COMPARATIVE STUDY ON INVENTORY MANAGEMENT PRACTICES AND PERFORMANCES AMONG HEALTH FACILITIES WITH AND WITHOUT AUDITABLE PHARMACY TRANSACTION AND SERVICE IMPLEMENTATION IN ADDIS ABABA, ETHIOPIA.

BY

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A Thesis Submitted to the Addis Ababa University School of Commerce in Partial Fulfillment of the Requirements for the Award of Master of Arts Degree in Logistics and Supply Chain Management

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Declaration

I, Betelhem Araya declare that this work entitled "***Comparative Study on Inventory Management Practice and Performances Among Health Facilities with and without Auditable Pharmacy Transaction and Service Implementation in Addis Ababa, Ethiopia***.", is the outcome of my own effort and study and that all sources of materials used for the study have been duly acknowledged. I have produced it independently except for the guidance and suggestion of the research advisor. This study has not been submitted for any degree in this University or any other University.

By: Betelhem Araya (B.Pharm)

Signature _____

Date _____

Certification

This is to certify that the study made by Betelhem Araya the topic entitled: *"**Comparative Study on Inventory Management Practice and Performances Among Health Facilities with and without Auditable Pharmacy Transaction and Service Implementation in Addis Ababa, Ethiopia.**"* is her original work and is suitable for submission for the award of Master of Art Degree in Logistics and Supply Chain Management.

Advisor: Shiferaw Mitiku (PhD)

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ADDIS ABABA UNIVERSITY

COLLEGEOF BUSINESS AND ECONOMICS

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DEPARTMENT OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

This is to approve that the study made by Betelhem Araya on the topic entitled: "Comparative Study on Inventory Management Practice and Performances Among Health Facilities with and without Auditable Pharmacy Transaction and Service Implementation in Addis Ababa, Ethiopia" submitted in partial fulfillment of the requirements of Master of Art in Logistics and Supply Chain Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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List of Acronyms and Abbreviations

ABC	Always Better Control
APTS	Auditable Pharmaceutical Transactions and Services
EHSTG	Ethiopian Hospital Services Transformation Guidelines
EOQ	Economic Order Quantity
EPSA	Ethiopian Pharmaceutical Supply Agency
FEFO	First Expire First Out.
FMOH	Federal Ministry of Health
HCs	Health Centers
HSDP	Health Sector Development Program
IFRR	Internal Facility Request and Resupply form
PFSA	Pharmaceuticals Fund and Supply Agency
RHB	Regional Health Bureau
RRF	Report and Requisition Form
SIAPS	Systems for Improved Access to Pharmaceuticals and Services
USAID	US Agency for International Development
VEN	Vital, Essential &Non-essential
WHO	World Health Organization

Abstract

Healthcare organizations need to efficiently use their available resources, improve their productivity, reduce response time, reduce operating costs, and provide high-quality services. The objective of the study was to examine the role of APTS implementation on inventory management performance of public health facilities in Addis Ababa. Mixed research approaches were employed. This study followed explanatory research design to compare and assess the inventory management performance. The sample size of health facilities was determined based on the LIAT, target population for this study were selected from 10 APTS and 10 non APTS implementing health centers and the unit of analysis included 100 pharmacists, who were working under the selected 20 health facilities. Data was collected through questioners; review of records, checklist observation, and from documented materials. The major findings from the study reveal that the inventory management practice of HCs implementing APTS were better than the HCs not implementing APTS on record keeping, stock levels, quality assurance, physical inventory status, ordering completeness, reporting accuracy & recording accuracy practices. The inventory management performance was evaluated using an independent t-test, regarding time, both HCs exhibit nearly the same mean value, but the study's findings on quality, finance, and productivity showed that HCs that implemented APTS had higher mean values than those that did not. The major issues related to quality related problems were, stock outs of medicine being regular situation in the health center, product theft and leakage not being controlled, and discrepancy between the stock balance recorded and actual inventory on hand. The two main problems with finance were the inability to handle orders for cost-effective resupply and failure to identify and monitor the value of missing or expired items. Factors affecting productivity were lack of tracking inventories turnover rate and ineffective use of the ABC/VEN analysis and EOQ to manage resources. The study recommended that the health centers need to implement APTS for regular physical inventory, for efficient utilization of medicines budgets, to create a facility-specific drug list, doing ABC/VEN analysis to find and reconcile the medications that are most required and inventories of products that have high & low turnover rate should be tracked to increase productivity.

Key words: Inventory management practice, Quality, Time, Finance, Productivity

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the study

The World Health Organization and the International Pharmaceutical Federation listed fundamental tasks for pharmacists, and managing resources (money, material, personnel, time, and information) is one of these roles that is essential to both individual and organizational success (Wiedenmayer *et al.,* 2006). Since pharmaceutical products are becoming more and more varied and expensive, inventory, which is the pharmacy industry's main current asset, is becoming more and more valuable (Desselle and David 2009). From a financial and operational perspective, efficient inventory management is essential in pharmacy practice. Effective inventory management reduces the cost of pharmaceutical items purchased and associated operational costs, which, from a financial perspective, boosts gross revenues and net profits. Cash flow will improve in addition to cost savings from purchasing and storing less expensive items. This aids in paying for running expenses and supplemental services. From an operational standpoint, an effective inventory management plan ensures that patient and consumer needs are addressed. (Carroll, 1998).

Pharmaceuticals are a vital, high-value input for health care systems that frequently have a significant impact on both the health of the person and the population. (Fidler and Msisha, 2008). Pharmaceutical systems are made up of all the elements that make up the larger health system, such as the people, resources, processes, and interactions between them, with the goal of ensuring timely and equitable access to pharmaceuticals that are safe, effective, and of high quality, as well as services that support their appropriate and cost-effective use to improve health outcomes (Hafner *et al.,* 2016).

Pharmaceutical inventory management aims to accomplish two key objectives. Firstly, assuring that patients have access to pharmaceuticals when they need them is the main purpose of inventory management. The second goal is minimizing medication expenditures. Medication costs can be reduced with proper stock management, including

using up prescriptions before they expire, and processing returns on a regular basis (Santhi and Karthikeyan, 2016).

Ethiopia's Ministry of Health created standardized inventory management solutions that are anticipated to be used by all public health facilities across the nation, whether they are run manually or using LMIS. The Internal Facility Request and Resupply Form (IFRR), the Stock Card, the Report and Requisition Form (RRF), and the Bin Card are among these. (FDRE/MOH, 2010)

The establishment of the Pharmaceuticals Fund and Supply Agency (PFSA) in Ethiopia under Proclamation No. 553/2007, which was based on the Pharmaceuticals Logistics Master Plan (PLMP), was intended to address issues with the pharmaceutical supply in healthcare facilities; however, the lack of a strong pharmaceutical inventory management culture prevented health facilities from accomplishing their objectives (PFSA and SIAPS, 2015). Several of the nation's health facilities often cite the pharmaceutical inventory control issue as a significant weakness in the supply chain's operation.

A system known as the Auditable Pharmaceutical Transactions and Services (APTS) was created on July 30, 2010, in response to problems with medicine transactions that arose during the deployment of the pharmacy chapter from the Ethiopian Hospital Services Transformation Guidelines (EHSTG) in the Debre Markos hospital. APTS was developed as a system to manage data on pharmaceutical transactions that makes transactions transparent, quantifiable, and responsible (FMHACA, 2014).

In the context of Ethiopia, APTS facilitates the recording of comprehensive descriptions of pharmaceuticals consumed and aids in the creation of monthly summaries of claims for insurances and sponsors, assisting in the rational management of pharmaceutical budgets and envisioning the implementation of health care financing. As a result, the system assists in ensuring a constant and cost-effective supply of drugs for the population. Additionally, the system enhances pharmaceutical services, which pleases clients, and produces optimal treatment outcomes and greater professional satisfaction (Adinew *et al.*, 2012).

1.2 Statement of the problem

The effectiveness of the health system as a whole and, consequently, the wellbeing of patients depend on a well-functioning supply management system (MSH, 2015).

Many health facilities in Ethiopia suffer several difficulties, including a lack of access to affordable, high-quality drugs, poor storage conditions, and inefficient stock management that led to significant levels of wastage and stock outs (Singh *et al.*, 2015).

Individual decisions about how frequently to reorder and how much to order, ad-hoc structure, inaccurate stock recording, a lack of transparency, an increase in complexity, and a lack of systematic monitoring all contribute to "sick" inventories. Most of these issues are brought on by a lack of understanding or awareness of rational techniques for warehouse organization and stock keeping. Overstocking of some pharmaceutical products may prevent a significant percentage of the medicine budget in developing nations like Ethiopia where money is limited, leaving insufficient cash for the purchase of other more vital, potentially life-saving medicine. To ensure that the public has a consistent supply of medications, it is crucial to develop or modify an inventory control system in healthcare facilities' pharmaceutical supply. This guarantees everyone's health while limiting the costs of maintaining inventory, reducing order processing, procurement, or delivery costs, controlling stock levels, and reducing stock out situations (Kokilam *et al.*, 2015).

One of the difficulties in controlling Ethiopia's medical supply chain is the management of drug waste (Project UD, 2015). Lowering the rate of drug waste to under 2% is the national objective of the Health Sector Development Program (HSTP II).

According to an assessment conducted on 7 public hospitals and 101 health centers by Addis Ababa City Administration Health Bureau from 01/11/2014 to 30/4/2015 shows that the Wastage rate of most health facilities were ≤2% which is on the standard (AACAHB, 2023).

The pharmaceutical transactions and services taking place at health facilities are not backed by well-designed and up-to-date systems and documentation. Currently the

system is insufficient to monitor consumption, inventory inconsistencies, wastages, product overstock or under-stock (Amber Pitts., 2013).

APTS is a data-driven package of interventions designed to establish an accountable, transparent, and good pharmacy services. It creates a better inventory management system by enabling health facilities to track the products transaction to optimize the utilization of medicine budgets, improve access to medicines, and decrease wastage.

There is no in-depth study that has been done on the role of APTS implementation in inventory management performance. Therefore, the study certainly will fill the gap. This study aims to make a comparison between the inventory management practice of health facilities with and without APTS implementation. It will measure the role of APTS implementation in improving the inventory management performance in terms of quality, time, finance, and productivity. Likewise, it will also help to formulate plans and policies regarding APTS implementation on inventory management performance. It will also provide a base line for further studies to researchers on related topics.

1.3 Research Questions

- How inventory management is being practiced in public health facilities in Addis Ababa?
- What is the role of APTS implementation in improving the inventory management performance in terms of enhancing quality?
- What is the role of APTS implementation in improving the inventory management performance in terms of reducing response time?
- What is the role of APTS implementation in improving the inventory management performance in terms of reducing cost?
- What is the role of APTS implementation in improving the inventory management performance in terms of increasing productivity?
- What is the inventory management performance of public health facilities with and without implementing the APTS system in terms of Quality, Time, Finance and Productivity metrics?

