



ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES

DEPARTMENT OF MEDICAL LABORATORY

Wastage rate, management practices, and contributing factors of medical laboratory reagents and consumables in selected public hospitals in Addis Ababa, Ethiopia.

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Acronyms/abbreviations

AIDS	Acquired immune deficiency syndrome
ATLAS	Assessment tool for laboratory service and supply chain
EPSS	Ethiopian pharmaceutical supply service
ETB	Ethiopian birr
FEFO	First expire first out
FIFO	First in First out
HIV	Human immune deficiency virus
HR	Human resource
IFRR	Internal facility report and resupply form
LIAT	logistic indicator assessment tool
LMIS	Logistic management information system
RDF	Revolving drug fund
RRF	Report and Requisition form
SNNPR	Southern nation and nationalities people region
TB	Tuberculosis

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Abstract

Background: Medical laboratory reagents and consumables are unusable due to expiration, damage or loss. Wastage have negative impact on both operational efficacy and financial sustainability. Identifying and addressing major challenged faced in managing stock available help to reduce waste and improve patient health care.

Objective: This study aimed to evaluate the wastage rate of medical laboratory reagents and consumables, along with their management practices and contributing factors, in selected public hospitals in Addis Ababa, Ethiopia, during 2024/25

Methods: A facility based cross-sectional study was conducted in six public hospitals in Addis Ababa. Retrospective one-year data and prospective data was collected during the study period. Checklist and a structured questioner was developed from assessment tools. After verifying the completeness, data were coded and entered into EPI info and exported to SPSS software for analysis. The association between the dependent and independent variables was also analyzed using a bivariate and multivariate logistic regression analysis. Qualitative data was analyzed using the open code 4.03 software. The data was then taken for thorough reading and a codebook was developed for analysis. Narrative approached was used to illustrate the finding.

Result: A total of 993 item Laboratory reagent and commodities expired in the study hospitals. The overall laboratory reagent and consumable wastage rate was 11.25%. Acceptable storage requirement were fulfilled in 85% of storeroom in the study hospital. In the study hospitals, items were purchased using the program and Revolving Drug Fund system. Inventory was managed using Bin Card, Internal facility report and resupply, Report and requisition form, and Model 22. computer based Logistic information management system, Item received near expiration and equipment breakdown were associated factor for wastage. In qualitative finding equipment breakdown, prolong shipment, receiving near expiration and push system were stated as cause of wastage.

Conclusion: The wastage rate of laboratory reagent and consumable in selected hospital was 11.25%. Model 22, internal facility report and resupply, Report and requisition form and bin card were used to manage inventory. Wastage is statistically associated with computer based Logistic information management system AOR=0.029; 95% CI (0.08, 0.11), item received close expiration AOR=3.24; 95% CI (1.09, 9.57) and equipment breakdown AOR=4.36; 95% CI (1.29, 14.77). To

reduce waste, public hospitals should work to address inventory management challenge and cause of wastage.

Key word: *Inventory management, Wastage rate, Laboratory reagent and consumable*

1. Introduction

1.1 Background

Medical laboratory services originated in the late 18th century, initially aimed at supporting research and later expanding to include diagnostic purposes. By the second half of the 19th century, these services had spread to various countries (1). In Ethiopia, the first health laboratory was established during World War II, with the country's first organized laboratory institution being the Pasteur Institute of Ethiopia (2). Medical laboratory services play a crucial role in disease investigation, control, and prevention, while also contributing to healthcare promotion and health education (2, 3).

Medical laboratories services encompassing hematology, microbiology, chemistry, histology, immunohematology, clinical pathology department, and more. Equipment such as a microscope, centrifuge, analyzer, different reagents, and consumables is utilized in the laboratory to analyze body fluid (1, 2). The laboratory uses different reagents and consumable to provide different types of tests to improve diagnosis and treatment. It permits testing samples, detection and prevention of disease (2).

Medical laboratory reagent and consumables that are utilized in laboratory to process patient sample are wasted when they expire, damage or lost (4). Laboratory reagent and consumables vary in stability, storage requirement, and level of hazard. Laboratory reagents should be stored segregated by threat level and protected against theft. Reagent wastage potentially and could during storage, distribution, security, lack of regular inspection, poor quantification, loading unloading, and inventory record keeping. Inventory management plays an important role in reducing reagent wastage (5-7).

Effective supply chain and inventory management guarantee the availability of commodities and services all the time .While poor practice emerge from limited resource, inadequate tracking and forecast challenge (8, 9). Effective inventory management of laboratory commodities ensure stock usage before expiration. The major challenge faced is manage available stock on hand to reduce waste. Poor Quantification cause under stock and over stock, which leads stock out, which disrupt service provision and stock damage through improper storage. As part of the efficient standard supply chain management, it is highly recommended to have a regular inspection of laboratory commodities and reagents. It is important to inspect for any distortion and expiration (10).

Poor inventory data management practice makes it hard to obtain the amount of wastage produced in addition, to possible causes. This will affect the procurement and quantification process, which

leads to overstocking or stock out. Effective data management reduce waste through monitoring stock level and identify near expired stock (11).

1.2 Statement of problem

Effective inventory management practice is critical to provide persistent service and reduce waste. In North America, overstocking lead discarding 52% of laboratory reagents due to inefficient inventory records (12). Poor inventory management increase waste, which affect both operational efficacy of laboratory and financial stability. Laboratory consumable wastage led significant losses for laboratories, as evidence a studies such as Jimma and Gambela health facilities report losses \$10,248.50 and \$37,488.76 in a year respectively. This emphasize the urgent need for implementing effective strategies to improve inventory management to reduce waste (10, 13).

Human immune deficiency virus commodities supply expiration threaten patient care and healthcare programs. According to recent research, in healthcare facilities expired HIV consumables cause significant financial losses of 942,067.40 Ethiopian Birr. This demonstrates the costly burden of inadequate inventory management has on healthcare systems. It also limit access to services provision for patients in need of HIV testing and treatment. Additionally, Laboratory reagent wastage has resulted in stock outs of essential commodities required for early neonatal diagnosis and viral load testing. Such stock outs can seriously compromise patient care by delaying diagnosis and treatment. This limit healthcare facilities' resources and reduce the overall effectiveness of HIV testing and treatment. Laboratory reagent wastage cause inconsistent supply and scarcity of HIV and anti-tuberculosis consumable (14-16).

This study assesses the wastage rate of laboratory reagent and consumable in selected public hospital in Addis Ababa. Its main goal is to assess medical laboratory reagent and consumable wastage rate, its management and contributing factor to research potential management approaches to reduce its effects. Effective inventory management is critical in healthcare settings, but only few studies, which is conducted in different part of Ethiopia show significant financial loss due, expired or damage. Those studies did not evaluate the entire laboratory reagent and consumable wastage rate, nor its management. Furthermore, this study contributes by providing insights into medical laboratory reagent and consumable management practice in selected public hospitals. It identifies critical areas where intervention is required and offers practical solutions to minimize waste. This statement of problem emphasize more on the consequence of HIV and TB commodities wastage due to shortage research in general laboratory reagent and commodities wastage.

1.3 Significance and justification of the study

Effective inventory management reduces waste and disposal cost by ensuring ongoing service provision, which facilitate diagnosis of disease and treatment. Whereas, Poor inventory management practice lead laboratory reagent and consumable waste. This study assessed wastage rate and contributing factor along with their management practice of laboratory reagent and consumable to give insight for health care professional to increase their knowledge and improve their management practice to reduce waste. This helps to provide uninterrupted and timely service for the community. The findings of this study will assist policymakers in the development of regulations aimed at reducing waste. By offering insights into management practices, this research can guide to develop more effective policies that target specific areas of laboratory reagent and consumable management to minimize waste. Additionally, the study serve as a valuable resource for researchers conducting literature reviews, contributing to and enriching the existing body of knowledge.

