ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

ASSESSMENT ON THE STORAGE CONDITION OF MEDICAL LABORATORY COMMODITIES IN MEDICAL STORES AND KNOWLEDGE, ATTITUDE AND PRACTICE OF THE STORE MANAGERS ON THE APPROPRIATE STORAGE OF MEDICAL LABORATORY COMMODITIES IN GOVERNMENT HOSPITALS IN ADDIS ABABA, ETHIOPIA

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ASSESSMENT ON THE STORAGE CONDITION OF MEDICAL LABORATORY COMMODITIS IN MEDICAL STORES AND KNOWLEDGE, ATTITUDE AND PRACTICE OF THE STORE MANAGERS ON THE APPROPRIATE STORAGE OF MEDICAL LABORATORY COMMODITIES IN GOVERNMENT HOSPITALS IN ADDIS ABABA, ETHIOPIA.

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Abbreviations/acronyms

AAU= Addis Ababa University

AARHB= Addis Ababa Regional Health Bureau

AIDS=Acquired Immunodeficiency Syndrome

CDC= Center for Disease Control and Prevention

DRERC= Departmental Research and Ethics Review Committee

EPHI= Ethiopian Public Health Institute

FEFO= First Expired First Out

HIV=Human Immunodeficiency Virus

JSI/DELIVER=John Snow Inc. / Deliver project

KAP= Knowledge, Attitude and Practice

LEFO= Last Expired First Out

LELO=Last Expire Last Out

LMIS= Laboratory Management Information System

NGO= Non-governmental Organization

PFSA=Pharmaceuticals Fund Supply Agency's

QA= Quality Assurance

SCMS=Supply Chain Management System

SPSS=Statistical Package for Social Sciences

TB=Tuberculosis

USAID= United States Agency of International Development

WHO= World Health Organization

Abstract

Background: Medical laboratory commodity management system especially storage system of laboratory supplies is a challenge for health professionals. Since absence of proper storage condition for laboratory supplies is leading to damaging and out of stock for essential supplies, the need of proper store management have gained a great attention.

Methods: A Cross sectional study was conducted in eleven government hospitals' medical stores in Addis Ababa from January, 1, 2014 -February, 1, 2014. Data was collected using structured questionnaires. Data was entered by EPI INFO version 3.1statistical software and analyzed with SPSS version 20 statistical analysis software. Frequencies were used to express the assessment on the storage condition of medical laboratory commodities and Knowledge, Attitude and Practice (KAP) of store managers on the appropriate storage of medical laboratory commodities.

Results: Data was collected from eleven governmental hospitals found in Addis Ababa. Ten (91%) hospitals' medical stores didn't have frozen storage of either -20^0C or -70^0C but all of the medical stores had cold storage of $2\text{-}8^0$C. All hospital medical stores, except one, had guidelines for storing cold chain items. Only 4 (36.4%) of the hospitals were separate flammable chemicals whereas 6(54.5%) of them did separate hazardous chemicals and majority 10 (91%) did separate damaged and expired supplies from the non-expired and non-damaged commodities. All of the sore managers were responded that, they knew the appropriate storage of cold chain items while 2(18.2%) of them did not know how to properly store cold items. Seven (63.6%) of the store managers thought that monitoring store temperature is necessary and 6(54.5%) them thought that the quality of their store was in compliance with the standard storage guideline.

Conclusion: The storage condition of majority of the facilities was in compliance with the standard storage guideline. Knowledge, Attitude and Practice of majority of the store managers on the appropriate storage of medical laboratory commodities, were adequate on all laboratory

storage. Lack of adequate space and infrastructures to store medical laboratory commodities were challenges in half of the facilities. Adequate and regular training should be given to the responsible personnel for better storage of medical laboratory commodities

1. Background

1.1.Introduction

Commodity management is the process of getting logistics, controlling, transporting, storing up and distributing commodities through keeping the commodities financial records. From the mid-1950s to the mid-1970s basic health commodities concepts began to grow up in countries as varied as Cuba, Norway, Papua New Guinea, Peru and Sri Lanka [1].

In the context of health services, commodities include reagents and test kits, laboratory equipment and supplies, and other medical supplies and equipment such as specimen collection tools [2]. Each test performed in a laboratory requires several different commodities: reagents, consumables, durables and equipment, slow moving and fast moving, long shelf life and short shelf life and non-fully supply and fully supply [3].

Laboratory logistics systems handle a vast range of testing commodities, with varying characteristics. Laboratory products required for each of these testing services may also vary greatly some products must be delivered to facilities every month because of their short shelf lives, other products may have different physical requirements, such as temperature sensitivity and packaging size, often requiring special storage and distribution handling [4].

Drug and other health commodities require appropriate storage condition as these influence their shelf lives, safety and efficiency. Because storage conditions of health commodities can significantly influence their physic-chemical properties, due care should be taken to preserve drug so that they remain physically, chemically and microbiologically stable [5]. The storage and distribution area includes all activities related to managing inventory: ordering, receiving, storing, and issuing supplies. These activities may take place at various levels of the system. The goals of distribution are to protect stored items from loss, damage, theft, or wastage, and to manage the reliable movement of supplies from source to user in the least expensive way [6].

Storage ensures the physical integrity and safety of products and their packaging, throughout the various storage facilities, until they are dispensed to clients. An important goal in storage of health products is the correct staging of health products to ensure that orders can be filled and distributed [7].

Medical supplies should always be kept in a secured, designated storage space because medical supplies are expensive and very marketable. These items need proper care or they may deteriorate, resulting in loss of potency or development of poisonous degradation products that might harm patients. To store medicines and supplies properly, health facilities need a store that is in good physical condition, can be secured, and has shelving [8].

Maintaining proper storage conditions for health commodities is vital to ensuring their quality. Product expiration dates are based on ideal storage conditions and protecting product quality until their expiration date is important for serving customers and conserving resources [9].

