Assessment of Pharmaceutical Store Management in Public Hospitals, Addis Ababa, Ethiopia

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Declaration

I, the undersigned, declare that this thesis entitled "Assessment of Pharmaceutical Store Management in Public Hospitals, Addis Ababa, Ethiopia" is my original work and to the best of my knowledge has not been presented for the degree by any other person, and all sources of materials used for the thesis have been duly acknowledged.

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List of abbreviations

AACAHO	Addis Ababa City Administration Health Office
AAHB	Addis Ababa Health Bureau
ALU	Artementer – Lumefantrine
APTS	Auditable Pharmaceuticals Transactions and Services
DACA	Drug Administration and Control Authority
DTC	Drug and Therapeutics Committees
ED	Essential Drug
EMLs	Essential Medicine Lists
ETB	Ethiopian Birr
FEFO	First to Expire- First-Out
FIFO	First-In-First-Out
FMHACA	Food, Medicines and Healthcare Administration and Control Authority
FMOH	Federal Ministry of Health
GSP	Good Storage Practice
GTP II	Growth and Transformation Plan II
HC	Health Center
HOSP	Hospital
HCMIS	Health Commodity Management Information System
HSDP	Health Sector Development Program
KIs	Key Informants
LIAT	Logistics Indicator Assessment Tools

MOH	Ministry of Health
MSD	Medical Stores Department
MSH	Management Science for Health
PFSA	Pharmaceutical Fund and Supply Agency
PHC	Public Health Center
PI	Principal Investigator
RRF	Report and Requisition Form
RDF	Revolving Drug Fund
SIAPS	Strengthening Improved Access for Pharmaceutical Service
SDP	Service Delivery Points
SPSS	Statistical Package for Social Sciences
SOP	Standard Operating Procedure
STG	Standard Treatment Guideline
TMs	Tracer Medicines
USAID	U.S. Agency for International Development
WHO	World Health Organization

Note- currently the name of Pharmaceutical Fund and Supply Agency (PFSA) and Food, Medicines, and Healthcare Administration and Control Authority (FMHACA) changed to Ethiopian Pharmaceutical Supply Agency (EPSA) and Ethiopian Food and Drug Authority (EFDA) respectively.

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Abstract

Assessment of Pharmaceutical Store Management in Public Hospitals, Addis Ababa, Ethiopia
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Addis Ababa University, 2019
Background: *Pharmaceutical store management plays an important role in the management of health. Efficient practice in this area can reduce financial wastage, shortage, and overstocking of pharmaceuticals thus, assessing pharmaceutical store management performance is important.*

Objective: *The purpose of this research was to assess the existing pharmaceuticals store management practices of public hospitals in Addis Ababa.*

Method: *A facility-based descriptive cross-sectional study using a sequential explanatory mixed-method was employed in 11, public hospitals. Data was gathered using standard observation checklists, document review, a physical count of tracer medicines, structured questionnaires, and interviews with key informants from April 15 to June 30, 2019. The quantitative data were entered and analyzed using Excel 2016 and SPSS version 20 and the qualitative data were analyzed using a thematic analysis approach.*

Result: *The average adherence in storage conditions was 47.1%, 45.5% in security and safety of stores, 40.3% in special storage requirements, 59.8% in storage procedures, 100% in receiving supplies, 68.8% in stock management techniques, and 67.9% in technical stock management preconditions. From tracer medicines, only 52.24% bin cards were accurately filled. The average stockout rate of tracer medicines was 17%. The total wastage rate of pharmaceuticals between July 1, 2018, to December 31, 2018, GC. was 6,644,899.24 ETB, it was about 2.92% of the total receiving. From the in-depth interview, all key informants said that none of them have disposed of pharmaceutical wastes in the last five years as well they mentioned that the performance of the drug and therapeutic committee was weak and the procurement handled by non-pharmacy professionals from private suppliers affect the availability of medicines.*

Conclusion: *The adherence towards physical storage conditions and storage procedures of the study hospitals was found to be less than 50% and the inventory management practice was also found to be weak. There were high stockout rates of tracer medicines and the wastage rate also beyond the acceptable amount. No disposal of pharmaceuticals in the last five years, therefore hospitals should work with the concerned governmental bodies to improve the above problems.*

Keywords: Pharmaceutical storage management, Drug storage, Inventory control, tracer medicines, Public hospitals, Addis Ababa.

1. Introduction

1.1 Background

Health is recognized as a fundamental human right by international treaties and governments all over the world. In health care systems, medicines always play a crucial role and have made a significant contribution towards improving the health status of populations over time (Summers and Mackie, 2006).

Health service delivery places are the final destination of the pharmaceutical supply chain. Managing the pharmaceutical supply chain at the facility level directly affects the quality of health care. If medicines are consistently unavailable, it has a negative impact on morbidity, mortality, and disease epidemiology. Patients and staff members lose confidence in the health system, and patient attendance decreases. A continuing pharmaceutical supply promotes effective care, evokes confidence in the health facility, and contributes to job satisfaction and self-esteem among employees (MSH, 2014).

As medicines are an essential building block in health systems, it is important for countries aiming to strengthen health systems to pay attention to issues related to access to medicines. Common weaknesses in this building block are medicine shortages and stock-outs which can adversely affect other functions such as service delivery in the health system (Bajaj, 2014). The causes of medicine stock-outs are widespread as the supply chain for medicines is a complex process involving many stakeholders. However, measures can be put in place at the health facility levels where services are delivered to reduce the occurrence of stock-outs (USAID | DELIVER PROJECT, 2011).

Well-placed, well-built, well-organized, and secure storage facilities are an important component of a pharmaceutical supply system. An effective and dedicated storage space provides the correct environment for the storage of medicines and commodities and assists the efficient flow of supplies (WHO, 2004).

Every health facility must store and manage its medicines in suitable conditions of light, humidity, ventilation, temperature, and security. All medicinal products should be stored by the manufacturer's directions and among the terms of product authorizations. Pharmacy stock should be stored under suitable conditions, acceptable to the nature and stability of the product concerned (Bajaj, Singla, and Sakhuja, 2012).

Inventory control is often viewed as the attainment of a cost balance between shortage and excess of stock. In many countries, poor inventory management in public health institutions

results in wastage of financial resources, irrational use of medicines, shortage or overage of essential medicines, expiration, and decline in quality of healthcare service. The availability of life-saving medicine and other hospital supplies can be crucial to good hospital care and patient satisfaction. Hence, it helps in achieving the goal of a good hospital supply system to ensure adequate stock of needed items for the uninterrupted supply of all essential items (Welfare, 2010).

Standard storing infrastructure encompasses efficient layout, adequate storage installations, good housekeeping, safety, internal quality control, and stock management. Appropriate product layout is essential for effective and efficient store management. Stores should be organized into sections or zones in line with the intended function they will have, or the characteristics of the products that will keep in them (MSH, 2014).

Good storage practices in the pharmaceutical store are, usually overlooked. The store should be kept clean and dry. The inventory ought to be stored according to the principles of "first expired, first out." There should be a regular review so that damaged or expired stock is disposed of safely. Disposal policies should be present and properly adhered to (FMOH, 2017).

Factors contributing to stock-outs on one hand and overstocking and expires on the other in Addis Ababa public hospitals are very common. Lack of proper pharmaceutical store management skills has been implicated as contributing factors. Therefore, this study assessed existing pharmaceutical store management practices using both quantitative and qualitative methods.

1.2. Statement of the problem

Good pharmaceutical store management is a prerequisite to ensure the safekeeping of products in a systematic manner, improves the continuous availability of quality, safe and effective medicines and supplies, and maintains appropriate stock levels in adequate quantities.

Proper storage facility for pharmaceuticals ensures the effectiveness, safety, strength, and quality of products. Unless the pharmaceuticals are separated from other products and stored properly, the long shelf life of the pharmaceuticals is not guaranteed. pharmaceuticals need to be stored to maintain the intended quality and prevent damages while handling until it reaches the consumer (Balakrishnan et al., 2015).

A study conducted in Addis Ababa showed that concerning the storage condition, none of the health centers (HCs') storage condition was complete; even some HCs scored as low as 35% in good storage practice and 40% in having store equipment. The size of stores in most of the HCs was not adequate. Insufficient storage space leads to the loading of pharmaceuticals one over the other, and make difficulty in first expire to first out prearrangement, easy picking of pharmaceuticals and cleaning of a store. A fire extinguisher was not available in most of the HCs which is non-compliant to the standard of FMHACA (Mudzteba, 2014).

Lack of proper physical infrastructure, shortage of trained human power, and inefficient inventory system are challenges of pharmaceutical stores. These challenges resulted in stock-outs, overstocking, and wastage of health resources. These are major difficulties in low-income country settings where resources for health are already limited (MSH, 2014).

According to WHO access to medicine is the precedence of citizens. Pharmaceuticals need to be accessible at all times in adequate amounts, in proper dosage and quality, and at a reasonable price for individuals and communities. It is estimated that two billion people do not have access to medicines and four million lives per year might be saved in Africa and Southeast Asia with the appropriate treatment and medicine (Marks, 2010).

The money spent on buying medicines by the governments is very large and 40 to 60 percent of the entire public sector health budget of both developed and developing countries goes into buying medicines. Despite such spending, one-third of the world population lacks access to essential medicine, which actually goes up to one half in Asia and Africa. A reason for this adverse situation is the mismanagement of available resources and according to one estimate, up to 70 percent of resources are wasted in any country due to poor medicine management systems. (LeMay, 2011)

The availability or absence of medicine contributes to the positive or negative impact on health. In many developing countries, especially in public supply chains, poor medicine management remains a critical issue. (Munyanganzo, 2016)

A survey conducted in Kenya in 2010 and 2011, on the Magnitude and trend of Artementer – Lumefantrine (ALU) stock-outs at public health facilities revealed that poor stock control systems had resulted in significant stock-outs for ALU. The poor stock control system was said to have caused unrealistic stock forecasting and financing, and ultimately led to stock-outs (Sudoi, 2011).

There is also empirical evidence that in Tanzania medical stock control system is still inefficient in health facilities due to persisting experience in stock-outs and expiry of medical stocks (Sikika, 2013).

In health facilities about 40 to 45 percent of the health, budget is allocated for the procurement of medicines and supplies to ensure the availability of essential pharmaceuticals. However, inventory control is a difficult task and challenging in many countries, thus public health facilities face financial wastage, essential medicine shortage, and decreased quality of patient care (Manso and et al., 2013).

Poor inventory management is evidenced by inaccurate stock records, lack of systematic monitoring of the stock, and unclear procedures on ordering frequency and quantity, which are linked to a lack of knowledge of the meaning of inventory management, as well as inefficient and ineffective management (MSH, 2014).

A study conducted in three countries in East Africa (Tanzania, Uganda, and Rwanda) emphasized that the pharmaceutical supply management in the above-mentioned countries was found to be deficient. The weakness was underlined by the incapacity to adequately quantify needs, place orders, and adequately keep records (Matowe *et al.*, 2008).

In the past twenty years, in Ethiopia, the primary health care service shows progress to achieve the Millennium Development Goals. But the patient's endpoint of care that is pharmaceutical services remains deficient. In some facilities, medicines are expired in stores while in other facilities the needed medicines are frequently unavailable. Nationally, on average 8% of medicines in health facilities expired (SIAPS, 2014b).

The national survey conducted in Ethiopia in 2014, on the Integrated Pharmaceutical Logistics System (IPLS) indicated that the average availability of essential tracer medicines at health facilities on the day of the visit was 89% but, PFSA target for HSDP IV to increase the

availability of essential pharmaceuticals from 65% to 100% (USAID | DELIVER PROJECT, 2015).

The whole wastage rates for medicines in the eight of the study hospitals in Ethiopia was found in 2005 EC, which was estimated to be 6,254,856.31 ETB, indicating an average wastage rate of 5.27%. Nationally the goal of the Health Sector Development Program (HSDP, IV) is minimizing the wastage rate of medicines below 2%, but the actual scenario is far away from the target (SIAPS, 2014a).

Staff engaged in warehouse operations are poorly trained, lack clearly defined roles and responsibilities, and are not held accountable for their actions, and store management operations will be inefficient and ineffective (SIAPS, 2014a).

The researcher is interested to conduct this research in public hospitals Addis Ababa because public hospitals providing the highest specialty of care for an enormous number of patients and the allocated budget is huge, however poor pharmaceutical store management practices in public hospitals in Addis Ababa is a key concern, thus this thesis is intended to identify the challenges and the underline causes and provide a recommendation for concerned governmental bodies to make correction measures.

2. Literature review

2.1 Storage conditions of essential medicines

Pharmaceutical medicines are the prime crucial and indispensable resource element of a health care system, regardless of the varying size of the health institution. To ensure better accessibility and availability of the adequate quantity of medicines in the required dosage and strength, they need to be stocked. All pharmaceutical medicines possess a defined shelf life and many require precise storage facilities (USAID | DELIVER PROJECT, 2013).

Essential medicines require specific procedures and conditions for safe storage that protect their integrity and effectiveness, maximize their shelf life, and make them promptly available for distribution. The procedures should include the size and design of the storage space, appropriate conditions for storage of medicines, and the importance of stock rotation and systematic arrangement of stock, as well as attention to cleanliness, fire prevention measures, and security inside the store. Medicines should retain its properties within specified limits to be useful. When EDs are stored appropriately, clients can be assured that they will receive a high-quality product. The stability of medicines depends on the active ingredient, which can be affected by its formulation and packaging. Inadequate storage and distribution can lead to physical deterioration and chemical decomposition, and reduced potency (MSH, 2014).

A study done in India showed that on average 40% of the store had a ceiling that is in good condition without any dampness, in all stores drug products are protected from direct sunlight, 45% of stores had tidy shelves, the floor is swept, and walls are clean and 21% of the store had supplies are arranged alphabetically on shelves as per the storage procedures (Iqbal MJ, 2015). Research done in Addis Ababa health center showed that Products had stacked 10 cm of the floor, 30 cm away from the wall, and not more than 2.5 meters high were evaluated to be 69.6%, 21.7%, and 78.3% respectively (Mudzteba, 2014).

2.1.1. Special storage conditions

Some classes of medicines and supplies require special storage conditions. These include vaccines, narcotics, and combustibles. Vaccines need both refrigerators and freezers. And narcotics and other controlled substances must be kept in secure locking rooms with only one entrance and the keys should be kept in a safe and secure place, solely the store manager, and one additional person should have access to them (WHO, 2004).

Combustibles such as alcohol and fuels must be stored in special rooms and it is preferred to be separate outbuilding since it guarantees that fire will not spread throughout the store if a separate store not available the combustible supplies must be stored in a fireproof and well-ventilated area (WHO, 2004).

2.1.2. Security and safety in storage

Security arrangements about poisons and medicines should at least meet the standards in the relevant legislation. Stock control methods should be robust to detect any loss by theft. Safety and risk reduction measures for handling, transportation, usage, and disposal of highly combustible liquids, toxic and corrosive materials according to the appropriate guide to be safe working. Firefighting precautions should include the training of selected staff to form a fire fighting team capable of using effectively the equipment available in the site and the routine maintenance and testing of firefighting alarms, detection systems, and sprinkler alarms (WHO, 2004).

