaceutical store management related information to be applied. The findings are presented in the table 4.3 below.

Table 4.3: Descriptive Statistics for pharmaceutical store management practice

No	Items	N	Mean	Std. Deviation
1	Standard guide line for items storage and management	53	3.85	1.15
2	Products are stored in manner FEFO and general Mgt	53	4.55	.89
3	The hospital has large enough storage area	53	2.49	1.07
4	Only medicines are stored in the store	53	3.57	1.35
5	You check your stock status regularly	53	4.30	.77
6	Uses Expiry tracking chart to follow expiry date	53	2.47	1.01
7	The systems help to detect low inv, obsolete, expired and damaged	53	2.45	1.12
8	Obsolete, expired and damaged items removed from stock	53	4.49	.89
9	The ceiling is in a good condition where medicine is stored	53	4.02	1.26
10	Products are protected from direct sunlight	53	4.53	.91
11	The wall of the store room had no cracks and holes	53	4.19	.96
12	The store is free from any signs of pest infestation	53	4.17	1.17
13	The room is well ventilated, dry clean and no moisture	53	4.09	1.04
14	The room has sufficient shelves and wooden pallets	53	3.75	1.21
15	There are products stored directly in direct contact with the floor	53	2.49	1.32
16	There is sufficient refrigerator or cold room	53	4.36	.98
17	Uses thermometer to monitor and record the temperature	53	4.13	1.23
18	Storage area is secured and limited to authorized personnel	53	4.34	.81
	Valid N (listwise)	53		
	Aggregate mean and Average standard deviation		3.79	1.07
Note: Values 1, 2, 3, 4 and 5 represent strongly disagree, disagree, neutral, agree and strongly agree, respectively.				
Where: Less than 2.8 = Disagree, 2.9-3.2 = Neutral, Above 3.2 = Agree				

Source: Own survey and SPSS output, June (2018)

As it can be seen from Table 4.3 above, the average mean and standard deviation of the total items of pharmaceutical store management related information represents 3.79 and 1.07 respectively, shows their agreement that pharmaceutical store management practices are applied in large extent. The standard deviation indicating that it is a small value thus respondents were agreeing to the same idea. However, the hospital has storage area large enough to store all the stock of pharmaceutical items, The hospital uses expiry tracking chart to follow expiry date of Pharmaceutical products, and The hospital's medication inventory management system help to detect low inventory levels for ordering purposes and to alert about possible medication shortages, obsolete, expired and damaged, and There are pharmaceutical products that are currently stored in direct contact with the floor with mean score 2.49, 2.47, 2.45 and 2.49 respectively shows that disagreement of respondent.

As observed in this study all hospital pharmaceutical stores were applied for pharmaceutical store management practices such as products are stored and organized in first-to expire, first out (FEFO), separate and remove expired and damaged products from the stock, secure storage practice and maintaining pharmaceutical store room in good condition. But it was observed that absence of expiry tracking chart to follow expiry date of pharmaceutical products and scientific method of categorizing drugs for storage. Drugs are segregated as per pharmacological category. As compared to enough storage area to store all items it was observed most private hospitals don't have sufficient storage area than those government hospitals.

4.3.3 Use of Technology in Inventory Control at Hospitals

The third objective of the study was to assess the status of use of technology in inventory control at health facilities. The respondents were asked to indicate their levels of agreement on the status of use of technology in inventory control. The findings are presented in the table 4.4 below.

Table 4.4 shows the status of use of technology in inventory control at health facilities based on arithmetic mean and standard deviation.

Table 4.4: Status of use of technology in inventory control

N O	Questions	Frequency	Level of agreement					Total	Statistical Comparison	
			SD	D	N	A	SA		Mean	Std. Devi
1	The hospital uses Computer software for Inventory control	Count	-	1	2	10	40	53	4.68	0.64
		%	-	1.9	3.8	18.9	75.5	100		
2	The hospital Uses computer Software continuously and updated the data	Count	12	24	10	4	3	53	2.28	1.08
		%	22.6	45.3	18.9	7.5	5.7	100		
3	The hospital has Computerized all inventory management system to provide information regarding each stock movement	Count	-	3	2	13	35	53	4.51	0.82
		%	-	5.7	3.8	24.5	66.0	100		
4	The hospital uses automated technology such as RFID and Barcode	Count	24	17	6	5	1	53	1.91	1.06
		%	45.3	32.1	11.3	9.4	1.9	100		
Valid N (listwise)							53			
Aggregate mean and average standard deviation								3.34	0.90	
Note: Values 1, 2, 3, 4 and 5 represent strongly disagree, disagree, neutral, agree and strongly agree, respectively.										
Where: Less than 2.8 = Disagree, 2.9-3.2 = Neutral, Above 3.2 = Agree										

Source: Own survey and SPSS output, June (2018)

From the findings as indicated in table 4.4 above, the average mean and standard deviation of the total item of use of technology in inventory control represents 3.34 and 0.90 respectively, which shows that use of technology in inventory control at health facilities were neither applied below nor above or undecided (neutral) and standard deviation indicating that it is a small value thus respondents were agreeing to the same idea. However, use of computer software for inventory

control and computerized all inventory management systems that provide information regarding each type of stock movement with mean score 4.68 and 4.50 respectively showed that agree to be applied at health facilities. However, the hospital uses it (computer software) continuously and updated the data in the software and the hospital uses automated technology such as radio-frequency identification (RFID) and Barcode for efficient management of records and effectiveness in stock management with mean score 2.28 and 1.90 respectively showed that disagreement to be applied in health facilities.