Efficient laboratory and medical commodities management ensures that appropriate commodities of adequate quality are reliable, so that technicians can perform laboratory test for individual patient care and health care staff can treat patients appropriately. Managing commodities in any setting (public or private sector) and at any level (local, regional, provincial or national) require appropriate knowledge [10].

If a product fulfils the customer's expectations, the customer will be pleased and consider that the product is of acceptable or even high quality. If his or her expectations are not fulfilled, the customer will consider that the product is of low quality. This means that the quality of a product may be defined as "its ability to fulfill the customer's needs and expectations" [11].

QA can be considered as the sum of all the policies and practices that ensure the quality of the commodities entering and moving through the logistics cycle. QA ensures that the right commodity reaches the right place in the right condition [12].

Health facilities should include procedures for managing commodities in the quality assurance program. They should also define and enforce procedures and policies for internal and external retesting for quality control. Established procedures for routine visual inspection of laboratory commodities as well as for handling of suspect, damaged, or expired commodities have to be in place. QA measures typically are defined in national laboratory policy and manual. However, in the absence of such a policy, many laboratories use the same commodities that are allocated for performing the tests themselves required for laboratory services; a wide variety of storage requirements exists for their maintenance [3].

Guidelines for the Storage of Essential Medicines and Other Health Commodities are a practical reference for those managing or involved in setting up a storeroom or warehouse. The guide

contains written directions and clear illustrations on receiving and arranging commodities; special storage conditions; tracking commodities; maintaining the quality of the products; constructing and designing a medical store; waste management; and resources. It was written to meet the needs of district-level facilities; however, the guidelines and information it contains apply to any storage facility, of any size, in any type of environment [9].

The risk factors that determine the quality of laboratory commodities storage are: flammables and corrosives, these should be stored separately from other commodities and reagents, that require several levels of temperature storage, including cool storage, which requires temperature conditions up to 25°C, cold storage, which requires refrigeration between 2°C and 8°C, frozen storage, which requires frozen conditions of either –20°C or –70°C, and commodities that deteriorate rapidly when exposed to light or moisture specimens (fragment of tissue) require freezing [6].

The risk factors or determinant for the problem of laboratory commodities storage are that Laboratory commodities are composed of a vast array of items with varying operational characteristics, shelf-life, installation, training, servicing, shipping, transportation, handling and storage requirements [13].

1.2 Statement of the Problems

Laboratory commodities present a unique challenge to laboratory staff, laboratory managers, store managers, logisticians and other individuals responsible for aspects of laboratory supply chain management. The timeliness and accuracy of diagnostic results is reliant on the availability of laboratory commodities that meet minimum quality standards and to enhance quality and maintain efficiency [13].

Functioning, good quality equipment and uninterrupted supplies of kit, reagent and other consumable are mandatory. Yet many countries have given a little attention to the particular needs of laboratories and what is required to create an effective commodity management system [10].

Managing supply chains in support of laboratory services is a formidable challenge, especially in developing countries. Laboratory services play a significant role in a country's health system and in the delivery of quality health services. Laboratory capacity depends on the availability of the required commodities to perform these tests, with most tests requiring multiple commodities to be available simultaneously. Well-functioning supply chains will enhance availability of the commodities required to provide the necessary laboratory services [4].

The most difficult challenges facing national laboratory systems in developing countries are acute shortage of workforce capacity, as seen with the limited number of trained and skilled personnel; poorly maintained physical infrastructure and inadequate supply of electricity and water; lack of equipment maintenance; weak supply-chain management systems for consumables and reagents; and lack of leadership and policies for standards [14].

Regarding to the Ethiopian context, laboratory commodity system was not systematically designed, strengthened nor supported [15]. Health service delivery in Ethiopia is characterized by poor quality resulting in very low service utilization. Lack o well trained health providers, a very limited physical health infrastructure, inadequate space; shortages of equipment and commodities at health facilities [16].

Different assessment and surveys revealed a lot of challenge on health commodity Management Practices in Ghana [1] and Zambia [17]. In both of the countries, Laboratory supply chain problem and storage system were the leading problem.

There a lack of literatures done on KAP of the store managers towards to medical laboratory commodities storage.

1.3.Significance of the study

This study will use as a reference material for the future study with similar topics and it will provide important information and input for those facilities which are going for Step wise Laboratory Quality Improvement Process towards Accreditation (SLIPTA).Also it will provide important information and input for policy makers.

2. Literature review

The use of quality reagents is an important aspect of the process, despite the fact that it is the responsibility of the laboratory to ensure the quality of the analytical system (including reagents). Since it is impossible to evaluate all commercial diagnostic kits, the laboratory often depends on statements issued by the manufacturer to select the most appropriate diagnostics for a particular laboratory [18].

The partnership with the Supply Chain Management System (SCMS) has supported the Ethiopian Public Health Institute (EPHI) in designing and implementing laboratory logistic management systems. SCMS procures laboratory supplies and helps distribute them and works to develop an efficient supply chain management system for laboratory commodities. To ensure long-term sustainability, SCMS works very closely with the Ethiopian Pharmaceutical Funding and Supply Agency in collaboration with SCMS; university partners are supporting EPHI in establishing an inventory control mechanism for laboratory commodities [19].

2.1. Dimensions of storage space

On pharmaceutical assessment in Rwanda, facilities were asked about the dimensions of storage space. While 56% of health facilities reported having storage spaces smaller than the standard requirement laid out at the national level for health, half of them expressed the need for additional storage space. In addition, 61% reported having separate storage areas for drugs and medical supplies. Dangerous and inflammable products were adequately stored in separate spaces in 43% of the facilities. About three-quarters of the sites (76%) were found to have independent storage and dispensing rooms. Maintenance of building infrastructure was found to be adequate in most of the stores [20].