2.2 Organization of a medical store

Essential medicines and supplies have a specific period of time during which they should be used (shelf life). This is indicated by the date of manufacture and expiry on the item's label. The shelf life indicates the time the item can be used safely if it has been stored under the manufacturer's recommended storage conditions. Poor storage may result in the development of poisonous degradation products that can be hazardous to the patient. Health workers responsible for medical supplies should monitor the shelf life of medical supplies closely and strictly adhere to the storage conditions recommended by the manufacturer. The two most significant factors that affect the quality of medicines and supplies during transit and storage are temperature and humidity (MOH, 2012).

2.3. Stock management

Stock management, also referred to as inventory management, involves all the policies, procedures, and techniques used to maintain the optimum amount of each item in stock. It involves ordering, receiving, storing, issuing, and reordering items. Stock and inventory management are the centers of the medicines supply system (MOH, 2012).

Stock control involves monitoring supplies through various reporting methods. By systematically monitoring and controlling stock, appropriate orders can be prepared that optimize limited resources and minimize stock-outs and expiry (MOH, 2012).

An effective stock management system ought to ensure that the right medicines of the right quality and quantities are available at the right place, at the right time, and the right cost. Within public health organizations, the aim is to constantly create safe, effective, quality, and affordable medicines and health supplies are accessible (MOH, 2012).

2.4. Receiving and storing pharmaceuticals

2.4.1. The receiving process

The store personnel must perform acceptable receipt procedures, while receiving a medicine, like reconciling medicines received to medicines ordered, to make sure that discrepancy between amount and medicine type does not exist. Once the medicines received have been verified, they ought to be physically maintained in secure storage areas or active dispensing areas of the pharmacy. Controlled substances need further storage security to prevent any unauthorized access and should be received by authorized personnel (Deloitte, 2015)**,** also, take care to follow any internal pharmacy procedures concerning the receipt of inventory. For example, you will make sure that the receipt of the order in the store computer system, either through manual entry or by bar-coding the incoming items. unless you let the computer recognize that the order has been received, the computer system shows an incorrect inventory level and will keep trying to order a lot of products even if an adequate amount is readily available on hand (Fredaric, 2016).

2.4.2. The storing process

When the pharmaceuticals have been appropriately received it should be stored properly. Depending on the size and type of store operation the product could be placed in bulk at the central medical store and in an average amount in the active dispensing area of the store. In any case, the expiration date of the product should be compared with the products currently available. Expired pharmaceuticals must be removed from the stock and pharmaceuticals that will expire shortly must be identified and placed in the front of the shelf. The newly received pharmaceuticals which have longer shelf life should be placed behind the one that will expire before them. This method is known as stock rotation. Stock rotation is crucial to minimizes the expiry of pharmaceuticals since it facilitates the use of products before expire and helps to avoid the use of expired pharmaceuticals (Fredaric, 2016).

The study conducted in India showed that only 20% of Supplies were arranged alphabetically on shelves as per the storage procedures as well 40% of medicines were grouped in quantities that are easy to count and 100% of Narcotic and psychotropic substances were stocked in separate double-locked storage space (Iqbal MJ, 2015). A study done in South Africa showed that only 15% of them were applying the FIFO/ /FEFO principles when issuing stock (Nakyanzi, Kitutu, and Fadhiru, 2010).

2.5. Stocks control systems

The stock control system is intended to determine the number of stocks on hand, the levels of replenishment, and how large orders should be. A stock control system provides the organizational structure and the operating policies for maintaining and controlling goods to stock. The pharmaceutical store control system is accountable for when to order, how much to order, from whom, tracking of the order and receipt of products. (F. Robert Jacobs, William L. Berry, 2018). There are two stocks control systems applicable in medical stock control. These are the Periodic Stock Control System and Perpetual Stock Control System (Ugwu and Attah, 2016).

2.5.1 Periodic stock control system

In this system, the balance of stock at hand is not checked on a daily basis. This system shows the beginning and end of stock levels during a specific period of time. This is the basic method of controlling stocks by quantity by fixing for each item stock level. Stock levels are recorded in the stock records system (say computerized and/or manual) and subsequently used as a means of indicating when some action is necessary (Ugwu and Attah, 2016).

The minimum stock level is a stock allowance to cover errors in forecasting and lead time or the demand during the lead time (Iwu *et al.*, 2014). A minimum stock level has to be set to create a buffer against the various uncertainties that exist (Coyle et al., 2016). On the other hand, a maximum stock level is set to ensure that not too much stock is kept because that would be unnecessary. Once the minimum level has been reached, items have to be reordered until the maximum is reached again. In practice, however, it mostly takes a while before ordered goods are actually delivered, therefore ordering level is also necessary to ensure that the stock will not fall under the minimum level. The ordering level makes sure that goods are ordered before the minimal level is reached, in such a way that the ordered goods are delivered just in time when the stock approaches the minimum level. If the ordering level is reached, items are ordered and due to the delay, they will be delivered just at the point where the stock level is at its minimum. The minimum stock is also referred to as safety stock. The safety stock forms an ultimate buffer to cope with uncertainties (e.g. in delivery times and varying demand). The more reliable the supplier and customer demands are, the lower the safety stocks can be because there is less uncertainty (Coyle et al., 2016).

2.5.2 The perpetual stocks control system

This system is useful since it continually updates the stock status when products are received, sold, and moved from one store to another. The perpetual stock control system is preferred because it gives up to date inventory information. Generally, it examines either the physical stock or the stock record cards of a specific product are examined at regular intervals and taking concurrent action for all products requiring replenishment (Ugwu and Attah, 2016). The stock level is reviewed continuously and whenever the stock falls below a predetermined reorder level order is initiated. The reorder level is based on the average lead time; when the reorder level is reached there should be enough stock to last until the next order arrives (Ugwu and Attah, 2016).

There are other stock control systems applicable in medical stock control which include: Pull system, Push system, and Just in time system. The pull system involves replenishment of stocks which is triggered by interpretation of the expected demand and scheduling of supply to meet that demand. This system involves a reaction to demands. Unlike the pull system, push replenishment is triggered by the usage or depletion of stocks. The adverse effect of the push system is the existence of more stock in the system than the requirements since the consideration of the actual demand is minimal. In Just in time system the replenishment of items is made for their immediate use. Thus, order delivery is made only for the present requirement (Hunt, 2018).

2.5.3. Indicators used to measure warehouse performance

The indicators for warehouse performance are divided into four categories; quality, time (response time), financial, and productivity. In this assessment, I shall consider the category of quality.

I. Inventory accuracy rate

This indicator measures the percentage of warehouse or storage locations that had no inventory discrepancies once stock cards were compared to a physical inventory count out of the whole number of items under review, during a specific period of time. On the other hand, this indicator can be calculated for one facility because as a percentage of months with no inventory discrepancies out of the entire number of months within the review period (e.g., annual). (USAID | DELIVER PROJECT, 2010).

The study done in Jordan ministry of health hospitals showed that the average percentage of stock discrepancy records that correspond with the physical count was 21%, while a study done

in South Africa showed that 50% of discrepancy occurred between bin card record from that of the physical count (Talafha, 2006; Motlanthe, 2010).

II. Stockout rates

This indicator measures the percentage of facilities (e.g., service delivery points [SDP], warehouses) that experienced a stock out of a specific product that the site is expected to provide, at any point, within a defined period of time (e.g., the past 6 or 12 months). Stockout rates are often calculated for a single product across facilities or aggregated for all products carried by a particular type of facility, or with a particular region. The stockout rate can be calculated over any period of time usually one year is common. (USAID | DELIVER PROJECT, 2010).

A study conducted in 54, public hospitals of Tanzania to inquire about stock-outs of essential medicines and medical supplies, found out that a majority, (94%), of hospitals, reported being out of stock of one or more essential medical supplies (Sikika, 2011).

Researches done in Tanzania and Jordan showed that the average availability of the basket of key drugs in public health facilities was 88.9% and 62.5% respectively (Welfare, 2010; Namaya, 2017).

III. Stock wastage due to expiration or damage

This indicator is defined as the percentage of stock for a product that is unusable because of expiration or damage out of the total quantity of stock on hand of that item, at a specific point of time (e.g., at a time of supervision, physical inventory). This indicator is often calculated for any facility that manages the products of interest. It can be measured over any time period but is usually calculated after a physical inventory is taken (USAID | DELIVER PROJECT, 2010).

A study done in selected public health facilities in the Southwest Shoa zone, Oromia regional state, Ethiopia reported that the average wastage rate of medicine was 7.5% (Tadesse, 2017). which was higher than the national target of 2% (FMOH, 2010).

2.6 Medicine waste management

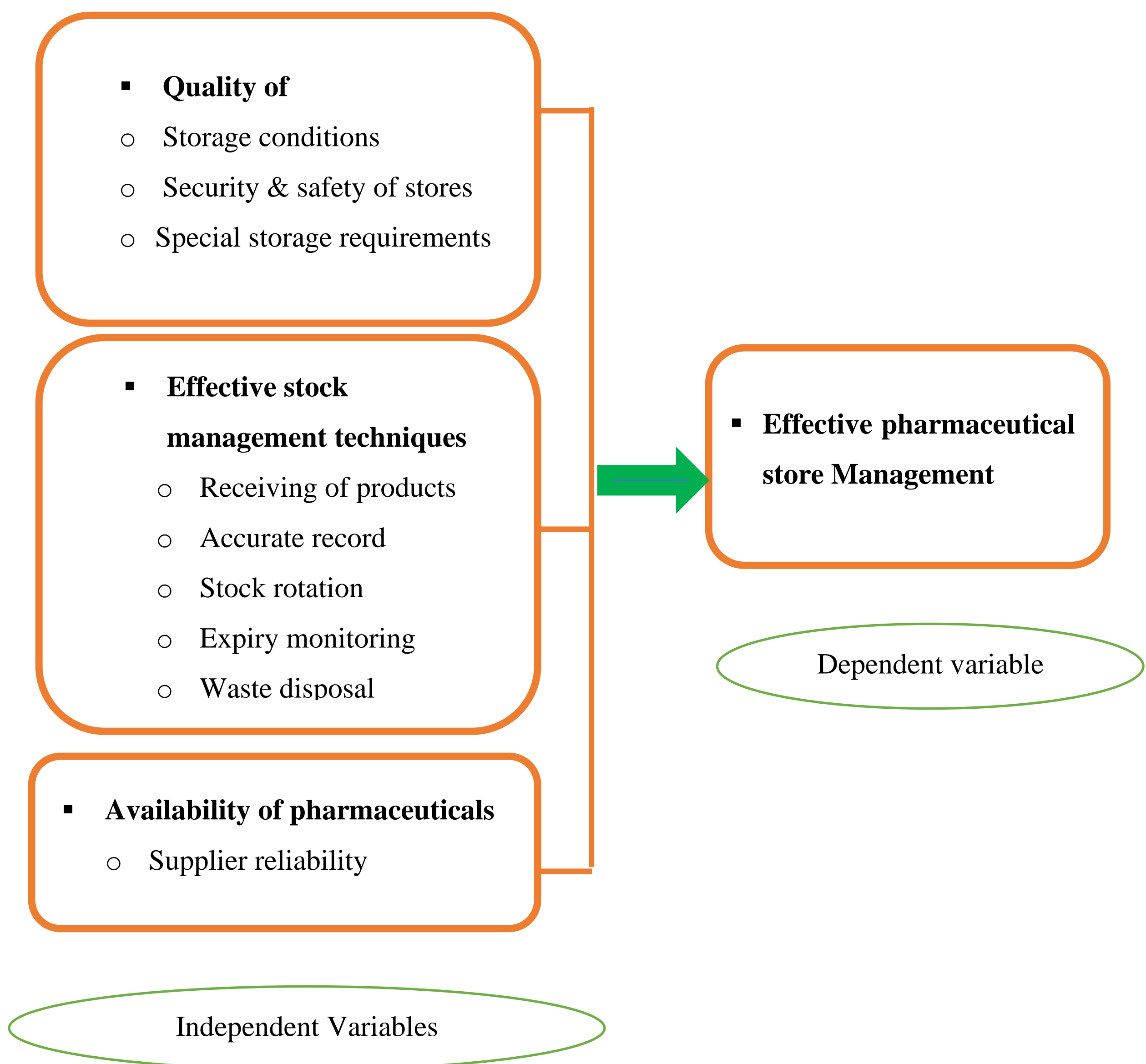
Pharmaceutical waste includes expired, counterfeit medicines, all cold chain damaged, unexpired medicines that should have been stored in a cold chain but were, improperly stored, sealed and labeled products, and discarded packing materials. Medicines that are unfit for use shall not be stored for more than six months (FMHACA, 2011).

Proper pharmaceutical waste management is an extremely complicated new frontier in environmental management for healthcare facilities. It desires trained persons and equipment

for collecting, treating, and disposal of pharmaceutical wastes. Health professionals such as pharmacists and nurses not trained on the management of hazardous pharmaceutical wastes during their academic carrier and environmental personnel may not be familiar with the active ingredients and formulations of pharmaceutical products (Greenhealth, 2008).

2.7 Conceptual framework

The conceptual framework for this study introduces the independent and dependent variables of the study. Independent variables are variables that determine the value of the dependent variable, whereas dependent variables are variables whose changes depend solely on the independent variable (Kothari, 2004).



2.8. Dissemination of results

The results of this study will be communicated to the Addis Ababa City Administration Health Office and the Federal Ministry of Health. It will be also accessed to other concerned governmental bodies, interested researchers, and academicians through the school of Pharmacy, Department of Pharmaceutics and Social Pharmacy, Addis Ababa University. Health managers and policymakers at the regional, and country-level will gain from the input of this study.

3. Objectives of the study

3.1 General objective

- To assess pharmaceutical store management in public hospitals Addis Ababa, Ethiopia.

3.2 Specific objectives

- To evaluate the availability of appropriate storage premises and facilities
- To assess the quality of stock management practices
- To identify factors affecting the performance of pharmaceutical store management

4. Methods

4.1. Study area and setting

Addis Ababa City, the capital city of Ethiopia covers an area of 540 km^2 with a total population estimated in 2020 is 4,793,699 million (World Population, 2020). It is administratively subdivided into 10 sub-cities. According to the 2018 Addis Ababa health bureau report, there are 11 public hospitals, 3 army and police hospitals, 35 private and NGO hospitals, and 102 health centers (HCs), 189 pharmacies and 232 drug stores are also in the city. 482 pharmacists and 41 pharmacy technicians' work in public hospitals in Addis Ababa (EPA, 2017).