2. Literature review

2.1 Medical laboratory reagent and consumable

Medical laboratory reagents and consumables are essential components in the provision of diagnostic services within laboratories, playing a critical role in ensuring accurate result. Several factors can lead to the expiration, damage, or loss of these laboratory reagent and consumable. Inadequate inventory management practices can result waste due to overstocking or understocking. Other factor such as lack of regular inspection, incorrect storage, and poor Logistic management information system practice also contribute to laboratory reagent and consumable waste (5, 9, 17, 18).

2.2. Medical laboratory reagent and commodities wastage rate

Reagent wastage and disposal expenses can be significantly reduced by carefully managing the quantity of item ordered for laboratory use (19). At Vanderbilt University, One significant issue was that ordering in large quantity to save money unexpectedly resulted in more waste because of the commodities' expiration. Reagents that are ordered in excess frequently have longer useable shelf lives, which leads to a higher amount of waste products which affect the environment and it cost more for disposal (20). Ineffective inventory record lead to discard 52% of laboratory reagent caused by overstocking (12).

A study conducted in Bayelsa present expired HIV/AIDS commodities found in 82.4% of the study facility. In 60% of the facility expired CD4 reagent, Facs-clean, shealth fluid were discovered. Similarly Glutamic-oxaloacetic transaminase (GOT), Glutamate Pyruvate Transaminase (GPT), creatinine (CR), Glucose, Potassium, Stromatolyser and cell clean were found in 50% of facility (11). According to a review on LMIS shows as a result of 42%,23% and 73.5% expired laboratory commodities were found in Rwanda, Maul, Ethiopia health facilities, respectively (21).

Study conducted in Southern nation nationalities people region of Ethiopia health facility show 2.5% of HIV/AIDS laboratory commodities wastage rate (14). Research conducted in Jimma zone indicate that 3.19% of reagent wasted (13). Most public health and hospital maintain adequate security and storage condition. It became apparent that certain public health and medical facilities had expired HIV test kits (17). Additionally, Study conducted in Gambela zone stated that 12.9% of laboratory reagent wasted. In addition, in Addis Ababa public hospital indicated that Laboratory commodities for Abbot Machine and Roche machine overstock with 20.6 % and 17.4%, respectively (16).

2.3 Management practice of laboratory reagent and consumable

According to study conducted in Tanzania, shows oversupply in four zone ware house as a result of push system that neglect the health care demand. This will increase cost operation and require more storage capacity. poor quantification, forecasting and inadequate trained professional increase waste (22). Overstock and understock of laboratory consumables are the results of a weak logistic system. Overstock is frequently caused by push systems that receive stock that is about to expire (23). HIV/AIDS related supply chain challenge arise when laboratory commodities expire. HIV/AIDS program weaken as result. Expired HIV/AIDS commodities found in 48% of the health facilities. Waste production also affect the health facility resource (24).

Managing Laboratory reagent and consumable is mandatory to reduce waste and prevent stock out. One of the system used to track stocks is LMIS. Good LMIS practice guarantee the availability of stock on hand, consumption and loss or adjustment data. This help to maintain balanced stock and reduce waste due to overstock. Hospitals use different type of LMIS tools such as bin card, RRF, IFRR to manage their inventory (6).

In Addis Ababa public hospitals, there was enough room in seven of the medical stores to accommodate all of the medical laboratory supplies that were available. Around 18% of hospital stores did not have adequate protection from sunlight whereas more than 90% did not have frozen storage. Only 36.36% of the hospital stores have separate flammable chemicals and 54.45% of hospital stores have separate hazardous chemicals (25). The average storage conditions met by the public hospitals under study were 70.59%. The study shows that three of the hospitals did not separate expired or damaged products from the usable stock. The current storage space was insufficient for the stock, fire safety equipment was not accessible, and the commodities were not protected from direct sunlight throughout the year. In 71.4% of hospital, laboratory commodities stored and organized in a manner accessible for first-to-expire, first-out (FEFO) counting and general management (13).

2.4 Associated factor with wastage of medical laboratory reagent and consumable

Different factors are associated with laboratory reagent and consumable waste production. Inadequate inventory management, equipment breakdown, lack of power supply and receiving close to expiration date are major cause of HIV commodities and other laboratory reagent waste in Bayelsa (11).

In Kenya and Nigeria, there are a number of contributing factors that is related to wastage of consumables and laboratory reagents. The absence of a logistic information system is a major problem that makes it difficult to track and manage laboratory supplies effectively. Inadequate

security measures may also result in the loss or theft of laboratory reagent and consumable. Inadequate bin card procedures make it hard to monitor the expiration dates and stock levels of laboratory reagent and consumable, which leads to unnecessary waste. These systemic problems point to a staff member's lack of professional expertise and training, which is crucial for effective inventory management (21, 26).

According to study conducted in East Gojam, Poor LMIS practices are contributing factor to wastage. It makes difficult monitoring laboratory consumable expiration dates difficult (27). In Jimma, issues such as poor storage conditions, a lack of access to medical refrigerators, electrical failures, and insufficient inventory management training increase the situation. These elements contribute to an inadequate inventory system, which fails to maintain optimal conditions for laboratory reagent and consumable (13). Meanwhile, in Gambela, the region troubles with limited storage space and cold chain facilities, as well as poor adherence to the First In, First out (FIFO) principle and frequent power outages which will affect the condition of stored products (10). Finally, in Addis Ababa, the key reasons of overstocking include excessive safety stock levels, inaccuracies in inventory records, over ordering practice (16).

2.5 Conceptual framework

The conceptual framework was developed based on study conducted inventory management performance for laboratory commodities in public hospital in Jimma. According to the study Human resource (HR) and management related, LMIS and Other factor such as equipment breakdown, receiving close to expiration, altering algorithm and primary source of power contribute to laboratory reagent and consumable waste (10). (Figure 1)

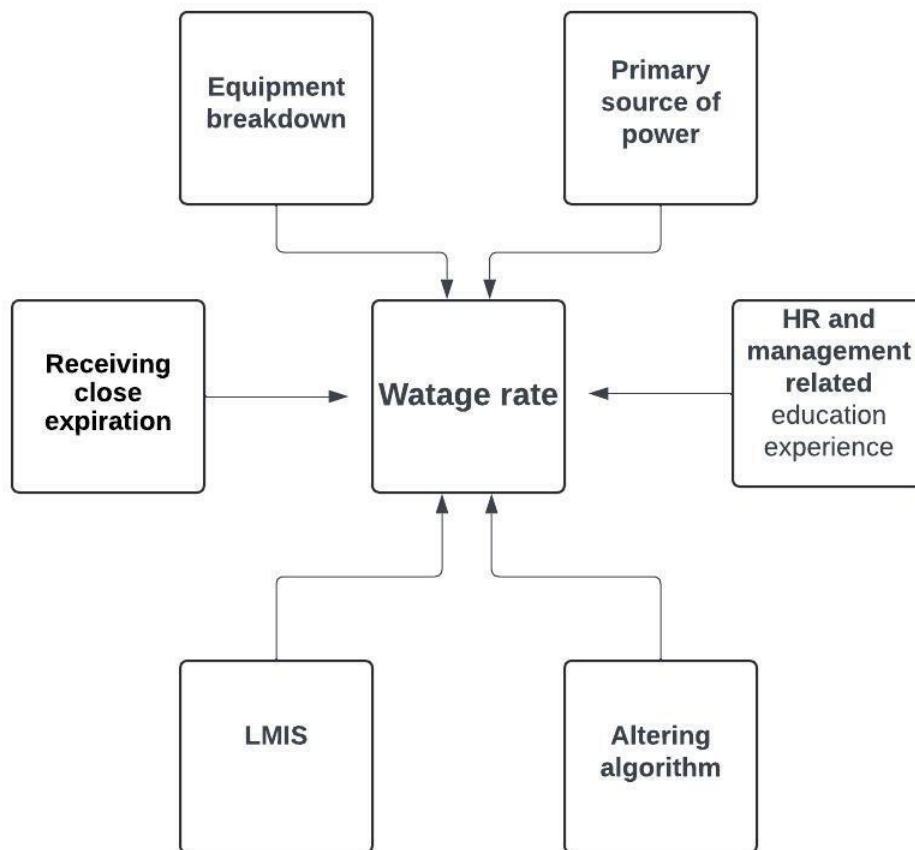


Figure 1. Conceptual framework

3. Objective

3.1 General objective

To assess the wastage rate, management practice and contributing factor of medical laboratory reagents and consumables in selected public hospitals in Addis Ababa, Ethiopia, from Jan to Mar 2025