Assessment of the Laboratory Commodities Supply Chain in Lesotho revealed that only 36% of pharmacies were found to have fire extinguishers; the floor space was inadequate in 50% of facilities for the activities and storage in the pharmacy and in 75% of cases, the facility layout was not adequate for the efficient and smooth flow of processes and activities [21].

2.2. Infrastructure and instruments

Based on assessment of infrastructure by direct observation in Rwanda, 98% of facilities were clean; 95% had walls in good condition. From those sites that reported problems, leakages in walls and roofs seemed to be the main concerns. However, less than half of facilities (47%) reported having a reliable supply of electricity, and 35% of facilities reported experiencing power cuts on a daily basis. Refrigerators were available in 78% of the facilities, but functional

in 73% of the sites. With respect to the adequacy of the equipment available, 43% of facilities indicated that equipment in the pharmacy needed improvement. Most facilities (98%) reported having shelving, 45% of facilities reported using pallets for storage, and 64% reported having cupboards. Office equipment was available in 82% of the sites; of those facilities some found that many of these storage spaces were not constructed for the storage of drugs and medical supplies, which could explain their inadequacy in some cases. The survey found that ventilation was not always ensured (70% for main storage, 43% for other rooms). Protection from light was adequate in most of the main storage areas (98%) but insufficient in other rooms (53%) [20].

Assessment was carried out to investigate the laboratory commodities supply chain in Lesotho in the area of cold chain maintenance. All hospital pharmacies visited had refrigerators, and in almost all of them (92 %) heat-sensitive items were kept in the refrigerator. In more than half of the pharmacies, there was no thermometer in the fridge, and in only a quarter of the cases were the temperature checked and charted twice daily as required by cold chain procedures [21].

2.3 Challenge of the medical store during storage of medical supplies.

Based on assessment of health commodities management practices in health care delivery in Ghana, 98% of respondents agreed to the fact that there were a lot of challenges impairing the proper management of health commodities, some insuperable, even whilst 2% said they did not face any challenges. The challenges brought up by these respondents were many and diverse; some of them were inadequate availability of health commodities, poor procurement practices, counterfeit and substandard commodities, irrational/incorrect use, delays in approving medicines and non medicines. The study also identified additional challenges like undermined distribution, transportation, unavailability of storage facilities, unavailability of skilled labor, internal bureaucracy, lack of funding, and logistical problems [1].

2.4Training and education opportunities.

Based on Kenya health system assessment in 2010, two hundred health care professionals, an average of 87% of healthcare professionals had received no training at all in the last three years. Only 2.6% have received some training in the last year. Interviews at facilities revealed that in-service training is largely opportunity-driven, rather than based on the skill acquisition needs of the sector or individual providers [22].

Pre-service training can effectively introduce the principles and practices of supply chain management (SCM) of health commodities to future health workers while they are still enrolled in school. Reducing the need for, and reliance upon, expensive in-service training are two significant benefits of using a pre-service training approach [23].

2.5. Storage practices of the study facilities.

According to an assessment result of the laboratory commodities supply chain in Lesotho, all laboratories reported that they had no written guidelines for storage of laboratory supplies according to their specifications. In most cases, the storage space had poor ventilation and was small, and there were no cupboards for flammable reagents. Thirty three percent of all laboratories reported that reagents were not stored according to the first expiring, first out (FEFO) practice. None of the laboratories practiced the separation of damaged/or expired supplies from usable products. Seventeen percent of the laboratories responded that cold chain items were not stored at appropriate temperatures due to refrigerators being too full and space not being available [21].

3. Objectives

3.1. General objective

To assess the storage condition of medical laboratory commodities in medical stores and knowledge, attitude and practices of medical store managers towards to the appropriate storage medical laboratory commodities storage in government hospitals in Addis Ababa, Ethiopia

3.2. Specific objectives

To determine the laboratory commodities storage quality of the medical store based on minimum standard storage requirements

To assess the knowledge, attitude and practices of medical store managers towards to the appropriate storage of s medical laboratory commodities based on the standard guide line

4. Materials and Methods

4.1. Study setting and area

The study was conducted in eleven government hospitals medical stores of which five are federal and six regional hospitals medical stores located in Addis Ababa, the capital city of Ethiopia, seat of African Union and Economic Commission. It is located in the geographic centre of the country and covers a landmass of 540 sq. km. It is administratively sub-divided into 10 sub cities and 116 Weredas. According to central statistical agency 2008 report the city has an estimated Population of 2.98 million [24].

The city has 45 public and private hospitals, 70 health centers and 551 clinics. From 45 hospitals 10 are public, 5 are under Addis Ababa Regional Health Bureau, 5 are specialized referral hospitals under the Federal Ministry of Health (one of which is under Addis Ababa University), 3 are uniformed forces (military), 4 are Non-Governmental Organizations' and the rest 28 are private hospitals [24].

4.2. Study design and period

Cross sectional study was conducted from January, 1, 2014 to February, 1, 2014.

4.3. Population

4.3.1. Source population

The source populations were all health facilities involved in storing health commodities in their stores and all medical store managers involved in controlling and managing health commodities in Addis Ababa.

4.3.2. Study populations

Study populations were all medical stores of government hospitals found in Addis Ababa and store managers of those hospitals were study populations.

4.4 Sampling technique.

Purposive sampling technique was used to select the study populations.

4.5. Sample size estimation and sampling procedure

All eleven governmental hospitals (six regional and five federal hospitals main medical stores), which had medical laboratory commodities in their stores, found in Addis Ababa were included,

Eleven persons, who are the main medical store managers of each hospital, working during the data collection period participated in responding the forwarded questioners.

4.6. Data collection procedure

A structured questionnaire which was originally developed by USAID | DELIVER PROJECT [3] and found in the laboratory logistics hand book about a guide to store laboratory commodities appropriately was used. Two data collectors, who were medical laboratory professionals, were trained and provided the guide how to collect data on the storage of medical laboratory commodities and KAP of the store managers. Questionnaire was held with medical store managers at main medical store at hospitals. As the participants in the study (medical store managers) were not expected to be in difficulty in English language and the data collector also were given introduction about laboratory commodities terms and other related issues, the questionnaires were presented by the English version.