As observed in this study all hospitals had computer in the store but it was observed that Computers are not utilized for stock management effectively except controlling list of stock items managed in the store. Most inventory management process such as calculating the consumption and quantification of the required quantity were done manually. There is absence of modern information technology application in the area of controlling inventory and quantification of drugs. In addition to that found in this study by interview, the respondents also mentioned that most of inventory management processes are manual and non value adding activities. There is lack of integrated and networked inventory management system. The inventory system is not supported by automated system. In general, there is lack of modern information technology application in the area.

4.3.4 Challenges Confronting Management Pharmaceutical Items at Hospitals

The study sought to determine the forth objective of the study which was to determine challenges confronting management of pharmaceutical items in the selected health facilities at Addis Ababa. The respondents were asked to indicate the extent to which challenges confront in management of pharmaceuticals items in health facilities. The findings are presented in the table 4.5 below

Table 4.5: Descriptive Statistics for Challenges of inventory management

N O	Questions	Frequency	Level of agreement					Total	Statistical Comparison	
			SD	D	N	A	SA		Mean	Std. Devi
1	Unavailability of Sufficient storage facility	Count	7	5	7	29	5	53	3.38	1.20
		%	13.2	9.4	13.2	54.7	9.4	100		
2	Lack of sufficient storage area	Count	2	5	6	24	16	53	3.89	1.07
		%	3.8	9.4	11.3	45.3	30.2	100		
3	Use of manual or lack of technology	Count	7	11	7	22	6	53	3.17	1.27
		%	13.2	20.8	13.2	41.5	11.3	100		
4	Poor warehouse and week inventory control technique	Count	4	4	7	27	11	53	3.70	1.12
		%	7.5	7.5	13.2	50.9	20.8	100		
5	Lack of proper training of inventory management	Count	3	5	5	27	13	53	3.79	1.10
		%	5.7	9.4	9.4	50.9	24.5	100		
6	Poor procurement practice	Count	10	4	10	23	6	53	3.21	1.31
		%	18.9	7.5	18.9	43.4	11.3	100		
7	Lack of commitment and support by top management	Count	3	2	9	23	16	53	3.89	1.07
		%	5.7	3.8	17.0	43.4	30.2	100		
8	Inadequate availability of health commodities	Count	3	4	8	24	14	53	3.79	1.10
		%	5.7	7.5	15.1	45.3	36.4	100		
9	An insufficient fund for procurement	Count	4	11	9	17	12	53	3.42	1.26
		%	7.5	20.8	17.0	32.1	22.6	100		
Valid N (listwise)							53			
Aggregate mean, average standard deviation and std. Error								3.58	1.15	
Note: Values 1, 2, 3, 4 and 5 represent strongly disagree, disagree, neutral, agree and strongly agree, respectively.										
Where: Less than 2.8 = Disagree, 2.9-3.2 = Neutral, Above 3.2 = Agree										

Source: Own survey and SPSS output, June (2018)

From the findings, as it can be seen from Table 4.5 above, majority of respondents showed that their agreement with most of the items used to determine the challenges of inventory management practices. It could be seen that most of the responses were more than 3.2 signifying agreement to those items that the researcher used to determine the challenges of inventory management practices at the hospitals. The average mean and standard deviation of the total item of challenges of inventory management represents 3.58 and 1.15 respectively. The standard deviation of all variables implies that there is high variation in the responses. However, in terms of Use of manual inventory management system/Lack of technology and Poor procurement practices with mean score 3.17 and 3.2 respectively showed that undecided (neutral) to be a challenge in the facilities.

As observed in this study almost all hospitals face a challenge or problems while managing pharmaceutical items. It was observed that lack of sufficient storage area, poor warehouse management and weak inventory control techniques, lack of proper training of inventory management and supply chain and lack of commitment and support by top management was the main challenge. In addition to that found in this study by interview, majority of interviewee revealed that Pharmacist and store keeper mainly involved in inventory control and store management are poorly trained on inventory management and supply chain management as well as poor knowledge and awareness on most commonly used scientific pharmaceutical inventory control techniques such as ABC analysis, VEN analysis and Economic order quantity.

4.3.5 Consequences of Poor Inventory Control at Hospitals

As a final objective, the researcher sought to determine the consequence of poor inventory management in health facilities at Addis Ababa. The respondents were asked to indicate the extent to which consequence resulted due to poor inventory management. The results are presented in the table 4.6 below:

Table 4.6: Descriptive Statistics for consequence of poor inventory control

N O	Questions	Frequency	Level of agreement					Total	Statistical Comparison	
			SD	D	N	A	SA		Mean	Std. Devi
1	There are overstocked inventories at the facility	Count	6	5	13	21	8	53	3.38	1.20
		%	11.3	9.4	24.5	39.6	15.1			
2	There are under stocked inventories at the facility	Count	-	5	8	28	12	53	3.89	0.87
		%	-	9.4	15.1	52.8	22.6			
3	There are expired inventories at the facility	Count	1	1	4	33	14	53	4.09	0.77
		%	1.9	1.9	7.5	62.3	26.4			
4	Stock outs of essential medicines is regular situation at the facility	Count	3	5	6	25	14	53	3.79	1.12
		%	5.7	9.4	11.3	47.2	26.4			
5	The hospital regularly places of emergency order as a consequence of stock out	Count	-	9	12	24	8	53	3.58	0.95
		%	-	17.0	22.6	45.3	15.1			
Valid N (listwise)							53			
Aggregate mean, average standard deviation and std. Error								3.75	0.98	
Note: Values 1, 2, 3, 4 and 5 represent strongly disagree, disagree, neutral, agree and strongly agree, respectively.										
Where: Less than 2.8 = Disagree, 2.9-3.2 = Neutral, Above 3.2 = Agree										