3.2 Specific objective

- To assess the wastage rates of medical laboratory reagents and consumable in selected public hospitals in Addis Ababa, Ethiopia.
- To assess the management practices for medical laboratory reagents and consumable in selected public hospitals in Addis Ababa, Ethiopia.
- To identify contributing factors associated with wastage of medical laboratory reagents and consumable in selected public hospitals in Addis Ababa, Ethiopia.

4. Hypothesis

Ho: There is no significant relationship between contributing factor and the wastage of medical laboratory reagents and consumables in selected public hospitals in Addis Ababa.

5. Methods

5.1 Study area

The study was conducted in selected public hospitals found in Addis Ababa. Addis Ababa is the capital city of Ethiopia. It is also the largest city in the country with total population 3,770,554 as of 2021 (28). The Addis Ababa administrative boundary span 364.5 kms² (30). Geographically, Addis Ababa is located 9° 1' 48" North latitude, and 38° 44' 24" East longitude with a total area of 527 square kilometers. The city has total 13 public hospital and 121-health center. The city has 11-sub city and 120 woreda. It has six hospital under federal ministry health, two under ministry of defense and six under Addis Ababa health bureau (28, 29)

Tikuer Anbessa Comprehensive Specialized hospital is a teaching Hospital with 700 inpatient beds. It was established in early 1972 and is biggest public hospital with 130 specialty, 250 medical doctor, 825 nurse, 74 pharmacist and 55-laboratory technologist. It offer service for approximately 370,000-400,000 patients a year (30).

St. Paul's Hospital Millennium Medical Collage is the one of the largest hospital in Ethiopia. It was built in 1961 and medical collage was started in 2007. The hospital has 392 beds with 1200 clinician. It offer service for 300,000 patients a year (31).

ALERT General Hospital, one of Ethiopia's oldest and largest medical institutions. Originally dedicated to leprosy-related health issues, ALERT has evolved into a comprehensive hospital providing general medical services, conducting impactful research. It was established in 1934 and is third-largest hospital in the nation by patient flow; ALERT serves over 1,500 patients daily and offer service to more than 450,000 patients annually with 530 beds and nearly 1,950 permanent staff members (32).

Yekatit 12 General Hospital medical college was oldest Hospital in Ethiopia, which, established in 1915 by Emperor HaileSELLASIE I and was called HaileSELLASIE I Hospital until the 1970s. The hospital has 300 bed with 130 specialist and sub specialists, 181 general practitioners, residents and public health professionals, 520 different types of nurses and 59 pharmacist (33).

Zewiditu memorial General hospital was founded in 1993 G.C. it is a teaching hospital and general referral hospital with 280 nurses and 156 beds. The hospital provided services for a total of 7,620 inpatients, 41, 000 emergency cases (34).

Dagmawi Minilik comprehensive specialized Hospital is found in the northeastern part of Addis Ababa, in Yeka sub city Kebele 06. It was established in 1896 following the defeat of the Italian military force at the battle of 'Adwa' and the settlement of the Ethiopian patriots in Janmeda, Addis

Ababa. It's a teaching and referral hospital with 59 physician, 203 nurse, 123 other professional and 250 administrative office (35).

5.2 Study design and study period

A facility based cross-sectional study was conducted from Jan 2025 to Mar 2025 in selected public hospitals in Addis Ababa, Ethiopia.

5.3 Population

5.3.1 Source of population

All laboratory professionals, pharmacist, store manager, document related to wasted laboratory item found in all public hospitals were considered as source of population.

5.3.2 Study population

All laboratory professional, pharmacy store manager, laboratory store managers, document related to wasted laboratory item found in selected public hospitals were included in this study.

5.4 Sample size

This study included six hospitals: three federal and three from the Addis Ababa Health Bureau. All laboratory professional who were available in selected hospital for questioner. Seven store personnel (4 laboratory profession and 3-pharmacy profession) from selected hospital were included for qualitative study.

5.5 Sampling technique

The purposive sampling method was utilized to select six public hospitals (3 from federal hospital and 3 from Addis Ababa health bureau). The rationale for this selection process was federal hospitals are some of the largest healthcare facilities, providing to an extensive patient population. At the same time, three hospitals from the Addis Ababa Health Bureau were chosen to guarantee a balanced sample size.

For quantitative study, questioner was allocate all laboratory professional from six public hospital who were available at the time of data collection.

For qualitative study, Purposive-sampling technique was employed to select professional until saturation level reached. Key informants was identified based on their position related to inventory management of laboratory reagent and consumable.

5.6 Inclusion and exclusion criteria

5.6.1 Inclusion criteria

Laboratory wasted item record, medical laboratory professionals, pharmacy and laboratory store managers who are directly engaged in laboratory reagents and consumable management in selected public hospitals were included.

5.6.2 Exclusion criteria

Laboratory wasted item incomplete record, medical laboratory Professionals, pharmacy and laboratory store managers who were on annual leave in their respective roles within the laboratory and pharmacy during the study period and professional who were not willing to participate in the study were excluded.

5.7 Study variable

5.7.1 Dependent variable

- ✓ Wastage rate
- ✓ Management practice

5.7.2 Independent variable

- ✓ HR and management related(Education, position and experience)
- ✓ LMIS
- ✓ Receiving close expiration
- ✓ equipment breakdown
- ✓ Altering algorithm
- ✓ Primary source of power

5.8 Data collection procedure

5.8.1 Data collection tool

Tools adopted from logistic indicator assessment tool (LIAT) (46), Assessment tool for laboratory service and supply chain (ATLAS) (47) were used to collect data. Checklist, questioner and in-depth interview were used to collect data.

For quantitative data, Laboratory reagent and consumable waste rate was analyzed from the retrospective one-year data from July 7, 2023 to July 7, 2024 taken physically during data collection. It was calculated using formula percentage of laboratory commodities for an item that is unusable

because of expiration or damage during a period of one year to the total quantity of that item received during a year plus the quantity of that items found during the beginning period of the year in selected public hospital.

For qualitative data, in depth interview, audio recorder and field notebook were qualitative data collection tools. Health professional who engaged in inventory management of laboratory reagent and consumable and have experience were interviewed.

5.8.2 Data collection procedure

Data were collected by public officer after they were given one day training about data collection technique. The principal investigator rechecked the completeness of the questionnaire upon receiving the filled questionnaires.

5.9 Data quality assurance

The questioner was pretested on 5% of professional in Gandhi Memorial General Hospital to ensure the validity of the tool and clarity and easy understandability for each respondent. After analyzing the pre-tested result, the refined questionnaire were used to collect the actual data. Double data entry were employed to enhance reliability of collected data.