4.7. Study variables

Dependent variables:

- Medical laboratory commodities storage condition.
- Knowledge, Attitude and Practice (KAP) of store managers towards the appropriate storage of medical laboratory commodities.

Independent variables: Socio-demographics of interviewees, Training, Presence of guide line, Educational back ground of the interviewee, temperature condition Presence of storage problems, Presence of standard storage space etc.

4.8. Data quality management

Before embarking upon data collection the prepared questionnaires were pre tested to ensure the validity of the survey tool. After the data collection tools were pretested, appropriate modification was made; vagueness was avoided and it became easily understandable, to standardize the questionnaire. Data collectors were trained and provided the guide line for how to collect data on the storage medical laboratory commodities in medical store and KAP of the store managers. Principal investigator made frequent checks on the data collection process to ensure the completeness and consistency of the gathered information; data was double entered to enable cross-checking during analysis as well.

4.9. Data analysis procedure

The data was cleaned, coded and entered by using EPI INFO version 3.1 statistical software. Then data was exported to SPSS version 20 statistical soft ware for analysis. Results were presented in tables and figures.Fisher's exact test was to show the association between dependent and independent variables. P value less than 0.05 was considered as significant.

4.10. Ethical consideration

The study proposal was approved by departmental research and ethics review committee (DRERC) of Department of Medical Laboratory Sciences, Addis Ababa University, in addition ethical approval also given from ethical committee of Addis Ababa Health Bureau and ethical review board of the respective federal hospitals. Then letters informing the facility administrators were written to the respective hospitals. There were high degrees of confidentiality during data collection. No name of any health facility and participating individuals were put in the result, instead the aggregate result of the facilities and summary results were projected.

4.11. Dissemination of the result

After conducting the research, the results of the study will be presented to the Department of Medical Laboratory Science, College of Health Science, AAU, AARHB, FMOH, EPHI, assessed hospitals, annual conferences of professional societies and other concerned bodies. Manuscript will be submitted to peer reviewed journals for publication.

4.12. Operational definitions

Medical laboratory commodities storage condition: is the status of medical laboratory commodities and taking account of the situations in store to store these commodities like, the need for refrigeration or cold storage of test kits or associated consumables, taking Maintain a cold chain for laboratory commodities that require it, store flammables separately, and ensure that a fire-extinguishing mechanism is available, store corrosives at normal room temperature, at ground level, and in the original manufacturer's containers, keep laboratory commodities in the original packaging to protect light-sensitive commodities, maintain commodities under the appropriate storage conditions, and storage facilities (warehouses, storage rooms) must be clean and secure.

Quality laboratory commodities: are commodities those are appropriately stored based on standard guidelines or manufacturer's manual or instruction.

Quality: it is the ability of medical laboratory commodities to fulfill the customers need and expectation.

KAP of medical store manger:is the knowledge, attitude and practice of medical store managers.

5. Results

5.1. Characteristics of study facilities

Data was collected from eleven governmental hospitals found in Addis Ababa. All hospitals had at least one medical store, where the largest number of stores found in 2 (18.2%) of the hospitals (four medical stores each). Five (45.5%) of them were served for more than 12 years, but the service year of the stores was not explained in 3 (27.3%) of the medical stores. The area of medical stores was not explained in most 7(63.6%) of the hospitals. Except 1(9%) of the medical stores, majority 10 (91%) of the medical stores were 100-200 meters far from the main laboratory (Table 1).

Table 1: Assessment of the general characteristics of medical stores of eleven governmental hospitals in Addis Ababa from January, 1, 2014 – February, 1, 2014

General Characteristics		No. of facilities	%
Number of store rooms	1	1	9
	2	5	45.5
	3	3	27.3
	4	2	18.2
Service year of store rooms (in years)	1-4	1	9
	5-8	2	18.2
	NE	3	27.3
	>12	5	45.5
Area of (in m^2) of store rooms	30-50	1	9
	60-80	2	18.2
	90-100	1	9
	NE	7	63.6
Distance store room from main laboratory (meter)	100-200	10	91
	300-500	1	9

NE= Not explained

5.2. Storage condition of the facilities

Except 2 (18.2%) of the hospital's medical stores, all other medical stores had a roof maintained in proper condition to avoid sunlight and water penetration. Ten (91%) of the hospital's medical stores did not have frozen storage of -20^0C or -70^0C but all of the medical stores had cold storage 2-8^0C. Three hospitals' medical stores (27.3%) of them had not consistent power supply and generators whereas 4 (36.4%) of medical stores explained that there were adequate number of

power points or sockets. Three (27.3%) of the medical stores did not have thermometer in the rooms and 4 (36.4%) of all the medical stores did not have adequate number of refrigerators for storing cold chain items.

5.3. Principal person responsible for managing medical laboratory commodities

We have tried to assess the principal person responsible for managing medical laboratory commodities and involvements of medical laboratory personnel in the management. All 11(100%) of the medical stores were managed and controlled by pharmacists. Laboratory personnel were involved in storing laboratory commodities in medical stores in 8(72.7%) of the hospitals

5.4. Presence of written guidelines and training opportunities

Among all medical store managers, less than half (45.5%) of the respondent said that they had ever received training about storage of medical supplies. But all hospital medical stores, except one, had guidelines for storing cold chain items. Regarding the presence of written guidelines, 5 (45.5%) had written guideline for storing medical laboratory supplies or commodities according to their specification. Except one hospital medical store, 10 (91%) of them followed manufacturer's instruction or WHO guide line for appropriate storage of medical laboratory commodities or items. More than half (54.5%) of the medical stores had a standard guide line to discard and incinerate dangerous chemicals and did train the responsible person (Table 2)

Table 2: Presence of written guidelines and training opportunities in eleven governmental hospitals' medical stores in Addis Ababa from January, 1, 2014 – February, 1, 2014.