Source: Own survey and SPSS output, June (2018)

From the above findings in Table 4.6 the results show that, the average mean and standard deviation of the total item of consequence of poor inventory control represents 3.74 and 1.03 respectively, this shows majority of respondents are agreed with most of the items used to determine the consequence as a result of poor inventory control. The standard deviation indicating that it is a small value thus respondents were agreeing to the same idea. Generally, overstocking, under stocking, expiration, stock outs of essential medicine and placing emergency order as a consequence of stock out which increases the ordering costs with mean scores 3.38, 3.89, 4.09, 3.79 and 3.58 respectively are the main consequence that results due to poor inventory control at hospitals.

As observed in the study all hospitals were observed with overstocked, under stocked and expired inventories during the field observation. The main reasons why they run out of stock and over stocked were single supplier and push system of PFSA respectively in addition to over all unavailability of medicine in the country especially for government hospitals, but most of the respondents were agreed on all of this consequence was resulted due to poor inventory control system of the facilities which is in turn that affect overall profitability of the facility due to wastage of the limited resources.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

The final part of this research paper provides summary of the findings of the study, conclusions and recommendations for effective and efficient pharmaceutical inventory management in health facilities which were drawn from the findings and discussions of the data collected by questionnaires, interview, and physical observation. The chapter is structured as follows: Summary, conclusion, recommendations and suggestions for further research

5.2. Summary of Findings

The purpose of this study was to assess the inventory management practices for pharmaceuticals items in selected health facilities found in Addis Ababa. The study was guided by the following research questions: What inventory management practices are used in managing pharmaceutical items in selected facilities, What pharmaceutical store management practices are applied, What are the specific challenges confronting management of pharmaceutical items in selected health facilities, and what are the consequence of poor inventory management of pharmaceutical items. Descriptive statistics was used to answers the research questions posed. The sampling techniques used for this study were probability and non-probability sampling techniques. Specifically simple random sampling was used to select 30 hospitals as a population and purposive sampling techniques to select head pharmacist and storekeepers. Therefore, the sample size for the study was 60 respondents. A total of 60 questionnaires were distributed to 60 pharmacy professionals working in 30 hospitals. Finally, 53 questionnaires were returned which represents nearly 88.4% of the total sample size.

The following summaries of major findings of the study are presented based on the analysis and interpretation of collected data.

Inventory control techniques: From questionnaire, physical observation, as well as interview results majority of hospitals are not effective in practicing the major inventory control techniques such as having essential medicine list, using established formula to determine facility resupply, establishing optimized stock level techniques such as Maximum, Minimum, safety stock and

reorder level, ABC analysis and VEN analysis. Instead, they practice a traditional way of inventory management system. Even though most hospitals had standard list of stock, policy or written procedure, conducts physical inventory and used bin card and stock card to control inventories they are not effective in record keeping and updating bin cards and stock cards regularly.

Pharmaceutical store management practice in hospitals: from questionnaire and physical observation the study of pharmaceutical store management practice in health facilities show all hospitals are effective in managing pharmaceutical store. They had standard guideline for pharmaceutical items storage, stored and organized products in a manner first to expire, first out (FEFO) and maintain good storage condition. Though most of respondents agreed that they don't use expiry tracking chart to follow expiry of pharmaceutical products, their inventory management system do not alert about possible medication shortages, obsolete, expired and damaged and do not have large enough area to store all medicines that results to store medicine on the floor due to insufficient storage space.

Use of technology in inventory control: from questionnaire, interview and physical observation the study on the use of technology in inventory control show that all hospital use computer, but not effective in utilization of controlling inventory and quantification of drugs. Respondents also agreed on that do not use automated technology such as radio-frequency identification (RFID) and barcode for effective management of records and effectiveness in stock management

Challenges or problems confronting management of pharmaceutical items: The study summarized that challenges or problems confronting while managing pharmaceuticals items observed in health facilities was shown by an overall mean 3.58. The main challenges facing both private and government hospitals while managing pharmaceutical items were as follows: Lack of sufficient storage area to store all products, poor warehouse management and weak inventory control techniques, lack of proper training of inventory management and supply chain, lack of commitment and support by top management, and Inadequate availability of health commodities. Unavailability of sufficient storage facilities in the hospital, use of manual inventory management system/lack of technology, Poor procurement practices and an insufficient fund for procurements with mean score 3.38, 3.17, 3.20 and 3.41, respectively were undecided (neutral) by respondents to be a challenge or problem.

Consequences of poor inventory control in health facilities: the last objective of the study was determining consequence resulted from poor inventory control in health facilities. The study revealed that consequence of poor inventory control by an overall mean 3.74. Under stock of medicine, expiration of medicine, stock out of essential medicine regularly and placing emergency order frequently with mean score 3.89, 4.09, 3.79 and 3.58 respectively were the main consequence that resulted due to poor inventory control. Respondents also agreed on that poor inventory management related to out of stock, over stock and expiration of medicine and affects overall profitability of the facility with mean score 4.13 and 3.62 respectively. Respondents show that their level of agreements on undecided(neutral) for currently over stocks inventories and quality of services affected by unavailability of essential medicine at the facility with mean score 3.38 and 3.41 respectively as a consequence of poor inventory control.