5.10 Data management and analysis

Medical laboratory reagent and consumable wastage rate was calculated unusable because of expiration or damage during a period of one year to the total quantity of that item received during a year plus the quantity of that items found during the beginning period of the year in selected public hospital. Quantitative data from questioner were coded and entered into epi info 7.2.6.0 version. Then the data was exported and analyzed using SPSS software. The analyzed data were presented using descriptive statistic such as percentage, frequency distribution, and appropriate graph. Further a bivariate and multivariate logistic regression analysis was performed to investigate the relationship between dependent and independent variables. All variable with a p value of ≤ 0.2 in bivariate analysis were included in multivariate logistic regression model to adjust for possible confounding variables. The strength of association was measured using odds ratio, 95% confidence interval, and a p-value ≤ 0.05 was considered statistically significant. The results were presented in the form of Adjusted Odds Ratio (AOR) and 95% of Confidence Interval (CI).

The analysis of qualitative data was analyzed and summarized thematically using open code 4.0 software, relevant quotation used to illustrate themes in presentation of the study finding using narrative approaches.

5.11 Operational definition

- Wastage rate;- It is the percentage of laboratory commodities for an item that is unusable because of expiration or damage during a period of one year to the total quantity of that item received during a year plus the quantity of that items found during the beginning period of the year in selected public hospital (36).
- Laboratory consumable; - are laboratory stock that are used only once to provide service.
- Acceptable storage condition;- a storage that fulfill >80 % of storage requirement (37).
- Value wasted; - amount of monetary value wasted due to expiration of item.
- Third party reagent;- a reagent not manufactured by instrument manufacturer(38).

5.12 Ethical consideration

The research was conducted after an Ethical clearance letter was obtained from Departmental research and ethics review committee (DRERC/794/24/ML) Addis Ababa University, College of Health Science, and Department of Medical Laboratory Sciences. Then officials and responsible bodies working in public hospitals were communicated through letter before data collection process. Additionally, each study participant was received a clear explanation of the study's purpose and benefits, and their written informed consent was obtained. To ensure confidentiality, all study participants' results and information was kept confidential, and personal identifiers were removed and analyzed anonymously. Participation in the study were voluntary.

5.13 Dissemination of result

The study's findings will be disseminated with the department of medical laboratory science, college of health science, Addis Ababa University, Addis Ababa Health bureau and study hospitals as well as the study participants, hospital administration, laboratory and pharmacy department. The findings will be disseminated through publication in respected journals, providing greater access to the research.

6. Result

6.1 Socio-demographic characteristics of personnel working in public hospitals who participated in this study

This study includes 126 laboratory professionals, and the majority of participants, 103(82%), have a first-degree in educational level. Forty six percent of the participants have five to ten of experience. Additionally, 50.8% of the professionals are female. (Table 1)

Table 1. Socio-demographic characteristic of study participant in selected public hospital, Addis Ababa, 2025

Variable	Frequency		Percentage
Sex	male	62	49.2%
	female	64	50.8%
Education	MSC degree	20	15.9%
	BSC degree	103	81.7%
	Diploma	3	2.4%
Experience	<5 year	57	45.2%
	5-10 year	58	46.03%
	>10	11	8.73%

6.2 Laboratory reagent and commodities wastage rate in selected public hospital

A total of 993 different laboratory reagent and consumable expired in study hospitals from July 7, 2023 to July 7, 2024. The overall wastage rate in the study hospitals was sum up as 11.25% which is greater than nationally set wastage rate(2%), with 1,795,855.85 ETB birr wasted from 2023-2024. It was calculated by percentage of an item that is unusable because of expiration or damage during a period of one year to the total quantity of that item received during a year plus the quantity of that items found during the beginning period of the year in study hospital. There is high wastage rate in hospital A and F at 1.73% and 6.46%, respectively. Table 2

Table 2. Laboratory reagent commodities wastage rate in selected public hospital, Addis Ababa 2024

S.no	Hospital	Total value wasted (ETB)	Total quantity wasted (item)	Total quantity received(item)	Wastage Rate (%)
1	A	420,039.64	241	13948	1.73
2	B	168,690.84	59	11906	0.49
3	C	98,198.09	64	10850	0.59
4	D	153,558.27	50	7724	0.65
5	E	496,269.41	115	8639	1.33
6	F	459,099.60	464	7186	6.46
Total		1,795,855.85	993	60,253	11.25

6.2.1 Top ten large quantity wasted item

Among the ten most wasted items out of 993 laboratory reagents and commodities, a significant quantity was found at the study hospital. The items with the largest amounts of expired products were blood group reagent and COVID-19 test kits, which had 255 and 163 expired items, respectively. Table 3

Table 3. Top ten large quantity wasted item in selected hospital, Addis Ababa 2024

Item	Quantity of item wasted	Quantity of item total received	Value of Item wasted (ETB)
Blood group	255	669	92,783.34
COVID 19 AG	163	796	442,904.59
Chemical hydrogen peroxide	73	98	15,000.40
Urine dipstick	50	1335	14,889.6
CRP	47	230	11,922.67
UNICEL DXH 800 diluent	27	666	92,783.34
ISE reference electrolyte solution	27	149	3991.68
SMS	24	153	106,601.97
Blood urea nitrogen	23	171	116,924.49
Blood bag	21	949	12,726
Total	710	5118	910,528.08

6.3 Repeated test and its potential cause

During the study period, 574,712 test were performed for GOT, GPT, ALP, CR, BUN, GLU and CBC in selected public hospital. Repeated test and repeated control across the hospital were 6539 and 1496, respectively. There was 278,730 ml CBC diluent reagent leftover, which was discarded. Due to using third party reagent and power interruption, in A and D, hospital there was high repetition of test 1558 and 1864, respectively. In other hospital clotting, low volume, bar code labeling error and critical result were common cause of repetition. These all incur a total estimated cost of 697,631 ETB. It is the summation of multiplied price of each test with repeated test. Table 4

Table 4. Total test performed and repeated test in the study period in selected public hospital, Addis Ababa 2025

Hospital name	Total test performed	Repeated test	Repeated control	Left over(ml)	Cost of repeated test ETB
A	121,371	2,285	268	51,940	263,590
B	126,746	868	276	48,660	85,900
C	87,244	395	187	77,010	19,750
D	99,018	2,169	233	0	144,300
E	97,214	610	354	68,000	62,291
F	43,119	212	178	33,120	31,800
Total	574,712	6,539	1,496	278,730	697,631

6.4 Storage condition

During the study period, 14 storerooms were assessed, including six mini laboratory storerooms, six pharmacy main storerooms from study hospitals, and the Ethiopia pharmaceutical supply service facility's main and branch office storerooms. Of these, 12 (85%) met acceptable storage conditions. Key requirements such as maintaining cleanliness and disinfection, storing stock in a dry, well-lit, and well-ventilated area away from direct sunlight, ensuring the availability of cold storage, storing insecticides separately, following the First-Expired, First-Out (FEFO) principle, restricting access to storerooms, and properly separating and disposing of damaged or expired products were fulfilled by 12 storerooms. However, two storerooms did not meet the desirable storage conditions. Figure 2

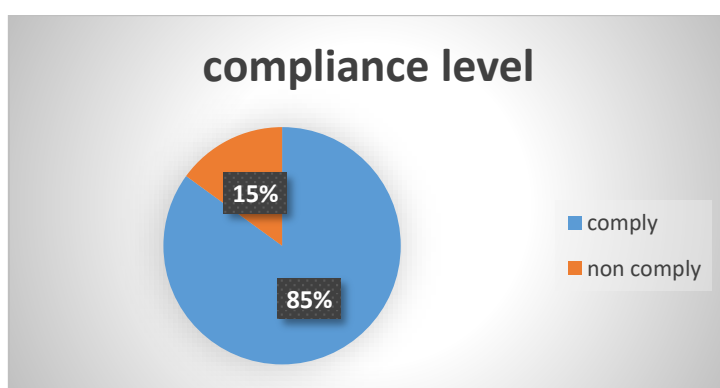


Figure 2. The compliance level of Storeroom

The study hospital was unable to meet five of the twelve storage requirements. Such as stack cartons were not placed at least 10 cm (4 in) off the floor, 30 cm (1 ft) away from the walls and other stacks, and no more than 2.5 m (8 ft) high in 3(21.45%) store room. In 5(35%) store room the cartoon were not arranged to point their identification label. Water penetration was noted in 2(14.2%) of store room. Fire safety equipment were not available in 2(14.2%) store room. Cartoon were crushed in 3(21.4%) store room. Figure 3

