



Assessment of pharmaceutical wastage and its contributing factors: The Case of Selected Public Health Facilities in the Four Wallaga Zones, Ethiopia.

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Nekemte, Ethiopia

Wallaga University
Institute of Health Sciences
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AUTHOR’S DECLARATION

I, Mr.Haileyesus Mulugeta, now declare and affirm that the thesis entitled “Assessment of Pharmaceutical Wastage and its Contributing Factors: the Case of Selected Public Health Facilities in four Wollega Zone Oromia Regional State, Ethiopia” is my own work conducted under the supervision of Worku Gadisa (PhD) and Mr.Gemechis Belay (B.pharm, MSc) . I have followed all the ethical principles of scholarship in the preparation, data collection, data analysis and completion of this thesis. All scholarly matter that is included in the thesis has been given recognition through citation. I have adequately cited and referenced all the original sources. I further declare that I followed all academic honesty and integrity rules and that I did not alter, fabricate, or manipulate any idea, data, fact, or source in my work. This thesis is presented in partial fulfillment of Wallaga University's Postgraduate Studies degree requirements. I further declare that this thesis has not been submitted to any other institution for the award of an academic degree, diploma, or certificate.

I accept that any breach of the above will result in disciplinary action by the University, as well as penal action from the sources that were not correctly referenced or from whom sufficient permission was not obtained when required.

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Abstract

Background

Pharmaceutical wastage refers to medication that are no longer used due to being expired, unused, spilled, withdrawn, recalled, damaged, contaminated, or for other reasons. The volume of pharmaceutical wastage has been increased primarily due to growth in the number of patients and prescriptions and the use and overproduction of pharmaceutical. It also poses a financial burden on the nation's economy, as well as, environmental implications associated with its disposal, and also continues to compromise public health in terms of safety and the environment.

Objectives: *This study was aimed to assess the extent of pharmaceutical wastage and identify the contributing factors in selected public health facilities of four Wallaga Zone, Oromia Regional State, Ethiopia*

Methods: *An analytical cross-sectional study design was employed with a mixed-method approach to analyze both quantitative and qualitative data to investigate the assessment of Pharmaceutical wastage and its contributing factors in selected public health facilities of four Wallaga zones from 2014 -2016EFY that involved 38 health facilities and 211 participants. Data collection was made by using Likert scale and in-depth interview of key informants. The data entry was done using Epi-Data version 4.6 and then exported to SPSS version 26. The pharmaceutical wastage rate was calculated. After liner regression models assumptions checked, contributing factors were analyzed in the multiple liner regression. Contributing factors with a P value ≤ 0.05 in multi-variable analysis were declared as contributing factors of pharmaceutical wastage.*

Result: *The result of this finding reveals that pharmaceutical wastage rate is 3.15%. Anti-infective, Anesthesia medicine and gastrointestinal drugs were the most commonly wasted class of medicine. Catgut Chromic, Plaster Of Paris and Oxygen Face Mask for Adult were the three commonly wasted medical supplies and Acetone Alcohol, Hepatitis C Antibody rapid test and Salmonella Typhi "H" + Salmonella Typhi "O" Antigen rapid test were the three commonly wasted laboratory reagents. poor inventory management with beta coefficients $\beta=0.191$ and $p \leq 0.001$ (95% CI, 0.136-0.245), poor supply chain management with beta coefficients $\beta=0.188$ and $p \leq 0.001$ (95% CI, 0.124-0.252), Poor storage condition with beta coefficients $\beta=0.126$ and $p \leq 0.001$ (95% CI, 0.059-0.193), were declared as contributing factors of pharmaceutical wastage. All key informants agreed that Pharmaceutical wastage is a problem in the health facilities and several contributing factors were identified to pharmaceutical wastage.*