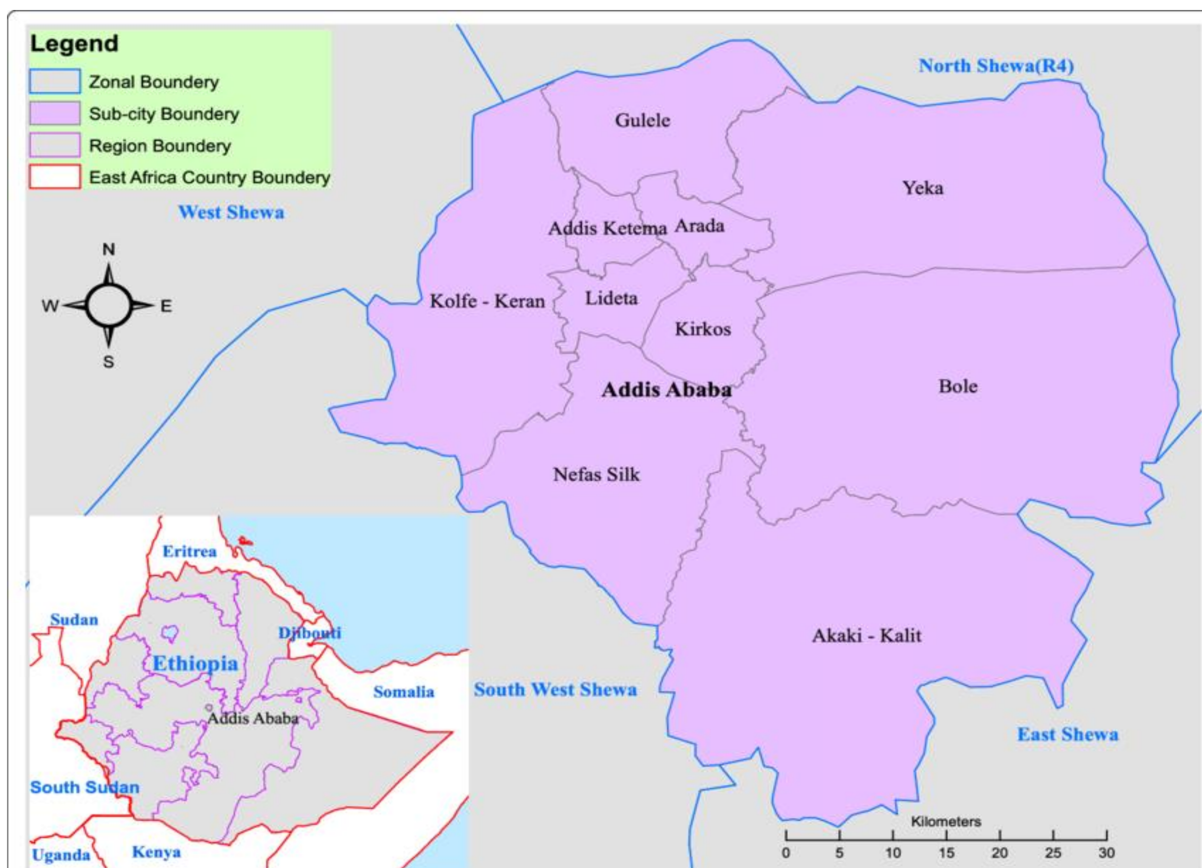


Figure 1. Map of Addis Ababa showing administrative sub-cities of Addis Ababa, 2019. (Source: Shapefile from Ethiopian Karta Agency)

The study was conducted in all public hospitals in Addis Ababa. These include Menelik-II hospital, Yekatit 12 hospital medical college, Ras Desta memorial hospital, Zewditu memorial hospital, Gandi memorial hospital and Tirunesh Beijing hospital from AACAHO, ALERT hospital, Amanuel mental specialized hospital, St. Paul's hospital millennium medical college, and St. Peter hospital, from the FMOH and Black Lion specialized hospital a university hospital.

4.2. Study design

The descriptive cross-sectional study design was used to assess the performance of pharmaceutical store management. A sequential explanatory mixed research method was used for collecting, analyzing, and interpreting both quantitative and qualitative data. A mixed research method was selected because it provides strengths that balance the weaknesses of both quantitative and qualitative research methods thus it gives a more complete and comprehensive understanding of the research problem. The confirmatory sequential design was used, first, the quantitative data was collected then followed by qualitative data thus, the quantitative data well understood. The quantitative survey was done to public hospitals comprising observation, document review, and self-administered questionnaires to the store personnel, and the qualitative data were collected from store personnel, pharmacy heads, and medical directors of the respective hospitals. The qualitative data were used to supplement the quantitative results especially for factors that affect the performance of pharmaceutical store management. The Positionality of the PI for qualitative inquiry is insider, in which the PI has special sensitivity, understanding of the matter and participants may be more confident in the PI's ability to represent their story. Therefore, the participants may be more willing to share and provide richer data (Berger, 2013).

4.3. Source and study population

The source and study population were all public hospitals found in Addis Ababa.

4.4. Sampling and study participants

All public hospitals in Addis Ababa were selected. A standard pharmaceutical store premise, storage, and facilities observation checklist were used to assess all hospitals as well its performance was measured by key performance indicators. All head of store personnel participated in a quantitative survey made using a self-administered questionnaire. Store personnel, pharmacy heads, and medical directors who are working in public hospitals during the study period were included for key informant interviews in which the researcher used random purposeful sampling and it randomly selected a desired number of respondents from the list and the data was collected until they reached saturation.

4.5. Data collection procedure

4.5.1. Data collection

Two pharmacists were recruited as data collectors for quantitative surveys and qualitative data were collected by the principal investigator. The quantitative data were collected by using standardized MSH and LIAT store management checklist through observation, document review from HCMIS and bin cards, physical count, and structured self-administered questionnaires to store personnel, and the qualitative data collection technique were using a semi-structured interview guideline. Key informant interviews were conducted to gather information from store personnel, pharmacy heads, and medical directors about the overall picture of pharmaceutical store management performances. Interviews were conducted by the principal investigator. Informed consent was obtained from all respondents. Interviews were prepared in English and it was translated to Amharic. On average interviews took about 25 minutes. The data were audio-recorded transcribed in Amharic and translated from Amharic to English by the principal investigator. Data collectors were trained on the aim of the study, the study procedures, data collection instruments, and research ethics.

4.5.2. Data collection instruments

A structured questionnaire checklist adapted from a supervisory checklist to assess pharmaceutical management activities at the facility level (MSH, 2014) and logistic indicator assessment tool (LIAT) (USAID | DELIVER PROJECT, 2008). which are used to conduct a facility-based survey to assess the premises of pharmaceutical storage condition, security, and safety of stores, special storage requirements, storage procedures, receiving supplies, stock management techniques, and technical stock management preconditions, from document review indicators such as inventory accuracy rate, stock out rate, and stock wastage rate was used to collect quantitative data. (see annexes,1)

A self-administered questionnaire to determine the adherence to stock management pre-conditions and techniques was adapted from pharmaceutical management activities at the facility level (MSH, 2014) and logistic indicator assessment tool (LIAT) ((USAID | DELIVER PROJECT, 2008) are administered to the store personnel of each hospital. As well questions which rank the main cause of stockout and expiry of pharmaceuticals was adapted from (Kagashe and Massawe, 2012). The store personnel were first asked their consent and then asked to fill the questionnaire.

A semi-structured interview questionnaire for store personnel, pharmacy heads, and medical directors were adapted from Guide to good storage practices for pharmaceuticals (WHO, 2003) and Guidelines for good storage practices (FMHACA, 2015). These questionnaires were used to collect qualitative data. The key informant interview was recorded by a voice recorder. (See Annexes, 2, to 5).

4.6. Data analysis and presentation

The quantitative data i.e. data from observation checklist, document review, performance indicators, and self-administered questionnaires were entered and analyzed using Excel 2016 and SPSS version 20 and the result are presented in the form of tables and graphs. Findings from document reviews such as the inventory accuracy rate of TMs, stockout rate of TMs, and the wastage rate of pharmaceuticals were calculated. The indicators described in the USAID/ Deliver project, Guide to key performance indicators for public health managers were used (USAID | DELIVER PROJECT, 2010)

Inventory accuracy rate, stock out rate, and wastage rate were calculated using the following formulas respectively.

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

$$\text{Stockout rate} = \frac{\text{number of facilities that experienced a stockout of a specific product}}{\text{total number of facilities that are expected to offer that product}} \times 100$$

$$\text{Wastage rate} = \frac{\text{unuseable stock}}{\text{the total quantity of usable and unusable stock}} \times 100$$

The percentage of inventory accuracy rate was verified by checking the equality of physical count of TMs with that of a bin card record of a specific product. A total of 20 TMs bin cards were used to gather information on the inventory accuracy rate. These 20 TMs were selected by MOH of Ethiopia from the essential medicines list.

Then a percentage of the physical count of TMs less than a bin card record, percentage of the physical count of TMs greater than a bin card record, and percentage of a physical count of TMs equal to a bin card record were calculated to verify the inventory accuracy rate.

The percentage of stock out of TMs was determined by measuring the stock out of a selected TMs on the store during the time of survey between April, 15 to June 10, 2019.

The wastage rate of pharmaceuticals was collected by reviewing the computerized stock recording system, i.e. HCMIS for the six months of the period before the survey from July 1, 2019, to December 31, 2019. The following data were collected.

Amount of pharmaceuticals on hand in Ethiopia Birr (EBR) on July 1, 2019

Amount of pharmaceuticals received between July 1, 2019, to December 31, 2019, in EBR

The total amount of wastage (expired) pharmaceuticals between July 1, 2019, to December 31, 2019, in EBR

For the qualitative part, data were analyzed using a thematic analysis approach. The records were listened to and transcribed from the voice recorder. The findings were grouped according to key themes and each of the different positions was summarized and the findings were presented by narration.

4.7. Data quality assurance

The quantitative data collection checklist is a standardized tool used to assess pharmaceutical store management activities at the facility level (MSH) and Logistics indicator assessment tool (LIAT). LIAT is a tool prepared by USAID | Deliver which is used to conduct a facility-based assessment on health commodity logistics system performance and product availability at health facilities. (USAID | DELIVER PROJECT, 2008). A one-day training was given to data collectors about the study procedures before data collection. Interviews guide were verified by looking to what was really on the ground at the public hospitals as applicable and commented by the staff of the Pharmacy school and approved by my advisor. The principal investigator was supervising the data collection process and reviewed completed questionnaires to clarify any data discrepancies.

4.8. Operational definitions

Safety stock: is the extra unit of inventory carried as a protection against possible stock-outs.

Overstock: Inventory on-hand in more than the order point.

Public health hospitals - This is hospitals owned by the government usually providing services to the public

Pharmaceutical wastes: unfit to use pharmaceuticals generated in the pharmacy premises of the hospitals, but not to medical equipment, and other health care wastes generated by the hospitals

Disposal-suggests that removal of medicines and supplies destined for destruction without the intention of retrieval, in compliance with existing legislation.

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

4.9. Ethical considerations

Before starting data collection, ethical approval was obtained from the Ethics Review Committee of the School of Pharmacy, Addis Ababa University, Then, communicated to Addis Ababa City Administrative Health Office and Federal Ministry of Health with formal letters from the School of Pharmacy AAU. Thereafter both AACAHO and FMOH wrote a formal letter to the respective hospitals, finally, the respective hospitals' administrative bodies permitted to do the study. Then, communicating with the respective pharmacy heads to facilitate the study. Participants of the study were asked for informed consent before participating in the study.

During the consent process, they were provided with information regarding the purpose of the study, why and how they were selected to be involved in the study, and participants were also assured about confidentiality and anonymity of the information obtained in the course of the study by not using personal identifiers and analyzing the data in aggregates. Concerning the key informant interviews, interviews were recorded by voice recorder after interviewees giving informed consent. The name of the interviewees and the hospital in which they work did not appear in data analysis, and interviewees were assured that the information they provide was only to be handled by the research team, and that was not discussed with the hospital administrators or other participants of the study.

5. Results

The results presented include the storage conditions of public hospitals, security, and safety of stores, special storage requirements, storage procedures, stock management techniques, the accuracy of bin cards with that of physical counts, availability of tracer medicines on the day of the survey, and wastage rate of pharmaceuticals and the qualitative data presented thematically by narration.

5.1. Storage conditions

The physical storage conditions of all public hospitals in Addis Ababa were assessed. About 45% of the stores had adequate lighting to enable all operations safely. Windows in the storage area that can be opened and ventilators are in good condition were only about 18%. Only 64% of stores were protected from direct sunlight. None of the stores had a clearly defined and separate area for reception and dispensing of products. In most stores, 73% were free of pests. (Table 1).

Table 1. Physical storage conditions of pharmaceutical in public hospitals, Addis Ababa, 2019(n=11)

S.NO	Physical storage conditions	frequency [yes] (%)
1.	A ceiling that is in good condition	9(81.8)
2.	Adequate lighting to enable all operations safely	5(45.5)
3.	Windows that can be opened and ventilators are in good conditions	2(18.2)
4.	No cracks, holes, or sign of water damage	7(63.6)
5.	Products are protected from direct sunlight	7(63.6)
6.	Separated area for reception, storing & dispensing of products	0(0)
7.	Free from insects and rodents	8(72.7)
8.	Clean shelves, floor, and walls	5(45.5)
9.	Products are stacked at least 10 cm off the floor.	7(63.6)
10.	Products are stacked at least 30 cm away from the walls and other stacks.	2(18.2)
11.	Products are stacked no more than 2.5 meters High	5(45.5)
	Average	**47.12**

5.2. Security and safety of stores

Only seven (63.6%) of store windows had grills. Only four 36.4% of the stores had a functional fire extinguisher. Only two (18.2%) hospitals had a service for fire extinguishers at least every 12 months. All the store managers 100% had not been trained on how to use the fire extinguishers. All 100% of the stores had no smoke detector (Table 2).

Table 2. Security and safety of storage conditions in public hospitals, Addis Ababa, 2019 (n=11)

S. No	Security and safety of stores	frequency [yes] (%)
1.	The door has 2 locks; each lock has a separate key	11(100)
2.	Windows secured with grills	7(63.6)
3.	Has a functional fire extinguisher	4(36.4)
4.	Trained how to use the fire extinguishers	0(0)
5.	Service fire extinguishers every 12 months	2(18.2)
6.	Has smoke detectors	0(0)
	Average	**45.46**

5.3. Special storage requirements

Pharmaceuticals products require special storage conditions to ensure its quality, thus proper temperature and humidity must be controlled, automatic back-up power supply for refrigerator must be available, psychotropic substances, inflammable and corrosive items must be stored based on its specifications (Shafaat, 2013).

Concerning special storage requirements, four (36.4%) of them have at least one functional wall thermometer. However, only three (27.3%) of them recorded and updated room temperature. All of the stores have no hygrometer for humidity monitoring. Only three (27.3%) of them recorded and maintained refrigerator temperature twice per day. All the surveyed hospitals have an automatic generator for the backup supply of power. Only three (27.3%) of them have separate and double-locked storage space for narcotic and psychotropic drugs. All of the stores have no fireproof area for combustible substances as well as separate space for corrosive chemicals (Table 3).

Table 3. Special storage requirements in public hospitals, Addis Ababa, 2019 (n = 11)

S. No	Special storage requirements	frequency [yes] (%)
1.	At least one functional wall thermometer	4(36.4)
2.	Functional humidity-monitoring equipment (hygrometer)	0(0)
3.	Room temperature was recorded and up to date.	3(27.3)
4.	Temperature-sensitive items are stored in a refrigerator.	11(100)
5.	Room humidity recorded and up to date	0(0)
6.	Refrigerators have thermometers	9(81.8)
7.	Refrigerator temperature maintained and recorded twice per day	3(27.3)
8.	An automatic backup supply of power	11(100)
9.	Availability of a generator operator all the time for 24 hours	11(100)
10.	Calibration schedule for monitoring equipment such as thermometer and hygrometer	5(45.5)
11.	Narcotic and psychotropic medicines stored in a double-locked cabinet	3(27.3)
12.	Combustible substances are stored in a fireproof area	0(0)
13.	Corrosive chemicals stored separately	0(0)
14.	High valued items are stored in a separated and locked area	2(18.2)
	Average	**40.3**

5.4. Storage procedures

The majority of the stores did not have adequate space for storage of pharmaceuticals so that products were not adequately arranged based on FEFO and FIFO principles and products not grouped in the amounts that are easy to count. Also, only four (36.4%) of them labeled the shelves properly. Table 4. Shows the percentage of compliance with the storage procedures.