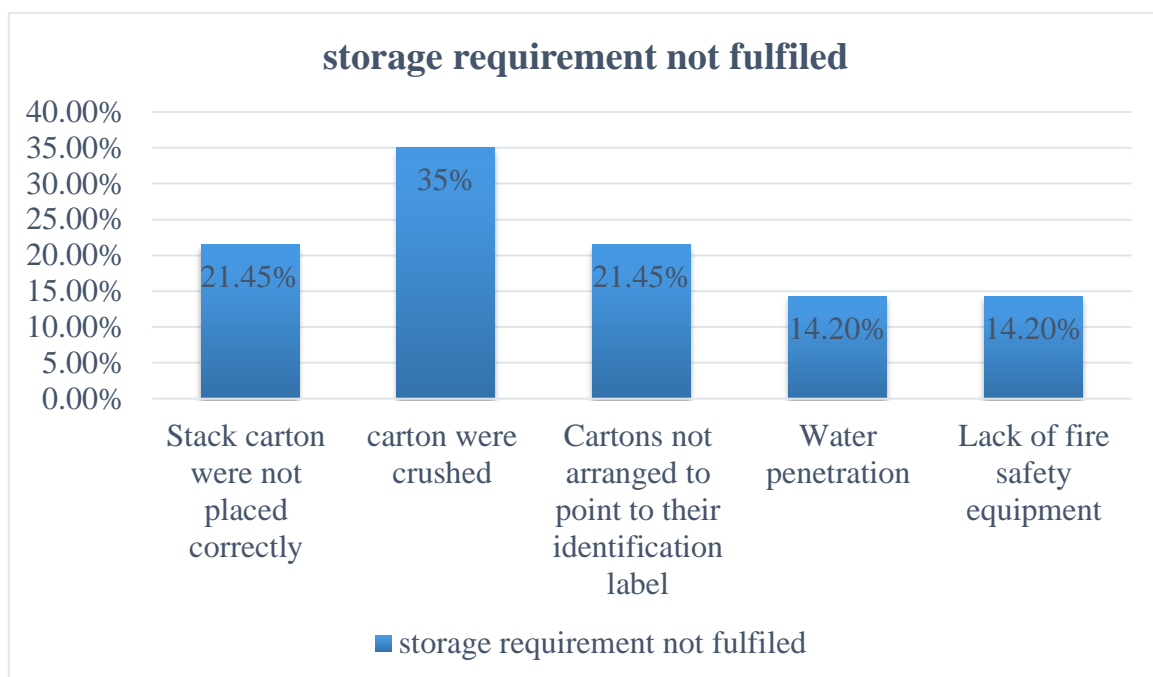


Figure 3. Storeroom requirement not fulfilled

6.5 Factors associated with laboratory reagent and consumable wastage

In the bi-variate analysis, type of LMIS and past alteration of algorithm were marginal, with p-values ≤ 0.2 but greater than 0.05. In contrast, the p values for computer based LMIS, Item received close expiration and equipment breakdown were become below 0.05. All these variable were pooled into multiple logistic regression. Computer based LMIS is 3 times less likely to cause waste AOR=0.029; 95% CI (0.08, 0.11). Item received close expiration are 3 times more likely to cause waste than items that receive close expiration AOR=3.24; 95% CI (1.09, 9.57). Laboratory that have Equipment breakdown in past are 3 times more likely to cause wastage than who doesn't have equipment breakdown in the past AOR=4.36; 95% CI (1.29, 14.77). Table 5

Table 5. Logistic regression analysis of contributing factor of laboratory and reagent wastage at selected public hospitals, Addis Ababa, 2025

Variable	Variable category	Is there expire or damage item		COR(95%)	p value	AOR(95%)	p value
		Yes n(%)	No n(%)				
Type of LMIS	Computer	6 (6.67%)	24(66.67%)	22.8(7.45,69.77)	0.000	0.029(0.08,0.11)	0.000
	Paper	27(30%)	2(5.56%)	0.42(0.086,2.06)	0.287	2.41(0.46,12.9)	0.3
	Both	57(63.33)	10(27.78%)	1	1	1	1
Past alteration of algorithm	Yes	57(63.33%)	18(50%)	0.58(0.265,1.26)	0.17	2.46(0.8,7.5)	0.12
	No	33(36.67%)	18(50%)	1	1	1	1
Item received close expiration	Yes	62(68.89%)	15(41.67%)	0.32(0.145,0.717)	0.06	3.24(1.09,9.57)	0.034
	No	28(31.11%)	21(58.33%)	1	1	1	1

Equipment breakdown	Yes	64(71.11%)	21(58.33%)	0.57(0.254,1.22)	0.169	4.36(1.29,14.77)	0.018
	No	26(28.89%)	15(41.67%)	1	1	1	1

¹

¹ P value<0.05,have statically association

6.6 Qualitative result

Qualitative study was performed to analyze the management practice of laboratory reagent and consumable in selected hospital.

Socio demographic

Seven key informants were interviewed for this study. Three pharmacist (2 store manager and 1 logistic officer), three laboratories (2 logistic officer and 1 store manager) from study hospitals and one key informant from EPSS facility were included. Two of them were female. The finding was categorized into five theme using open code software and the information was summarized and presented using narrative approach.

Theme 1: Inventory management of laboratory reagents and consumable

Most hospitals manage their inventory using different system. The hospital utilizes both computer and paper based to manage their stock. RDF, Program purchase, model 22 and IFRR were reported as inventory management system of laboratory reagent and consumables the study hospitals use.

RDF system

Hospitals purchase items using RDF system in which item to be sold ideally at price sufficient to replace the stock of item. This strategy enables that hospitals can maintain their inventory levels stable while minimizing major losses. A participant mentioned they manage their inventory using RDF system using consumption data.

Participant working as store man said

“... RDF system by which purchasing is made by EPSS and we would make the annual consumption plan based on previous years’ data after that they will give it to us quarterly to avoid expiration.”

Another store manager and logistic officer said

“For RDF, first we make the forecasting of quantification then we will display a Bid after that based on the quality of the product and price we will purchase by batch...”

Program purchase

Hospitals purchase laboratory item using program purchasing system. Program purchase allow hospitals to maintain their stock level. Most hospitals purchase item from EPSS. EPSS provide laboratory products to hospital.

Personnel who work as laboratory mini store manager said

“...Program purchase every two months we fill and send the data. The pharmacy should have a 4-month data on the hand. When we fill and send in two months the pharmacy should hold the previous month data on hand. When it reaches at the pharmacy the laboratory will ask item based on their consumption.”

Another logistic officer said

” ...for program, every week or every two week EPSS will update the item available and we will order if there is item we wanted”

Model 22

Most study hospitals use model 22 to receipt and issue item in store. This model helps to track items in hospital. Most public hospitals use this model 22 to take out items from pharmacy store. A participant mentioned they use model 22 to take item from pharmacy store.

A laboratory store manager said

“We ask laboratory commodities from pharmacy store by model 22...”