5.3. Conclusions

Inventory Management is the core of pharmaceutical supply management. Inadequate controls of inventories can result in both under and overstocking of items. An effective inventory management system plays an important role in reducing the associated costs across different stages of the supply chain system which include selection, quantification, procurement, storage, distribution and use.

Effective pharmaceutical items management has a great impact on the efficiency and effectiveness of the service delivery of hospitals. However the awareness, knowledge, practice and implementation of inventory control techniques were exist on a much lower scale in the facilities. The research findings show that overall inventory management practice is not satisfactory and effective.

Finally, from this study it can be concluded that inventory management practices were poor. Most of the hospitals do not use scientific method that can be used in controlling inventory and those for quantifying needed pharmaceutical products. On the other hand sufficient storage area to store all the needed products, lack of technology in inventory control and lack of proper training of inventory management and supply chain is the main challenge that almost all facility faced. In general, over stock of medicine which can lead to expiration and spoilage of medicine and out of stock of medicine which might have lead to interruption of quality health care delivery and affect overall profitability is a result of poor inventory control as a consequence.

5.4. Recommendations

Based on the findings of this study, the following recommendations were suggested by the researcher to help improve pharmaceutical inventory management practice and quality healthcare delivery in health facilities.

1. The study recommends that applying the scientific inventory management concepts along with the practices such as having essential medicine list, use of established formula to determine facility resupply need, established optimized stock level (i.e. maximum, minimum, safety stock and reorder level) and use of inventory management techniques such as ABC analysis, VEN analysis and Economic order quantity in order to classify items and ensure their availability ensures inventory control efficiency and effectiveness in health care delivery.
2. The study recommends that all pharmaceutical stores should adopt good storage practices and use of expiry tracking chart to prevent wastage of medication due to expiration. The researcher further recommends that all facilities must use the first- expiry, first out (FEFO) method in the storage and issuance of pharmaceutical products. The FEFO method is considered the best because, a medicine can be received which may have the expiry date nearer than that same type of medicine that is already stocked.
3. The study recommends that all facilities to computerize all inventory management system to provide information regarding each stock movement and for better controlling inventory and quantification of drugs instead of manual methods.
4. The study also recommends that top management or stake holders should provide support for personnel that directly related to stock and inventory management practice by providing proper training of inventory management and proper storage facilities. It is also recommended that the government should allocates more funds to public hospitals to invest in modern information technologies and training in inventory control as these reduced associated cost related to wastage and improve quality health care delivery.
5. Finally, the study recommends that facilities should be effective and efficient in practicing and keeping records to improve pharmaceutical inventory management practice. Using stock cards and updating bin cards should be regularly used for all products to track the level of stock and prevent stock outs of essential medicines, overstocking and expiration of medicine.

The private hospitals also should make sure that there is an effective inventory management system in their facilities as this will bring much benefit to them.

5.5. Suggestions for Further Research

A similar study should be conducted in the other counties across the country other than Addis Ababa to know the extent of implementation of inventory management practices. This will create a platform to make a comparison on the findings upon which reliable conclusion can be made.

Moreover, it would be interesting to investigate the extent of implementation of inventory management practices and their influence in performance of health care delivery and effect on profitability, as well as the use of integrated information systems in the inventory management of various inventories in the health facilities.

REFERENCES

- Abate, S.M. 2013. Assessment of Pharmaceuticals Inventory Management Systems for the Years (2008,2009,2010) Using ABC-VEN Matrix Analysis at Addis Ababa University College of Health Sciences Tikur Anbessa (Black Lion) Specialized Hospital, 2012. *Advances in Pharmacoepidemiology & Drug Safety*, 2(3), 137. doi:10.4172/2167-1052.1000137
- Adzimah, E. D., Irene A, Meshach A and Agyemang D. 2014. An assessment of health commodities management practice in health care delivery: a supply chain perspective. The case of selected hospitals in Ashanti region Ghana. *European Journal of Business and Social Sciences*, 3 (8), 78-103.
- Ali, A.K. 2011. Inventory management in pharmacy practice: A review of literature. *Journal of pharmacy practice*, 2 (4), 152-156.
- Awaya, T., Ko-ichi O, Takehiro Y, Kuniko Y, Toshiyuki M, Yu-ichi I, Yoshikazu T, Nobumasa H and Kazuo M. 2005. Automation in drug inventory management saves personal time and budget. *The pharmaceutical society of Japan*, 125(5), 427-432.
- Azeb S. 2017. *Assessment of health commodities inventory management practices and challenges: The case of Zewditu memorial hospital, Addis Ababa, Ethiopia*. Unpublished MBA thesis, Addis Ababa University.
- Chhajad, D. Timoty J. 2008. *Building Intuition; Insights from Basic Operations Management Models and Principles*. New York; Springer Science+Business Media, LLC.
- Coustasse, A., Shane T, and Chelsea S. 2013. Impact of Radio-Frequency Identification (RFID) Technologies on the Hospital Supply Chain: A Literature Review. *Perspectives in Health Information Management Fall*. 2013.
- Dawson C Dr. (2007). *A Practical Guide to Research Methods*. : Spring Hill House, UK.
- Dwivedil, S., Arun K, and Preeti K. 2012. Inventory management: A tool of identifying items that need greater attention for control. *The pharma innovation journal*, 1 (7), 125-128.