Table 4. Storage procedures in public hospitals, Addis Ababa, 2019 (n = 11)

S.NO.	Storage procedures	frequency [yes] (%)
1.	Pharmaceuticals arranged systematically & have designated place	8(72.7)
2.	All shelves labeled properly	4(36.4)
3.	Liquids, ointments, and injectables stored on the middle shelves	6(54.5)
4.	Surgical items, condoms, and bandages stored on the bottom of the shelves	6(54.5)
5.	Items grouped in amounts that are easy to count	4(36.4)
6.	Labeled area for expired medicines within the store	8(72.7)
7.	Shorter expiry dates are placed in front of those with later expiry dates (FEFO)	6(54.5)
8.	Supplies with no expiry date are stored in the order received (FIFO)	8(72.7)
9.	No damaged containers or packages are on the shelves	7(63.6)
10.	The disposal of medicines is recorded	11(100)
11.	No staff food and drinks in the refrigerator	11(100)
12.	Nonpharmaceutical products stored with medicines	0(0)
	Average	**59.83**

5.5. Stock management techniques

All eleven (100%) of the stores used a computerized stock management system. In nine (81.8%) of them have bin cards for each item, however, in only five (45.5%) of them, the bin cards were kept on the same shelf with the items, as well in all stores the bin cards were not fully updated concerning tracer medicines (Table 5).

Table 5. Adherence to stock management techniques in public hospitals, Addis Ababa, 2019 (n=11)

S.NO.	Stock management techniques	frequency [yes] (%)
1.	Each product in the store have a bin card	9(81.8)
2.	The bin card kept on the same shelf as the item	5(45.5)
3.	All the information on the bin card up to date	0(0)
4.	Computerized stock management system used	11(100)
5.	Standard order form using all the time	2(18.2)
6.	The requisition book kept at the facility	9(81.8)
7.	Information on the requisition form is accurately written	11(100)
	Average	**68.83**

5.6. Availability of tracer medicines on the day of the survey

On the day of the survey, the availability of each tracer medicine both in the program and budget stores of all public hospitals was calculated in percentage. The result indicated that Amoxicillin, Oxytocin, Adrenaline, Normal saline, Tetanus antitoxin (TAT), and TDF/3TC/EFV were available in all public hospitals. While Zinc dispersible tablet was available in 65% of the hospitals (Table 6).

Table 6.Tracer medicines stock availability on the day of survey in public hospitals, Addis Ababa, 2019 (n=11)

S. No.	List of tracer medicines	% of hospitals in which the tracer medicines are available (n=11) %
1.	Amoxicillin 500 mg capsule	100%
2.	Oral Rehydration Salts	85%
3.	Zinc dispersible tablet	65%
4.	Gentamycin Sulphate 20 mg/ml	90%
5.	Cotrimoxazole 240 mg/5 ml Suspension	95%
6.	Oxytocin 10 units/ml	100%
7.	Medroxyprogesterone Injection	80%
8.	Adrenaline (Epinephrine) injection	100%
9.	Enalapril 5mg tablet	85%
10.	Hydralazine injection	85%
11.	Glibenclamide 5mg Tablets	80%
12.	Glucose 40%	95%
13.	Normal saline 1000 ml	100%
14.	Ferrous sulphate + folic acid	80%
15.	Ciprofloxacin 500 mg tablet	90%
16.	Ceftriaxone 1 gm injection	95%
17.	Tetanus antitoxin (TAT)	100%
18.	TDF/3TC/EFV adult	100%
19.	TB (RHZE/RH) patient kit	95%
20.	Tetracycline eye ointment	95%
	Average	**90.75**

5.7. Stock-outs of tracer medicines

Results from the survey revealed that the average stock out of tracer medicines in the stores of public hospitals was 16.8% with a median value of 15 % and a range of 5% - 30%. The majority of the hospitals were found to have greater than 10% stock out of tracer medicines. Figure 2 shows the results.

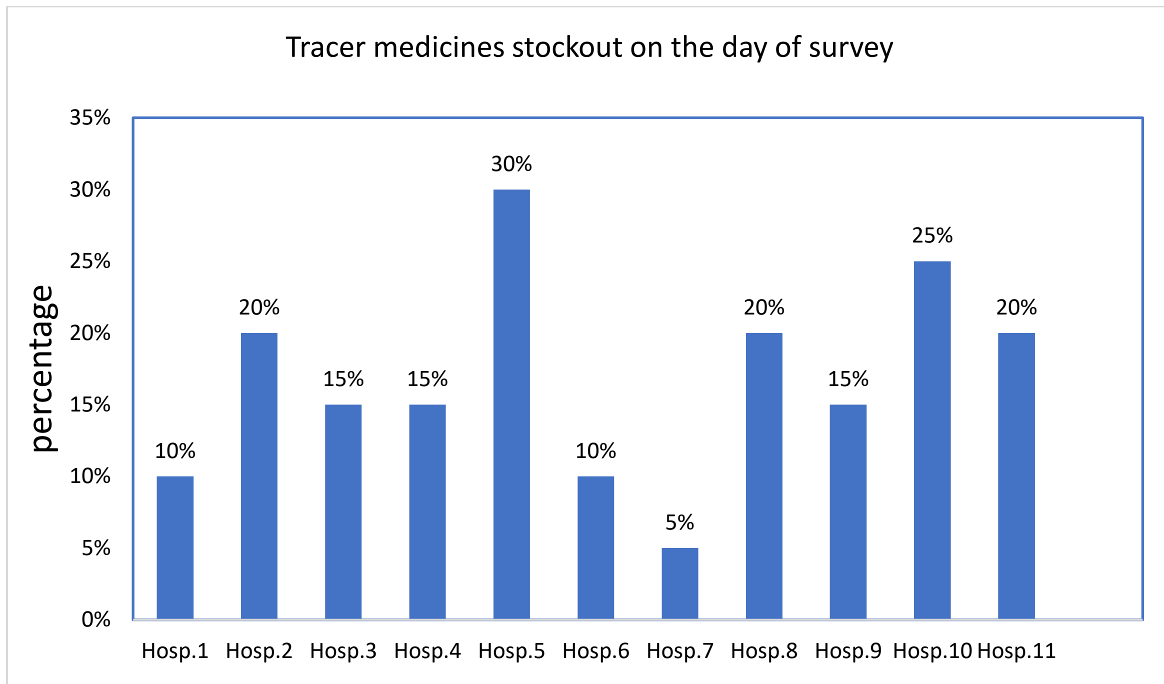


Figure 2. Percentage stock out for 20 tracer medicines in public hospitals, Addis Ababa, Ethiopia (n=11)

5.8. Accuracy of bin cards with that of physical counts

Accurate stock record balance between manual bin card with that of physical count ranges from 40% to 65% while the percentage of manual bin card record balances that were less than physical inventory ranges from 10% to 35%, whereas, percentage of manual bin card record balance that was greater than physical count ranges 15% to 40%. (Figure. 3).

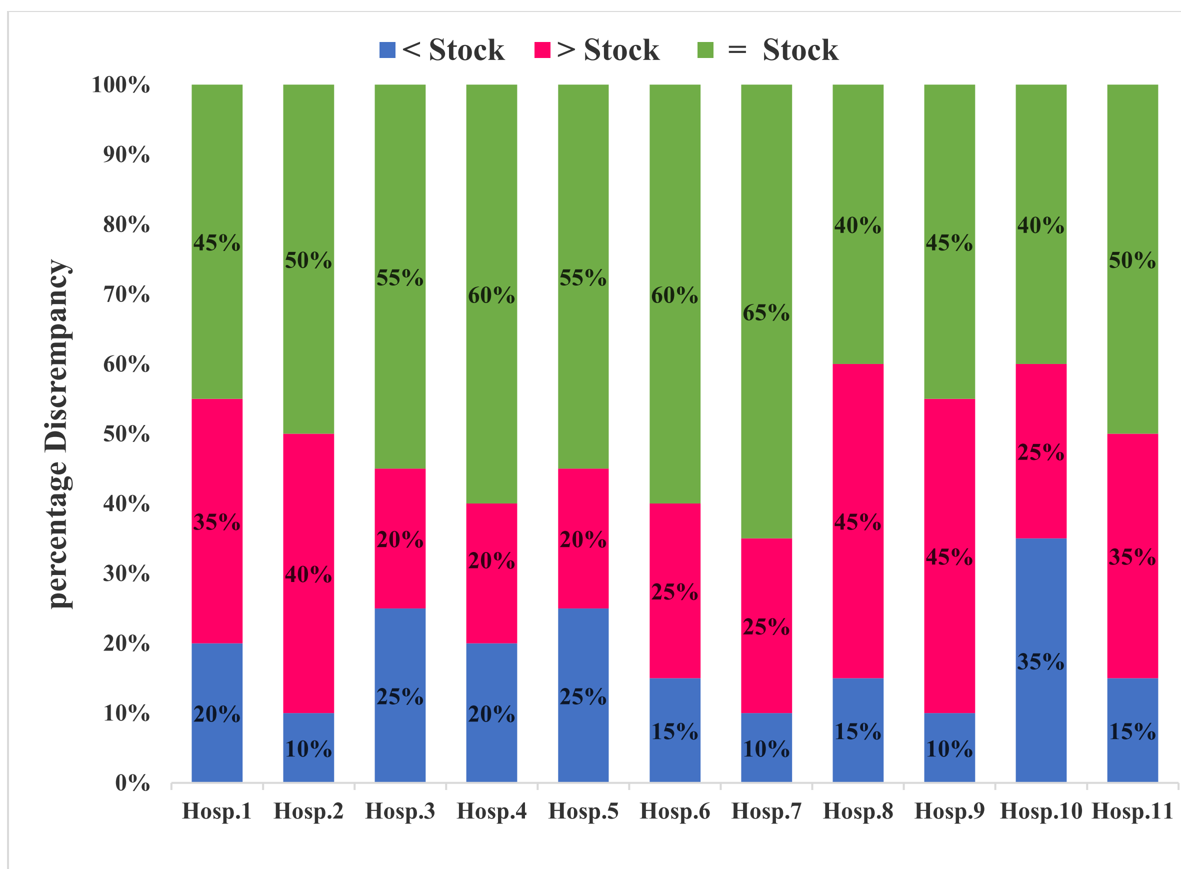


Figure 3. Percentage discrepancy between physical count and balance on bin card of tracer medicines at public hospitals, Addis Ababa, 2019. (n=11)

5.9. Overall adherence to pharmaceutical store management practices

Standard pharmaceutical stores with adequate equipment, storage procedures, and stock management techniques are expected to be followed by all health facilities. These ensure medicines quality, minimizing wastage, and ensures a regular supply to health facilities. This study revealed that the overall adherence to physical storage condition is 47.1% and the storage procedure and stock management techniques are 59.8% and 68.8% respectively (Figure 4).

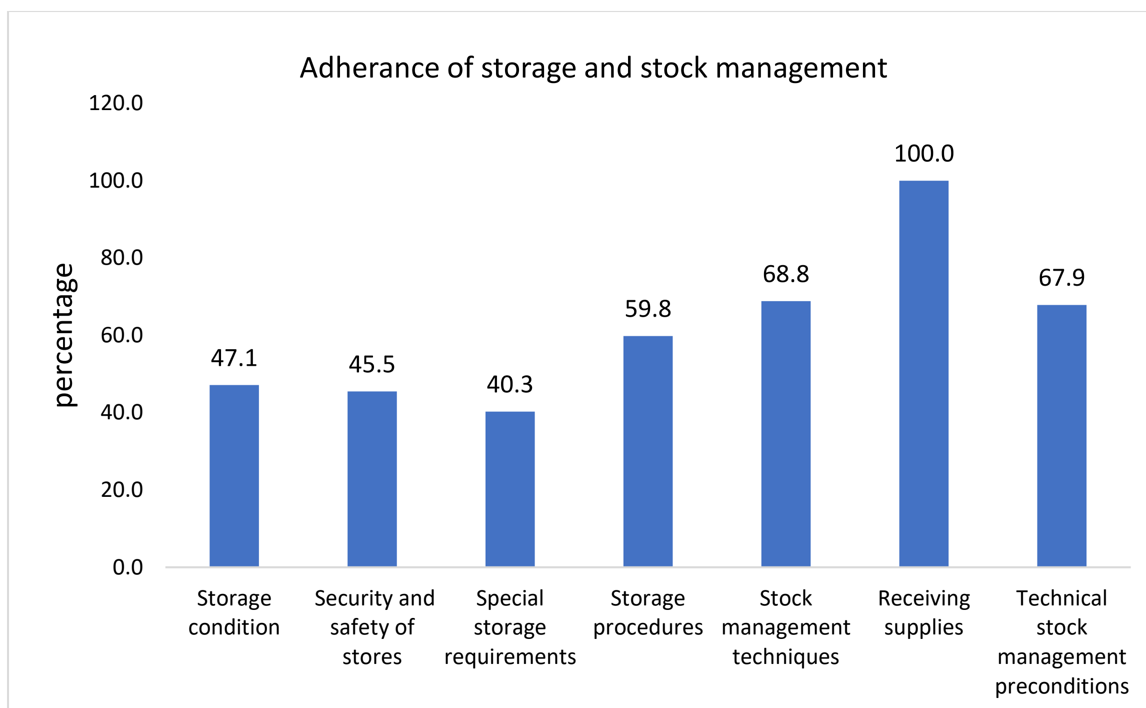


Figure 4. Overall percentage adherence to pharmaceutical store management in public hospitals, Addis Ababa, (n=11)

5.10. Stock wastage rate

The wastage rate of pharmaceuticals from RDF and program medicines was collected from HCMIS between July 1, 2018, to December 31, 2018 GC, in eleven public hospitals in Addis Ababa were found to be at a rate between 1.7% to 16%. The highest wastage rate was identified in hospital number 6 which was 583,978.05 ETB while the total received amount was 3,649,862.81 ETB resulting in the wastage rate of 16%. Within the above specified time, the overall wastage was 6,644,899.24 ETB, accounting for an average wastage rate of 2.92% of the total value of medicines and supplies received by eleven hospitals (Table 7)

Table 7. Total medicines wastage (expired) in public hospitals, Addis Ababa, between July 1, 2018, to December 31, 2018 GC (N=11)

Hospitals	Received in birr	Expired in birr	Wastage in %
Hosp.1	18,978,967.27	417,537.28	2.2
Hosp.2	47,506,707.85	665,093.91	14
Hosp.3	6,135,729.75	245429.19	4
Hosp.4	14,510,031.11	261,180.56	1.8
Hosp.5	4,504,027.82	103,592.64	2.3
Hosp.6	3,649,862.81	583,978.05	16
Hosp.7	74,792,128.08	1,645,426.81	2.2
Hosp.8	13,385,456.80	669,272.84	5
Hosp.9	12,517,541.76	212,798.21	1.7
Hosp.10	21,114,567.30	1,330,217.74	6.3
Hosp.11	10,207,440.20	510,372.01	5
Total	**227,302,460.75**	**6,644,899.24**	**2.92**

5.11. Findings from a self-administered questionnaire

5.11.1. Socio-demographic features of a self-administered questionnaire respondents

Eleven store personnel's working in eleven public hospitals participated in this study as a respondent for self-administered questionnaires. Seven (63.6 %) of the respondents were males. About six (54.5%) of the respondents were in the age range of (20- 30) years. The mean age of the respondents was (29.77 years), SD= (5.48), range 20 to 40 years. In terms of profession, six (54.5 %) of respondents were pharmacists and five (45.5%) were Pharmacy technician. About three (36.4%) of the respondents were having 7-10 years of work experience as shown in (Table 8).