Another store manager said

“Most of the time we receive item from the government institution, when we receive from EPSS we will give them model 22 when we receive the item after that when we will distribute using Model 22...”

IFRR

IFRR is one of the method used in study hospital to manage their inventory. IFRR is used to report internal item transfer between store and dispensing. A laboratory store manager mentioned that they use IFRR when they want to take item from store.

A participant who is store personnel and logistic officer said

“We take out laboratory item from main store once per month using IFRR. After doing physical inspection to check if there is a damage...”

Theme 2: responsible personnel

In most hospitals, laboratory personnel work with pharmacist to quantify laboratory item using different type of date. Few participants mentioned every department will analyses their demand based on their consumption or patient load then they will communicate with pharmacy department. Another participant mentioned only laboratory personnel order their need. In some hospital, the pharmacy store will see laboratory consumption from bin card and they will communicate the case team.

One of the participant who work as store manager said

“We ask every department their consumption and we will calculate the total and report it to the pharmacy department”

Another laboratory store personnel said

“Each department head estimate their month consumption based on patient load. There is annual meeting held then we will discuss over all reagent demand and quantify based on our consumption.”

A participant who is pharmacy store manager said

“Every month we will request necessary commodities to case team based on their consumption from bin card. Sometimes if the laboratory has high consumption they will communicate directly with case team and the case team will verify from here before ordering.”

Another participant from pharmacy store said

“Laboratory department purchase their own reagents and come to pharmacy store for documentation purpose. The pharmacy store handle if it come from EPSS and donation programs. So they purchase their own product alone without communicating to pharmacy department.”

A participant from EPSS said

“In current system after the hospital order their need based on their consumption while our institution is providing them with the capacity to reduce waste.”

Theme 3: Monitor and document quantity

Item received and issued must be documented to manage stock available on hand and to know their consumption. RRF, Model 22 and Bin card are reported to use this system to document and monitor quantity.

RRF

RRF is used in hospital to report stock level, track stock and to place order. Report and requisition form is a document used by hospital to report stock level, to track stock and to place order. A participant mentioned they collect data from RRF once or twice a month.

A participant who is store manager and logistic officer said

“There is a system. RRF there is a data collected once a month or twice a month I generate and is it collected by the pharmacy and send to EPSS...”

Bin card

Most hospital use bin card to maintain quantity received, issued and loss/adjustment. A participant mentioned using bin card to manage stock in store.

A participant who work as store manager said

“I use bin card to manage reagent received, issued but for expired item there is no documentation...”

Theme 4: Challenge

EPSS, Shortage of staff, stock out, small storage and not purchasing quality control are reported as challenge faced in inventory management.

EPSS

Since EPSS is primary laboratory commodities provider in Ethiopia. Many hospitals purchase items from EPSS. So any issue from EPSS will affect hospitals inventory management. A participant mentioned there has been challenge faced from EPSS.

A participant from laboratory store manager said

” We annually make plans but the EPSS don’t bring item based on our consumption. In order to avoid this, we are currently working with EPSS...”

Shortage of staff

A participant who is store manager said

“Shortage of staff is the main problem. I am the only personnel who is working in the store other personnel is on leave and currently there is no vacancy for staff. “

Stock out

Most hospital mentioned in they frequently faced stock out within a year that lead to service interruption. Some item was not available during the study period. A participant mention they struggle with shortage of stock.

Store personnel said

“Main challenge is shortage of laboratory commodities in this hospital.”

Small storage

A participant who is pharmacy store manager and logistic officer said

“ Main challenge we are facing is small storage space. As you can see, most item is placed on the floor. The store is jam with both medication and laboratory commodities so it’s not stored properly...”

Not purchasing quality control

Purchasing quality control is mandatory to produce quality laboratory result. A participant from EPSS mentioned that some hospitals do not buy quality control to reduce cost.

A participant from EPSS said

” hospitals do not buy laboratory quality control to reduce control cost, but it affects the laboratory test results. So as a solution our institution adds the quality control price to the reagent price so they will pay for both when they purchase the reagent”

Theme 5: cause of wastage

Failure to provide Timely and continuous manner

Laboratory reagent and consumable should be delivered timely and in continuous matter in order to deliver service to patient. Failure to provide laboratory item timely and continuously there will be service interruption.

A participant from laboratory store manager said

“As I think of there won’t be any reagent’s that will expire if product were provide with timely and in a continuous manner it would be good...”

Equipment breakdown

Some hospitals face equipment breakdown during the study period. Those machine face malfunction in system or part of the machine and this lead to service interruption. Few participant mention equipment breakdowns contribute to laboratory reagent to waste.

A participant who is store manager and logistic officer said

“Last year CBC machine were out of service for six months. The reagent was left unused. This will lead reagent to expire. After that we again buy a new machine to work so if we would get continuous supply from EPSS. There wouldn't be much reagent to expire.”

A participant from pharmacy store said

“Equipment breakdown, since there is no backup machine when equipment breakdown the reagent remains unused until it's fixed. Most of the time spare part is not easily available and this will lead to reagent to expire. For example, there is two CBC machine and one of the machine reagent is purchased for a year but it's not functioning for few months till now due to maintenance problem.”

A Participant from EPSS said

“...equipment breakdown will limit purchasing power of reagents that makes reagent to stay more in store. Sometimes it takes 2/3 month to fix the equipment during this time reagent will stay in store unused. Especially in province use poor quality water in distil water deionized machine that lead machine to breakdown. due to limited availability of spare part in the country it will take several months to fix the machine this makes reagent to stay unused which will increase its chance to expire and also equipment damage due to war will lead to reagent to expire.”

Prolong shipment

Most medical item is manufactured from outside the country it came to country by shipment. Therefore, shipment usually take prolong time to reach country. In this case, some hospital will be stock out until the shipment delivered and the reagent and commodity service time most of their service time will be on shipping process so they will expire soon. A participant mentioned how prolong shipment contribute to wastage.

A participant from laboratory store manager said

“Generally in this country mostly reagent is not manufactured here so shipment take 3 months. Most item life span is 9 months -1 year so the order take 3 month and

shipment 3 month when the item get here it expire soon. Due to this, there is shortage of many laboratory reagents. The chemistry machine also requires many item to function so if one item expire or missed the machine will stop working...”

Another participant who is store manager and logistic officer said

“Primary cause is prolong shipment more than 2 or 3 month. This lead to expiration. In some case reagent come without calibrator in that case reagent will stay unused...”

Receive near expiration

Sometimes item is deliver near expiration due to prolong shipment or short shelf life which will increase waste if it's not used before its expiration.

A pharmacy store manager said

“Mostly program items will expire because when we receive it, it's almost near expiration so it will expire quickly before using it...”

A participant from EPSS said

” primary cause of wastage is receiving products near expiration due to prolong shipment.”

Push system

In push system, the supplier will determine the quantity without order.

A participant from pharmacy store said

“...EPSS dump (push) system will lead to expiration even though it has close expiration they still donate it and it will expire in the store.”

Another participant from EPSS said

“Many people misunderstood the push system. EPSS will only distribute the donated product to hospitals. It does not interfere with quantity only donor organization determine how much to donate and this will increase waste because it is donated

without considering their consumption. So as a suggestion it's better to donate based on their capacity and consumption to avoid waste”

Observation

During the study period, observational assessments were conducted to supplement both quantitative and qualitative data modeling approaches. These observations focused on the handling of laboratory consumables and reagents during loading, unloading, and receipt at the Ethiopian Pharmaceutical Supply Service (EPSS) main and branch offices, as well as at St. Paul's Hospital Millennium Medical College.

Across all facilities, untrained carriers handled laboratory consumables and reagents during the loading and unloading process. As a result, improper handling frequently led to mishandling and potential damage. Items often fell out during transport, and in every facility, carriers were observed throwing supplies into and out of the trunk during loading and unloading operations.