Guidelines		No. of facilities	%
Presence of written guidelines to store items	Yes	5	45.5
	No	6	54.5
Presence of guidelines to store cold chain items			
	Yes	4	36.4
	No	7	63.6
Following WHO/manufacturers' Instructions for storing lab items	Yes	10	91
	No	1	9
Presence guidelines for incinerating/discarding items	Yes	6	54.5
	No	5	45.5
Training opportunities how to store medical laboratory items	Yes	5	45.5
	No	6	54.5

5.5. Storage practice of the selected health facilities

Only 4 (36.4%) of the hospital store rooms were separate flammable chemicals whereas 6 (54.5%) of them did separate hazardous chemicals and majority 10 (91%) of them did separate damaged and expired supplies from normal commodities. Four (36.4%) of the medical stores did separate flammable, hazardous, damaged/expired medical laboratory commodities. Moreover, these hospitals also had adequate no of shelving/boxes and standard storage space to store all available medical laboratory supplies. Seven (63.3%) of the medical stores had sufficient space to store all available medical laboratory commodities in the stores. Damaged/expired medical laboratory supplies were not separated only in 1 (9%) of the medical store. Eight (72.7%) of the hospitals had adequate no of shelving and boxes (Table 3).

Table 3: Assessment of storage activity of medical stores in eleven governmental hospitals' medical stores in Addis Ababa from January, 1, 2014 – February, 1, 2014.

Activities		No. of facilities	%
Separating flammable chemicals	Yes	4	36.4
	No	7	63.6
Separating hazardous chemicals	Yes	6	54.5
	No	5	45.5
Separating damaged/expired chemicals	Yes	10	91
	No	1	9
Presence of standard storage space for storing all items	Yes	7	63.6
	No	4	36.4
Presence of adequate no of shelving and boxes	Yes	8	72.7
	No	3	27.3

5.6 presence and types of problems in the assessed hospitals

Accordingly, half of the medical stores 6(54.5%) of them had problems in storing medical laboratory commodities and 4(66.7%) of them had both problems those were absence of adequate storage area and absence of standard storage space for the storage equipments like refrigerators for appropriate storage of medical laboratory commodities according to their specifications.

5.7. Knowledge, Attitude and Practice (KAP) of Store Managers on appropriate storage medical laboratory commodities.

5.7.1. Knowledge of store managers about the appropriate storage medical laboratory commodities.

All of the store managers in the eleven governmental hospitals in Addis Ababa were pharmacists (100%). More than half (54.5%) of them were females and only 1 (9%) was a diploma holder.

All sore managers respond that they knew the appropriate storage of cool chain items and 2(18.2%) of them knew that cool chain items were stored at 15^0C and the rest stored these items at 25^0C. Four (36.4%) of them knew what quality commodity means and 3(75%) of them maintained the quality of medical laboratory commodities using standard guidelines. The rest maintained the quality of medical laboratory commodities using manufacturer's manuals. Majority 10 (91%) of the store managers knew whether flammable chemicals need a separate storage. All of the store managers who knew appropriate storage of cold chain items responded that cold chain items should be stored at 2-8^0C. More than three fourth 9 (81.8%) of the store managers responded that they knew appropriate storage of frozen items. Five (55.6%) of them knew that frozen storage is at either-20 or -70^0C and 2(22.2%) knew that frozen storage is either at -10 or -15 ^{0}C. Ten (91%) of the store managers knew that medical laboratory commodities should be protected from direct sun light and all medical laboratory commodities should be stored at temperatures according to their specifications. A few less than three fourth 8 (72.7%) of the respondents explained that all responsible personnel had adequate knowledge about how to store medical laboratory commodities (Table 4).

Table 4: Knowledge of the store managers on appropriate storage medical laboratory commodities in eleven governmental hospitals in Addis Ababa from January, 1, 2014 – February, 1, 2014.

Knowledge Related Questions		No. of facilities	%
Quality commodity	Yes	4	36.4
	No	7	63.6
Separation of flammable chemicals	Yes	10	91
	No	1	9
Appropriate storage of cold chain items	Yes	10	91
	No	1	9
Appropriate storage of cool chain items	Yes	11	100
	No	0	0
Appropriate storage of frozen items	Yes	9	81.8
	No	2	18.2
Protection of medical laboratory commodities from sun light	Yes	10	91
	No	1	9
Temperature specification	Yes	10	91
	No	1	9
Knowledge of responsible personnel about how to store laboratory commodities	Yes	8	72.7
	No	3	27.3

5.7.2. Attitude of the store managers towards the appropriate storage medical laboratory commodities.

All of the store managers thought that standard guidelines were important for appropriate storage and management of medical laboratory commodities and caring for cartons containing medical laboratory commodities is important. Seven (63.6%) of the store managers thought that monitoring store temperature was necessary and 6(54.5%) thought that the quality of their store was in compliance with the standard storage guideline. (Table 5).

Table 5: Attitude of store managers towards the appropriate storage medical laboratory commodities in eleven governmental hospitals in Addis Ababa from January, 1, 2014 – February, 1, 2014.

Attitude related questions		No. of facilities	%
standard guide line for medical laboratory commodities supplies storage and management	Yes	11	100
	No	0	0
monitoring store room temperature	Yes	7	63.6
	No	4	36.4
caring for the cartons containing medical laboratory commodities and products	Yes	11	100
	No	0	0
store standard of your commodities	Compliance with standard guide line	6	54.5
	Did not compliance with the standard guide line	5	45.5

5.7.3. Practice of the store managers on the appropriate storage medical laboratory commodities.

Two (18.18%) of the stores were prevent rapidly deteriorating items by preventing store windows from direct sun light and moisture where the rest stores used guidelines for storing rapidly deteriorating items. Four (36.4%) of the stores did nothing when the temperature is out of range while others did adjusted it. Among 8 (72.7%) medical store who regularly cleaned and

deforested the refrigerators, 7(87.5%) of them were cleaned and deforested one by one using other refrigerators (Table 6).