- Federal Democratic Republic of Ethiopia Ministry of Health (FMOH). Health Sector Development Programme IV 2010/11 – 2014/15
- Fentie, M., Addisie F, Firehiwot M, Habtam O, Sintayehu B, Yeheyes S, Tadele A, Tadesse M and Jeevanandham S. 2015. Availability of Essential Medicines and Inventory Management Practice in Primary Public Health Facilities of Gondar Town, North West Ethiopia. *Journal of PharmaSciTech*, 4 (2), 54-56.
- Food, Medicine and Healthcare Administration and Control authority of Ethiopia (EFMHACA). *National Essential Medicine List*, Fifth Edition. Addis Ababa January, 2015
- Food, Medicine and Healthcare Administration and Control authority of Ethiopia (EFMHACA). *Guidelines for good storage practice*, First edition. Addis Ababa, Ethiopia. September, 2015.
- Fredrick, M.W. and Willy M. Factors influencing frequent stock outs of essential medicines in public health facilities in Kisii County, Kenya. *IOSR Journal of Business and Management (IOSR-JBM)*, 18 (10), 63-75.
- Goren, H.G., Ozage D. 2017. An Excel-Based Inventory Control System Based on ABC and VED Analyses for Pharmacy: A Case Study. *Galore International Journal of Health Sciences and Research*. 2 (1), 11-17.
- Hawkins, S., Tsige G, and Erwin L. 2009. RPM+/SPS and SCMS in Ethiopia: an evaluation. The global health technical assistance project. Available at www.ghtechproject.com/resources.aspx.
- Iqbal, M. J., Mohammed I.G, and Parvez A.D. 2017. Medicines Management in Hospitals: A Supply Chain Perspective. *Journal of Systematic Reviews in Pharmacy*, 8(1), 80-85,
- Jabareen, Y. 2009. Building a conceptual Framework: philosophy, definition, and procedure. *International Journal of Qualitative Methods*, 8 (4), 49-62.
- Kagashe, Godeliver. A.B., Terevael N. 2012. Medicine stock out and inventory management problems in public hospitals in Tanzania: A case of Dareselam region hospitals. *International journal of pharmacy*, 2 (2) 252-259.

- Kant, S., Partha H, Arvind S and Ankita K. 2015. Inventory Management of Drugs at a Secondary Level Hospital Associated with Ballabgarh HDSS- An Experience from North India. *Journal of Young Pharmacists*, 7 (2), 113-117.
- Kassie, G.M. and Samson M. 2014. Assessment of pharmaceutical store management in woreda health office of west hareghe zone, Ethiopia. *International research journal of pharmacy*, 5(8), 642-645.
- Kaurana, S., Neelam C, and Vinod K. 2013. Inventory control techniques in medical stores of a tertiary care neuropsychiatry hospital in Delhi. *Journal of health sciences and research*, 5 (1), 8-13. Available at <http://dx.doi.org/10.4236/health.2013.51002>.
- Kokilam, M.B., Harish G.J, and Veena G. K. 2015. Assessment of Pharmaceutical Store and Inventory Management in Rural Public Health Facilities—A study with reference to Udupi District, Karnataka. *Journal of Pharmaceutical Methods*, 6 (2), 53-59.
- Mahyadin, F.A., Rohaizah S, Mohd N.M.A and Rushami Z.Y. 2015. The Influence of Inventory Management Practices towards Inventory Management Performance in Malaysian Public Hospitals. *International Academic Research Journal of Business and Technology* 1(2), 142-148.
- Malhotra, N. 2015. Inventory Control Techniques for Materials Management of Dental Stores in Clinical Dental Set-up's: A Review Materials Management of Dental Stores in Clinical Dental Settings. *SEGi Review*, 9, 47-60.
- Management Science for health, 2010. *Health System in Action: An Handbook for leaders and managers*. Cambridge, MA. Available online at <http://www.msh.org/resources/health-systems-in-action-an-e-handbook-for-leaders-and-managers>
- Management science for health, 2012. *MDS-3: Managing Access to Medicines and Health Technologies*, Arlington, VA, Management Science for Health. Available at <http://www.msh.org/resources/mds-3-managing-access-to-medicines-and-health-technologies>.

- Migbaru, S., Mahlet Y, Berhanemeskel W, and Workineh S. 2016. ABC-VEN matrix analysis of pharmaceutical inventory management in Tikur Anbessa Specialized Hospital for the years 2009 to 2013, Addis Ababa, Ethiopia. *Indian Journal of Basic and Applied Medical Research*, 5 (2), 734-743.
- Ministry of health government of Uganda; the division of pharmacy service. *Management of medicine and health supplies manual*. Uganda March, 2012.
- Montoni, C., Laksana C, and Jirapornchai S. 2014. Purchasing and inventory management by pharmacist of a private hospital in northeast of Thailand. *International Journal of Pharmacy and Pharmaceutical Sciences*, 6 (5), 401-405.
- Mugenda O, Mugenda A (2003). *Research methods quantitative and qualitative Approaches*. Nairobi Acts press.
- National drug policy (NDP) of the transitional government of Ethiopia. Nov. 1993.
- National Health policy (NDP) of the transitional government of Ethiopia. Nov. 1993.
- Nijoroge, M. W. 2015. *Inventory management practices and performance of public hospitals in Kenya*. Unpublished MBA thesis, University of Nirobi.
- Oballah, D., Esther W, and Elizabeth W W. 2015. Effect of inventory management practice on organization performance in public health institutions in Kenya: A case study of Kenyatta National hospital. *International journal of education and research*, 3 (3), 703-714.
- Ofori-Ayeh, K. E. 2016. The Impact of Inventory Management Practices in Health Service Delivery: A Look at the New Edubiase Government Hospital. *Dama International Journal of Researchers (DIJR)*, 1 (12), 1-38.
- Osiei MSEI MENSAH Esther, (2015), *the effect of inventory management practices on service delivery at ST Martin's hospital, Agroyesum, Amansie west*. Unpublished MBA thesis, KNUST School of Business, Ghana.
- Ozcan, Y.A. 2005. *Quantitative methods in health care management: Techniques and application*. San Francisco; Jossey-Bass A Wiley Imprint.