At the EPSS branch office store, key checks including quantity, quality, batch number, and expiration date were conducted upon unloading. Two items with near-expiry dates and one item with a different batch number were identified. The personnel communicated with the facility that had ordered the items, which agreed to accept one of the near-expiry items since it was intended for routine testing but refused to accept the other. The rejected item was returned and replaced with another of the correct batch number after further communication with the EPSS main office.

Similarly, at St. Paul's Hospital Millennium Medical College, received items underwent thorough verification for quality, quantity, batch number, and expiration date. The same handling issues observed in other facilities were noted at this location as well.

7. Discussion

This study was conducted in selected six public hospital in Addis Ababa. It assess wastage rate in selected public hospital and their management practice along with their contributing factor. This study show there was 11.25% wastage rate which is five times higher than nationally set wastage (36). The result is lower than the wastage rate found in North America. As 52% reagent were wasted due to lack of system that track inventory level (12). Whereas the finding is comparable with finding in Gambela wastage rate 12.9% (10). Another study conducted in SNNPR and buno bedelle and Illu Aba bora zone show 2.5%, 3.1% and 1.7% wastage rate, respectively(14, 37). This variation can be explained by research conducted in SNNP assess only HIV/AIDS commodities. Our study finding show, there was higher wastage in study hospitals. This study show 1,795,855.848 Ethiopian birr were lost in study hospitals. This finding is comparable with study finding in Gambela in which 1,186,353.3 Ethiopian birr were lost. In this study, high amount of monetary value was lost compared to finding in jimma and Illu aba bora and buno beadle zone where 277,291.31 and 238,211.6 Ethiopian birr was lost, respectively (13, 37).

Our study finding indicate 6,539 test were repeated for GOT, GPT, ALP, CR, BUN, GLU, CBC tests. This study indicate 607,631 Ethiopian birr was cost of repeated test. A study finding in Queen Mary hospital, repeated test for tumor marker tests were 19,102. Repeated test lead to wastage of reagent and increase workload. Total cost of repeated test were estimated US \$ 132,151 (39). In this study, Five hospital depending on the hematology CBC machine. It was found that the CBC diluent reagent of 1.75-3 ml is left over and discarded at the end, as the machine stop processing when the diluent reaches this volume. Totally, 278,730 ml CBC diluent was discarded. In one of the study hospital the machine process with all diluent available unlike the other study hospitals. In two-study hospital, there was higher repeated test due to power interruption and using third party reagent (shortage of company reagent).

In this study 12 storeroom met acceptable storage condition. This shows majority of storeroom in study hospital Fulfil the desired storage condition. Similar study finding in west Wollega zone shows 73.91% of hospital fulfil desirable storage condition (40). Two-study hospital did not fulfil the acceptable storage condition. Cold storage was found in all study hospitals. Similar finding were found in Lesotho and in Addis Ababa, cold storage were found in 100% of the study hospital (25, 41). All study hospital separate flammable, hazard, insecticide, expired and damaged product in this study. Whereas only 36.36% of study hospital separate flammable, hazard, insecticide, expired and damaged product in Addis Ababa (25). Another study finding in Lesotho and show none of the

facility separate damaged or expired stock from usable stock (21). In this study, 14.2% of the facility had no fire safety equipment. finding in Wollega zone show none of facility had modern fire safety equipment (40).

The finding indicates significant association between computer-based computers based LMIS and wastage. Computer based LMIS [AOR=0.029; 95%CI (0.08, 0.11)] 3 times less likely to cause wastage. This finding align with previous finding conducted in Ethiopia show wastage were decrease due to LMIS implementation (42). This study finding show item received close expiration [AOR=3.24; 95%CI (1.09, 9.57)] cause wastage 3 times more compared to items receive on time. In this finding there was 4 times more wastage found in study hospital with equipment break down [AOR=4.36; 95%CI (1.29,14.77)]. This finding suggests reagents remain unused due to equipment break down are more likely to cause reagent wastage.

Qualitative study focus on how hospital manage laboratory commodities and reagents. Five theme were identified Inventory management of laboratory reagents and consumable, responsible personnel, Monitor and document quantity, Challenge, cause of wastage. RDF, RRF, Program purchase, model 22 and IFRR were mentioned inventory management system. In this study, in four of the hospital both laboratory and pharmacy work together to order laboratory product using consumption data. Another study finding showed, Laboratory department and pharmacy team was working together to decide how much to order based on consumption data (13). In one hospital laboratory department handle their procurement alone without pharmacy involvement. In addition, in another hospital, pharmacy department handle laboratory commodity using Bin card data.

EPSS did not bring based on consumption, stock out, not purchasing quality control, small storage and shortage of stuff were mentioned as challenge face handling laboratory inventory in study hospital. Another study finding indicate, supplier fail to provide facility with the requested amount, resulting to stock out (13). Ineffective inventory management of laboratory commodities results in frequents stock outs, which disrupt service provision (43).

Frequent stock out and associated product not ordered are some challenge of inventory management. Quality control is mandatory to produce accurate and reliable laboratory test result. Lack of quality control affect both accuracy and precision of laboratory result (6). Inadequate storage space were mentioned by participant in another study as inventory challenge (44). In another study finding in Addis Ababa shows, 5(18.52%) of respondents stated lack of adequate storage in facility is also challenge in inventory management of laboratory commodities (45). Shortage of stuff is consider as

one of challenge faced in inventory management. It increase workload on the other personnel and decrease job satisfaction (46).

Failure to provide timely and continuously, equipment breakdown, receiving near expiration, push system and prolong shipment were stated by participant as cause of laboratory reagent and commodities wastage. Unavailability of Spare part is common challenged which prolong equipment downtime. As a result, reagent remain without providing service. Equipment breakdown affect service delivery, inventory and financial (47). Participant from another study mentioned receiving near expiry item cause laboratory commodity to waste (44). Push system increase risk of laboratory commodities wastage as result of expiration and require larger storage capacity (48). According to a research conducted in Nigeria, 21% of healthcare facilities that acquire items through the push system have expired items since the approach does not take facility demand into consideration (49).

8. Strength and limitation of study

Strength:-This study were able to study major issue in medical laboratory reagent and consumable wastage. In addition, it give insight on management practice of laboratory reagent and consumable through qualitative study. This research include observation loading and unloading laboratory commodities in truck and in facility. It is done to assess their management practice

Limitation: - this study were limited to public hospital. This give insight on only public hospital practice.

9. Conclusion and Recommendation

9.1 Conclusion

In this study wastage rate in selected public hospital were 11.25% which is higher than nationally set wastage rate (36). Wastage is associated with item receive close expiration and equipment breakdown. Computer based LMIS less likely to cause wastage. Most of the storage fulfil the acceptable requirement. This study provide insight on management practice of laboratory reagent and consumable. The inventory was managed using RRF, RDF, IFRR, program purchase and model 22. In most of the study hospital, pharmacy department work with laboratory to order item based their consumption. Shortage of stuff, small storage stock out are some of inventory challenge. Cause of wastage include failure to provide timely and continuously prolong shipment, receiving close expiration, and equipment breakdown and push system.

9.2 Recommendation

As wastage rate of selected public hospital in Addis Ababa is shown to be 11.25%. The following recommendation are given

- Public hospital Laboratory department, pharmacy department and EPSS should work together and thoroughly to avoid overstock and stock out
- Public hospitals and EPSS should develop open communication and develop item exchanging trend
- Public Hospitals should work more on equipment maintenance and providing uninterrupted source of power to reduce wastage
- Public Hospital and EPSS should train staff who work on loading and unloading truck
- For researcher, further study should be conducted including private hospital and large data.