Conclusion and recommendation: *Both quantitative and qualitative finding revealed that the pharmaceutical wastage rate is higher than acceptable range which is targeted by Health Sector Development Program. Pharmaceutical wastage is a significant issue that leads to economic losses, negatively impacts environmental health due to improper disposal, causes service interruptions, and reduces patient satisfaction. Therefore, responsible authorities should prioritize minimizing pharmaceutical wastage through conducting inventory, proper storage and strengthening pharmaceutical supply chain system at all levels of healthcare facilities.*

Keywords: *Pharmaceutical wastage, contributing factors, public health facilities.*

Table of Contents

Acknowledgment	III
Abstract	IV
List of tables	VIII
List of Figures	X
List of acronyms /abbreviations.....	XI
1. Introduction.....	1
1.1. Background of the study	1
1.2. Statement of the problem	4
1.3. Significance of the Study	6
1.4. Scope of the study.....	7
2. Literature Review	8
2.1. Theoretical Literature Review	8
2.1.1. Pharmaceutical supply chain management	8
2.1.2. Factors contributing to Pharmaceutical wastage.....	8
2.1.2.1. Storage condition.....	9
2.1.2.2. Inventory management practice	10
2.1.2.3. Poor Guideline & Policy changes and Facility practice	10
2.1.2.4. Supply chain management	10
2.1.2.5. Drug shelf life	10
2.1.2.6. Health Commodity Management Information System.....	10
2.1.3. Pharmaceutical Waste Management.....	11
2.1.4. Impact of Pharmaceutical Wastage	11
2.2. Empirical Literature Review	12
2.3. Conceptual Framework and Proposed Hypothesis	14
3. Objectives of the study	15
3.1. General objective	15
3.2. Specific objective.....	15
4. Methods	16
4.1. Study setting and period.....	16
4.2. Study Design	16
4.3. Population.....	16

4.3.1. Source Population	16
4.3.2. Study population	16
4.4. Eligibility Criteria	16
4.4.1. Inclusion Criteria	16
4.4.2. Exclusion Criteria.....	17
4.5. Sample size determination	17
4.6. Sampling technique and procedure.....	18
4.7. Study variable	19
4.7.1. Dependent Variable	19
4.7.2. Independent Variables.....	19
4.8. Operational definitions.....	20
4.9. Data Collection tools and procedure.....	20
4.10. Data Processing and Analysis.....	21
4.11. Data Quality Assurance	22
4.12. Ethical Issues Consideration.....	22
4.13. Dissemination plan	22
5. RESULT	23
5.1. Sociodemographic characteristics of respondent	23
5.2. Extent of pharmaceutical wastage	24
5.3. Types of Commonly wasted pharmaceuticals	28
5.3.1. Medicine wastage	28
5.3.2. Laboratory reagents wastage	30
5.3.3. Medical supplies wastage.....	31
5.4. Reason of pharmaceutical wastage	32
5.5. Health care professionals Perception on the presence of pharmaceutical wastage	33
5.6. Health care professionals perception on the contributing factors of pharmaceutical wastage.....	34
5.7. Assumption of linear regression.....	35
5.7.1. Normality test.....	35
5.7.2. Linearity test	36
5.7.3. Multicollinearity test	36
5.7.4. Correlations test	37
5.7.5. Autocorrelation.....	39

5.7.6. Outlier	39
5.7.7. Model fitness.....	40
5.7.8. Homoscedastic assumption.....	40
5.8. Multiple linear regressions of contributing factors for Pharmaceutical wastage	41
5.8.1. Hypotheses test results.....	41
5.9. Qualitative Themes	44
5.9.1. Thematic area	44
5.9.1.1. Status of Pharmaceutical wastage	45
5.9.1.2. Contributing factors of pharmaceutical wastage	46
5.9.1.3. Impact of Pharmaceutical wastage	48
5.9.1.4. Efforts made to prevent/reduce Pharmaceutical wastage	49
6. Discussion.....	51
6.1. Strength of the study	54
6.2. Limitation of study	54
7. Conclusion	55
8. Recommendation	56
9. References.....	57
Annexes	61
Annex I: Assessment of Medicines Wastage Tools.....	61
Annex II: The perceived factors contributing to pharmaceutical wastage by health professionals in selected public health facilities	68