Table 8. Demographic features of self-administered questionnaire respondents in public hospitals, Addis Ababa, 2019. (n=11)

Socio-demographic profile		Number	Percentage
Sex	Male	**7**	**63.6**
	Female	**4**	**36.4**
Age	20-30	**6**	**54.5**
	31- 40	**5**	**45.5**
	41-50	**0**	**0**
	51- 60	**0**	**0**
Profession	Pharmacy technician	**5**	**45.5**
	Pharmacist	**6**	**54.5**
Work experience	1-3 years	**2**	**18.2**
	4-6 years	**4**	**36.4**
	7-9 years	**3**	**27.2**
	Over 10 years	**2**	**18.2**

5.11.2. Adherence to stock management precondition & techniques

As shown in Table 10, four (36.4%) of hospitals have the current Ethiopian essential drug list (2014). Only five (45.5%) of the store had adequate store equipment i.e. shelves, ladder, and pallet. About four (36.4%) of them had adequate space for the movement of goods while receiving maximum stock. In all stores, the physical count was made at regular intervals. None of the stores have a pest control program. Expired medicines were recorded in all stores. Only seven (63.7%) of them had a guideline for the disposal of expired medicines. About eight (72.7%) of store personnel had written responsibilities and procedures for daily work, however, only two (18.2%) of store personnel were trained on good storage practices by their hospitals (Table 9).

Table 9. Adherence to stock management precondition & techniques in public hospitals, Addis Ababa,2019. (n=11)

S.No.	Adherence to stock management precondition & techniques	frequency [yes] (%)
1.	Availability of the current EDLs and STG (2014/15)	4(36.4)
2.	Adequate storage equipment, i.e. shelves, ladder, pallet	5(45.5)
3.	Adequate space for movement of goods when you received a maximum stock	4(36.4)
4.	Physical count made at regular intervals	11(100)
5.	Items checked regularly for potential deterioration (i.e. bad odor or discolored tablets)	11(100)
6.	Shorter expiry dates are exchanged and documented	10(90.9)
7.	Stock records checked by supervisors regularly	10(90.9)
8.	Written pest control program and the agent used	0(0)
9.	All the discrepancies documented and reported	9(81.8)
10.	Record for expired drugs	11(100)
11.	Receive systematic supportive supervision for drug store activities	9(81.8)
12.	Availability of guideline for the disposal of expired	7(63.6)
13.	Trained in good pharmaceutical storage practices by your employer	2(18.2)
14.	Written responsibilities and procedures followed in your daily work	8(72.7)
	Average	**67.88**

5.11.3. Reason for stock out of medicines

Concerning the contributing factor of the stock out of medicines, the respondents' rate factors which cause stock out of pharmaceuticals sequentially starting from the major factor to the least factor. The first factor was quantities delivered not in conformity with the quantity ordered about 20% and followed by an unexpected increase of patients accounted for 15% and the least factor for stockout of medicines was no stock control which accounted for 5% (Figure 5).

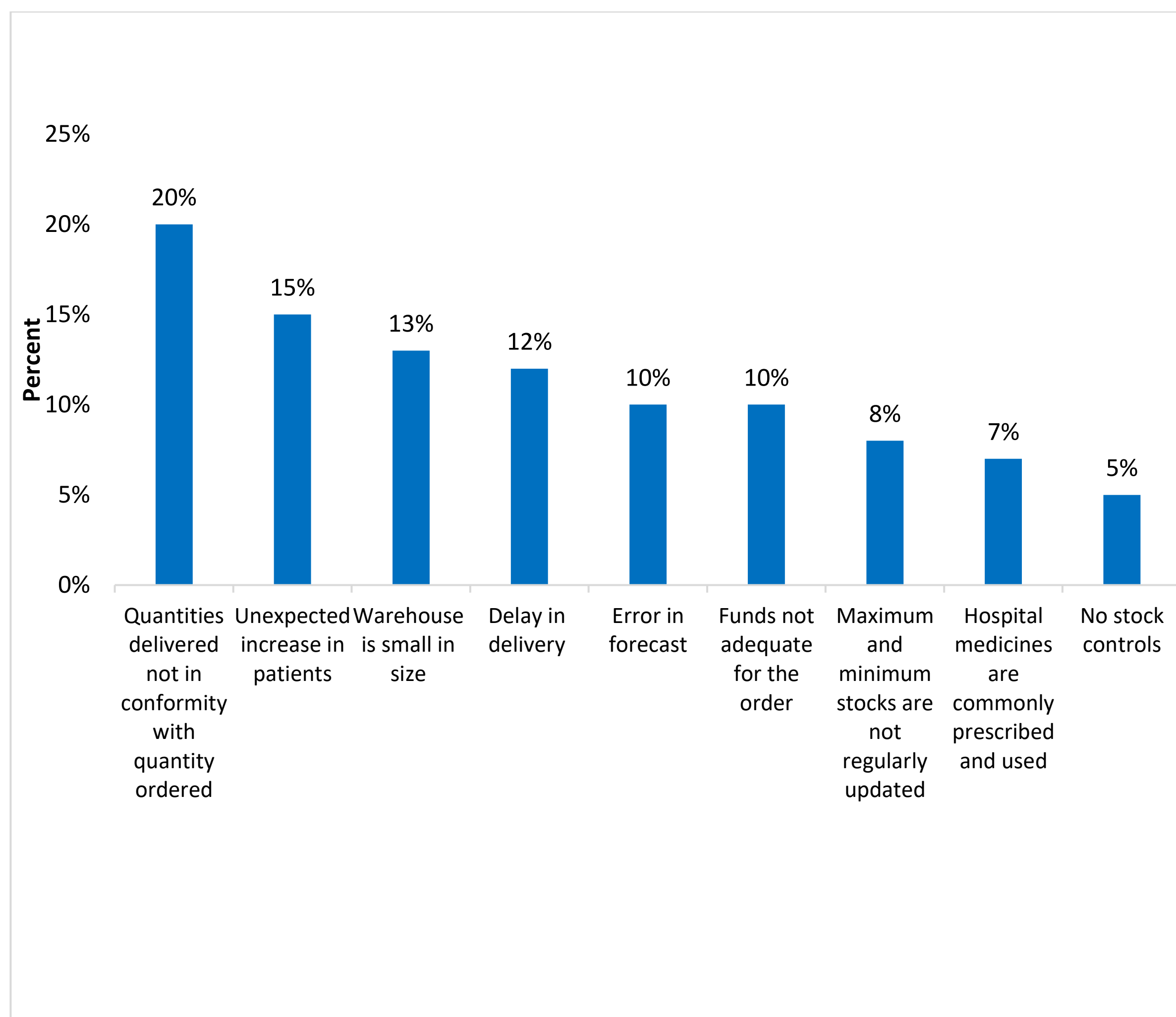


Figure 5. Factors sighted as contributing to the stock out of medicines

5.11.4. Reason for expiry of medicines

The respondents' rate factors cause the expiry of medicines sequentially starting from the major factor to the least factor. According to the respondents, the major reason for the expiry of medicines was short expiring products provided by the PFSA accounted by 25% of the respondents. The second reason was donors provide near expiry products mentioned by 21% of respondents (Figure 6).

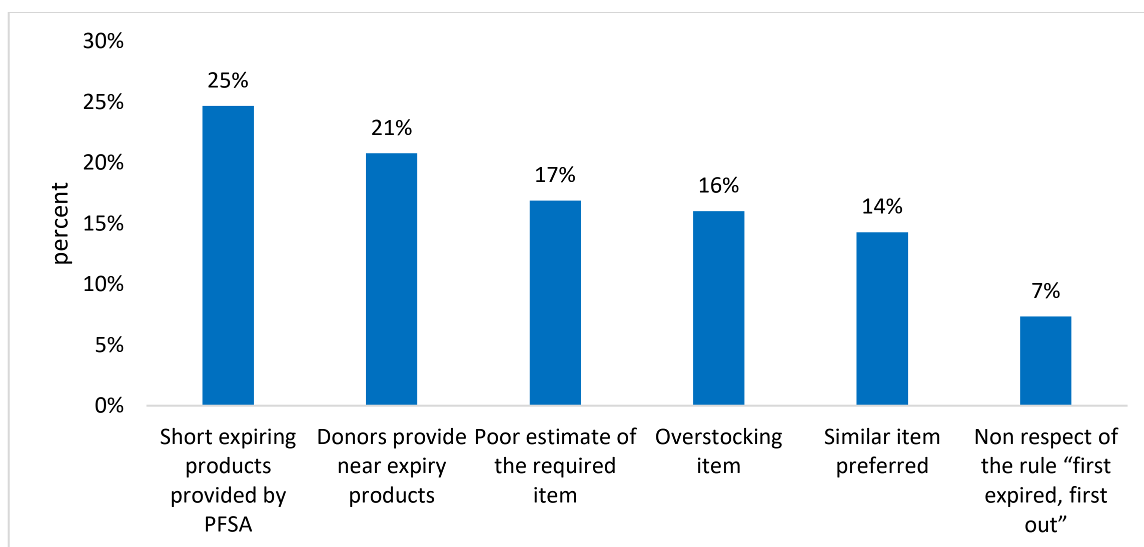


Figure 6. Factors sighted as contributing to the expiry of medicines

5.12. Findings from key informant interview

5.12.1. Socio-demographic characteristics of key informants

Eighteen health professionals working in eleven public hospitals participated in this study as a key informant interviewee. From these fifteen (83.3 %) of the respondents were males. The majority of the respondents were in the age range of (31- 40) years. The mean age of the respondents was (34.3 years), SD= (4.98), range 20 to 50 years. In terms of profession, seven (38.9%) of respondents were pharmacists, five (27.8%) were Pharmacy technician and five (27.8 %) were medical doctors, most of the respondents, seven (39%) were having 7-10 years of work experience as shown in (Table 10).

Table 10. Demographic features of KIs in public hospitals, Addis Ababa, 2019. (n=11)

Socio-demographic profile		Number	Percentage
Sex	Male	**15**	**83.3**
	Female	**3**	**16.7**
Age	20-30	**3**	**16.7**
	31- 40	**14**	**77.8**
	41-50	**1**	**5.5**
	51- 60	**0**	**0**
Profession	Pharmacy technician	**5**	**27.8**
	Pharmacist	**7**	**38.9**
	Supply chain specialist	**1**	**5.5**
	General practitioner	**3**	**16.7**
	Medical specialist	**2**	**11.1**
Work experience	1-3 years	**1**	**5.5**
	4-6 years	**4**	**22.2**
	7-9 years	**7**	**38.9**
	Over 10 years	**6**	**33.4**

The key informants (KIs) were interviewed to find the overall picture of pharmaceutical storage management practices. They included drug store personnel, pharmacy head, and medical director.

The majority of the hospitals are challenged by inadequate storage space thus it is difficult to arrange pharmaceuticals based on the standards as well as not properly implementing FEFO principles. All hospitals used manual and computerized stock recording system. The conformity of the quantity ordered and delivered from PFSA mainly affects the availability of pharmaceuticals. In the majority of hospitals, DTC is not functional. None of the hospitals disposed of expired pharmaceuticals in the last five years.

5.12.2. Performance of pharmaceutical store management

When asked about the pharmaceutical store management practice, the majority of KIs said that they arranged pharmaceuticals based on pharmaco-therapeutically order and uses both manual and computerized recording systems to control inventories.

One KI mentioned that

"The strength of pharmaceutical store management practice includes we used both manual and computerized recording systems to manage the inventories. The computerized recording system i.e. Health Commodity Management Information System enhances data visibility, hospital managers and pharmacy head have access to know what we have in the store without going to the store and we have a committed staff, they love what to do" (Respondent 1, pharmacy head)

Almost all hospitals are challenged by the shortage of adequate storage space. One the KI said that

"The premises of pharmaceutical stores we used has insufficient space to accommodate all products properly and do not fulfill the standard of medical stores in different parameters as well it is scattered in different places of the hospital thus the same products stored in different stores and creates a difficulty to track the product easily thus, the long-dated stock being dispensed earlier than shorter-dated stock, and expiries not being noticed." (Respondent 2, store personnel)

Most KIs mentioned that the challenges in pharmaceutical store management include EPSA and donors push near expiry products to hospitals, pushes too many products from EPSA to hospitals, leakage of water to a store and sometimes electronic health commodity management information system (HCMIS) was stacked. This statement supported by one KI and said that

"The main challenge in our store is EPSA and donors push near expiry products to our hospital which is the main cause of expiry of products, as well pushes too many products which resulted in overstock of items." (Respondent 3, store personnel)

Another KI mentioned that

"*The main challenge in our store is leakage of water to a store and sometimes the electronic health commodity management information system (HCMIS) was stacked and cannot able to update the data until the problem is fixed*." (Respondent 4, store personnel)

5.12.3. Availability of pharmaceuticals

All KIs said that the availability of essential medicines is improved but not free from stockouts. One KI explained that

"The availability of essential medicines is improved when we compare from the previous time but still there is a shortage, the reasons include our hospital have no adequate budget to pay the consumed amount which was taken by credit from EPSA, usually the MOH paid the credit to EPSA as well stockout at EPSA causes unavailability of essential medicines." (Respondent 5, Pharmacy head)

Another KI said that

" In our hospital, the supply of pharmaceuticals mainly relies on EPSA, as we obtained the data from HCMIS, currently the availability of pharmaceuticals is good, But still, some vital items are stockout at EPSA for a long time as well in our hospital, we took a stockout list of pharmaceuticals from EPSA to procure from a private supplier, unfortunately, we do not get some items in the market because of the current shortage of hard currency in our country." (Respondent 6, Pharmacy head)

Another KI said that

"The *supply of pharmaceuticals in our hospital is divided into two. These are budget and program. In budget pharmaceuticals unavailability occurred due to stockout at EPSA as well some items are not supplied by EPSA, thus we procure these items from private importers which requires a long time because of lengthy bureaucracy. In program items, some items are stocked out the reason is ordered amounts not conformity with the delivered amount"* (Respondent 7, store personnel)

5.12.4. Performance of DTC

Some KIs said that they have functional DTC, members are selected from the main departments and meet once every two months. DTC members prepare EMLs of the hospital, quantify the amount, and approved to procure. As well DTC discussed the availability of pharmaceuticals, clinical service, and the rational use of pharmaceuticals based on STG, even though their meeting lacks regularity by several factors. This was supported by one KI

"We have a functional DTC, which was established based on the guideline. At the beginning of the physical year, the DTC updates the lists of medicines and medical supplies, quantifies

the amount needed, and participates in the evaluation and ratification of procurement. But the challenge is DTC members do not attend the meeting based on the schedule regularly." (Respondent 4, pharmacy head)

Other KIs said that they do not have functional DTC in their hospitals, even the members of the committee do not know the roles and the responsibilities of the DTC.