1.4 Objective of the study

1.4.1 General objective

The main objective of the study is to examine the role of APTS implementation on inventory management performance of public health facilities in Addis Ababa.

1.4.2 Specific objectives

- To assess the inventory management practices of public health facilities in Addis Ababa.
- To measure the role of APTS implementation in improving the inventory management performance in terms of enhancing quality.
- To measure the role of APTS implementation in improving the inventory management performance in terms of reducing response time.
- To measure the role of APTS implementation in improving the inventory management performance in terms of reducing cost.
- To measure the role of APTS implementation in improving the inventory management performance in terms of increasing productivity.
- To measure the inventory management performance of public health facilities with and without implementing the APTS system in terms of Quality, Time, Finance and Productivity metrics.

1.5 Significance of the study.

This study was designed to assess the role of APTS implementation on inventory management performance of public health facilities in Addis Ababa city and proposed possible intervention measures for better improvement of the health facilities inventory management performance.

The study proposed an appropriate intervention area for the city health department and other concerned bodies working in the pharmaceuticals sector to take actions and to measures the assessment of inventory management performance gaps between APTS implementation and non APTS implementation public health facilities for a major improvement target on the gaps to be identified, assess challenges to strengthen the inventory management system and to scale up APTS implementation in all health facilities.

The study also highlighted the avoidance of wastage of resources, manage the record keeping, reporting, and will focus on availability and reduction of stockout regarding stock management service at public health facilities.

This study will also serve as a reference for other researchers who are interested in the subject to further discuss and offer suggestions regarding the role of APTS on enhancing the effectiveness of pharmaceutical inventory management performance by offering an insight on the real-world experience of Addis Ababa city.

1.6 Scope of the study

This study focused on inventory management performance in terms of quality, time, financial and productivity mainly on sites with APTS implementation and sites without APTS implementation on public health centers located in Addis Ababa city. The geographical scope of the research was on public health facilities found in Addis Ababa.

The scope of the study was limited to pharmaceuticals and medical supplies only because of the wider nature of health facility inventory management system. Despite many parties being involved in the inventory management of the health facility, it only included the view of pharmacist staffs. The study didn't include the view of its supplier (EPSA) and other stake holders like MOH.

1.7 Definition of terms

APTS: is a collection of data-driven interventions that track information regarding pharmaceutical transactions and make them measurable, transparent, and accountable (Alemayehu, 2017).

Inventory management: is defined as the continuous process of planning, organizing, and controlling inventory that aims at minimizing the investment in inventory while balancing supply and demand (Ali, 2011).

Lead time: is the time between the placement of order and replenishment of products (Kumurya, 2015).

Stock records: contain the information that is used to compile and generate performance reports, consumption data and various reordering formulas respectively (Ramaa & Subramanya, 2012).

1.8 Operational definition

Financial: It comprises of inventory cost, the value of stock, and stock wastage.

Productivity: It comprises of inventory turnover, utilization rate, and standardization.

Quality: It comprises of availability such as service level and stock-out. Inventory visibility such as on-hand and safety stock.

Time: It comprises of replenishment time, clinical staff involvement, searching and picking time, and storage (holding) time.

1.9 Organization of the study

There are five chapters in this study. Background of the study, problem statement, research questions, objective, scope of the study, limitation of the study, significance of the study, and organization of the study are all described in chapter one. Relevant literatures review is covered in Chapter 2, and the research design, which included the study area description, study design, data collection methods and tools, study population, data analysis strategy, and ethical considerations, is covered in Chapter 3. Findings of the study including data presentation and discussion are included in Chapter 4. A summary of the research's findings, conclusions, and suggestions are presented in the fifth chapter.

CHAPTER TWO

2. RELATED LITERATURE REVIEW

2.1Theoretical Literature Review

2.1.1 Introduction to inventory management

An inventory is a piece of property retained by a business primarily for the purpose of selling it to a customer. Both the stockpile of goods a company is selling, and the component parts are referred to as inventory. Ordering, storing, and using the components that a company uses to make the goods it sells are all activities that fall under the category of inventory management. The transfer of goods from producers to warehouses and from these locations to points of sale is governed by inventory management, a component of supply chain management. The administration of supplies, raw materials, work-in-progress, and finished commodities with efficiency is known as inventory control. (Odisha State Open University, 2017).

The vital, essential, and desirable (VED), always, better and control (ABC) are two of the more popular selected inventory control procedures (Migbaru, 2016; Pirankar, 2014). ABC analysis is a technique of characterizing items in terms of their cost (Pirankar, 2014; Kaushik, 2016). Pharmaceuticals are subject to a vital, essential, and non-essential (VEN) analysis based on their importance and potential effects on patients' health (Pund *et al.*, 2017).

The ABC-VEN matrix analysis, which is produced by cross-tabulating ABC and VEN analysis, is crucial for assisting decision-making in medication selection, purchasing, and inventory management and thereby contributes to cost reduction, the detection of medication use issues, and increased efficiency in the pharmaceutical supply system. (Kokonya, 2016).

2.1.2 Pharmaceutical inventory management

In the healthcare delivery system, managing the pharmaceutical inventory is a difficult but crucial process since it has an impact on both clinical and financial outcomes (Osei, 2015; Krishna *et al.*, 2017; Gurmu and Ibrahim, 2017). Since inventory is defined as a

stock or store of pharmaceuticals, includes all operations involved in establishing and monitoring the levels of pharmaceutical inventory such that adequate pharmaceutical supplies are accessible and the costs of overstocks or understocks are minimal (Duangpun and Watcharaphong, 2015; Stock & Lambert, 2001). There are safety stock and basic stock. Basic stock is the amount of inventory kept on hand to meet average demand levels, whereas safety stock is the amount of inventory kept on hand to account for demand fluctuations. (NCPA, 2021).

2.1.3 Fundamental factors of inventory management

There are seven essential components that must be carefully taken into account when creating an inventory management system. The setting in which the inventory management system must operate is defined, identifying the necessary stock records and inventory reports, choosing which things to stock as standard items, maintaining suitable service levels for various item classes adoption of a model or decision rule to determine when to reorder, adoption of a model or decision rule to decide how much to reorder, Utilizing product classification systems like ABC analysis, VEN analysis, degree of usage, and other cost-cutting methods, inventory management cost is identified and controlled. (MSH, 2012).

2.1.4 Performance indicators of inventory management

Hospital inventory management performance indicators were researched and grouped into four groups by certain researchers. These groupings are as follows:

1. Quality (Q): Stock-out and other aspects of availability are included. errors and delays that could endanger patient safety. Availability of inventory, including on-hand and backup stock (Moons *et al.*, 2019; Manuel, *et al.*, 2012).
2. Time (T): It includes time spent replenishing, time spent by healthcare staff, time spent looking for and picking items, and time spent in storage (holding) (Moonset *et al.*, 2019; Sylvain, L., & Martin, B. 2013).
3. Financial (F): It includes inventory costs, stock values, and stock waste or obsolescence (Moons *et al.*, 2019; Manuel *et al.*, 2012; Aronovich *et al.*, 2010)
4. Productivity (P): It includes standardization, usage rate, and inventory turnover (Moons *et al.*, 2019; Nachtmann *et al.*, 2009; Kelle *et al.*, 2012).

2.1.5 Auditable Pharmaceutical Services and Transaction System

APTS is a collection of data-driven interventions that track information regarding pharmaceutical transactions and make them measurable, transparent, and accountable (Alemayehu, 2017). It produces trustworthy information, makes transactions visible and accountable, and allows for effective budget usage. By implementing innovative working arrangements and aesthetics that improve both professional and consumer pleasure, it also updates efficient workforce development and deployment (FDRE, MoH 2017).

Pharmaceutical practices use APTS, which is a collection of data-driven interventions utilizing an approach that is well recognized. It consists of five elements: effective budget use, transparent and accountable transactions, trustworthy data for decision-making, pharmacy service organization, and increased client satisfaction. (FMOH, 2018).

Poor governance in the pharmaceutical industry is thought to be a direct cause of the challenges faced in managing drugs at different levels of the health system. By all measures, the management of the limited financial resources used to purchase medications at healthcare facilities is inefficient. Health facilities have relatively inadequate accountability for drug sales. Auditing transactions and services is virtually impossible due to the lack of systems and methods for tracking goods and financial data. The system is vulnerable to theft, embezzlement, and pilferage since there is a lack of accountability and transparency in the management of medications and financial activities (Tadeg *et al.*, 2014).

The Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Project, funded by the US Agency for International Development (USAID), in collaboration with the Debre Markos Hospital and the Amhara Regional Health Bureau (RHB), developed and tested a series of interventions known as Auditable Pharmaceutical Transactions and Services, which raises the accountability and transparency of pharmaceutical transactions and services (APTS). To better utilize available funds, increase transaction openness and accountability, estimate, and create workforce needs, produce reliable information, and increase customer satisfaction, APTS employs both established and novel methodologies and tools. By reducing medicine waste, boosting stock turnover, and creating accurate information on medicine sales to enable prompt decision-making, an increase in revenue

is produced as a result of APTS deployment. It increases the overall effectiveness of pharmaceutical services, which in turn ensures the availability of necessary medications and ultimately leads to an improvement in health outcomes (Adinew *et al.,* 2012).

The following are some of the interventions included in APTS (FMOH and SIAPS, 2013).

- Creating/using instruments to ensure openness and accountability: registers, sales tickets, receipts, daily summary forms, and monthly reporting forms are a few examples of tools.
- Developing/using strategies for the effective use of the medicine budget, such as pricing, producing data on goods, finances, and pharmaceutical services, and developing a daily sales report that includes cash, credit, and no charges. Making a facility-specific drug list that is segmented into essential, vital, and non-essential (VEN) items; doing an ABC/VEN analysis to identify and reconcile the pharmaceuticals that are most necessary.
- Making plans for routine audits and physical inventories to maintain accountability and transparency.

2.2 Empirical Literature Review

2.2.1 The role of APTS in enhancing inventory management performance in terms of quality.

A good inventory control system ensures accountability for supplies and keeps track of their usage. The inventory management tool known as stock cards is used to keep track of the amount of medicine and medical supplies in stock as well as their usage. The team in charge of maintaining stocks can accurately predict future needs by keeping an eye on consumption rates (MSH, 2015).

A strong inventory system ensures that an organization's inventory counts are always correct, that customers are treated well, that they receive accurate information, and that the organization's reputation is enhanced (S. L. Adeyemi & A. O. Salami, 2010). Manager must have access to real-time inventory information using an inventory management system. As a result, management will be able to manage inventories

effectively while also saving time and money on manpower and making precise decisions whenever, wherever (Mahatme, M. *et al.*, 2012).