List of tables

Table 1: Distribution of Socio-demographic characteristics of respondent in Wallaga Zone's health facilities, 2014-2016EFY (N=211)	23
Table 2: Distribution of pharmaceutical wastage in the Wallaga Zone's public health facilities, 2014EFY.....	25
Table 3: Distribution of pharmaceutical wastage in the Wallaga Zone's public health facilities, 2015EFY.....	26
Table 4: Distribution of pharmaceutical wastage in the Wallaga Zone's public health facilities, 2016EFY.....	27
Table 5: Estimated value of medicines wastage by classes in Wallaga Zone's health facilities, 2014-2016EFY.....	29
Table 6: Distribution of top ten medicinal wastage in Wallaga Zone's public health facilities, 2014-2016EFY.....	29
Table 7: Frequency and estimated value of medicines wastage by dosage forms in Wallaga Zone's public health facilities, 2014-2016EFY	30
Table 8: Distribution of most common Laboratory reagents wastage in Wallaga Zone's health facilities, 2014-2016EFY	31
Table 9: Distribution of most common Medical supplies wastage in Wallaga Zone's health facilities, 2014-2016EFY	31
Table 10: Distribution of Health care professionals Perception on the presence of pharmaceutical wastage in Wallaga Zone's health facilities, 2014-2016EFY	33
Table 11: Distribution of Health care professionals perception on the contributing factors of pharmaceutical wastage in Wallaga Zone's health facilities, 2014-2016EFY	34
Table 12: Data normality test in Wallaga Zone's health facilities, 2014-2016EFY.....	35
Table 13: Multicollinearity test assumption to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY.....	37
Table 14: Correlation test assumption to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY.....	38
Table 15: Autocorrelation test assumption to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY.....	39

Table 16: Model fitness test to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY	40
Table 17: Multiple linear regression for pharmaceutical contributing factors in Wallaga Zone's health facilities, 2014-2016EFY	42
Table 18: Distribution of Sociodemographic characteristics of key informants in to assess pharmaceutical wastage in Wallaga Zone's health facilities, 2014-2016EFY	44

List of Figures

Figure 1: Conceptual Framework adapted from a review of literature author (2024)	14
Figure 2: Classification of Health Facilities in the Four Wallaga Zones and its Sampling Technique	19
Figure 3: Trend of pharmaceutical wastage rate in Wallaga Zone's public health facilities, 2014-2016EFY	24
Figure 4: Pharmaceutical wastage in category in Wallaga Zone's health facilities, 2014-2016EFY	28
Figure 5: Reason of pharmaceutical wastage rate in Wallaga Zone's health facilities, 2014-2016EFY	32
Figure 6: Histogram data normality test assumption in Wallaga Zone's health facilities, 2014-2016EFY	35
Figure 7: Normality P-P plot assumption in to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY	36
Figure 8: Outlier data assumption test to assess pharmaceutical wastage and contributing factors in Wallaga Zone's health facilities, 2014-2016EFY	39
Figure 9: Homoscedacity test assumption to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY	40

List of acronyms /abbreviations

APTS	Auditable pharmaceutical transaction and services
CEO	Chief executive officers
CSA	Central Statistical Agency
DTC	Drug and therapeutically committee
EFMHACA	Ethiopian food, medicines, and health care administration and control authority
ETB	Ethiopian Birr
HCMIS	Health commodity management information system
HSTP	Health Sector Development Program
PHCUD	Primary health care unit directors
SDP	Service Delivery Point
UK	United Kingdom
WHO	World Health Organization

1. Introduction

1.1. Background of the study

Pharmaceutical wastes are drugs that can no longer be used because they have expired, unused, spilled, withdrawn, been recalled, damaged, contaminated, or for any other reason. They also include discarded items heavily contaminated during pharmaceutical handling, such as bottles, vials, and boxes containing pharmaceutical residues, gloves, masks, and connecting tubing (1). By preventing and treating illnesses, pharmaceuticals are used in healthcare institutions to save millions of lives and enhance everyone's quality of life worldwide (2). Drugs, supplies, and laboratory commodities are expensive pharmaceuticals and need to be utilized optimally to avoid wastage(3).