- Pagare, M., Santosh K.Y, Rupesh M, Mahendra P, Pankaj P and Dinesh B. 2016. A study on inventory control and management techniques. *International journal of science technology and management*, 5 (1), 461-468.
- Rachmania, I. N., and Mursyid H. B. 2013. Pharmaceutical Inventory Management Issues in Hospital Supply Chains. *Journal of Management*, 3 (1), 1-5.
- Romero, A. 2013. World Congress on Engineering and Computer Science. *Managing Medicines in the Hospital Pharmacy: Logistics Inefficiencies*, San Francisco, USA, 23-25 October 2013.
- Santhi, G. and Karthikeyan K. 2016. Recent review article on Pharmaceutical Inventory Models. *International Journal of PharmTech Research*, 9 (5), 435-443.
- Shewarega, Abiy, Paul Dowling, Welelaw Necho, Sami Tewfik, and Yared Yiegezu (PFSA). 2015. *Ethiopia: National Survey of the Integrated Pharmaceutical Logistics System*. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 4, and Pharmaceuticals Fund and Supply Agency (PFSA).
- Singh, S., Anil K.G, Latika and Mahesh D. 2015. ABC and VED Analysis of the Pharmacy Store of a Tertiary Care, Academic Institute of the Northern India to Identify the Categories of Drugs Needing Strict Management Control. *Journal of Young Pharmacists*, 7 (2), 76-80.
- Singh, V., Harwinder S, and Sukhjeet S. 2015. Drug inventory management of a pharmacy store by combined Abc-Ved analysis. *International journal on mechanical engineering and robotics (IJMER)*, 3 (5), 19-22.
- Tayob, S. 2012. Challenges in the management of drug supply in public health care centers in the Sedibeng District, Gauteng province. Unpublished MBA thesis, University of Limpopo.
- USAID | DELIVER PROJECT, Task Order 1. 2011. Guide to Conducting Supply Chain Assessments Using the LSAT and LIAT. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.
- USAID | DELIVER PROJECT, Task Order 1. 2011. *The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities*. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.

Wandalkar, P., Pandit P. T, and Zite A. R. 2013. ABC and VED analysis of the drug store of a tertiary care teaching hospital. *Indian Journal of Basic and Applied Medical Research*, 3 (1), 126-131.

Waters, D. 2003. *Inventory Control and Management*. England; John Wiley & Sons Ltd.

Wisayawickrama, K and Karolyon W. Evaluating hospital pharmacy inventory management and revenue cycle process. White paper guidance for healthcare internal auditors. Deloitte development llc, 2015.

APPENDIX A: Individual Consent Form

Dear respected Participant,

My name is....., I am a graduate student in the department of General MBA at St, Mary’s University. I am working on the thesis entitled “Inventory Management Practices for Pharmaceutical items at selected health facilities in Addis Ababa. The study will benefit the facility by determining the main problems occurring in managing pharmaceutical items and providing the optimum solution. To this end, that I am engaging myself on data collection process and your organization is one of the selected health facilities for the above mentioned study. Now I am requesting you your kind voluntariness on providing information according to the developed questionnaires designed for this purpose. The information you provide will be treated with a very high degree of confidentiality and will not be disclosed to anyone. It will only be used for research purposes. Thank you, the questions are not such a difficult to answer it contains some personal details, The Inventory control system related activities, Management of pharmaceutical store, major problems and challenges confronting management of pharmaceutical items at your facility and the consequences due to poor inventory management. I hereby assure you that your name will not be recorded in the formats and never be requested in connection with any of the information you are going to provide for me. Your name will be removed from the questionnaire, and only a code will be used to connect your name and your answers without identifying who you are; however providing honesty response for the questions will contribute generating quality and factual outcome for the study which enables me to come up with pertinent intervention point at the end.

Date.....

Are you willing to participate in the study? a) Yes [] b) No []

Name of Facility..... Facility phone no.....

Part Two: Pharmaceutical items management related Information

Section A-Inventory control system

Please indicate the extent to which you agree with the following statements on the inventory control techniques used by the hospital using (√) in the column. The scale below will be applicable: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree

No	Statement	Level of Agreement				
		1	2	3	4	5
1	The hospital has a standard list of stock items managed in your institution store.	[]	[]	[]	[]	[]
2	There is essential medicine list at your facility that must be kept always in the store.	[]	[]	[]	[]	[]
3	The hospital has a policy or written procedure to control inventory.	[]	[]	[]	[]	[]
4	The hospital always uses established formula to determine facility resupply need.	[]	[]	[]	[]	[]
5	The hospital has established optimized stock level techniques that need to be kept in the store (i.e. Maximum, Minimum, Safety stock and Re-order levels).	[]	[]	[]	[]	[]
6	The hospital is effective in practicing inventory management techniques such as ABC analysis, VEN analysis and Economic Order Quantity)	[]	[]	[]	[]	[]
7	The hospital uses VEN (Vital, Essential& Non essential) analysis to classify items in order to ensure their availability.	[]	[]	[]	[]	[]
8	The hospital uses Bin card and Stock card to manage inventories.	[]	[]	[]	[]	[]
9	The hospital is effective in record keeping and bin cards and stock cards are regularly updated at the store.	[]	[]	[]	[]	[]
10	The hospital conducts physical inventory in the store at least once a year.	[]	[]	[]	[]	[]
11	Inventory records reconciled and differences explained at the end of physical count.	[]	[]	[]	[]	[]

12. Do you have any additional point to mention regarding the hospital inventory management practices?

.....