The strategy for all pharmacy settings, particularly community and hospital practice, includes managing pharmaceutical items as part of that process. On the other side, improper inventory management results in an unneeded rise in procurement and carrying expenses as well as an imbalance in the supply and demand equation. It is important to adequately address the development of managerial abilities in pharmacy students and pharmacists (Santhi and Karthikeyan, 2016).

The results of a study carried out in Kenya on the association between efficient drug inventory control and drug stock outs in public hospitals revealed that three factors were found to be significant predictors of successful drug inventory control. The first aspect was system accessibility; both Kenyatta National Hospital (KNH) and the Defense Forces Memorial Hospital (DFMH) place a high value on ICT for managing medicine inventories. (87.5%) of the respondents affirm that they use computers to manage their inventories. The other variable studied was employee capability; The respondents identified shortcomings in the necessary staffing levels and training shortages for the equipment needed to handle drug inventories effectively. The third factor was policies and legal frameworks; The respondents said they had all the necessary policies in place to encourage drug availability, except for two instances where they mentioned public procurement policies that did not address the need to obtain drugs urgently and hospital staff who did not follow the formulary (Awle, 2016).

According to a study on the availability of essential medications and pharmaceutical inventory management practices conducted at health centers in Adama Town, Ethiopia, the main problems with the inventory management practices in the health centers were long stock out periods, which may be caused by a high rate of consumption, and government problems with buying medications from private suppliers only when they were unavailable in PFSA. One sign of inadequate record-keeping procedures is when the physical count is lower than the balance on the bin card. The percentage of disparity in this study differs between all HCs, with Dembela HC having the greatest percentage (Kefale and Shebo, 2019).

H1a: APTS implementation positively influences the inventory management performance of public health facilities in terms of quality.

2.2.2 The role of APTS in improving inventory management performance in terms of reducing response time.

The lead time, or average time between drug requisition and receipt, was used to assess the effectiveness of the pharmaceutical procurement and distribution system in APTS. When ordering pharmaceuticals from the zonal store or PFSA, it frequently takes fewer than 5 days before they arrive, according to research conducted in the Jimma Zone's Seka Primary Hospital. (Aboma *et al.,* 2020).

A study on public health facilities in Gambella found that inventory management performance for laboratory supplies showed that, on average, hospitals and health centers had (65.71%) and (55.06%) of the necessary supplies available, respectively, in 2021. Hospitals and health centers experienced stock-outs of laboratory supplies on average for 58 days, or 19.86 and 96.32 days, respectively. When compared to similar studies done in Jimma in 2019 (Efrem, G. *et al.,* 2021) and 2020 (Befekadu *et al.,* 2020), where the average stock-out duration was 51 and 8.5 days, respectively, it was a lengthy period. Budget restrictions, frequent supplier stockouts, closed-system lab equipment, chemicals supplied by a single source, and the short shelf life of laboratory goods were contributing factors for this issue (Bochea *et al.,* 2022).

H1b: APTS implementation positively influences the inventory management performance of health facilities in terms of reducing response time.

2.2.3 The role of APTS implementation in improving inventory management performance in terms of reducing cost.

The management of inventory, particularly the selection of medications to be ordered, is influenced by the analysis of medical expenditures, and as a result, the level of service received is directly impacted. Additionally, it has an impact on how financial resources are managed, particularly budget allocation (Seema *et al.,* 2016).

The main objectives of hospital inventory management and healthcare supply chain research are to raise the efficiency and productivity of the healthcare system while

maintaining the quality of patient care. (Dubey *et al.*, 2022). Providing patients with the highest possible standard of care is the healthcare industry's main priority (Hasanbasri, 2012). The three main issues with existing inventory management techniques have been identified as overstock, improper forecasting techniques, and a lack of IT support. (Dubey *et al.*, 2022).

According to research conducted in Kenyan healthcare institutions, (2.3%) of medicines on dispensing shelves in government facilities were expired, compared to (1.9%) in private facilities (WHO, 2009). Similarly, a study carried out in Uganda revealed that storage of medications for uncommon diseases (81.8%) and drug donations (56%), which account for a large portion of the medications that have expired (Richard, 2011). According to a study done in Ethiopia, health care facilities, regional drug stores, and private drug retail outlets all had average medication expiry rates of (8%), (2%), and (3%), respectively (FMOH, 2014)

The Health Sector Development Program (HSDP) IV has a national aim of less than (2%) for medication wastage. According to a study done in Ethiopia in 2004 EC, there was an overall loss of 3,281,562.20 Ethiopian Birr (ETB), or (3.9%) of the total amount of pharmaceuticals purchased by six hospitals. The projected amount of waste in 2005 EC was expected to be 6,254,856.31 ETB, which represents an average wastage rate of (5.27%) for the eight study institutions. 1,542,491.6 ETB were wasted in total during the first half of 2006 EC, which represents an average wastage rate of 5.1% (FMOH, 2014).

According to FMOH 2014 report, 88.2% of hospitals do a physical inventory of their medication stock. The result shows that physical inventories are performed on 17 hospitals annually (80%), biannual (13.1%), monthly and annual (6.7%) basis. One of the key methods for reducing waste, stock-outs, theft, and pilferage is physical inventory. Physical inventories ought to be done more regularly than they are in most hospitals. More frequent physical inventories will make it easier to keep track of theft, pilferage, expirations, and other wastage and act on it as soon as possible (Beyene *et al.*, 2020).

In a study on the effectiveness of the APTS pharmaceutical service in the public hospital of the SNNPR, the pharmaceutical wastage rate was examined using records of the hospital's yearly physical inventory and its financial reports at the end of the year.

Financial records were evaluated to determine how much money was spent on medications during the year (useless stock plus stock on hand), and physical inventory reports provided the total amount of unusable stock. The average wastage rate at APTS hospitals was found to be (2.2%) (SD 2.6) and to be (3%) in one non-APTS facility when the report was made accessible (Beyene *et al.,* 2020).

According to research done on the process evaluation of APTS in 2020 at Seka Primary Hospital in Jimma Zone, Southwest Ethiopia, there were 0% of expired medications on the shelves in hospital storerooms and dispensaries, which is above the HSDP III7's (1%) achievement goal and the judgment criteria's ideal (100%) achievement level (2%). The APTS's decentralized procurement method may be responsible for the improvement, even if it was noticeably higher (9.7%) in the 2003 National Assessment Study for Ethiopia. (Aboma *et al.,* 2020).

H1c: APTS implementation positively influences the inventory management performance of public health facilities in terms of reducing cost.

2.2.4 The role of APTS implementation in improving the inventory management performance in terms of increasing productivity.

Information technology is important in several areas, including pharmacy inventory management. The efficiency, accuracy, and precision of inventory management operations and evaluation methodologies are improved by technology. For better administration of their pharmacy inventory, pharmacists can take advantage of contemporary technologies in their work (Ayad, 2011). A further benefit of automation in pharmacy inventory management is that it frees up pharmacists' time to devote to patient and customer care as well as other pharmaceutical services. (Awaya *et al.,* 2011).

A study conducted in Gamo Gofa, southern Ethiopia, revealed that when it came to the transparency and accountability of pharmaceutical transactions, secondary hospitals scored 45% and primary hospitals scored 50%. All prescription drugs that were given out and received at the pharmacy using regular APTS issuing and receiving vouchers are included in this. Before the research period, the hospital didn't have either daily or monthly finance and service reports. Physical inventory, financial audits, and service audits were completed in both hospitals. (Mensa *et al.,* 2017).

H1d: APTS implementation positively influences the inventory management performance of public health facilities in terms of increasing productivity.

2.3 Conceptual framework of the study

The conceptual framework is based on the study's and the literature review's major concepts. It has independent factors like APTS deployment and dependent variables like inventory management performance. The performance of pharmaceutical inventory management is the issue that is being investigated, and the discovered independent factors have an impact on it.

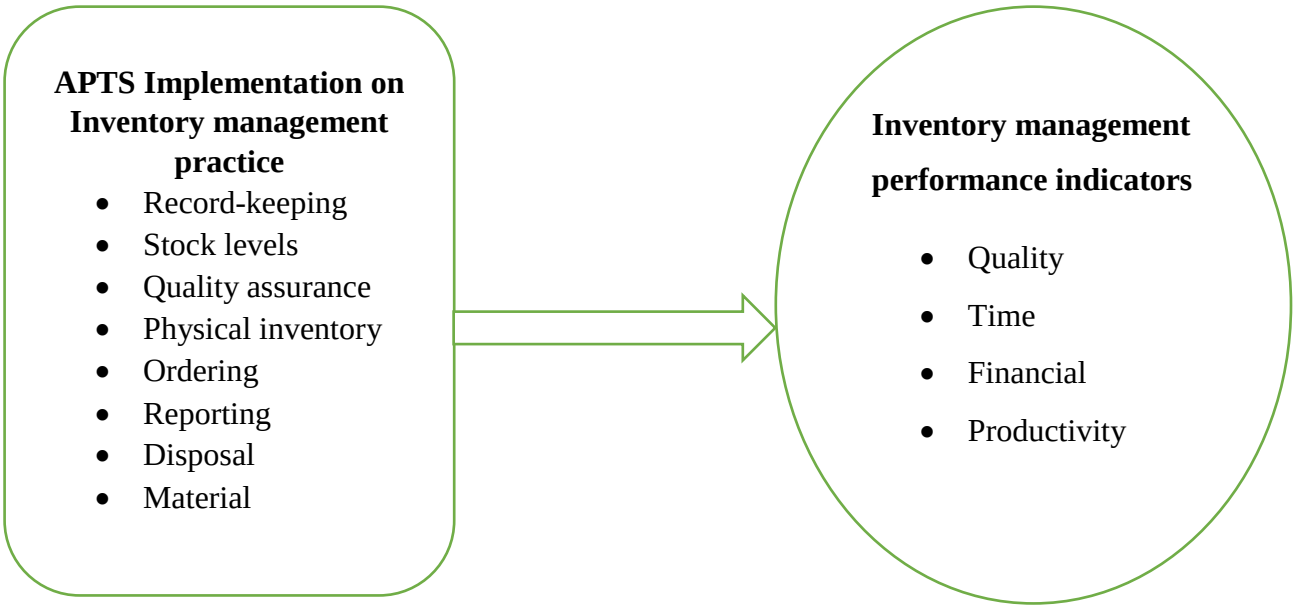

Figure 2.3: A conceptual framework of inventory management performance

Source: Researcher own construct based on the literature review (Moons et al., 2019).

2.4 Hypothesis Summary

H1a: APTS implementation positively influences the inventory management performance of public health facilities in terms of quality.