Table 6: Practice of store managers in storing medical laboratory commodities in eleven governmental hospitals in Addis Ababa from January, 1, 2014- February, 1, 2014.

Practice related questions		No. of facilities	%
Storage of rapidly deteriorating items	According to guidelines	9	81.8
	By preventing windows from sun light and moisture	2	18.2
measure taken when temperature is out of range	Adjusting	7	63.6
	Do nothing	4	36.4
cleaning and deforesting refrigerators	Yes	8	72.7
	No	3	27.3
Way of cleaning and deforesting refrigerators	Using other refrigerator	7	87.5
	I don't know	1	12.5

Table 7: Association of some characteristics with the general storage condition of medical laboratory commodities in eleven governmental hospitals in Addis Ababa from January, 1, 2014 - February, 1, 2014, Addis Ababa, Ethiopia

		General storage condition of lab commodities			
		Good n (%)	**Not good n (%)**	**Fisher's exact test**	**P value**
Education	Diploma	1(100)	0(0)	2.2	0.14
	BSc	3(30)	7(70)		
Presence of guidelines	Yes	4(57)	3(43)		
	No	2(50)	2(50)	4.86	0.08
Presence of storage problems	Yes	4(50)	4(50)	3.3	0.07
	No	0(0)	3(100)		
Presence of adequate space	Yes	2(33)	4(67)		
	No	2(40)	3(50)	0.05	0.82
Receiving training	Yes	4(100)	0(0)		
	No	0(0)	7(100)	3.2	0.003

Neither of educational status of interviewees, presence of adequate space, presence of guideline, presence of problems and the respondent those had received training showed significant association with the general storage condition of medical laboratory commodities, but the respondent those hadn't received training has a significant association with the general medical laboratory storage condition by Fisher's exacttest of the analysis.

6. Discussion

In our study setting, except 2 (18.2%) hospital medical stores, all other medical stores had a roof maintained in proper condition to avoid sunlight and water penetration which was in line with a study from Rwanda where maintenance of building infrastructure was found to be adequate in most of the stores. Seven (63.3%) of the medical stores had standard storage space to store all available medical laboratory commodities in the stores in this study which was higher than a study conducted in Rwanda (44%) and Lesotho (50%) [20, 21]. This difference could be due to smaller sample size and only hospitals were involved in this study. While the study in Rwanda examined health centers and Lesotho examine health centers and clinics involved respectively.

In this study four (36.4%) of all the medical stores did not have adequate number of refrigerators for storing cold chain items in this study which was lower than a study conducted in Lesotho where 17% of the laboratories responded that cold chain items were not stored at appropriate temperatures [21]. This indicates that there was a better number of a refrigerator for cold chin items in Lesotho; the difference could be due to there was better accessibility of refrigerators in Lesotho.

In this study 4 (36.4%) of medical stores were separating flammable, hazardous, damaged/expired laboratory commodities this finding was somewhat smaller than a study conducted in Rwanda where dangerous and flammable products were adequately stored in separate spaces in 43% of the facilities and higher than a study conducted in Lesotho where none of the laboratories practiced in their study reported the separation of damaged/or expired supplies from usable products [20, 21]. This could be due to lack of adequate rooms, carelessness of the staffs or absence of guidelines how to separately store these products.

In our case, three hospitals' medical stores (27.3%) were responded that, they did not have consistent power supply and generators whereas 4 (36.4%) of medical stores explained that there were adequate number of power points or sockets which was a little smaller than a study conducted in Rwanda where 35% of facilities reported experiencing power cuts on a daily basis

[20]. This low percentage could be due to small sample size and only hospital based study in our case.

The result on the absence of thermometer in the rooms 3 (27.3%) was different from a study in Lesotho where thermometer was absent in more than half of the pharmacies [21]. Moreover, the finding indicated that 4 (36.4%) of all the medical stores did not have adequate number of refrigerators for storing cold chain items, this finding is inconsistent with a study conducted in Rwanda where refrigerators were available in 78% of the facilities [20]. This indicates presence of better number of refrigerators in Rwanda and the difference could be due to there was a better accessibility of refrigerators in Rwanda.

With respect to availability of standard storage space, 36.4% of medical store had adequate number shelving and boxes and standard storage space to store all available medical laboratory supplies. This result was much lower than a study from Rwanda where most facilities (98%) reported having shelving [20]. This lower availability of shelves and boxes in comparison with previous studies could be due to poor financial ability of our study facilities to accomplish these requirements or small sample size.

In this study protection from direct sun light was adequate in all (100%) of the stores in this study which was in line with a study conducted in Rwanda where 98% of medical stores did protect medical laboratory commodities from sun light [20].

Among all store managers, less than half (45.5%) of the respondent answered that they had ever received training about storage of medical supplies. This was much higher than a study done in Kenya where only 2.6% of health professionals had received some training [22]. This high percent in our study could be due to involvement of only store managers (and so small in number) without participating all health professionals.

Regarding the presence of written guidelines, relatively better number 5(45.5%) had written guideline for storing laboratory supplies or commodities according to their specification. This result was higher than the study conducted in Lesotho, where all laboratories reported that they

had no written guidelines for storage of laboratory supplies according to their specifications [21]. This higher number could be due to better use of guidelines in our study since all facilities were hospitals.

Neither of educational status of interviewees, respondent those had training opportunities, and presence of standard storage space, presence of guideline and presence of problems showed significant association with the general storage condition of medical laboratory commodities but the respondent those had not receive training had a significant association with that of the storage condition in Fisher's exact test of the analysis.