Section B – Pharmaceutical store management related information.

Please indicate the extent to which you agree with the following statements on the management of pharmaceutical store used by the hospital using (√) in the column. The scale below will be applicable: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree.

No	Statement	Level of Agreement				
		1	2	3	4	5
1	The hospital has standard guide line for Pharmaceutical items storage and management.	[]	[]	[]	[]	[]
2	Products are stored and organized in a manner accessible for first-to-expire, first-out counting (FEFO) and general management.	[]	[]	[]	[]	[]
3	The hospital has storage area large enough to store all the stock of pharmaceutical items.	[]	[]	[]	[]	[]
4	Only medicines are stored in the store.	[]	[]	[]	[]	[]
5	In your institution you check your stock status regularly.	[]	[]	[]	[]	[]
6	The hospital uses Expiry tracking chart to follow expiry date of Pharmaceutical products.	[]	[]	[]	[]	[]
7	The hospital's medication inventory management system help to detect low inventory levels for ordering purposes and to alert about possible medication shortages, Obsolete, Expired and damaged.	[]	[]	[]	[]	[]
8	Obsolete, expired, or damaged inventories are properly identified, Separated and removed from stock.	[]	[]	[]	[]	[]
9	The ceiling is in a good condition in the area where medicine is stored.	[]	[]	[]	[]	[]
10	Pharmaceutical products are protected from direct sunlight in the store.	[]	[]	[]	[]	[]
11	The walls of the medicine store room had no cracks and holes.	[]	[]	[]	[]	[]
12	The pharmaceutical store room is free from any signs of pest infestation (i.e. cockroaches, rats)	[]	[]	[]	[]	[]

13	The pharmaceutical store room is well ventilated, dry, clean, and doesn't have moisture.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	The pharmaceutical store room has sufficient shelves and wooden pallets.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	There are pharmaceutical products that currently stored in direct contact with the floor.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	The facility has sufficient refrigerator/cold room to Store products that require cold storage in appropriate temperature.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	The hospital maintains the store at a constant temperature and use a wall thermometer to monitor and record the temperature at least daily.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	Storage area is secured with a lock and key, but is accessible during normal working hours; access is limited to authorized personnel.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section C – Use of Technology in Inventory Control.

Please indicate the extent to which you agree with the following statements on the use of technology in inventory control practice at your facility using (√) in the column. The scale below will be applicable: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree.

No	Statement	Level of Agreement				
		1	2	3	4	5
1	The hospital uses computer software for inventory control.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	The hospital uses it (computer software) continuously and updated the data in the software.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	The hospital has computerized all inventory management systems that provide information regarding each type of stock movement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	The hospital uses automated technology such as radio-frequency identification (RFID) and Barcode for efficient management of records and effectiveness in stock management.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section D – Challenges Confronting Management of Pharmaceutical Items at Health Facilities.

Please indicate the extent to which you agree with the following statements on the challenges or problems confronting management of pharmaceutical items at your facility using (√) in the column. The scale below will be applicable: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree.

No	Statement	Level of Agreement				
		1	2	3	4	5
1	Unavailability of sufficient storage facilities in the hospital is the challenge in managing pharmaceutical items at the facility.	[]	[]	[]	[]	[]
2	Lack of sufficient storage area to store all products is the challenge in managing pharmaceutical items at the hospital.	[]	[]	[]	[]	[]
3	Use of manual inventory management system/Lack of technology is the challenge in managing pharmaceutical items at the hospital.	[]	[]	[]	[]	[]
4	Poor warehouse management and weak inventory control techniques are a challenge in managing pharmaceutical items at the hospital.	[]	[]	[]	[]	[]
5	Lack of proper training of inventory management and supply chain is the challenge in managing pharmaceutical items at the hospital.	[]	[]	[]	[]	[]
6	Poor procurement practices are the challenge in managing pharmaceutical items at the hospital.	[]	[]	[]	[]	[]
7	Lack of commitment and support by top management is a challenge in managing pharmaceutical items at the hospital.	[]	[]	[]	[]	[]
8	Inadequate availability of health commodities are the challenge in managing pharmaceutical items at the hospital.	[]	[]	[]	[]	[]
9	An insufficient fund for procurement is a challenge in managing pharmaceutical items at the hospital.	[]	[]	[]	[]	[]

10. Do you have any additional point to mention regarding the challenge in managing pharmaceutical items at your institution?

.....

Section E – Consequences of Poor Inventory Control of Pharmaceutical Items at Health Facilities

Please indicate the extent to which you agree with the following statements on the consequences of poor inventory management of pharmaceutical items at your facility using (√) in the column.. The scale below will be applicable: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree.

No	Statement	Level of Agreement				
		1	2	3	4	5
1	There are inventories (pharmaceutical items) which are overstocked at the facility.	[]	[]	[]	[]	[]
2	There are inventories (pharmaceutical items) which are under stocked at the facility.	[]	[]	[]	[]	[]
3	There are expired inventories (Pharmaceutical items) in the facility over the last 12 months.	[]	[]	[]	[]	[]
4	The Stock out of essential medicine is a regular situation in the facility.	[]	[]	[]	[]	[]
5	The hospital regularly places emergency order as a consequence of stock out.	[]	[]	[]	[]	[]

6. List three main reasons why you experience Medication stock out?

1.
2.
3.