As described in the Medicines Waste Management and Disposal Directive of Ethiopian Food, Medicines and Health Care Administration and Control Authority (EFMHACA) pharmaceutical waste encompasses at least one of the following; expired, unused, spilt, and contaminated medicines, all cold chain damaged, unexpired medicines that should have been stored in a cold chain but were not, expired, damaged, and improperly sealed or stored medical supplies; expired, damaged, and improperly sealed or labeled or stored raw materials, and discarded packing materials(4).

According to Ethiopian Federal Ministry of Health (MOH), maladaptive drug supply systems lose over 70% of the funds spent on necessary medications. Thus, the number of medications that patients can obtain is decreased, which lowers the standard of overall healthcare. They not only unnecessarily burden a health care system that is already having financial difficulties, but they also raise health care costs and endanger human life and health because they are overstored in health facilities, which reduces the amount of space available for inventory of usable medicine supplies, and are loaded and stored for extended periods of time, which pose serious risks to both the environment and people(5).

Medication waste can occur at any stage of the pharmaceutical supply chain, with various stakeholders, including manufacturers, distributors, healthcare providers, and patients, contributing to the problem. It may occur from multiple causes, including poor drug management and weak governance. Inefficiencies in the healthcare supply chain such as expired products, theft, and damage result in significant resource losses. Furthermore, a lack of transparency and

accountability in medicine management and financial processes increases the risk of theft and resource misappropriation (1).

The rising volume of pharmaceutical waste is largely driven by increasing patient numbers, higher prescription rates, and the overproduction or excessive use of medications. The accumulation of unused, expired, or misplaced medicines exacerbates drug shortages and leads to greater proportions of pharmaceutical wastage(6).

Numerous studies conducted in both developing and developed countries have confirmed that medication wastage poses a significant challenge to healthcare systems worldwide. For instance, studies in Germany and New Zealand documented significant pharmaceutical wastage, with 10,603 and 1,399 unused medicine packages discarded, respectively (6, 7). A review of records for 27 essential medicines and 11 medical supplies at Kilembe Hospital in western Uganda compared two inventory management systems ('Push' vs 'Pull') across two time periods. The analysis revealed significantly higher volumes and quantities of expired drugs and medical supplies under one system compared to the other. Expired drugs were worth US Dollar 1, 584 (25 items) in 2000/2001 and US Dollar 1, 307 (13 items) in 2004/2005(3). A study from Rwanda indicates that 42% of laboratory reagents and medical supplies expire before use, highlighting deficiencies in inventory management systems and the absence of formal policies for disposing of expired medical items(7).

In Ethiopia, hospitals implementing auditable pharmaceutical transaction systems reported an average wastage rate of 2.1%, amounting to 3,196,865 birr in financial losses during the 2014/2015 fiscal year(8). Additional findings reveal that 12.94% of laboratory commodities (valued at \$37,488.76 USD) were lost to expiration and damage within a one-year period, concurrent with an average stock out duration of 58 days (9). On the other hand, a study across thirty-four Ethiopian health facilities providing laboratory services (including regional laboratories and hospitals) revealed that nearly all facilities experienced shortages of essential laboratory supplies and reagents. These shortages were compounded by significant wastage of existing reagents, creating critical gaps in service provision(10).

Medicine wastage poses a significant health problem. Unused medication endangers human life and health, results in non-optimal utilization of resources, and causes considerable loss of money. Thus, improving medicine use would have important financial and public health benefits(11). In addition to the financial costs to the country's economy, medication waste has negative

environmental effects from its disposal and continues to endanger human health in terms of both safety and the environment(12).