H1b: APTS implementation positively influences the inventory management performance of health facilities in terms of reducing response time.

H1c: APTS implementation positively influences the inventory management performance of public health facilities in terms of reducing cost.

H1d: APTS implementation positively influences the inventory management performance of public health facilities in terms of increasing productivity.

2.5 Identified Literature Gap

All researchers, institutions, and organizations who have assessed the role of inventory management performance on health facilities and the role of APTS implementation on health facilities for the improvement of the pharmaceutical service and patient satisfaction are acknowledged.

However, there is a lack of sufficient information how the implementation of APTS affects inventory management performance and the purpose of this study is to compare the inventory management performance system of health facilities with and without APTS implementation in public health facilities in Addis Ababa.

CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1Description of the study area

Addis Ababa is the largest city of Ethiopia. It is located on a well-watered plateau surrounded by hills and mountains in the geographic center of the country. According to the 2012 (EFY) health and health related indicators published by MoH, Addis Ababa has 13 Hospitals and 98 Health Centers, totally accounting 111 health facilities.

APTS was started in Debre Markos Referral Hospital. Due to its proven benefits, other hospitals in the region scaled up the system. According to the 2013 (EFY) report there are currently 324 health facilities in Ethiopia using the APTS system (MOH, 2021).

3.2 Research Approach

The study used a mixed research approach (both quantitative and qualitative approach) whereby data were collected and analyzed both quantitatively and qualitatively from questionnaires'', review of records and observation checklists. The results are expressed both qualitatively and quantitatively.

3.3 Research Design

The study used explanatory research design to compare and assess the inventory management performance between the health facilities with APTS and without the APTS implementation.

3.4 Population and Sample

3.4.1 Target population

The target populations for this study were selected from APTS and non APTS implementing health centers. 44 health centers implemented APTS, while 54 health centers didn't implement APTS.

Pharmacy professionals who are directly involved in the inventory management practices on the day of the visit were included.

3.4.2 Sampling Design

This study used probability sampling, particularly simple random sampling technique using the "lottery" method and purposive (judgment) sampling from non-probability technique. The target populations for the study were classified as APTS implementing health facilities and health facilities not implementing APTS. Then the sample was selected randomly according to the population.

The primary goal of the purposive sample strategy was to assist the researcher in choosing respondents who had a direct connection to the inventory management performance concerns under discussion.

3.4.3 Sample size determination

There are 111 public health facilities in Addis Ababa (13 hospitals & 98 health centers). The sample size of health facilities was determined based on the logistics indicators assessment tool that recommends 15% of health facilities (USAID | DELIVER PROJECT, 2008). Hospitals were excluded since all public hospitals found in Addis Ababa had implemented APTS. From which 20 health facilities were selected. Accordingly, the sample size for the study is calculated as:

$$X = Z * 15\%$$

where, X; represents sample size and Z; represents population size. X= 98*0.15 =14.7≈15, In which 15/2 =7.5≈8, However, 8+2=10. To reduce the response error, a total of 4 more health facilities (2 APTS implementing and 2 not implementing APTS) were added. Increasing the sample size contributes to more reliable and accurate results.

Five pharmacists are assigned in one health center. From these:

5*20 = 100

Therefore, the unit of analysis was all pharmacists, working under the selected 20 health facilities using the census method.

3.5 Data Sources and Types

Data was collected both from primary and secondary data sources. Primary data was collected from the pharmacy staff to measure the inventory management performance system using questionnaires and inventory management practice using observational checklist.

Secondary data was collected from documented data on record keeping, budget report, stock status analysis, bin card, stock card and ABC/VEN analysis reports. Observation was conducted during the days of the visit.

3.6 Data Collection Procedures

To acquire approval for data gathering, a support letter was obtained from the school of business and given to the head of the healthcare facility. Data were gathered through questioners, records review, checklist observation, and written materials. To obtain their approval, respondents were contacted. Once their consent had been obtained, the completed questionnaires were given to each participant while expressing gratitude for their participation and willingness to devote their valuable time to the study. To analyze the record keeping status, reporting aspect, stock status analysis, and financial aspect of the inventory management performance, questionnaires were gathered by verifying the accuracy of the data and using recorded materials.

3.7 Ethical Consideration

The purpose of the study, the right to voluntarily participate, the right to ask questions, the right to obtain a copy of the study, the right to have their privacy respected, and the right to choose not to answer any questions was all clearly explained to the respondents. The information that participants provided was not revealed in any way. The researcher also recognized all of the materials and data sources used in the study. Participants gave the researcher their permission before any data were collected. In order to maintain anonymity, names, phone numbers, addresses, and other information were not included in the questionnaire.

3.8 Method of Data Analysis

The collected data was coded, entered, and analyzed using SPSS version 26.0 software. Both descriptive and inferential statistics were used to analyze the data. Descriptive statistics such as frequency and percentage were calculated to describe the data and results were presented in table. Inferential statistics such as independent sample t-test was computed to determine if there is a significant difference between the means of two groups.

3.9 Validity and Reliability

When conducting research, validity and reliability are key considerations. The degree to which an instrument measures what it is intended to measure is known as validity, whereas the accuracy and precision of a measurement technique are the focus of reliability. A measuring instrument is reliable if it provides consistent results (Pin, 2015).

3.9.1 Validity of the study

Validity is a tool used to determine whether a study is measuring what it is supposed to assess. A pilot study was carried out before the real data collection to evaluate the validity of the data collection instruments.

Before administering the final phase, a pilot study was conducted to refine the questionnaires, test instrument, and identify unclear or vaguely formulated statements. Questionnaires were tested on potential respondents to make the data collecting instrument's objective, relevant, suitable to the problem and reliable as recommended by (Adams et al., 2007). To test validity a checklist for 2 health centers: one APTS implementing & one not implementing APTS were used. As a result of issues reported by respondents during the pilot test, questionnaires were improved. The researcher was available to offer assistance as needed while eight pharmacists had ten minutes to complete the questionnaire. The format and phrasing of the questionnaire were also open for comment from the respondents. Additionally, the questionnaire was modified from several questionnaires used by other researchers.

3.9.2 Reliability of the study

Statistical Package for Scientific Studies (SPSS) version 26 was used to evaluate the collected data using quantitative techniques. First, a reliability test was performed using Cronbach's Alpha to evaluate the internal consistency of the items of each construct. The reliability test's outcomes are shown in Table 3.1. Cronbach's Alpha ranged from 0.71 and 0.84, according to the findings. As advised by every research a Cronbach's Alpha greater than 0.7 (Hair, J.F., 2009). As a result, the findings show that the questionnaire's items are reliable and appropriate.

Table 3.9.2: Reliability Statistics

No	Dimensions	Cronbach's Alpha	N of Items
1	Quality	.714	4
2	Time	.710	4
3	Finance	.842	3
4	Productivity	.802	3

Source: Own survey and SPSS output, June (2023)

CHAPTER FOUR

4. RESULTS, DISCUSSIONS, AND INTERPRETATIONS

4.1 Introduction

This chapter presents the analysis of data followed by a discussion of the research findings. The findings are related to the research questions which guide the study. Data were analyzed to examine the role of APTS implementation on inventory management performance of public health facilities in Addis Ababa.

The survey was conducted from May 2-12, 2023. Permission was received to conduct the study at 20 of the eligible sites.

The primary data were obtained from the selected health center employees, such as pharmacists. Secondary data were obtained from documentation such as Bin cards, stock cards, RRF, IFRR.

4.2 General information

A total of 20 health centers, of which 10 health centers implementing APTS & 10 health centers not implementing APTS were included in the study. 6(75%) of them were using the APTS system for the past 6 years. Most of the health centers 18 (77%) manage the inventory both electronically & manually.

A total of 100 questionnaires were distributed to 100 pharmacy professionals working in 20 health centers. These groups of respondents were selected because they have relevant experience in pharmaceuticals inventory management at the health centers. Finally, 100 questionnaires were returned, which represents 100% of the total sample size.

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

4.2.1 Socio-Demographic Characteristics of respondents

Introduction

The demographic data of the respondents, including both personal and general data, are provided in this section. The characteristics of respondents were examined using the demographic data from the survey. Gender, profession type, education level, years of work experience, in-service (on-job) training status and certificates achieved were indicators. The demographic profile of the respondents generally showed that a high percentage of the respondents had a higher education degree, and that the majority of the respondents were pharmacists. These data show that most respondents were skilled, which increases confidence in the findings.

Table 4.2.1 Demographic Profile of Study Participants

S. N	Indicators	Indicators	Frequency	Percent
1	Gender	Female	56	56%
		Male	44	44%
		Total	100	100%
2	Profession	Pharmacist	99	99%
		Nurse	1	1%
		Total	100	100%
3	Education level	Diploma	21	21%
		BSc	73	73%
		MA and above	6	6
		Total	100	100%
4	Work experience	0-2 years	14	14%
		3-5 years	31	31%
		6-10 years	38	38%
		>10 years	17	17%
		Total	100	100%
5	In service (On job) training	Yes	86	86%
		No	14	14%
		Total	100	100%
6	Certificates achieved	APTS	48	48%
		LMIS	11	11%
		PMIS	4	4%
		IPLS	25	25%
		Other	12	12%
		Total	100	100%

Gender Characteristics

There were 100 participants in all for this study. 56% of the participants were female, and 44% were male. This shows that most of the employees at the study's chosen health center were women.

Profession

99% of the 100 participants were pharmacists, and 1% were nurses. Due to their involvement in pharmaceutical inventory management, the respondents were suitable for providing answers to the study's questions.

Education level

The respondents were asked to provide their degree of education. According to the results in table 4.2.1, the educational backgrounds of the respondents were as follows: 6% had a master's degree or more; 7% had a bachelor's degree; 21% had a diploma; and 0% had a degree below that level. This means that the majority of employees employed by the organization had obtained education up to the university level, had earned valuable knowledge, and were familiar with the procedure; as a result, they were qualified to respond to our study's questions.

Work Experience

The respondents were asked about their work experience. Table 4.2.1 shows that 14% of respondents had between 0-2 years' experience, 31% had between 3-5 years' experience, 38% had between 6-10 years' experience, and 17% had experience of more than 10 years. In terms of service years, most of the pharmacy employees had between 6 and 10 years of experience (38%) followed by 3-5 years (31%).

Received relevant In-service (on-the-job) training & certificate.

The respondents were asked if they have received relevant In-service (on-the-job) training. As shown in table 4.2.1, 86% of them have received training. Of these 48% received APTS training, 11% received LMIS training, 4% received PMIS training, 25% received IPLS training & 12% received other training.

4.3 Inventory management practices of public health facilities in Addis Ababa.

Introduction

In this section of the study's report, descriptive static analysis was done on data collected to evaluate the inventory management practice of health facilities implementing APTS & not implementing APTS in relation to the research question and objectives of the study.