Thus, one KI said that

"… in our hospital, the DTC is not functional. The members of DTC are department heads, they have too much responsibility on clinical and academic services, thus they do not attend the regular meeting as well they may think that DTC is a job of pharmacy so that is not committed and consider as secondary activity. So that the hospital medicine list not updated for the last four years, no insertion or deletion of pharmaceuticals and other duties and responsibilities are not exercised…" (Respondent 8, pharmacy head)

5.12.5. Performance of EPSA

Some KIs said that EPSA has good performance in supplying pharmaceuticals. The reasons mentioned that we cannot give adequate quantification data, with that data EPSA satisfy the needs of the majority and argued that if we provide reliable quantification data to EPSA, EPSA can satisfy the national demand. Other KIs claimed on contrary to this.

One KI said that

"We rate the efficiency of EPSA based on the refill rate, its refill rate is about 23% thus more than half items procured from private sources. A year before EPSA prepared its own medical supplies list by insertion and deletion of some items from the previous list but the gap still existed to supply adequately especially medical equipment." (Respondent 9, pharmacy head)

5.12.6. Factors causing expiry of pharmaceuticals

KIs were asked about the causes of the expiry of pharmaceuticals and their control methods and all respondents informed that the push supply system from EPSA for program medicines, poor pharmaceutical store management, poor prescribing practice i.e. not to adhere to the STG, and some other factors which lead to the expiry of pharmaceuticals. Thus, hospitals

tried to minimized expiry by updating EMLs by insertion and deletion of items, by proper quantification based on needs, and by transferring overstocked and near expiry items to other facilities.

One KI said that

"… when we look at the expiry trends of pharmaceuticals in our hospital it was minimized from the previous years. The main cause of expiry is the usage trend of prescribers to certain medicines thus the other medicines will be expired. The other reason is some medicines are stock out at the national level and if it is available, we procure in bulk this also causes the expiry of pharmaceuticals, but we are controlling the expiry by using near expiry items exhaustively and also transferring overstocked items to other health facilities." (Respondent 10, medical director)

5.12.7. Factors causing stockout of pharmaceuticals

Regarding the cause of the stockout of pharmaceuticals, KIs informed that poor stock status prediction, unavailability at EPSA, long procurement time from the private sector as well some items not available at the national level causes stockout.

One KI said that

"…. the reasons of stockout include "quantification is not based on needs resulting in inaccurate forecasting from service units, also, we used consumption data for quantification, it affected by seasonality, prescribing habit and expired drugs also considered as consumed, these affects quantification and EPSA used this data to quantify the national demands which lead to stockout at the national level, as well private suppliers do not import some items because they have no any information about the needs of service giving facilities these leads to stockout." (Respondent 11, pharmacy head)

thus, it tried to minimize stockouts by borrowing from other hospitals as well implementation of APTS controls stockout.

5.12.8. Performance of waste disposal practices

All KIs said that expired pharmaceuticals are registered by items and prices and stored in a separate store. In the last five years no disposal of pharmaceuticals the reason they mentioned

that currently no proper pharmaceutical disposal site at the country level thus, all hospitals communicated with the concerned governmental bodies to facilitate the disposal process.

One KI said that

"…in the last five years we did not dispose of expired pharmaceuticals, currently five stores fully occupied by expired pharmaceuticals, thus it created a shortage of space for useable one. Handling of expired medicines especially volatile anti-cancer medicines has high risks for workers even to the environment and asked concerned governmental bodies to get a priority for disposal, as well we are tried to give training to workers about how to handle wastes and their safety measures." (Respondent 12, pharmacy head)

6. Discussion

This study was conducted to assess the current practices of pharmaceutical store management in public hospitals, Addis Ababa, Ethiopia. Pharmaceutical store management is intended to protect stored products from damage, theft, expiry, and to control the consistent movement of pharmaceuticals from source to user (MOH, 2012).

To provide patients with high-quality products, each hospital must have safe, protected, and well-organized storage areas that will prevent damage. This study found that the physical storage conditions, security, and safety of stores and special storage requirements are on average below 50%. Storage procedures and stock management techniques on average are 59.83% and 68.83% respectively. The average availability of TMs in the stores of the hospitals on the day of the survey was 90.75%. The accuracy of physical count and bin card records of TMs on average was 51.4%. The wastage rate of pharmaceuticals between July 1, 2018 – December 31, 2018, was 2.92%. Short expiring products provided by EPSA and quantities delivered not in conformity of quantities ordered are the main causes of expiry and stockout of pharmaceuticals respectively. No disposal of expired pharmaceuticals in the last five years. In the majority of the hospitals, the DTC not functioning properly.

This study revealed that 81.8% of the stores had a good ceiling, products that had protected from direct sunlight were only 63.6%, the stores that had brushed shelves, swept floor, and clean walls 45.5% which is slightly different with the study conducted in India on Indicator based assessment of medicine storage and inventory management practices in public hospitals where a good ceiling, products protected from sunlight and good cleanliness reported to be 40%, 100%, and 40% respectively (Iqbal MJ, 2015). keeping a clean store will create a conducive working environment for the staff and serve the customers better. As well medicines are protected from direct sunlight since some of them are photosensitive so light exposure may make them lose their potency, color, and consistency.

Products had stacked 10 cm of the floor, 30 cm away from the wall, and not more than 2.5 meters high were evaluated to be 63.6%, 18.2% and, 45.5% respectively which is nearly similar to the study conducted by Mezid Mudzteba on pharmaceuticals' logistics system in the health center of Addis Ababa, where Products had stacked 10 cm of the floor, 30 cm away

from the wall and not more than 2.5 meters high were reported to be 69.6%, 21.7%, and 78.3% respectively (Mudzteba, 2014).

Inadequate storage space leads to stacking of products one over the other and make difficult FEFO arrangement, easy picking of products, and cleaning (WHO, 2003). As noted from the in-depth interview the majority of KIs indicated that they do not have an adequate and standard pharmaceutical store, thus they used several mini stores which resulted in poor pharmaceutical arrangement to truck items easily since the same items stored in different stores and proper stock rotation principle not applied which resulted in the expiry of products at the store.

Concerning the safety of the store, only 36.4% of the store had a functional fire extinguisher and none of the store personnel were trained how to use the fire extinguisher as well all the stores had no smoke detectors which could not comply the minimum standards set by world health organization (WHO, 2004).

Regarding special storage requirements, only 36.4% of the stores had at least one functional thermometer and only 27.3% of the store's temperature record was up to date. Most refrigerators 81.8% of them had a thermometer but only 27.3% of them had recorded the temperature twice per day. All of them had an automatic backup supply of power. Unfortunately, all the stores had no hygrometer. Separate and locked areas for narcotic and psychotropic drugs and high valued items were evaluated to be 27.3% and 18.2% respectively. All the stores had no fireproof area for flammable substances and corrosive chemicals.

The stock record of twenty tracer medicines was assessed at the time of the visit and the actual physical count for each medicine was checked against the amount recorded on bin cards at the pharmacy store. The result showed that 30% of the recorded balances were greater than of the physical count meaning that issued items not recorded immediately when items dispatched and 17.76% of the recorded balances were less than that of the physical count this means that receipts were not correctly recorded, thus the average discrepancy rate was 47.76% which is greater than the study conducted in Gondar and Adama which was 17.5% and 30.8% respectively (Fentie *et al.*, 2014; Kefale, 2019). Medicine quantification, procurement, and use depend on inventory records thus having inaccurate records leads to stock-outs and/or overstock of medicines.

DTC has various responsibilities which include developing policies and procedures to manage pharmaceuticals, thus DTC prepares essential medicines list and medicine formulary, monitors medicine procurement and inventory management as well as investigate problems with medicine use and supply. Concerning its functionality, most KIs said that the DTC is established but not fully functional the reason mentioned includes a high workload and many responsibilities of members, a high turnover rate of members and lack of training about DTC, thus in the majority of the hospitals, the DTC couldn't perform the above responsibilities.

Ensuring pharmaceuticals availability is a crucial element to improve health outcomes. Without medicines being available, appropriate treatments cannot be providing and this will seriously affect the health status of the population. This assessment used twenty tracer medicines that were selected by the ministry of health for measuring availability. Overall, the majority of the hospitals had most of the tracer medicines in stock on the day of the visit, the average availability was 90.75%, however, this finding is similar to the study conducted in Tanzania but higher than the study conducted in Uganda where the average availability rate was reported to be 89% and 62.5% respectively (Ministry of Health and Social Welfare, 2008; Namaya, 2017).

The present study shows that on average about 17% of tracer medicines were out of stock at the time when this study was carried out. Several factors were sighted as causes of out of stock. The major factor was quantities delivered not in conformity with the quantity ordered about 20% and followed by the unexpected increase of patients about 15% and followed by small store size, delay in delivery, error in the forecast, and funds not adequate for the order. Similar reasons were identified by the study conducted by Kagashe Gab et.al on medicines stockout and inventory management problems in public hospitals in Tanzania: A case of Dar es Salaam region identified that lack of funds 77.7% was the main reason of stock out followed by out of stock at MSD, unexpected increases of patients and small warehouse mentioned (Kagashe and Massawe, 2012) . This was supported by some key informants, they explained that our supply of pharmaceuticals mainly relies on EPSA, but EPSA can not adequately supply the items we need in quantity and also some items are stockout at EPSA for a long time as well in our hospital. The consequences of stock out of medicines include patients will not be able to receive the proper treatment they need thus led to a higher mortality rate as well patients may be less willing to visit the hospital.

Concerning the wastage rate of medicines and supplies this study revealed that on average about 2.92% of the total pharmaceuticals were expired, this finding is less than the study conducted by Esayas Tadesse on the Assessment of medicines wastage and its contributing factors in selected public health facilities in South West Shoa Zone, Oromia Regional State and the study conducted on APTS: Findings of the Baseline Assessment at Federal, Addis Ababa, and Teaching Hospitals where the average wastage rate was 7.5% and 5.1% respectively(Tadeg et al., 2014; Tadesse, 2017). The national target in the Health Sector Transformation Program (HSTP, IV) for the medicines wastage rate is below 2%. Thus, this study identified some possible reasons for the expiry of pharmaceuticals in which short expiring products provided by EPSA accounted 25%, the donor provides near expiry product about 21% followed by a poor estimate of the required item, overstocking item, similar items preferred, and non-respect of the rule FEFO was mentioned. Similar findings were also reported that delivery of nearly expired medicines by suppliers, lack of a system to move nearly expired medicines from one facility to another, the presence of overstocked medicines due to improper forecasting was mentioned as major contributing factors for medicines wastage (Tadesse, 2017).

Finally, the key informant interview showed that none of the hospitals disposed of pharmaceutical wastes in the last five years, even if the national waste management directive was not allowed to store pharmaceutical wastes for more than six months (FMHACA, 2011).

7. Strength and limitation of the study

The strengths of this study include that the study used both quantitative and qualitative methods to supplement each other. It also used different data collection methods, (using observation checklist, document review, a physical count of TMs, semi-structured questionnaires, and key informant interviews).

The limitations of the study include that, the study was conducted only in eleven public hospitals, in Addis Ababa by excluding health centers, health posts, and private health service providers due to financial constraints, thus it is difficult to generalize the results as a pharmaceutical store management condition of Addis Ababa.

8. Conclusion and Recommendations

8.1 Conclusion

The finding of this study revealed that the majority of the physical storage conditions in the visited hospitals do not meet the minimum requirements. It also evident that a significant percentage of hospitals do not fulfill the requirements of security and safety, and the special storage conditions of pharmaceuticals. Regarding the pharmaceutical storage procedure, the majority of the hospitals do not fully exercise standard storage procedures. Accuracy of record-keeping was low which further decreases the availability of medicines or resulted in stock out and overstock since quantification is based on incorrect data. Quantities delivered not in conformity with the quantity ordered, an unexpected increase in patients and small store size are the main causes of stock out of medicines. Delivery of near expiry medicines by EPSA, donors, and the presence of overstocked medicines was identified as major contributing factors for medicines expiry as well as expired medicines fully occupied storage spaces. Since all hospitals do not dispose of expired pharmaceuticals in the last five years which is beyond the allowable wastage rate limit. The wastage rate of pharmaceuticals in all except two hospitals was above the acceptable limit i.e. 2%. Furthermore, this study revealed that the majority of the hospitals do not have functional DTC, thus there is no medicine's utilization reviews and updated essential medicine lists and institutional formulary, which will directly influence procurement and product availability.

8.2 Recommendations

- EFDA should enforce hospitals to construct standard and adequate pharmaceutical stores based on the requirements
- Hospitals should improve the security and safety of stores and special storage requirements
- Store personnel should standardize Storage procedures and stock management techniques
- EPSA should improve its capacity of supplying pharmaceuticals
- Hospitals should develop a strategy in which the procurement of pharmaceuticals from private suppliers should be handled by the pharmacy department
- The wastage rate of pharmaceuticals should be minimized to an acceptable rate. i.e. less than 2%. In this regard, Hospitals should improve pharmaceutical store management practices
- Hospitals should be strengthening drug and therapeutic Committees (DTC) to work on their duties and responsibilities.
- Hospitals should work with EFDA and EPSA to dispose of pharmaceutical wastes timely based on directives.
- Hospitals should give pharmaceutical store management training to store personnel.

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Annexes

Annex 1. Pharmaceutical store evaluation checklist

Verbal consent form before the observation of the drug store

Good day! My name is Ayalew Tesfaye, I am MSc student in the School of Pharmacy, Addis Ababa University. The purpose of this study is to assess the implementation of pharmaceutical store management practices in public hospitals Addis Ababa.

This is not a supervisory visit and the performance of individual staff members is not being evaluated. This research will provide the current pharmaceutical store management situation at public hospitals Addis Ababa and provide baseline information to track changes and improvements in pharmaceutical store management over time.

All of the information collected is strictly confidential. No one other than the research team will have access to your responses. Your personal identifiers such as your name and that of your health facility will not, refer to individual respondents or individual facilities in the report, but rather will describe the overall picture of all facilities.

Thank you for your cooperation in Advance!!!