Medication wastage at health facilities is a worldwide concern due to wastage of potentially useful medications(13). Pharmaceutical wastage is one of the challenges in managing Ethiopia's medical supply chain. Although lowering the rate of pharmaceutical wastage to less than 2% is the national goal of the Health Sector Development Program (HSTP II), the actual situation is somewhat different(14). Ethiopia faces an identical issue to the rest of the world, with massive amounts of medicine waste building up along the supply chain. Expired and unfit-for-use pharmaceuticals occupy a significant percentage of the space at the medicines stores in many public health facilities(15).

Minimizing pharmaceutical waste at healthcare facilities requires maintaining appropriate storage conditions .Pharmaceutical products stored in pharmacies with good storage facilities maintained their potency, and the shelf life of drugs could also ultimately result in disruption of health services delivery and poor quality of health services, thus constraining the attainment of health coverage. It was calculated that approximately 70% of the money spent on medications might be lost or wasted. However, enhancing basic pharmaceutical management could greatly decrease these losses. For instance, research indicated that it is achievable to reduce pharmaceutical wastage due to expiry by 3% and wastage due to improper storage by 4% (16).

On the other hand, Inefficient inventory control may result in overstocking or understocking of medicines, ultimately wasting resources (17). Proper pharmaceutical supply management and inventory control prevent stock outs, reduce losses from unnecessary expiration, and minimize theft. Additionally, weak regulations and policies often result in poor procurement planning, leading to either shortages or wastage of medicines(18).

Thus, public health facilities are facing several challenges that require strategic intervention. These include frequent stock outs of medications, medicine wastage due to theft, damage, and expiration, lack of transparency and accountability in medication transactions and service delivery, poor supplier performance, long procurement lead times for certain drugs, inadequate record-keeping and low-quality data, inadequate support, and follow-up mechanisms, lack of performance monitoring and evaluation systems, training gaps, and high staff turnover(4).

1.2. Statement of the problem

Pharmaceuticals are necessary in order to improve patients' well-being in the health care setting, However, Pharmaceutical waste impairs therapeutic benefits and imposes a financial strain on the country's economy(19). Pharmaceutical supply chain must be properly handled in developing nations, where funding for medications is frequently limited, to avoid all forms of waste, such as theft, abuse, and expiration(20).

According to evidence, more than half of the medicines are improperly prescribed, administered, or sold(8). And that globally only about 50% of patients take their medications correctly. The World Health Organization (WHO) has revealed that only 50% of people worldwide take their medications as prescribed over an extended length of time(13).

The financial impact of prescription medication waste illustrated the massive financial waste at all levels that exists in communities around the world (19). If ignored, lost therapeutic benefits, financial waste, and environmental contamination from waste could make it more difficult to achieve sustainable development goals and universal health coverage, especially in low- and middle-income nations(21).

The issue of pharmaceutical wastage is universal among all developed nations. For instance, medication waste in England costs almost £300 million a year(22). In Canada, medication noncompliance costs approximately 8\$ billion per year. In the United States, the cost of wasted medication for adults aged 65 years and older would reach \$1 billion annually(23).

The majority of district-level facilities in Uganda have significant amounts of expired medications and medical supplies, according to an analysis of drug management and procurement in the country(3). Medication waste in medical wards was found by a study conducted at a tertiary hospital in Dar Es Salaam, Tanzania. The most commonly wasted categories of medicines were those commonly utilized by patients; anti-infective medicines 18.9%, cardiovascular medicines (8.9%), and the other categories were 23.7% of the total medicines dispensed(13).