A checklist was used to evaluate and compare the inventory management practice of the health facilities using 8 indicators namely, record keeping practice, stock level practice, quality assurance practice, physical inventory practice, ordering completeness practice, reporting accuracy practice, disposal management practice & record accuracy practice.

Table 4.3 Inventory management practice in 10 HCs implementing APTS & 10 HCs not implementing APTS Addis Ababa, June 2023.

S. No.	**Inventory Management Practice (Check the list of tracer drugs) Item**	**APTS status**			
		Implemented (Frequency)		**Not implemented (Frequency)**	
1	**Record-keeping practice**	**YES**	**NO**	**YES**	**NO**
1.1	The health center has a standard list of stock items managed in the institution's store.	10	0	8	2
1.2	Each item in the store has a stock card.	10	0	5	5
1.3	Each item in the dispensary has a Bin card.	10	0	4	6
1.4	Are the inventory records up to date? (Check the IFRR to see how recently they have been used).	10	0	2	8
1.5	Are the inventory records accurate? (Do they agree with what is on the shelves?)	10	0	2	8
1.6	Is Bin ownership implemented?	10	0	2	8
1.7	All transactions of the product to or from the store are recorded on the Bin card.	10	0	4	6
1.8	The Bin card and Stock record cards for the health supplies are updated on the day of the physical count.	10	0	2	8

Grand mean for record keeping practice			10	0	3.62	6.38
2	**Stock level practice**		**YES**	**NO**	**YES**	**NO**
2.1	Are minimum and/or maximum stock levels		10	0	6	4
2.2	Has the average monthly consumption been		10	0	3	7
2.3	Has the store avoided stock-outs for the past 100		10	0	0	10
Grand mean for stock level practice			10	0	3	7
3	**Quality assurance practice**		**YES**	**NO**	**YES**	**NO**
3.1	Are medicines & supplies checked for quality		10	0	8	2
3.2	Are all reported problems documented?		9	1	0	10
3.3	Are all documented problems reported?		10	0	0	10
Grand mean for quality assurance practice			9.67	0.33	2.67	7.33
4	**Physical inventory practice**		**YES**	**NO**	**YES**	**NO**
4.1	Does the health facility conduct physical inventory at		10	0	10	0
4.2	Does the health facility conduct physical inventory		10	0	0	10
4.3	Is monthly physical inventory conducted in the dispensary?		10	0	1	9
4.4	How long does the physical inventory take place in the dispensary unit?	2 hours	5	0	0	0
		3-6 hours	3	0	6	0
		>1day	2	0	4	0
4.5	How long does the physical inventory take place in the store?	1 day	8	0	0	0
		2-5 days	1	0	4	0
		>5day	1	0	6	0
Grand mean for physical inventory practice			10	0	6.2	3.8
5	**Ordering completeness practice**		**YES**	**NO**	**YES**	**NO**
5.1	If the facility orders its supplies, are orders placed on		10	0	2	8
5.2	Are the quantities to order calculated correctly?		9	1	1	9
5.3	Has an ABC and/or VEN analysis been performed?		10	0	9	1
Grand mean for ordering completeness practice			9.67	0.33	4	6
6	**Report accuracy practice**		**YES**	**NO**	**YES**	**NO**
6.1	Internal Facility Report and Resupply Form (IFRR) is		10	0	5	5
6.2	Are reports filled out completely?		10	0	5	5
6.3	Does the facility use RRF to request program drugs		9	1	7	3
6.4	Does the pharmacy generate daily summery report,		10	0	4	6
6.5	Dose the facility calculate pharmaceutical wastage		10	0	8	2
6.6	If yes, no 6.6 write the percentage	<0.5%	5	0	0	0

	of pharmaceutical wastage rate?	0.6%-1%	5	0	2	0
		1.1%-2%	0	0	2	0
		>2%	0	0	4	0
Grand mean for report accuracy practice			9.83	0.16	6.16	3.5
7	**Disposal management practice**		**YES**	**NO**	**YES**	**NO**
7.1	Is there physical inventory of unusable stock that is set aside?		10	0	10	0
7.2	Are damaged or expired products removed and		10	0	10	0
7.3	The health center submits applications for disposal of		10	0	4	6
Grand mean for disposal management practice			10	0	8	2
8	**Recording accuracy practice**		**YES**	**NO**	**YES**	**NO**
8.1	Is there an up-to-date supply manual available to the		9	1	0	10
8.2	Is there an adequate supply of the correct forms for		10	0	3	7
8.3	Records are easily accessible when needed.		10	0	2	8
Grand mean for record accuracy practice			9.67	0.33	1.67	8.33
Grand mean of Inventory Management practice			**9.86**	**0.29**	**4.41**	**5.42**

Source: SPSS output of the survey, 2023

4.3.1 Record keeping practice.

As illustrated in table 4.3, all (n=10) HCs implementing APTS & (n=8) HCs not implementing APTS had a standard list of stock items managed in the institutions store, (n=10) of APTS implementing HCs & (n=5) HCs non APTS implementing had a stock card for all items, (n=10) of APTS implementing HCs have bin card for all items and only (n=4) HCs from the non APTS implementing HCs. Regarding up to dated inventory records & accuracy of inventory records all (n=10) APTS implementing HCs and (n=2) HCs not implementing APTS properly record inventories, Bin ownership was implemented in all (n=10) APTS implementing HCs and in (n=2) HCs not implementing the APTS. All institutions implementing APTS (n=10) & (n=4) HCs not implementing APTS record all transactions of the product to or from the store on the bin card. (n=10) of the HCs implement APTS and (n=2) HCs not implementing APTS update bin card and stock record cards on the day of the physical count.

Record keeping serves as the basis for the information needed when ordering new stocks of medicines and other supplies. Keeping records saves time and protects all the supply system. If there are accusations of theft or misuse of supplies, it will be easy to refer to the records and provide a clear audit trial and evidence.

As observed in the study all APTS implementing HCs had a standard list of stock items which helps in preparing effective orders, maintain sufficient safety stock and helps to prevent expiry of medicines. Most of the HCs not implementing APTS don't have stock card & bin card; stock card is a core record in inventory management & base for reordering items, bin cards facilitate visual checks, act as a reminder to maintain records, and assist in acting as a backup to previously mentioned records. When inventories are accurate and up to dated it helps to improve cash flow, reducing waste and improving service offer. All HCs implementing APTS practice bin ownership which improves the record keeping practice by following the assigned bin card during requesting & receiving medicines, following expiry dates, movement of stocks, performing random audit, keeping up-to date information on stock status by performing SSA, & availing medicines.

4.3.2 Stock Level practice

The findings on stock level practice show that, (n=10) APTS implementing HCs and (n=6) non APTS implementing HCs calculate minimum/maximum stock level for each item. Average monthly consumption has been accurately calculated for all (n=10) APTS implementing HCs and (n=3) of the HCs not implementing APTS. All APTS implementing HCs whereas none (n=0) HCs not implementing APTS avoided stock outs for the past 100days.

The HCs calculating minimum/maximum stock level facilitates smooth stock-flow, avoid stock out and serves client with an effective performance. Calculating the average monthly consumption helps to manage the stock and check if it's over stock or under stock and allows taking on time action. It also helps to avoid stock out by processing emergency orders before the end of the review period.

4.3.3 Quality Assurance practice

The quality assurance practice consists of 3 indicators. (n=10) of APTS implementing HCs and (n=8) of the HCs not implementing APTS check medicines and supplies quality

immediately upon arrival. (n=9) & (n=10) of APTS implementing HCs document all reported problems and report all documented problems. whereas none (n=0) of the HCs not implementing APTS neither document reported problems nor report documented problems.

Finding from the study indicated that most of the HCs check the quality of medicines & supplies during arrival and before they are reached patients which include visual inspection of the items if there is any damage, near expiry items and check if the received quality is the same with the requested quantities. Documenting reported problems and reporting documented problems increases customer satisfaction by assuring the regular supply of high-quality goods or services.

4.3.4 Physical inventory practice

The finding on physical inventory status practice shows that (n=20) both APTS implementing HCs and HCs not implementing APTS conduct physical inventory at least once a year, whereas only (n=10) APTS implementing HCs conduct physical inventory quarterly. (n=10) APTS implementing HCs conduct monthly physical inventory in dispensary whereas only (n=1) HC not implementing APTS conduct monthly physical inventory in the dispensary. From the HCs implementing APTS (n=5) HCs take 2 hours, (n=3) HCs take 3-6 hours and (n=2) HCs take >1 days to conduct physical inventory in the dispensary and for HCs not implementing APTS (n=6) HCs take 3-6 hours & (n=4)HCs take > 1days to conduct physical inventory in dispensary. (n=8) APTS implementing HCs takes 1 day to conduct physical inventory in the store & (n=6) non APTS implementing HCs takes >5 days to conduct physical inventory in the store.

The purpose of physical inventory is to provide staff with instructions on how to buy the product and how much to get in order to maintain ongoing medication availability, to monitor losses through expiry and pilferages. The HCs implementing APTS perform better physical inventory than the HCs not implementing APTS, because in APTS implementing HCs physical inventory is conducted using 3 steps; preparatory, actual physical count: analysis, interpretation & reporting.

4.3.5 Ordering Completeness practice

The ordering completeness practice shows that (n=10) HCs implementing APTS & (n=2) HCs not implementing APTS order supplies on time. The quantities to order are correctly calculated for (n=9) APTS implementing HCs and only for (n=1) non APTS implementing HC. Both APTS implementing & non APTS implementing HCs perform ABC/VEN analysis.

From the finding APTS implementing HCs analyze their pharmaceuticals stock and consumption regularly to avoid overstock or under stock while by analyzing the consumption pattern of the product in the past and predicting utilization of available stock. Performing ABC/VEN analysis helps the HCs to prioritize and procure pharmaceuticals that are most important to the HCs with the available resources, for determining & comparing pharmaceuticals cost with in the health facility.

4.3.6 Report Accuracy practice

The report accuracy practice was evaluated and (n=10) APTS implementing HCs and (n=5) non APTS implementing HCs use IFRR form regularly and completely. (n=10) APTS implementing and (n=4) non APTS implementing HCs generate daily summery report, monthly finance/product and service reports for decision making. Pharmaceutical Wastage rate was calculated for (n=10) APTS implementing HCs and (n=8) non APTS implementing HCs. From these (n=10) HCs implementing APTS and (n=6) non APTS implementing HCs had a wastage rate <2%.