7. Limitations of the study

- The study was conducted in hospitals and did not include health centers and regional laboratories.
- The study was conducted in Addis Ababa (urban area) that is relatively better to get training and other information.
- Absence of similar literature, especially in Ethiopia on storage condition and KAP of professionals.

8. Conclusions

- Lack of adequate and standard storage space and absence of sufficient equipment including refrigerators were the main storage problems in half of medical stores.
- In most of the medical stores, the storage condition of medical laboratory commodities was in compliance with the standard guide line. But in some facilities, the storage condition of medical laboratory supplies was not in compliance with standard guide line including inability of controlling room temperature and unordered arrangement of flammable, dangerous, non-functional and expired products together.
- There was a lack of written guidelines, adequate no of infrastructure, thermometer, and adequate training of store managers in some facilities.
- Even though, Laboratory personnel have indispensible role in controlling medical laboratory commodities storage, they were not involved in some medical stores.
- There was a lack of adequate power supply, sockets and inconsistent power sources in some stores to accommodate temperature sensitive reagents.
- Guidelines to incinerate and discard items were not adequate in most stores.
- In majority of the facilities, store managers had adequate knowledge how to store and practiced medical laboratory commodities and they had also a positive attitude towards the importance of appropriate storage of medical laboratory commodities.

9. Recommendations

- Hospitals should have adequate and standard storage space and sufficient equipment to store medical laboratory commodities appropriately
- Regular trainings should be given to responsible personnel in storing medical laboratory commodities
- Hospitals should have adequate power supply and consistent power source like generators for better storage of medical laboratory commodities
- Flammable, dangerous, damaged/expired and non-functional items should be separately stored
- Special attention should be given to discarding and incinerating items
- Regular inspection and control should be focused in store rooms
- Store managers should know how to appropriately store items, how to take measures to faults and should have positive attitude to proper storage of medical laboratory commodities

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11. Annexes

Annex I: Information Sheet (English Version)

Addis Ababa University School of allied health science, department of medical laboratory science.

The objective of the study is assessment on the storage condition of medical laboratory commodities in medical stores and knowledge, attitude and practice of the store managers on the appropriate storage of medical laboratory commodities in governmental hospitals in Addis Ababa, Ethiopia. This is not a supervisory visit and the performance of individual staff members is not being evaluated. The information you provide will be used to improve laboratory commodities storage quality. If you decide to participate, we will guarantee that there is no any influence related to study but only request you that to provide all relevant information regarding the study. We cannot guarantee, however, that you will receive any benefits from this study. Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. Your name will not be written on the questionnaire or be kept in any other records.

Your participation is voluntary and you are free to withdraw your consent and to discontinue participation at any time without penalty. Your participation or not, do not have any influence for your position or responsibilities in your health facility. The interview may take about 45-60 minutes. For the successes of our study, you are kindly requested to respond genuinely and voluntary with patience. You are making a decision whether or not to participate in this study. Your signature below indicates that you have read the information above and have decided to participate in the study.

Thank you for your participation

Contact address of PI, 0912 63 43 97, DRERC address: 251-116 75517

Annex-II*:* Consent form in English

I_____ here by giving my consent for giving accurate

Information about the status of laboratory commodities storage and its quality in the laboratory and pharmacy store. Health facility as recommended by the researcher/data collector and to answer those commodities questions. I understand there is no problem within my position in the health facility by participating in this assessment at the beginning as well as at the end of the study. I understand this study will be used not only for my health facility but also for other health facilities those provide medical laboratory services. I believe that at the end of study the result will not refer individual facilities but rather will describe the overall picture of all facilities.

Participants Name _____ *Signature*_____ *Date*_____

Researcher's Name_____ *Signature* _____*Date*_____

Thank you in helping with this important study

N.B: If you want to request additional information about the study, you will call by those

phone numbers

Contact address of Principal investigator, 0912 63 43 97 DRERC: 251-116 755170

Annex III: Questionnaires

Research title is assessment on the storage condition of medical laboratory commodities in medical stores and knowledge, attitude and practice of the store managers on the appropriate storage of medical laboratory commodities in governmental hospitals in Addis Ababa, Ethiopia. Please provide your assistance by giving your answers to the following questions!

General information.

Date……

Time worked in facility: years……..months……

Region……

Level of the facility ……...

Type of facility……

1. Sex:

1. Male 2. Female

2. Educational level:

1. College diploma 2. BSc degree 3.MSc 4. Other

3. Profession:

1. Pharmacist 2.Medical lab tech. 3. Nurse 4. Other

Data collection method: questioner and in-depth inter view.

Back ground information

1 .How many store rooms found in this institution?

1. One 2 .Two 3.Three 4.Four

2. How long, since it has been started providing service?

1.1-4years 2.5-8 years 3.9-12years 4.More than 12

3. How wide each store has an area?

1.30-50m^2 2.60-80m^2 3.90-100m^2 4.Other

4 .Who is the principal person responsible for managing laboratory commodities that are used at this facility?

1. Laboratory personnel 2.Pharmacysts 3.Both 4.Store manager

5 .Is there any involvement of the laboratory personnel during managing the storage of especially the medical laboratory commodities?

1. Yes 2.No 3.I don't know

6. How far the main store from laboratory?

1.100-200m 2.300m-500m 3.600-800m 4.Other

Assessment questions

1. Do you know what a quality commodities means?

1. Yes 2. No 3. If other specify

2. If yes how do you maintain the quality of medical laboratory commodities?

1. By using standard guide line 2. By using manufacturers manual or instruction 3. If other specify

3. From which sources do you get information on how to maintain the quality medical laboratory commodities in your store?

1. From training 2. From standard guide line 3. From other health professional

4. Are there written guideline for storing laboratory supplies or commodities according to their specification?

1 .Yes 2. No 3. I don't know

5. 2. Do you monitor your store room temperature?