According to a study carried out in Ethiopia, public health facilities consistently struggle with medication waste(16). As evidence, according to a study done in six facilities in Gondar town, about 26,760 ETB were lost over the course of six months as a result of expiration. Additionally, A study carried out in public health facilities in East Shewa Zone, Oromia Regional State, between March 29 and April 29, 2016GC, found that expired medicines resulted in a total loss of 174,366.98 Ethiopian Birr and During the 2013/2014GC assessment, which collected baseline data for

Auditable Pharmaceutical Transactions and Services (APTS) in government hospitals under the Federal and Addis Ababa City administrations, researchers discovered that the average medication wastage rate across eight hospitals over three years (2012–2014GC) was 4.8%. This resulted in a total financial loss of 11,078,910.52 Ethiopian Birr (ETB)(24).

While existing studies confirm that medicine wastage is a significant issue in Ethiopia, there remains a need to determine the exact quantity and types of wasted medications, as well as the underlying causes, including the financial impact, in health facilities across the Four Wollega Zone. Although some researches and limited reports address this problem, comprehensive data on the extent and economic consequences of pharmaceutical wastage in this specific region are still lacking.

In addition, most previous research has primarily focused on medicine wastage. This study aims to broaden the scope by including not only medicines but also laboratory reagents and medical supplies. To the best of my knowledge, there has been no prior research specifically examining pharmaceutical wastage at the public health facility level within this zone.

Furthermore, there are only a limited number of reports in the literature regarding pharmaceutical wastage in the hospitals. Therefore, this study aimed to assess the volume of pharmaceuticals wasted, identify the key factors contributing to this wastage and also the monetary value of wasted pharmaceuticals in selected public health facilities in East Wollega Zone.

1.3. Significance of the Study

In order to increase the effectiveness of the healthcare systems in the area, this study on pharmaceuticals is essential. Pharmaceutical waste affects the population's access to necessary medications in addition to directly resulting in the loss of important resources. Through the identification of the underlying causes of waste, this study was offer evidence-based suggestions to minimize avoidable losses, guaranteeing better use of available resources and enhanced community access to healthcare. Reducing waste also results in cost savings that can be used to pay for other crucial healthcare services.

Additionally, this study can assist policymakers and program-supporting organizations in creating a suitable system to lessen the degree of wastage, which results in the loss of beneficial medication, financial costs, environmental issues, and antibiotic resistance as well as increasing the overall productivity of the supply system by applying the data from this study about the amount of medicine that has wasted.

Finally, the study's conclusions can influence national, regional, and municipal healthcare policies pertaining to the distribution, purchase, and inventory control of pharmaceuticals. This study adds to the increasing body of knowledge that can spur changes in Ethiopia's healthcare system and improve the sustainability and quality of pharmaceutical services throughout the nation by addressing local inefficiencies. Knowing the burden and contributing factors of pharmaceutical wastage would help the regional health bureau and Ministry of Health to design strategies helpful for curtailing the burden of medicine wastage and ensuring their appropriate use. The evidence from this study would have a positive impact on the healthcare delivery systems of the area, and the nation at large. Moreover, the findings of this study also serve as baseline information for future studies.

1.4. Scope of the study

This study aimed to assess pharmaceutical wastage and its contributing factors across selected public health facilities in the Four Wallaga Zones. This study was also focus on identifying common factors contributing to pharmaceutical wastage.

The study was focus on a number of important independent factors that affect the dependent variable, pharmaceutical wastage. These include inventory management techniques, which analyze the effectiveness of stock monitoring, ordering, and usage; storage conditions, which look at how appropriate or inappropriate storage affects drug viability; and regulatory and policy factors, which take into account the effects of rules, enforcement, and compliance. Drug shelf life is also investigated to determine how expiration dates affect wastage, and supply chain management assesses how well demand forecasting and procurement processes minimize pharmaceutical losses. When combined, these variables offer a thorough framework for comprehending the elements influencing pharmaceutical wastage.

This study also focuses on determining the relationship between independent variables and pharmaceutical wastage in the context of public health facilities and the extent of pharmaceutical waste in selected public health facilities of four Wallaga zones was assessed. Additionally, this study was assessed pharmaceuticals that are commonly wasted in selected public health facilities. The study area was confined to health facilities located in the four Wallaga zones of Ethiopia, specifically focusing on hospitals and health centers. Also, this study was delimited to tracer Pharmaceuticals.