7. List three main reasons why you experience Medication Expired

1.
2.
3.

8. List three main reasons why you experience medication overstocked

1.
2.
3.

Thank You

APPENDIX C: Researcher observation check list

Name of Facility..... Date.....

Please tick (√) appropriate box

No	Statement	Yes	NO
1	Is there procedure manual for inventory management available in the health facilities?	<input type="checkbox"/>	<input type="checkbox"/>
2	Is there a standard inventory control system at health facilities?	<input type="checkbox"/>	<input type="checkbox"/>
3	Are minimum and/or maximum stock levels calculated for each item in the health facilities?	<input type="checkbox"/>	<input type="checkbox"/>
4	ABC and/or VEN analysis has been performed in the facilities for prioritizing procurement according to public health value and monetary value?	<input type="checkbox"/>	<input type="checkbox"/>
5	Products are stored and organized in a manner accessible for first-to-expire, first-out (FEFO) counting and general management	<input type="checkbox"/>	<input type="checkbox"/>
6	Has the staff responsible for ordering and storing pharmaceutical products been formally trained in inventory management?	<input type="checkbox"/>	<input type="checkbox"/>
7	The facility makes it a practice to separate damaged and/or expired products from usable products and removes them from inventory.	<input type="checkbox"/>	<input type="checkbox"/>
8	Is only medicine stored in pharmaceutical store at the facility?	<input type="checkbox"/>	<input type="checkbox"/>
9	Does each item in the store have a bin card and stock card?	<input type="checkbox"/>	<input type="checkbox"/>
10	Is all information in the bin card and stock card up-to-date?	<input type="checkbox"/>	<input type="checkbox"/>
11	Do the calculated quantities on the stock cards generally agree with the physical inventory quantities?	<input type="checkbox"/>	<input type="checkbox"/>
12	Is there an overstocked medicine currently in stock?	<input type="checkbox"/>	<input type="checkbox"/>
13	Is there under stocked medicines currently in the stock?	<input type="checkbox"/>	<input type="checkbox"/>
14	Is there an expired medicine currently in the stock?	<input type="checkbox"/>	<input type="checkbox"/>

15	Is there stock out medicines currently in the stock?	<input type="checkbox"/>	<input type="checkbox"/>
16	The hospital uses automatic stock tracking.	<input type="checkbox"/>	<input type="checkbox"/>
17	The store structure is in good condition; there is no a crack, holes, or signs of water damage.	<input type="checkbox"/>	<input type="checkbox"/>
18	The current space and organization is sufficient for existing products and reasonable expansion.	<input type="checkbox"/>	<input type="checkbox"/>
19	Is there any medicine stored in direct contact with the floor?	<input type="checkbox"/>	<input type="checkbox"/>
20	Is the store room dry, clean and well ventilated?	<input type="checkbox"/>	<input type="checkbox"/>
21	Is medicines storage areas well-lit and temperature controlled?	<input type="checkbox"/>	<input type="checkbox"/>
22	Is medications, vaccines, and products that require refrigeration or freezing stored at the appropriate temperatures?	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX D: Interview questions

1. Do you think that the hospital is effective in practicing the inventory management techniques such ABC analysis, VEN analysis and Economic Order Quantity to ensure availability of essential medicines and to reduce inventory carrying and associated cost problems? If Yes, How and if No, why?
2. At your facility are you going to check your stock status regularly? If Yes, How often are you going to check your stock status?
3. At your facility do you store other things in medicine store? If yes, what else is stored in the medicine store?
4. What are the main problems that encounter in the existing inventory and warehouse management system at your facility?
5. Is there any client's complaint about poor healthcare service delivery which ultimately results due to poor pharmaceutical inventory management practice? If yes, what are the main consequence resulted due to poor inventory management?

APPENDIX E: List of Hospitals included in the studied

No	Private Sector Hospitals	No	Public sector Hospitals
1	Addis General Hospital	1	Army General Hospital
2	Addishiwot General Hospital	2	Balcha Hospital
3	Amin General Hospital	3	Gandi Memeorial Hospital
4	Bethel General Hospital	4	Minilic II Referral Hospital
5	Bethezatha General Hospital	5	Police General hospital
6	Genet General Hospital	6	Ras Desta General Hospital
7	Ethio-Tebib General Hospital	7	St. Paul Referral Hospital
8	Girum General Hospital	8	St. Peter General Hospital*
9	Haleluya general Hospital	9	Tirunesh Beijing General Hospital *
10	Hayat General Hospital	10	Yekatit 12 Referral Hospital
11	ICMC General Hospital		
12	Kadisco General Hospital		
13	Landmark General Hospital		
14	Legehar General Hospital		
15	MCM (Korea) General Hospital		
16	National General Hospital*		
17	St. Gebriel General Hospital		
18	St. Yared General Hospital		
19	Teklehimanot General Hospital		
20	Zenbaba General Hospital		
N.B: * Data not collected			

APPENDIX F: Reference for questionnaire

No	Research Title	Authors	Year of published
1	Managing access to Medicines and Health Technologies	Management science for Health (WHO)	2012
2	Inventory management practices and performance of public hospital in Kenya	Margaret W,Njoroge	2015
3	The effect of inventory management practices on service at St Martin's hospital, Agroyesum, A Mansie	Osiei msei M, Esther,	2015
4	Challenges in the Management of Drug Supply in Public health Care Centers in the Sedibeng district, Gauteng Province	SHAMIMA TAYOB	2012