1. Yes 2. No 3. If others specify

6. Are flammable chemicals stored in a specialized or in separate area? Do you know whether it needs specialized area?

1. Yes 2. No 3. I don't know

7. Are hazardous chemicals stored in a specialized or in separate area? Do you know whether it needs specialized area?

1. Yes 2. No 3. I don't know

8. Does the pharmacy separate damaged or expired supplies or commodities from other goods?

1. Yes 2. No 3. I don't know

9. Are cold chain items always stored at appropriate temperature?

1. Yes 2. No 3. I don't know

10. If yes what is the temperature it requires?

1. 2^0c and 8^0c? 2.27^0c 3.37^0c 4.Other

11. Has there been any problem with the storage of laboratory supplies or commodities?

1. Yes 2. No 3. I don't know

12. If your answer is yes in what are few of them?

1. Lack of adequate area for storage

2. Shortage of enough refrigerators for appropriate storage

3. If others, specify

13. How is the store standard for yourcommodities

1. In compliance with the storage standard 2. Not in compliance with the storage standard 3. I don't know

14. Is the storage condition maintained clean and all trash removed?

1. Yes 2. No 3. I don't know

15. Is the store room has good shelving and organized boxes?

1. Yes 2. No 3. I don't know

16. Do you store flammable and corrosive laboratory commodities separately from other goods?

1. Yes 2. No 3. I don't know

17. Are cool chain items stored at appropriate temperature?

1. Yes 2.No 3. I don't know

18. If yes what is the temperature it requires?

1.15^0c 2.20^0c 3.25 ^{0}c 4.30^0c 5 Other

19. Do you have frozen storage which requires frozen condition?

1. Yes 2.No 3. I don't know

20. If yes what is the temperature it requires?

1.10^0c or 15^0c 2.20^0c or 25^0c 3. 20^0c or 70^0c

21. How do you store commodities those deteriorate rapidly when exposed to light or moisture?

1. Appropriately according to standard guide line for those commodities

2. Coil the glass with container or color spray store and put them in dark and dry place

3. Preventing windows and doors from light and moisture.

4. I don't know

22. Does the store have a standard storage space to adequately store the existing supplies?

1. Yes 2. No 3. I don't know

23.Does cartons contain laboratory commodities and products are stored in a good condition, not crushed due to mishandling, if cartons are open determine if the products are not wet or cracked due to heat or radiation e.g. fluorescent lights in the case of BD FACS flow?

1. Yes 2. No 3. I don't know

24. Does laboratory commodities are protected from direct sun light?

1. Yes 2.No 3. I don't know

25. Are laboratory commodities are stored at the appropriate temperature according to product temperature specification?

1. Yes 2. No 3. I don't know

26. Does the store has consistent power supply and a generator with a guaranteed supply of petrol or solar power?

1. Yes 2. No 3. I don't know

27. Does the store has an adequate number of power points or socket?

1. Yes 2. No 3. I don't know

28. Does the roof is maintained in a good condition to avoid sunlight and water penetration?

1. Yes 2. No 3. I don't know

29. Do you store laboratory commodities in a dry, well-lit, well ventilated and store room out of direct sunlight?

1. Yes 2. No 3. I don't know

30. What type of problems do you typically encountered with the storage of medical laboratory commodities? Pleas list some of them

1. Lack of enough refrigerators

2. Lack of awareness about storage protocol

3. Short expiry date

4. Lack of enough space in store room

5. Lack of personnel training.

6. I don't know

31. Are there adequate refrigeration to store cold chain regents?

1. Yes 2. No 3. I don't know

32. If your answer on question 31 is yes, do you record the refrigerator temperature daily on the temperature registration sheet?

1. Yes 2. No 3. I don't know

33.Does the store has guide line for handling cold chain products that have been exposed to higher temperature e.g. sitting out side for a while or after a relatively long power outage?

1. Yes 2. No 3. I don't know

34. Have you ever received training in the proper storage laboratory commodities?

1. Yes 2. No 3. I don't know

35. Are all laboratory commodities arranged in ordered for the use?

1. Yes 2. No 3. I don't know

37. Do you use all laboratory commodities before their expire date?

1. Yes 2. No 3 .I don't know

38. Does your store room have thermo meter for room temperature measurement?

1. Yes 2. No 3. I don't know

39. If your answer in question 38 is yes do you record the temperature daily?

1. Yes 2. No 3. I don't know

40. What measure do you take for the temperature out of range?

1. We are going adjust the temperature

2. We are going do nothing

3. If others specify

41 Is there any non functional medical laboratory instrument or item in your store?

1. Yes 2. No 3. I don't know

42. If your answer in question 41 is yes do separate it from the functional?

1. Yes 2. No 3. I don't know

43. Do all responsible personnel for storage have adequate knowledge on how to use and handle each laboratory commodities or items?

1. Yes 2. No 3. I don't know

44. Do you follow manufacturer's instruction or WHO guide line for appropriate storage of medical laboratory commodities or items?

1. Yes 2. No 3. I don't know

45. Do you clean and deforest your refrigerator when it needs?

1. Yes 2. No 3. I don't know

46. If your answer is on question 45 explain how are you going do it

1. By using other refrigerator when deforest and clean the one

2. I don't know

3. If others specify

47. Who is responsible for discarding and incinerating harmful and dangerous chemical?

1. Laboratory personnel 2. Pharmacy personnel 3.If other specify

48. Do you have a standard guide line to discard and incinerate dangerous chemicals and do train the responsible person?

1. Yes 2. No 3. I don't know

Thank you!

Annex IV: Declaration

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

Name: KelemeworkHussien

Signature _____

Place _____

Date of submission _____

This thesis has been submitted with my approval as University advisors.

Name _____

Signature _____

Place _____

Date of submission _____

Name _____

Signature _____

Place _____

Date of submission _____