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Informed consent form

Informed consent form for participation in study of Wastage rate, management practices, and contributing factors of medical laboratory reagents and consumables in selected private and public hospitals in Addis Ababa, Ethiopia.

I have read the information sheet on the topic stated above and had a verbal discussion with the investigator. I clearly understand the purpose as well as the anticipated benefits of the research. I hereby assure, with my signature below, that I have voluntarily decided to take part in the study without any pressure or forceful act by the research coordinators. I understand that my participation is important for the successful completion of the research on wastage rate of medical laboratory reagents and consumables, along with their management practices and contributing factors in selected private and public hospitals in Addis Ababa, Ethiopia,

Signature _____ Date_____

Thank you for your cooperation

Annex 2. Questioner

Hospital Name _____

Date: _____

Three different questioner will be asked based their duty and responsibility. Pharmacy Store personnel and laboratory professionals. Then, visit the warehouse and laboratory store.

For laboratory professionals

Part A; - General question

1. What is your position in this health facility?

. Store manager

. Pharmacy head

. Supply manager

. Laboratory technologist

2. How many years you have served in this position? Year _____ Month _____

3. What is your education level?

. Master's Degree

.BSC degree

. Diploma

. Certificate

4. Do information system reports at all levels of the system show:

A. Quantity dispensed or issued during a specified reporting period? Yes .No

B. Losses and adjustments? % Yes .No

C. Quantities received. % Yes . No

5. Is there written guidelines for storing laboratory supplies according to their specifications (Flammable, caustic, etc.) Exist. (Are Material Safety Data Sheets available?)

5. Does the program have a system for tracking product losses and other adjustments?
- .Yes
- .No
6. Is there expired or damaged product.
- .Yes
- . No
7. What are the reasons for expiry?
8. The laboratory makes it a practice to separate damaged and/or expired supplies from good products.
- .Yes
- .No
9. Are cold chain items always stored at appropriate temperatures?
- . Yes
- . No
10. Have there been any problems with storing laboratory supplies?
- . Yes
- . No
11. If yes, list the three major problems with storing laboratory supplies? (Start with the highest priority.)

Part D; - Logistic management information system

12. Is there LMIS system in your facility?
- .Yes

. No

13. If yes to ques. No 13, is it computer based or paper based?

.Computer

. Paper

.Both

14. What LMIS forms does the hospital use?

. Bin cards

. Stock cards

. IFRR

. RRF

. Other (specify):.....

. None

15. Do LMIS reports include the following?

. Quantity received

. Stock on hand

. Quantities used

. Loss/adjustment

Part E; - power supply

16. is there a primary power source available at all times.

. Yes

. No

17. is there a backup generator installed in case of primary power failure.

.Yes

. No

Part F; - altering algorithm, short shelf life and receiving close to expiration date

18. Is there change to current algorithm?

.Yes

.No

19. Have past alterations to the algorithm resulted in increased waste production?

.Yes

. No

20. Are there any items received that have close expiration.

. Yes

. No

21. Are there procedures established for returning or disposing of expired consumables?

.Yes

. No



Storage

S/N	Description	Yes	No	Comment
1	Is the room clean and disinfected?			
2	Are the Stock in a dry, well-lit, and well-ventilated storeroom, out of direct sunlight?			
3	Is the store Secure from water penetration?			
4	Is fire safety equipment is available and accessible, and is the personnel trained to use it?			
5	Is there available cold storage, including refrigerator? For commodities that require it			
6	Do they Store flammable products separately using appropriate safety precaution?			
7	is Stack cartons at least 10 cm (4 in) off the floor, 30 cm (1 ft) away from the walls and other stacks, and no more than 2.5 m (8 ft) high?			
8	Do they store consumable separately, away from insecticides, chemicals, old files, office supplies, and other materials?			

9	Are the carton Arranged so that arrows point up, and ensure that identification labels, expiry dates, and manufacturing dates are visible?			
10	Cartons and products are in good condition, not crushed due to mishandling. If cartons are open, determine if products are wet or cracked due to heat/radiation (fluorescent lights in the case of condoms, cartons right-side up			
11	Is the Store supplies in a manner accessible for FEFO, counting, and general management?			
12	Separate and dispose of damaged or expired products			
13	Is there a system in place to restrict access to storage areas?			

Annex 3; - Dummy table

S/N			Frequency	Percentage
1	Position in hospital	Store manager		
		Pharmacy head		
		Supply manager		
		Laboratory technologist		
2	Sex	Female		
		Male		
3	Experience	1-2		
		3-4		
		5-6		
		Above		
4	Education status	Master's Degree		
		BSC degree		
		Diploma		
		Certificate		
5	Information system show	Quantity dispensed		
		Quantity loss/adj		
		Quantity received		
6	Written guideline for storage	Yes		
		No		
7	System for tracking product loss/adj	Yes		
		No		

8	Is there expire product	Yes		
		No		
9	Reason for expiry	equipment breakdown		
		not routinely requested		
		receiving near expiry		
		prolong shipment		
		poor quantification		
		Storage temperature Fluctuation on transportation		
		not used in time		
		reagent received from program		
		short life span		
		Short life span, Equipment breakdown Unsafe transportation		
		Poor forecasting and supply chain management		
		Poor quantification and equipment breakdown		
		no expired item		
		not routinely requested and EPSS distribution		
		Hospital purchasing system		
poor inventory system and receiving close expiration				

		poor forecasting		
10	Practice separating expire or damage item	Yes		
		No		
11	Cold chain always appropriate temp	Yes		
		No		
12	Is there problem in storing	Yes		
		No		
13	Major problem	Inadequate storage		
		shortage of cold storage and leakage		
		Inadequate storage and inventory management		
		shortage of cold storage and narrow store room		
		No problem		
14	LMIS available	Yes		
		No		
15	LMIS	computer		
		paper		
		Both		
		No		
16	LMIS form	Bin cards		
		Stock cards		
		IFRR		
		RFF		
		Other		
		None		
17		Quantity received		

	LMIS report include	Stock on hand		
		Quantities used		
		Loss/adjustment		
18	Primary source available	Yes		
		No		
19	Backup generator	Yes		
		No		
20	Change in algorithm	Yes		
		No		
22	Past alteration cause waste	Yes		
		No		
23	Received close to expire stock	Yes		
24	Procedure for returning damage stock	Yes		
		No		
		No		

Dummy table storage

S/N	Description		frequency	percentage
1	Room clean and disinfect	Yes		
		No		
2	Stock dry, room well ventilated	Yes		
		No		
3	Store secure from water penetration	Yes		
		No		
4	Fire safety equipment available	Yes		
		No		
5	Available cold storage	Yes		
		No		
6	Store inflammable product separate	Yes		
		No		
7	Stack carton 10cm off floor,30 cm away from wall	Yes		
		No		
8		Yes		

	Do they store consumable separate from insecticide other supply	No		
9	Carton arrange so ex-date label is visible	Yes		
		No		
10	Carton and product in good condition	Yes		
		No		
11	Supplies in FEFO manner	Yes		
		No		
12	Separate and dispose of damaged or expired products	Yes		
		No		
13	Restrict access to storage area	Yes		
		No		

Declaration

I declare that this thesis Paper entitled “Wastage rate, management practices, and contributing factors of medical laboratory reagents and consumables in selected public hospitals in Addis Ababa, Ethiopia” is my original work in partial fulfilment for a master’s of science degree in clinical laboratory science, clinical laboratory management and Quality assurance.

Name	Signature	Date
Birhantinsea keyfalew	_____	_____

“This paperwork has been submitted for examination with our approval as advisors.”

Advisors	Signature	Date
Dr Abay Sisay	_____	_____
Mr. Alemayehu Nigatu	_____	_____

Place of submission

Department of medical laboratory sciences, college of health science, and Addis Ababa University

Date of Submission