S.NO	Physical storage Conditions	yes	No
1	The store has a ceiling that is in good condition		
2	The store has adequate lighting to enable all operations safely		
3	There are windows in the storage area that can be opened and ventilators are in good conditions		
4	The store has no cracks, holes, or sign of water damage		
5	Products are protected from direct sunlight		
6	Clearly defined and separated area for reception, storing & dispensing of products		
7	The store is free of pests; there are no signs of pest infestations.		
8	The store is tidy; the shelves are brushed, the floor is swept, and the walls are clean.		
9	Products are stacked at least 10 cm off the floor.		
10	Products are stacked at least 30 cm away from the walls and other stacks.		
11	Products are stacked no more than 2.5 meters High		

S. No	Security and safety of stores	yes	No
1	The door to the store has 2 locks; each lock has a separate key		
2	The store is kept & locked at all times when not in use		
3	Windows are secured with grills		
4	The store has a functional fire extinguisher		
5	Have you ever been trained on how to use the fire extinguishers?		
6	Service fire extinguishers at least every 12 months.		
7	The store has smoke detectors		

S. No.	Special storage requirements	yes	no
1	The store has at least one functional wall thermometer		
2	The store has functional humidity-monitoring equipment (hygrometer)		
3	The Room temperature record is available and up to date.		
4	Temperature-sensitive items are stored in a refrigerator.		
5	Room humidity record is available and up to date		
6	The refrigerators have thermometers		
7	The refrigerator temperature maintained and recorded twice per day		
8	Is there a Backup supply of power?		
9	Is there a generator operator all the time for 24 hours?		
10	Availability of calibration schedule for monitoring equipment such as thermometer and hygrometer		
11	Narcotic and psychotropic drugs are in separate, double-locked storage space.		
12	Combustible substances are stored in a fireproof area		
13	Corrosive chemicals stored separately		
14	High valued items are stored in a separated and locked area		

S.NO.	Storage procedures	yes	No
1	Medicines are systematically arranged on the shelves by		
	A. Alphabetical order by generic name		
	B. pharmacologic-therapeutic order		
	C. Dosage form-i.e. solid, liquid, semi-solid, injectables		
	D. others		
2	All shelves for medicines are labeled properly		
3	Liquids, ointments, and injectable are stored on the middle shelves.		
4	Supplies, such as surgical items, condoms, and bandages are stored on the bottom of the shelves.		
5	Items are grouped in amounts that are easy to count.		
6	Dedicated and labeled area for expired medicines within the store.		
7	Medicines with shorter expiry dates are placed in front of those with later expiry dates (FEFO)		
8	Supplies with no expiry or manufacture date are stored in the order received (FIFO)		
9	No damaged containers or packages are on the shelves.		
10	The disposal of medicines is recorded in a separate register and includes the date, time, witness, value, qualities, and reasons.		
11	No staff food and drinks in the refrigerator.		
12	Nonpharmaceutical products stored with medicines		

S.NO.	Stock management techniques	yes	No
1	Does each item in the store have a bin card?		
2	Is the bin card kept on the same shelf as the item?		
3	Is all the information on the bin card up to date?		
4	Is a computerized stock management system used?		
5	Is a standard order form used all the time?		
6	Is the requisition book kept at the facility?		
7	Is all information on the requisition form accurately and clearly written?		

S.No	How supplies are received	yes	No
1	Are deliveries received by a health worker in person?		
2	Are deliveries inspected by the store personnel before acceptance?		
3	Are supplies received checked against the items listed on the packing delivery form?		
4	Are deliveries acknowledged and recorded on the prescribed forms?		
5	Does the delivery person sign the form before he leaves the facility?		
6	Are the expiry dates of all items checked before final acceptance?		
7	Does the health worker check poor quality items, such as discoloration of medicines, vaccines, Broken containers?		

S.No.	Adherence to stock management precondition & techniques	yes	No
1	Do you have a copy of the current Ethiopian Essential Drug List and the Ethiopian standard treatment guidelines? (2014/15)		
2	Is there adequate storage equipment? i.e. shelves, ladder, pallet		
3	The store has adequate space for the movement of goods when you received a maximum stock		
4	Is a physical count made at regular intervals such as once or twice a year?		
5	do you keep medical stock records in computers and/or papers?		
6	Items are checked regularly for potential deterioration (i.e. bad odor or discolored tablets)		
7	Drugs with shorter expiry dates are exchanged and documented.		
8	regularly?		
9	Are there written pest control program indicating the frequency and the pest control agent used to be used		
10	Are all the discrepancies documented and reported?		
11	Is there a record for expired drugs		
12	Do you receive systematic supportive supervision for drug store activities?		
13	Is there any documented policy or guideline for the disposal of expired / unwanted medicines?		
14	Have you ever been trained in Good Storage Practices by your employer?		
15	Do you have written responsibilities and written procedures followed in your daily work?		

Key performance indicators measuring tools

$$\mathbf{1}.\ \text{Stockout rate} = \frac{\text{number of tracer medicines stockout}}{\text{total number of tracer medicines}} \times 100\%$$

Procedure - use the lists of tracer drugs (TDs) which was selected by which federal ministry of health to check for their availability in the drug store

- Count the number of TDs available in the store on the day of visit and divide it by the total number of TDs that the warehouse managed

S.No.	List of tracer drugs	Available	Not available
1	Amoxicillin 500 mg capsule		
2	Oral Rehydration Salts		
3	Zinc dispersible tablet		
4	Gentamycin Sulphate 20 mg/ml		
5	Cotrimoxazole 240 mg/5 ml Suspension		
6	Oxytocin 10 units/ml		
7	Medroxyprogesterone Injection		
8	Adrenaline (Epinephrine) injection		
9	Enalapril tablet		
10	Hydralazine injection		
11	Glibenclamide 5mg Tablets		
12	Glucose 40%		
13	Normal saline 1000 ml		
14	Ferrous sulphate + folic acid		
15	Ciprofloxacin 500 mg tablet		
16	Ceftriaxone 1 gm injection		
17	Tetanus antitoxin (TAT)		
18	TDF/3TC/EFV adult		
19	TB (RHZE/RH) patient kit		
20	Tetracycline eye ointment		

$$2.\text{Inventory accuracy rate} = \frac{\text{No. of TMs where stock record count equals physical stock count}}{\text{Total number of TMs}} \times 100\%$$

S.No.	List of tracer drugs	Stock record quantity	Physical count
1	Amoxicillin 500 mg capsule		
2	Oral Rehydration Salts		
3	Zinc dispersible tablet		
4	Gentamycin Sulphate 20 mg/ml		
5	Cotrimoxazole 240 mg/5 ml Suspension		
6	Oxytocin 10 units/ml		
7	Medroxyprogesterone Injection		
8	Adrenaline (Epinephrine) injection		
9	Enalapril tablet		
10	Hydralazine injection		
11	Glibenclamide 5mg Tablets		
12	Glucose 40%		
13	Normal saline 1000 ml		
14	Ferrous sulphate + folic acid		
15	Ciprofloxacin 500 mg tablet		
16	Ceftriaxone 1 gm injection		
17	Tetanus antitoxin (TAT)		
18	TDF/3TC/EFV adult		
19	TB (RHZE/RH) patient kit		
20	Tetracycline eye ointment		

$$3.\ \text{Stock wastage} = \frac{\text{Unusable physical stock in the last six months}}{\text{Tot. quantity of usable \& unusable in the last six months}} \text{X } 100\%$$

Procedure: record unusable stock from July- December 31. 2018

- Take unusable stock in birr from distribution office, if not available
- Segregate unusable products and take the price from HCMIS and calculate the loss
- Record the last 6 months usable and unusable stock in birr, if not available
- Obtain July 1, 2018 inventory report and use HCMIS price
- Then add received items b/n July 1 up to December 31

$$\text{beginning amount} + \text{received b. n } July\ 1 - Dec. 31 = tot. usable\ \&\ unusable$$

Annex 2. A self-administered questionnaire for store personnel

Pharmaceutical store personnel's response to pharmaceutical store management practices and its implementation.

Good day! My name is Ayalew Tesfaye, I am MSc student in the School of Pharmacy, Addis Ababa University. I am doing research for the partial fulfillment of a Master's Degree. The purpose of the study is to assess the implementation of pharmaceutical store management practices in public hospitals Addis Ababa.

This is not a supervisory visit and the performance of individual staff members is not being evaluated and purely for academics. So, I assure you will not have any negative effect on your individual or your organization. All of the information collected is strictly confidential. No one other than the research team will have access to your responses. Your personal identifiers such as your name and that of your health facility will not be used. The principal investigator will not refer to individual respondents or individual facilities in the report, but rather will describe the overall picture of all facilities.

The effectiveness of the study depends on your genuine and frank responses which will be kept strictly confidential. Therefore, I request you to fill the questioner honestly and frankly. I would like to extend my deep appreciation to your organization and you for the willingness and cooperation in undertaking this research. I request your cooperation to fill and respond truthfully to the asked questions.

Demographic features of respondents

Age: 20-30 ☐ 30-40 ☐ 40-50 ☐ 50-60 ☐

Sex: Male ☐ Female ☐

Education level:

Pharmaceutical technician ☐ Pharmacist ☐ Supply chain specialist ☐

Work experience

1-3 years ☐ 4-6 years ☐ 7-9 years ☐ over 10 years ☐

A research questionnaire

S.No	**Adherence to stock management precondition & techniques**	**Yes**	**NO**
1.	Do you have a copy of the current Ethiopian Essential Drug List and the Ethiopian standard treatment guidelines? (2014/15)		
2.	Is there adequate storage equipment? I.e. the shelves, ladder, pallet		
3.	The store has adequate space for movement of goods when you received a maximum stock		
4.	Is a physical count made at regular intervals such as once or twice a year?		
5.	do you keep a medical stock record in computers and/or papers?		
6.	Items are checked regularly for potential deterioration (i.e. bad odor or discolored tablets)		
7.	Drugs with shorter expiry dates are exchanged and documented.		
8.	Are stock records checked by supervisors regularly?		
9.	Are there written pest control program indicating the frequency and the pest control agent used to be used		
10.	Are all the discrepancies documented and reported?		
11.	Is there a record for expired drugs		
12.	Do you receive systematic supportive supervision for drug store activities?		
13.	Is there any documented policy or guideline for the disposal of expired / unwanted medicines?		
14.	Have you ever been trained in Good Storage Practices by your employer?		
15.	Do you have written responsibilities and written procedures followed in your daily work?		

Rate the main causes of "stock outs of drugs" at this hospital in sequential order

1. Delay in delivery ____

2. Funds not adequate for the order _______________________________

3. Error in forecast ____

4. Unexpected increase in patients ________________________________

5. Hospital medicines are commonly prescribed and used _____________

6. Warehouse is small in size ____________________________________

7. No stock controls ____

8. Maximum and minimum stocks are not regularly updated___________

9. Quantities delivered not in conformity with quantity ordered_________

10. Others____

Rate the main causes of "expiry of drugs" at this hospital in sequential order

1. Donors provide near expiry products___________________________

2. Non respect of the rule "first expired, first out" __________________

3. Short expiring products provided by central store ________________

4. Poor estimate of the required item_____________________________

5. Overstocking item ____

6. Similar item preferred ______________________________________

7. Others____

Thank you for your time and cooperation!!!

Annex 3. Interview guide for drug store personnel

Verbal consent form before the interview for the store personnel

Greetings! My name is Ayalew Tesfaye, I am MSc student in the Health Supply Chain Management MSc program, School of Pharmacy, Addis Ababa University. I am doing research for partial fulfillment of my Master's Degree. The purpose of the study is to assess the implementation of pharmaceutical store management practices in public hospitals Addis Ababa.

This is not a supervisory visit and the performance of individual staff members is not being evaluated and purely for academics. So, I assure you will not have any negative effect on your individual or your organization. All of the information collected is strictly confidential. No one other than the research team will have access to your responses. Your personal identifiers such as your name and that of your health facility will not be used. The principal investigator will not refer to individual respondents or individual facilities in the report, but rather will describe the overall picture of all facilities.

The effectiveness of the study depends on your genuine and frank responses which will be kept strictly confidential. Therefore, I request you to answer questions frankly. I would like to extend my deep appreciation to your organization and you for the willingness and cooperation in undertaking this research.

Do I have your permission? Yes ☐ No ☐ If Yes, Continue

Name of Institution___________________________

Position: ___________________________________

Demographic features of respondents

Age: 20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐

Sex: Male ☐ Female ☐

Education level:

Pharmaceutical technician ☐ Pharmacist ☐ Supply chain specialist ☐

Work experience:

1-3 years ☐ 4-6 years ☐ 7-9 years ☐ Over 10 years ☐

1. Can you tell me about the pharmaceutical store management practices in your facility?

Probing (1) with respect to:

I. Arrangement

II. Quality

III. Security

IV. Inventory management

V. Record keeping

VI. waste management

Probing (2): What challenges have you faced in store management?

Probing (3): What improvements do you suggest for the store management?

2. How is the availability of pharmaceuticals in your hospital?

Probing (1): Do you always experience shortages of essential drugs at this hospital?

Probing (2): (If yes to the above), in your opinion, what are the major causes of these shortages?

Probing (3): Are there specific drugs that are frequently out of stock?

Probing (4): In your opinion, what can be done to improve the availability of drugs at the hospitals?

3. Are there any problems related to drug management at this hospital?

Probing (1): what is the major problem regarding the storage of pharmaceuticals, inventory management and waste disposal?

4. Can you suggest ways of improving drug management at this hospital?

Annex 4. Interview guide for pharmacy heads

Verbal consent form before the interview for the for-pharmacy heads

Greetings! My name is Ayalew Tesfaye, I am MSc student in the Health Supply Chain Management MSc program, School of Pharmacy, Addis Ababa University. I am doing research for partial fulfillment of my Master's Degree. The purpose of the study is to assess the implementation of pharmaceutical store management practices in public hospitals Addis Ababa.

This is not a supervisory visit and the performance of individual staff members is not being evaluated and purely for academics. So, I assure you will not have any negative effect on your individual or your organization. All of the information collected is strictly confidential. No one other than the research team will have access to your responses. Your personal identifiers such as your name and that of your health facility will not be used. The principal investigator will not refer to individual respondents or individual facilities in the report, but rather will describe the overall picture of all facilities.

The effectiveness of the study depends on your genuine and frank responses which will be kept strictly confidential. Therefore, I request you to answer questions frankly. I would like to extend my deep appreciation to your organization and you for the willingness and cooperation in undertaking this research.

Do I have your permission? Yes ☐ No ☐ If Yes, Continue

Name of Institution___________________________

Position: ___________________________________

Demographic features of respondents

Age: 20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐

Sex: Male ☐ Female ☐

Education level:

Pharmaceutical technician ☐ Pharmacist ☐ Supply chain specialist ☐

Work experience:

1-3 years ☐ 4-6 years ☐ 7-9 years ☐ Over 10 years ☐

1. How do you describe the pharmaceutical store management practices in your hospital?

Probing (1): with respect to:

a) Strength

b) weakness

c) Frequent stocks out of drugs and supplies at this hospital have been reported. Can you explain the causes?

d) Can you suggest ways of improving the availability of essential drugs at this hospital?

2. How do you describe the drug and therapeutics committees (DTC) in your hospital?

Probing (1): with respect to:

a) Strength

b) Weakness

c) Challenges

3. Does this hospital have its own essential drugs list?

Probing (1): How often it is revised?

4. How do rate the performance of EPSA in the purchase and distribution of essential drugs to hospitals?

Probing (1): with respect to:

a. How often do you place an order?

b. What is the approximate time of delivery of drugs after making a requisition from the EPSA?

5. How is the pharmaceutical waste disposal practice in your hospital?

Probing (1): with respect to:

a) Approximately, how long medicine wastes are stored usually?

b) Where do you dispose of medicine wastes?

c) Approximately, when did you dispose of medicine wastes for the last time?

d) Is the medical waste disposal practice attended by an inspector from appropriate organ (EFDA/MOH)?

e) Are all personnel involved in the handling of medicines waste trained and/or well informed about the potential risks of hazardous medicines wastes and their management?