Findings from the study revealed that HCs not implementing APTS don't regularly use IFRR based on the schedule during re-supply for the dispensing unit. RRF should be properly filled on time for the resupply of items and to avoid stock outs. When medications become dangerous for use due to deterioration, obsolescence, or expiration, they are wasted. This burdens many healthcare facilities and drives up the expense of the healthcare system. HCs not implementing APTS had a higher wastage rate than the HCs implementing APTS.

4.3.7 Disposal Management Practice

The finding for disposal management shows that both the APTS implementing HCs and the HCs not implementing APTS had a physical inventory for unusable stock that was set

aside. damaged, or expired products are disposed of according to the government's guideline. (n=10) APTS implementing HC & only (n=4) non APTS implementing HC submit applications for disposal of unfit for use medicines to the central disposal site.

4.3.8 Recording Accuracy (Materials) practice

As shown in table 4.3 regarding the recording accuracy (n=9) APTS implementing HCs and (n=0) HCs not implementing APTS had up-to-dated supply manual. (n=10) HCs implementing APTS and only (n=3) HCs not implementing APTS had an adequate supply of the correct forms for recording stock movements, reporting, and ordering. In all (n=10) HCs implementing APTS and (n=2) HCs not implementing APTS easily access records when needed.

4.4 Summary of Mean Score

All statements' scores and answer means were computed for each variable and interpreted in accordance with the results. The scale for these statements is 1 to 5, with 1 denoting strongly disagree, 2 denoting disagree, 3 denoting neutral, 4 denoting agree, and 5 denoting strongly agree. The researcher employed criterion-referenced definitions for rating scales to characterize the obtained data to compare the mean score of each variable with the respondent level agreement on the Likert scale and to sum up the narrative outcomes. Criterion-referenced scales measure answer scores in comparison to a predetermined set of criteria, as opposed to norm-referenced scales.

As a result, the researcher discussed the results of the descriptive statistics of each variable's mean score based on the criterion-referenced scale definition table mentioned above.

Table 4.4 Criterion– Referenced Scale Definitions

Mean rating	**Respondents level of agreement**	**Description of respond**
1.00 - 1.49	Strongly disagree = SD	Very low= VL
1.50 - 2.49	Disagree = D	Low = L
2.50 - 3.49	Neutral = N	Medium =M
3.50 - 4.49	Agree = A	High =H
4.50 - 5.00	Strongly agree = SA	Very high =VH

Source: Sheskin, (2014)

4.5 The role of APTS implementation in improving inventory management performance in terms of enhancing quality.

The success of correct item replenishment processing is determined by the quality of inventory management, which shows how well a facility can meet customer needs with a comprehensive range of products and services, by tracking the stock balances shown on a stock ledger, bin card, or automated system matching with the inventory in stock & controlling security issues in the health facilities.

The following tables show the descriptive statistics result on the role of APTS implementation on inventory management performance in terms of enhancing quality.

Table 4.5 Respondents' perception on the inventory management performance of public health facilities in terms of enhancing quality.

S. No.	**Inventory management performance indicator Item**	**APTS status**	
		Implemented	**Not implemented**
1	**Quality**	**(Mean/ SD)**	**(Mean/ SD)**
1.1	Stock outs of medicine is a regular situation in the health center.	1.94(0.24)	2.80(1.05)
1.2	The health center process order fill rate accordingly with the identified products and quantities.	4.74(0.44)	2.00(0.49)
1.3	Security issue such as: Theft & leakage of product is controlled in the health center.	4.94(0.24)	1.76(0.47)
1.4	Stock balance recorded on a stock card, bin card, or automated system is accurate to the actual inventory on hand.	4.80(0.53)	1.90(0.30)
Grand mean for Quality		**4.10**	**2.11**

Source: SPSS output of the survey, 2023

Table 4.5 shows the descriptive statistics on the role of APTS implementation enhancing quality in inventory management performance based on arithmetic mean and standard deviation. According to the respondents, Stock outs of medicine is a regular situation in the health center: APTS implementing HCs (mean 1.94) shows that stock out of medicine is low compared to HCs not implementing APTS (mean 2.80) indicating there is a moderate issue on the stock out of medicine. On the second question, the health center process order fill rate accordingly with the identified products and quantities; APTS implementing HCs mean (4.74) indicates very high process order fill rate accordingly with the identified products and quantities whereas (mean 2.00) shows lower order fill rate for the HCs not implementing APTS. According to the respondents concerning Security issue such as: theft & leakage of product being controlled in the health center: (mean 4.94) shows that theft & leakage of product is highly controlled in HCs implementing APTS, whereas (mean 1.76) indicates that HCs not implementing APTS had a low control on theft & leakage of products. In addition, respondents perception regarding the balance recorded on the stock card, bin card, or automated system being accurate to the actual inventory on hand, for APTS implementing HCs (mean 4.80) indicates that its very highly that the stock balance recorded on a stock card, bin card, or automated system is accurate to the actual inventory on hand and for HCs not implementing APTS (mean 1.90) indicates the low chance of stock balance being accurate with the stock card & bin card.

Generally, based on the data obtained from the respondents' perception the average mean on the role of APTS implementation enhancing quality represents (mean 4.10) for APTS implementing HCs indicating high effect and (mean 2.11) for HCs not implementing APTS indicating low effect respectively.

The average standard deviation for APTS implementing HCs is (0.36) and (0.57) for HCs not implementing APTS indicating a high value that the respondents were agreeing to the same idea.

4.6 The role of APTS implementation in inventory management performance in terms of reducing response time.

This indicator measures the periodic replenishment of stocks, standardized location of items, on time resupply of orders & the efficiency of requests process.

Descriptive statistics on the role of APTS implementation in improving inventory management performance in terms of reducing response time.

Table 4.6 Respondents' perception on the inventory management performance of public health facilities in terms of reducing response time.

S. No.	**Inventory management performance indicator Item**	**APTS status**	
		Implemented	**Not implemented**
2	**Time**	**(Mean/ SD)**	**(Mean/ SD)**
2.1	The health center uses periodic replenishment of stocks.	4.18(0.80)	2.54(1.26)
2.2	Standardized location of inventory items reduces the time spent on searching.	4.42(0.60)	1.32(0.47)
2.3	Orders are accurately filled out during a defined period of time as requested.	4.32(0.47)	1.58(0.49)
2.4	Longer lead time being one of the significant challenges faced during the process of inventory management.	1.98(0.37)	2.54(1.11)
Grand mean for Time		**3.72**	**1.99**

Source: SPSS output of the survey, 2023

Concerning the first question; The HCs using periodic replenishment of stocks, (mean 4.18) in APTS implementing HCs indicates the HCs very highly use periodic replenishment of stocks whereas the respondents from non APTS implementing HCs

(mean 2.54) indicates that the HCs moderately use period replenishment of stocks. According to the respondent's perception in APTS implementing HCs (mean 4.42) indicates they highly agree on using standardized location of inventory items reduces the time spent on searching, and (mean 1.32) in HCs not implementing APTS indicates that very low participants of the HCs agree that standardizing location of inventory items reduces the time spent on searching. (Mean 4.32) indicates in APTS implementing HCs highly orders are accurately filled out during a defined period as requested whereas for HCs not implementing APTS (mean 1.58) indicates orders aren't accurately filled out during a defined period as requested. Regarding longer lead time being one of the significant challenges faced during the process of inventory management, (mean 1.98) indicates that in APTS implementing HCs longer lead time is a low challenge whereas for HCs not implementing APTS (mean 2.54) indicates that longer lead time moderately affects the process of inventory management.

Generally, based on the data obtained from the respondents' perception the average mean on the role of APTS implementation reducing response time, (mean 3.72) for APTS implementing HCs indicating high effect and (mean 1.99) for HCs not implementing APTS indicating low effect respectively.

The average standard deviation for APTS implementing HCs is (0.56) and (0.83) for HCs not implementing APTS indicating a high value that the respondents were agreeing to the same idea.

4.7 The role of APTS implementation in improving the inventory management performance in terms of reducing cost.

Inventory cost have become one of the major contributors to the inefficiency of the health facilities inventory management performance, therefore it should be managed effectively and efficiently to minimize the total cost. Using ABC analysis helps to determine and compare pharmaceutical costs within the health facility, it enables managers to adjust order quantities to avoid wastage of product and monetary losses.

Descriptive statistics of the role of APTS implementation in improving the inventory management performance in terms of reducing cost.

Table 4.7 Respondents' perception on the inventory management performance of public health facilities in terms of reducing cost.

S. No.	Inventory management performance indicator Item	APTS status	
		Implemented	Not implemented
3	**Finance**	**(Mean/ SD)**	**(Mean/ SD)**
3.1	Lost or expired items are monitored to identify the value of unusable stock.	4.48(0.54)	2.28(0.99)
3.2	The health center use ABC analysis to reduce stock holding cost &maintain budget accurately.	4.46(0.50)	3(0.96)
3.3	Cost effective resupply of order is processed in the health centers.	4.42(0.57)	2.8(0.72)
Grand mean for Finance		**4.45**	**2.69**

Source: SPSS output of the survey, 2023

In the first question respondents were asked if lost or expired items were monitored to identify the value of unusable stock, for APTS implementing HCs (mean 4.48) indicates that lost or expired items are very highly monitored to identify the value of unusable stock whereas for HCs not implementing APTS (mean 2.28) indicates lost or expired items are moderately monitored to identify the value of unusable stock. Concerning the health centers using ABC analysis to reduce stock holding cost & maintain budget accurately, (mean 4.46) shows APTS implementing HCs highly use the ABC analysis whereas for HCs not implementing APTS respondents shows (mean 3.00) indicating moderate use of ABC analysis to reduce stock holding cost & maintain budget accurately. Regarding the third question, APTS implementing HCs (mean 4.42) indicates highly using cost-effective resupply of orders, whereas (mean 2.80) indicates HCs not implementing APTS moderately practice cost-effective resupply of orders.

Generally, based on the data obtained from the HCs respondents' perception the average mean on the role of APTS reducing cost shows (mean 4.45) for APTS implementing HCs indicating high effect and (mean 2.69) for HCs not implementing APTS indicating moderate effect respectively.

The average standard deviation for APTS implementing HCs is (0.54) and (0.89) for HCs not implementing APTS indicating a high value that the respondents were agreeing to the same idea.

4.8 The role of APTS implementation in improving the inventory management performance in terms of increasing productivity.

The productivity of inventory management performance was measured using inventory turnover rate, SSA, ABC/VEN & EOQ method to increase productivity of inventory management performance.

Descriptive statistics of the role of APTS implementation in improving inventory management performance in terms of increasing productivity.

Table 4.8 Respondents' perception on the inventory management performance of public health facilities in terms of increasing productivity.