6. What is being done to improve medicines management at this hospital?

Probing (1): is there any support from DTC, regional health bureau, and MOH?

Annex 5. Interview guide for medical directors

Verbal consent form before interviewing the Medical directors.

Greetings! My name is Ayalew Tesfaye, I am MSc student in the Health Supply Chain Management MSc program, School of Pharmacy, Addis Ababa University. I am doing research for partial fulfillment of my Master's Degree. The purpose of the study is to assess the implementation of pharmaceutical store management practices in public hospitals Addis Ababa.

This is not a supervisory visit and the performance of individual staff members is not being evaluated and purely for academics. So, I assure you will not have any negative effect on your individual or your organization. All of the information collected is strictly confidential. No one other than the research team will have access to your responses. Your personal identifiers such as your name and that of your health facility will not be used. The principal investigator will not refer to individual respondents or individual facilities in the report, but rather will describe the overall picture of all facilities.

The effectiveness of the study depends on your genuine and frank responses which will be kept strictly confidential. Therefore, I request you to answer questions frankly. I would like to extend my deep appreciation to your organization and you for the willingness and cooperation in undertaking this research.

Do I have your permission? Yes ☐ No ☐ If Yes Continue

Name of Institution___________________________

Position: ___________________________________

Demographic features of respondents

Age: 20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐

Sex: Male ☐ Female ☐

Education level:

General practitioner (GP) ☐ Specialist (any) ☐

Work experience:

1-3 years ☐ 4-6 years ☐ 7-9 years ☐ Over 10 years ☐

1. How do you describe the pharmaceutical store management practices in your hospital?

   Probing (1): what is the major problem regarding pharmaceutical store management practices

2. How do you describe the drug and therapeutics committees (DTC) in your hospital?

   Probing (1): with respect to:

   a. Strength

   b. Weakness

   c. Challenges

3. What do you think about the causes of medical stock expiry at this hospital?

   Probing (1): what is the major cause of the expiry of pharmaceuticals?

a. How does this hospital control expiry of stocks?

   Probing (1): is there any support and assessment to minimize expiry?

4. What do you think about the causes of medical stockouts at this Hospital? Probing (1): what is the major cause of the stockout of pharmaceuticals?

a. how does this hospital reduce/control stockouts?

   Probing (1): is there any support and assessment to minimize stockouts?

5. Which factors do you think affect the performance of medical stocks control system? Probing (1): what are the major factors that hinder the stock control system?

6. What do you think should be done to improve the performance of medical stock control at his hospital? Probing (1): On improvement of availability of pharmaceuticals, reducing expiry, proper storage, and waste disposal of pharmaceuticals.

Annex 6. The interview guide (Amharic version)

ለቃለ-መጠይቅ ለመሳተፍ የፍቃደኝነት መጠየቂያ ቅፅ

ጤና ይስጥልኝ! አያሌው ተስፋዬ እባላለው፣ በአዲስ አበባ ዩኒቨርሲቲ ፋርማሲ ት/ ቤት የ Health Supply Chain Management MSc. program, ተማሪ ነኝ።ለድህረ ምረቃ የሚሟያ ጥናታዊ ፅሁፍ እየጻፍኩ ነው። የጥናቱ ዓላማ በአዲስ አበባ ሆስፒታሎች ውስጥ የመድሃኒት መጋዘን አስተዳደር ተግባራትን ለመፈተሽ ነው። በመድኃኒት አስተዳደር ላይ ያሉ ጠንካራ ጎኖችና አበራታች ነገሮችን መለየት እነዲሁም የሚያጋጥሙ ውስንነቶችና መሰናከሎችን መለየት ለህብረተሰቡ የመድኃኒት ተደራሽነትን ለማሻሻል ለሚደረጉ ጥረቶች ከፍተኛ አስተዋፅኦ እንደሚኖረው ይታወቃል። በመሆኑም በሆስፒታላቹ ውስጥ ያለውን የመድኃኒት አስተዳደር ሁኔታ በሚመለከት ያሎትን የግል አስተያየት በግልፅ እንዲነግሩን በአክብሮት እንጠይቃለው።

በቃለ-መጠይቁ ወቅት የሚያነሱዋቸውን ነጥቦች ሙሉ በሙሉ ለመያዝ ይረዳን ዘንድ የርሶ ፍቃድ ከሆነ ይህ ቃለ-መጠይቅ በመቅረጸ-ድምጽ የሚቀዳ ይሆናል። ይሄም ከጊዜዎት ከግማሽ ሰዓት ያነሰ ጊዜ ይወስዳል። በዚህ የቃለ-መጠይቅ ሂደት የሚገኙ ማናቸውም መረጃ በምስጢር የሚጠበቅ ይሆናል። ይህም ማለት የሚሰጡንን መረጃ ከጥናት ቡድኑ አባላት ውጭ ለማንም ግልፅ የማናረግ ሲሆን የሚዘጋጁ የቃለ-መጠይቆች ዘገባዎችም እርስዎን እንደ መረጃ ሰጪ የማይጠቅሱ ይሆናል።ለሆስፒታልዎና እና ለርስዎ ያለኝን ጥልቅ አክብሮት እየገለጽኩ ይህን ጥናት ለማካሄድ ላሳዩት ፈቃደኝነት እና ትብብር ማመስገን እፈልጋለሁ፤.እርስዎ መናገር ስለማይፈልጉት ነገር ለመናገር እንደማይገደዱ እና ቃለ-መጠይቁን በማንኛውም ጊዜ ማቋረጥ እንደሚችሉም ላስታውስዎት እወዳለሁ።

በቃለ-መጠይቁ ለመሳተፍ ፍቃደኛንዎት? አዎ ☐ አይደለውም ☐

በቃለመጠይቁ ለመሳተፍ ፍቃደኛ ከሆኑ ቃለ-መጠይቁን እንጀምራለን፡

ለመድኃኒት መጋዘን ኃላፊዎች ቃለ-መጠይቅ

የተቋሙ ስም________________________

የመላሾች ዲሞግራፊክ ገፅታዎች

ዕድሜ፡ 20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐

***ፆታ*:** ወንድ ☐ ሴት ☐

የትምህርት ደረጃ:

ፋርማሲ ቴክኒሺያኒያ ☐ ፋርማሲስት ☐ የመድሃኒት አቅርቦት ሰንሰለት ባለሙያ ☐

የስራ ልምድ:

1-3 ዓመት ☐ ከ 4 እስከ 6 ዓመት ☐ ከ 7-9 ዓመታት ☐ ከ 10 ዓመት በላይ ☐

1. ስለ ሆስፒታላችሁ መድሃኒት መጋዘን አስተዳደር አሰራር ሁኔታ ከተለያዩ መስፈርት አንፃር ገለጻ ቢያደርጉልን?
   - I. የመድሃኒቶች አደራደር ____________________________________
   - II. የመጋዘን ጥራት፤ ደህንነት __________________________________
   - III. ስለኢንቨንተሪ አስተዳደር __________________________________

IV. መዝገብ አያያዝ ____

V. የተበላሹመድኃኒቶች አወጋግድ ______________________________

ለ. በመድሃኒት መጋዘን አስተዳደር ውስጥ ምን ተግዳሮቶች አጋጥመውታል?

____

2. በሆስፒታላቸሁ ውስጥ የመድሃኒቶች አቅርቦት ምን ይመስላል?

____

ሀ. ሆስፒታላችሁ ውስጥ አስፈላጊ የሆኑ መድሃኒቶች እጥረት ይጋጥምዎታል?

____

ለ. (መልስዎ አዎ ከሆነ) የእነዚህ እጥረቶች ዋነኛ ምክንያት ምንድን ነው?

____

ሐ. በብዛት ክምችት ውስጥ እጥረት የሚያጋጥሙ መድኃኒቶችን ቢዘረዝሩልን?

____

መ. በርስዎ ሀሳብ በሆስፒታላቹ ውስጥ የመድሃኒትን አቅርቦት ለማሻሻል ምን መደረግ አለበት ይላሉ?

____

3. በሆስፒታላቹ ውስጥ ከመድሃኒት አስተዳደር ጋር የተያያዙ ችግሮች አሉ ወይ?

____

4. በሆስፒታላቹ ውስጥ የመድሃኒት አስተዳደርን ለማሻሻል ምን መደረግ አለበት ይላሉ?

____

ለፋርማሲ ክፍል ኃላፊዎች ቃለ-መጠይቅ

የተቋሙ ስም ________________________

የመላሾች ዲሞግራፊክ ገፅታዎች:

ዕድሜ፡ 20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐

ፆታ: ወንድ ☐ ሴት ☐

የትምህርት ደረጃ:

ፋርማሲ ቴክኒሺያኒያ ☐ ፋርማሲስት ☐ የመድሃኒት አቅርቦት ሰንሰለት ባለሙያ ☐

የስራ ልምድ:

ከ1-3 ዓመት ☐ ከ4 እስከ 6 ዓመት ☐ ከ 7-9 ዓመታት ☐ ከ 10 ዓመት በላይ ☐

1. የሆስፒታላቹሁን የመድሃኒት መጋዘን አስተዳደር አስራር እንዴት ይገልጹልናል?

   ____

ሀ) ከጥንካሬና ጎን አንጻር____

ለ) ከደካማ ጎን አንጻር____

ሐ) በሆስፒታላቹ በተደጋጋሚ የመድሃኒትና የህክምና መገልገያዎች አለመኖር ምክያቱን ቢያስረዱን?

   ____

መ) በሆስፒታላቹ ውስጥ በጣም አስፈላጊ የሆኑ መድሃኒቶችን አቅርቦት ለማሻሻል ምን መደረግ አለበት ይላሉ?____

2. በሆስፒታላቹ ውስጥ ስላለው የመድሃኒት እና የህክምና ኮሚቴ (DTC) ገለጻ ቢያደርጉልን?

ሀ) ጥንካሬ ____

ለ) ድክመት ____

ሐ) ተግዳሮቶች____

3. ሆስፒታላቸሁ የራሱ የሆነ የመድሃኒቶች ዝርዝር አለው?

   ____

ሀ. በየምን ያህል ጊዜው ይሻሻላል?

   ____

4. መድሃኒቶችንና የህክምና መገልገያዎችን ከመግዛትና ከማከፋፈል አንጻር የEPSAን የስራ አፈፃፀም እንዴት ያዩታል?____

ሀ. በየ ስንት ጊዜው ከ EPFA ትዕዛዝ ያዛሉ?____________________________________

ለ. የመድሃኒት ግዥ ከEPSA ከተጠየቀ በኋላ የመድሐኒት አቅርቦቱ በአማካይ ምን ያህልጊዜ ይፈጃል? ____

5. በሆስፒታላቹ ጥቅም ላይ መዋል የማይችሉ መድሃኒቶች አወጋገድ አሰራር ምንይመስላል?

   ____

ሀ. በግምት ጥቅም ላይ መዋል የማይችሉ መድሃኒቶች ለምን ያህል ግዜ ይከማቻሉ?

   ____

ለ) ጥቅም ላይ መዋል እማይችሉ መድሃኒቶች የምታስወግዱት የት ነው?

   ____

ሐ) በግምት ለመጨረሻ ጊዜ ጥቅም ላይ መዋል የማይችሉ መድሐኒቶችን ያስወገዳችሁት መቼ ነበር?

____

መ) ጥቅም ላይ መዋል የማይችሉ መድሃኒቶች ሲወገዱ አግባብነት ያለው ተቆጣጣሪ አካላት (EFDA / MOH) ይገኛሉ?

____

ሠ) ሁሉም የመድሃኒት መጋዘን ሰራተኞች ስለ ተበላሹ መድሃኒቶች ሊያስከትሉ ስለሚችሉት አደጋዎች እና ችግሮቻቸው ስልጠና ተሰጥቶአቸዋል?

____

6. በሆስፒታላቹ ውስጥ ስለመድሃኒት አስተዳደር መሻሻል ምን እየተደረገ ነው?

____

<u>የህክምና ዳይሬክተሮች ቃለ-መጠይቅ</u>

የተቋሙ ስም________________________

የመላሾች ዲሞግራፊክ ገፅታዎች

ዕድሜ፡ 20-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐

ጾታ: ወንድ ☐ ሴት ☐

የትምህርት ደረጃ: አጠቃላይ ሐኪም (GP) ☐ ስፔሻሊስት ሐኪም ☐

የስራ ልምድ፡

ከ1-3 ዓመት ☐ ከ 4 እስከ 6 ዓመት ☐ ከ7-9 ዓመታት ☐ ከ10 ዓመት በላይ ☐

1.የሆስፒታላቹሁን የመድሃኒት መጋዘን አስተዳደር አሰራር እንዴት ይገልጹልናል?

____

ሀ) ከጥንካሬና____

ለ) ከተግዳሮቶች አንጻር____

2. በሆስፒታላቹ ውስጥ ስላለው የመድሃኒት እና የህክምና ኮሚቴ (DTC) ገለጻ ቢያደርጉልን?

ሀ) ጥንካሬ ____

ለ) ድክመት ____

ሐ) ተግዳሮቶች____

3. ሆስፒታላችሁ ውስጥ መድሃኒቶች ከአገልግሎት ውጬ እንዲሆኑ የሚሆኑበት ምክንያቶች ምን ምን ናቸው ብለው ይስባሉ?__________________________________

ሀ. በሆስፒታላቹ መድሃኒቶች ከአገልግሎት ውጬ እንዳይሆኑ ምን አይነት ቁጥጥር ታደርጋላቹ?

____

4. በሆስፒታላቹ ውስጥ የአንዳንድ መድሀኒቶች አለመኖር ምክንያቱ ምን ነው ብለው ያስባሉ?

____

ሀ. በሆስፒታላቹ የመድሃኒት አለመኖርን እንዴት ትቆጣጠሩታላቹ?

____

5. በሆስፒታላቸሁ የመድሃኒትና የህክምና መገልገያዎችን ቁጥጥር ስርዓት ላይ ተጽእኖ የሚያረጉ ነገሮች ምን ምን ናቸው ብለው ያስባሉ? ________________________

6. በሆስፒታላቸሁ ውስጥ የመድሃኒትና የህክምና መገልገያ መሳሪያዎችን ቁጥጥር ለማሻሻል ምን ማድረግ አለበት ይላሉ?________________________

በ ፋርማሲ ት/ቤት

የኢቲካል ሪቪዉ ቦርድ

አዲስ አበባ ዩኒቨርሲቲ
Addis Ababa University

School of Pharmacy

Ethical Review Board

ቀን
Date April 08, 2019

ቁጥር
Ref. No. ERB/SOP/61/04/2019

To: **Ayalew Tesfaye**
School of Pharmacy

Re: **Ethical Clearance**

It is to be recalled that you submitted a study proposal entitled ***"Assessment of pharmaceutical store management in public hospitals, of Addis Abaaba"*** for ethical approval by the School's Ethical Review Board (ERB). The Board thoroughly reviewed the proposal based on its operational guidelines and found it to fulfill all ethical requirements stipulated in the guidelines. This is, therefore, to inform you that the proposal is ethically approved for implementation.

With best regards,

Arebu Issa
Chairperson, ERB

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