S. No.	**Inventory management performance indicator Item**	**APTS status**	
		Implemented	**Not implemented**
4	**Productivity**	**(Mean/ SD)**	**(Mean/ SD)**
4.1	The health center track inventories of products that have a high & low turnover rate.	4.22(0.68)	2.26(0.69)
4.2	Adequately conducting stock status analysis (SSA) twice a year leads to effective inventory management.	4.46(0.50)	3.4(1.00)

4.3	ABC/VEN analysis and Economic Order Quantity is practiced to efficiently manage resources.	4.36(0.59)	2.76(0.96)
Grand mean for Productivity		**4.34**	**2.8**

Source: SPSS output of the survey, 2023

According to the respondent's perception on the first question, the health center track inventories of products that have a high & low turnover rate; for APTS implementing HCs (mean 4.22) indicates inventories of products that have high & low turnover rate are highly tracked, whereas for HCs not implementing APTS (mean 2.26) indicates tracking inventories of products turnover rate is low. Concerning the second question, adequately conducting stock status analysis (SSA) twice a year leads to effective inventory management; (mean 4.46) indicates APTS implementing HCs highly agree on conducting SSA twice a year leads to effective inventory management, whereas (mean 3.40) indicates HCs not implementing APTS moderately agree on conducting SSA twice a year leads to effective inventory management. Regarding the third question, ABC/VEN analysis and EOQ is practiced to efficiently manage resources, (mean 4.36) indicates HCs implementing APTS highly practice ABC/VEN analysis and EOQ to efficiently manage resources, whereas for HCs not implementing APTS (mean 2.76) indicates ABC/VEN analysis and EOQ are moderately practiced to efficiently manage resources.

Generally, based on the data obtained from the respondents' perception the average mean on the role of APTS implementation in terms of increasing productivity represents (mean 4.34) for APTS implementing HCs indicating high effect and (mean 2.80) for HCs not implementing APTS indicating moderate effect respectively.

The average standard deviation, for APTS implementing HCs is (0.59) and (0.88) for HCs not implementing APTS indicating a high value that the respondents were agreeing to the same idea.

4.9 Inventory management performance of public health facilities with and without implementing the APTS system in terms of Quality, Time, Finance and Productivity.

The inventory management performance consists of four indicators these are Quality, Time, Finance and Productivity. The independent t-test is used to compare two sample means of APTS implementing health centers and health centers not implementing APTS on the inventory management performance.

Table 4.9: Mean & standard deviation of inventory management performance indicators.

Inventory Management performance indicators	**APTS Status (Mean/SD)**	
	Implementing (N=50)	**Not implementing (N=50)**
Quality	15.94(0.95)	10.08(2.89)
Time	15.10(1.14)	14.42(1.90)
Finance	13.36(1.35)	8.08(1.63)
Productivity	13.04(1.39)	8.42(1.67)
Grand mean for Inventory management performance.	**14.36**	**10.25**

The mean value of inventory management performance in terms of quality accounts for 15.94 for HCs implementing APTS while; a mean of 10.08 was for HCs not implementing APTS. The mean value of inventory management performance in terms of time accounts for 15.10 for HCs implementing APTS while; a mean of 14.42 was for HCs not implementing APTS.

The mean value of inventory management performance in terms of Quality accounts for 13.36 for HCs implementing APTS while; a mean of 8.08 was for HCs not implementing APTS.

The mean value of inventory management performance in terms of Quality accounts for 13.04 for HCs implementing APTS while; a mean of 8.42 was for HCs not implementing APTS.

Table 4.10: Levene's Test for Equality of Variances

Independent Samples Test						
	Levene's Test for Equality of Variances					
		F	Sig.	t	df	Sig. (2-tailed)
Quality	Equal variances assumed	57.67	.00	13.57	98	.00
	Equal variances not assumed			13.57	59.54	.00
Time	Equal variances assumed	29.44	.00	2.16	98	.03
	Equal variances not assumed			2.16	80.36	.03
Finance	Equal variances assumed	.14	.70	17.57	98	.00
	Equal variances not assumed			17.57	94.56	.00
Productivity	Equal variances assumed	.06	.80	14.94	98	.00
	Equal variances not assumed			14.94	94.90	.00

Based on the result (F=57.67), it can be concluded that the variance in quality of inventory management at HCs with APTS implementation is significantly different than that of HCs without APTS implementation with ($t(98) = 59.54$, $P<0.001$). The average inventory management performance in terms of quality for HCs with APTS implementation was 5.86 higher than the average quality of inventory management performance for HCs without APTS implementation.

Based on the result (F=29.44), it can be concluded that the variance in time of inventory management at HCs with APTS implementation is significantly different than that of HCs without APTS implementation with ($t(98) = 80.36$, $P<0.005$). The average inventory management performance in terms of reducing response time for HCs with

APTS implementation was 0.62 higher than the average of inventory management performance for HCs without APTS implementation.

Based on the result (F=0.14), it can be concluded that the variance in finance of inventory management at HCs with APTS implementation is significantly different than that of HCs without APTS implementation with (t (98) = 94.56, P<0.001). The average inventory management performance in terms of reducing cost for HCs with APTS implementation was 5.28 higher than the average of inventory management performance for HCs without APTS implementation.

Based on the result (F=0.06), it can be concluded that the variance in productivity of inventory management at HCs with APTS implementation is significantly different than that of HCs without APTS implementation with (t (98) =94.90, P<0.001). The average inventory management performance in terms of productivity for HCs with APTS implementation was 4.62 higher than the average quality of inventory management performance for HCs without APTS implementation.

The Grand mean of APTS implementing HCs is 14.36 and 10.25 for HCs not implementing APTS these indicates the inventory management performance regarding enhancing quality, reducing response time, reducing cost, and increasing productivity it was higher in APTS implementing HCs than the HCs not implementing APTS.

CHAPTER FIVE

5. SUMMARY, CONCLUSION AND RECOMMONDATIONS

5.1 Introduction

This chapter provides a summary of the study's findings, conclusions, and recommendations. These conclusions and suggestions were drawn from an examination of the impact of APTS implementation on the inventory management performance of public health facilities in Addis Ababa, Ethiopia. The findings and discussions in chapter four served as the basis for these recommendations.

5.2 Summary of the Findings

The summary of the study's findings is presented in relation to the study's objective in order to guarantee achievement of those goals. Examining the impact of APTS implementation on the inventory management performance of public health facilities in Addis Ababa, Ethiopia, was the study's main objective. This study had the following six objectives: To assess the inventory management practices of public health facilities in Addis Ababa, To measure the inventory management performance of public health facilities with and without implementing the APTS system in terms of Quality, Time, Finance and Productivity, To measure the role of APTS implementation in improving the inventory management performance in terms of enhancing quality, To measure the role of APTS implementation in improving the inventory management performance in terms of reducing response time, To measure the role of APTS implementation in improving the inventory management performance in terms of reducing cost, To measure the role of APTS implementation in improving the inventory management performance in terms of increasing productivity. The discussion of the results in the previous chapter shows the following main findings:

Inventory management practices of public health facilities in Addis Ababa.

The first objective of the study was to assess the inventory management practices of public health facilities in Addis Ababa. According to the grand mean of inventory management practice, HCs implementing APTS perform much better (9.86) than the HCs not implementing APTS (4.41) in record keeping practice, stock level practice, quality

assurance practice, physical inventory practice, ordering completeness practice, reporting accuracy practice, disposal management practice & recording accuracy practice.

The role of APTS implementation in improving the inventory management performance in terms of enhancing quality.

The second objective of the study was to measure the role of APTS implementation in terms of enhancing quality in inventory management performance. The study revealed that the average mean on the role of APTS enhancing quality represents (4.10) for APTS implementing HCs and (2.11) for HCs not implementing APTS respectively, which indicated that APTS implementation had a high effect on enhancing quality in inventory management performance.

The role of APTS implementation in improving the inventory management performance in terms of reducing response time.

The third objective of the study was to measure the role of APTS implementation in reducing response time on inventory management performance. The study revealed that the average mean for APTS implementing HCs (3.72) and (1.99) for HCs not implementing APTS respectively, indicating APTS implementation had a high effect on reducing response time in inventory management performance.

The role of APTS implementation in improving the inventory management performance in terms of reducing cost.

The fourth objective of the study was to measure the role of APTS implementation in improving the inventory management performance in terms of reducing cost. The study revealed that the average mean for APTS implanting HCs (4.45) and (2.69) for HCs not implementing APTS respectively, which indicated that APTS implementing HCs had a high effect whereas HCs not implementing HCs had a medium effect on reducing cost in inventory management performance.

The role of APTS implementation in improving inventory management performance in terms of increasing productivity.

The fifth objective of the study was to measure the role of APTS implementation in improving inventory management performance in terms of increasing productivity. The study revealed that the average mean for HCs implementing APTS (4.34) and (2.80) for HCs not implementing APTS respectively, indicating APTS implementing HCs had a high effect and HCs not implementing APTS had medium effect on increasing productivity in inventory management performance.

Inventory management performance of public health facilities with and without implementing the APTS system in terms of Quality, Time, Finance and Productivity.

The sixth objective of the study was to measure the inventory management performance of public health facilities with and without implementing the APTS system in terms of Quality, Time, Finance and Productivity. An independent sample t-test was conducted and ($p<0.001$) indicated there was a significant difference in quality, time, finance & productivity in HCs implementing APTS and in HCs not implementing APTS.

5.3 Conclusions

The objective of the study was to examine the role of APTS implementation on inventory management performance of public health facilities in Addis Ababa. The study used a mixed research approach and explanatory research design to compare and assess the inventory management performance between the health facilities with APTS and without the APTS implementation.

A checklist developed by management science for health was used to check and compare the inventory management practice for HCs implementing APTS and for HCs not implementing APTS. The findings of this study reveal that the inventory management practice on record keeping, stock levels, quality assurance, physical inventory status, ordering completeness, reporting accuracy & recording accuracy practices, HCs implementing APTS had a better practice than the HCs not implementing APTS.

Descriptive analysis was used to compare the average mean scores for HCs implementing APTS and for HCs not implementing APTS; for HCs implementing APTS the average mean value was high whereas low for HCs not implementing APTS. The major issues related to quality problems were, stock outs of medicine being regular situation in the health center, the HCs not processing orders in accordance with the identified products and quantities, product theft and leakage not being controlled, and discrepancy between the stock balance recorded and actual inventory on hand. The main factors affecting the response time were the HC's failure to use periodic stock replenishment and requests that were not precisely filled out within a certain time frame or as requested. The two main problems with finance were the inability to handle orders for cost-effective resupply and failure to identify and monitor the value of missing or expired items. The issues affecting productivity were lack of tracking inventories turnover rate and ineffective use of the ABC/VEN analysis and EOQ to manage resources.

The inventory management performance was evaluated between the HCs implementing APTS and HCs not implementing APTS using an independent t-test. There was a significant difference between HCs implementing APTS and HCs not implementing APTS regarding quality, time, finance & productivity.

5.4 Recommendations

The following suggestions are provided to enhance the performance of pharmaceutical inventory management on the basis of the study's findings and the conclusions drawn from them.

- The study recommends that the health centers need to implement APTS for regular physical inventory and auditing, for efficient utilization of medicines budgets, to create a facility-specific drug list that is divided into VEN items; doing ABC/VEN analysis to find and reconcile the medications that are most required.
- It is advised that periodic stock replenishment be based on usage statistics to avoid medications expiry.
- The health centers need standardized location of inventory items to reduce the time spent on searching.

- To improve inventory management and increase pharmaceutical availability, health facilities must implement effective and efficient identification and selection of pharmaceuticals.
- The health centers need to minimize waste and expiration of pharmaceuticals to decrease the cost and be efficient mange resources.
- The health centers should track inventories of products that have a high & low turnover rate to increase productivity.
- The health centers should adequately conduct stock status analysis (SSA) twice a year to effectively manage inventories.

5.5 Limitation of the study

Findings of this study are believed to fill the gaps for alleviating the pharmaceutical inventory management performance of public health facilities. However, the study is limited only to public health centers in Addis Ababa, and it didn't see the pharmaceutical inventory management practices and performance of private health sector studies for comparison. Moreover, the study didn't consider potential regional variations of pharmaceutical inventory management practices and performances.

5.6 Directions for Future Research

To determine the impact of APTS implementation on inventory management practices and performance, more research in various healthcare institutions should be done. In addition, including a significant number of respondents in future research helps to better examine the impact of APTS implementation and strengthen the research findings.

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APPENDIX 1. Inventory Management Performance Indicators Questionnaire

COMPARATIVE STUDY ON INVENTORY MANAGEMENT PERFORMANCES AMONG HEALTH FACILITIES WITH AND WITHOUT AUDITABLE PHARMACY TRANSACTION AND SERVICE IMPLEMENTATION IN ADDIS ABABA, ETHIOPIA.

APPENDIX A: Individual Consent Form

Dear all,

My name is Betelhem Araya, I am a graduate student in the department of LSCM at Addis Ababa University, School of Commerce. I am working on the thesis entitled, "Inventory management performances among health facilities with and without APTS implementation in Addis Ababa, Ethiopia." I am engaging myself in the data collection process and your organization is one of the selected health facilities for the above-mentioned study.

My purpose is to evaluate and compare the inventory management performance of public health facilities with and without the APTS system. The data process will involve Check list & collecting data from all pharmacists who work in the health center.

You are selected to complete the questionnaire as part of the sample of the target population. Please note that your honesty in providing genuine information will make the study meaningful. Throughout this questionnaire the confidentiality of all information will be protected surely. 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.

For any of your inquiries or in need of additional information I can be reached via email or telephone at:

Email; betelhemaraya212121@gmail.com or Tel; + 251-921-028367 or Addis Ababa University School of Commerce Department of LSCM.

Thank you in advance for your cooperation.

Your sincerely

Betelhem Araya

Consent form

Are you willing to participate in the study? Yes ☐ No ☐

Appendix B: General Information

Fill appropriate answer based on the questions and Use (✓) for your answer.

1. Name of the Heath facility ----------
2. Duration that the health facility has been in operation. ----------(To be filled only by the head of the health center)
3. What tools are used to manage the inventory?
   Manual ☐ Electronic ☐ Both (Manual & Electronic) ☐
4. APTS implementation status
   Implemented ☐ Not implemented ☐
5. If your answer for question number 4 is "Implemented', The duration that the health facility has been using the APTS system. ----------(To be filled only by the head of the health center)

General Information (Respondent Profile)

1. Gender Female ☐ Male ☐
2. Profession (To be filled only by the head of the health center)
   Nurse ☐ Pharmacist ☐ Health officer ☐ Other ☐
3. Highest Education Qualification
   Below Diploma ☐ Diploma ☐ BSc ☐ MA & above ☐
4. Total years of work experience service.
   0-2 years ☐ 3-5 years ☐ 6-10years ☐ ≥10 years ☐
5. Relevant In-service (on-the-job) training is given to the professionals that are directly involved in pharmaceutical inventory management.
   Yes ☐ No ☐
6. Certificates achieved from training. (More than one answer can be possible).

APTS ☐ LMIS ☐ PMIS ☐ IPLS ☐ Other(specify) ------

Inventory Management Performance of The Health Center

Please indicate the extent to which you agree with the following statements on the Inventory management performance of the health facility using (✓) in the column. The scale below will be applicable: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree.

S. N	Items	SD	D	N	A	SA
1	**Quality**					
1.1	Stock outs of medicine is a regular situation in the health center.					
1.2	The health center process order fill rate accordingly with the identified products and quantities.					
1.3	Security issue such as: Theft & leakage of product is controlled in the health center.					
1.4	Stock balance recorded on a stock card, bin card, or automated system is accurate to the actual inventory on hand.					
2	**Time**					
2.1	The health center uses periodic replenishment of stocks.					
2.2	Standardized location of inventory items reduces the time spent on searching.					
2.3	Orders are accurately filled out during a defined period of time as requested.					
2.4	Longer lead time is one of the significant challenges faced during the process of inventory management.					
3	**Finance**					
3.1	Lost or expired items are monitored to identify the value of unusable stock.					
3.2	The health center use ABC analysis to reduce stock holding cost & maintain budget accurately.					
3.3	Cost effective resupply of order is processed in the health center.					
4	**Productivity**					

4.1	The health center track inventories of products that have a high & low turnover rate.					
4.2	Adequately conducting stock status analysis (SSA) twice a year leads to effective inventory management.					
4.3	ABC/VEN analysis and Economic Order Quantity is practiced to efficiently manage resources.					

Open Ended Questions.

1. How Inventory management is being practiced in terms of Quality, Time, Finance and Productivity?

2. If your organization implements APTS, how does APTS implementation affect the inventory management performance?

APPENDIX 2. Health Facility Inventory Management Practice Observation Check List

COMPARATIVE STUDY ON INVENTORY MANAGEMENT PERFORMANCES AMONG HEALTH FACILITIES WITH AND WITHOUT AUDITABLE PHARMACY TRANSACTION AND SERVICE IMPLEMENTATION IN ADDIS ABABA, ETHIOPIA.

APPENDIX A: Individual Consent Form

Dear all,

My name is Betelhem Araya, I am a graduate student in the department of LSCM at Addis Ababa University, School of Commerce. I am working on the thesis entitled, "Inventory management performances among health facilities with and without APTS implementation in Addis Ababa, Ethiopia." I am engaging myself in the data collection process and your organization is one of the selected health facilities for the above-mentioned study.

My purpose is to evaluate and compare the inventory management performance of public health facilities with and without the APTS system. The data process will involve Check list & collecting data from all pharmacists who work in the health center.

You are selected to complete the questionnaire as part of the sample of the target population. Please note that your honesty in providing genuine information will make the study meaningful. Throughout this questionnaire the confidentiality of all information will be protected surely. 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.

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Email; betelhemaraya212121@gmail.com or Tel; + 251-921-028367 or Addis Ababa University School of Commerce Department of LSCM.

Thank you in advance for your cooperation.

Your sincerely

Betelhem Araya

Consent form

Are you willing to participate in the study? Yes ☐ No ☐

Appendix B: General Information

Fill appropriate answer based on the questions and Use (✓) for your answer.

3. Name of the Heath facility ----------
4. Duration that the health facility has been in operation. ----------(To be filled only by the head of the health center)
5. What tools are used to manage the inventory?

   Manual ☐ Electronic ☐ Both (Manual & Electronic) ☐
6. APTS implementation status

   Implemented ☐ Not implemented ☐
7. If your answer for question number 4 is "Implemented', The duration that the health facility has been using the APTS system. ----------(To be filled only by the head of the health center)

Name of the Health Center ----------

Checklist For Inventory Management Practice

Review a sample of records and carry out informal interviews and observations to answer the following questions.

Please indicate; 1=Yes & 2= No

S. N	Inventory Management Practice (Check the list of tracer drugs)	YES	NO
1	**Record-keeping**		
1.1	The health center has a standard list of stock items managed in the institution's store.		
1.2	Each item in the store has a stock card.		
1.3	Each item in the dispensary has a Bin card.		
1.4	Are the inventory records up to date? (Check the IFRR to see how recently they have been used).		
1.5	Are the inventory records accurate? (Do they agree with what is on the shelves?)		
1.6	Is Bin ownership implemented?		
1.7	All transactions of the product to or from the store are recorded on the Bin card.		

1.8	The Bin card and Stock record cards for the health supplies are updated on the day of the physical count.		
2	**Stock levels**		
2.1	Are minimum and/or maximum stock levels calculated for each item?		
2.2	Has the average monthly consumption been calculated recently and accurately?		
2.3	Has the store avoided stock-outs for the past 100 days?		
3	**Quality Assurance**		
3.1	Are medicines & supplies checked for quality immediately upon arrival and before they are dispensed to patients?		
3.2	Are all reported problems documented?		
3.3	Are all documented problems reported?		
4	**Physical Inventory Status**		
4.1	Does the health facility conduct physical inventory at least once in a year?		
4.2	Does the health facility conduct physical inventory quarterly?		
4.3	Is monthly physical inventory conducted in the dispensary?		
4.4	How long does the physical inventory take place in the dispensary unit?		
4.5	How long does the physical inventory take place in the store?		
5	**Ordering Completeness**		
5.1	If the facility orders its supplies, are orders placed on time to maintain inventories at agreed stock levels?		
5.2	Are the quantities to order calculated correctly?		
5.3	Has an ABC and/or VEN analysis been performed?		
6	**Reporting Accuracy**		
6.1	Internal Facility Report and Resupply Form (IFRR) is used regularly per the schedule.		
6.2	Are reports filled out completely?		
6.3	Does the facility use RRF to request program drugs from EPSA every two months)? (Check at least the two preceding reports)?		
6.4	Does the pharmacy generate daily summery report, monthly finance/product and service reports for decision making?		
6.5	Dose the facility calculate pharmaceutical wastage rate? (See document)		
6.6	If yes, no 6.6 write the percentage of pharmaceutical wastage rate……		
7	**Disposal Management Practice**		
7.1	Is there physical inventory of unusable stock that is set aside?		
7.2	Are damaged or expired products removed and disposed of according to government guidelines?		
7.3	The health center submits applications for disposal of unfit for use medicines to the central disposal site?		
8	**Recording Accuracy (Materials)**		
8.1	Is there an up-to-date supply manual available to the staff?		

8.2	Is there an adequate supply of the correct forms for recording stock movements, reporting, and ordering?		
8.3	Records are easily accessible when needed.		