2. Literature Review

2.1. Theoretical Literature Review

2.1.1. Pharmaceutical supply chain management

Access to medicine as a human right is one of the main objectives of healthcare systems. In accordance with the goals of the health system, the pharmaceutical supply chain should deliver medications in the appropriate quantity, with acceptable quality, at the appropriate location and clients, at the appropriate time, and at the best possible price. It should also benefit its stockholders. Disruptions in the pharmaceutical supply chain not only lead to resource wastage but also endanger patients' lives by limiting access to essential medications (25).

The pharmaceutical supply chain comprises complex, interconnected subsystems, each influencing overall performance. Among these, inventory management serves as a critical component, directly impacting the efficiency of the entire supply system. Enhancing inventory management practices can lead to substantial improvements in supply chain effectiveness(9).

The ability of a country to solve public health issues is directly correlated with its pharmaceutical management practices. Pharmaceutical products can be expensive to purchase and distribute, but shortages of essential medicines, improper use of medicines, and spending on unnecessary or low-quality medicines also have high costs in terms of wasted resources and preventable illness and death. Having excess inventory leads to wastage of resources. So, carrying over stock opens up the chance of losing thousands of dollars on expired, unsaleable items. Once pharmaceuticals pass their expiry date, no one can utilize them. Effective pharmaceutical inventory management requires diligent oversight of expiration dates, stock levels, unexplained losses, and proper storage conditions. So, Strengthened inventory management in public health facilities directly improves medicine accessibility, reduces waste and costs, and enhances patient care outcomes(26).

2.1.2. Factors contributing to Pharmaceutical wastage

Pharmaceutical expiration results from multiple interrelated factors spanning supply chain characteristics, inventory management practices, and healthcare delivery systems. However, in low-income countries, the specific determinants contributing to pharmaceutical expiry within public supply chain retailers remain understudied(27). Poor adherence, adverse effects, stopping or switching medications, patient deaths, or expiration are the leading causes of pharmaceutical wastage in developed countries .In developing nations, pharmaceuticals are often wasted because

they spoil or expire due to ineffective and poorly managed medicine supply systems. Medicines are also wasted due to excessive stockpiling and the selection of drugs without proper data or evidence-based decision-making. Other key factors contributing to medicine wastage include supplying near-expiry medications to clinics or patients, excluding clinicians from medicine selection and quantity decisions, sudden changes in treatment protocols, and a lack of accountability for wasted pharmaceuticals. Additionally, pharmaceutical waste stems from poor inventory management, lengthy procurement procedures, improper storage conditions, failure to monitor expiration dates, inefficient distribution systems, and irrational drug use(24).

Medication wastage can occur when medicines (whether prescribed or over-the-counter) remain unused for extended periods, or when they are damaged, lost, spilled, or contaminated due to mishandling or neglect (28). The World Health Organization (WHO) reports that over 50% of medications are prescribed or dispensed incorrectly, leading to excessive stockpiling. When medicines accumulate in households, they are often used irrationally, increasing risks such as adverse drug reactions, accidental poisoning, delayed diagnosis of illnesses, harmful drug interactions, antibiotic resistance, and financial losses(29).

Medication wastage is a growing global concern, affecting nations worldwide without geographic limitation. Research indicates that in the United States alone, pharmaceutical waste contributes to over \$2.3 trillion in annual healthcare expenditures. Studies from various countries highlight distinct causes: in Tanzania, overstocking emerged as the primary driver of medicine waste, while Uganda identified insufficient technical expertise in drug expiry monitoring as the key factor. Similarly, Ethiopia reported that more than 8% of its total medicines expired due to inefficiencies in supply chain management(30).

2.1.2.1. Storage condition

Maintaining the quality of pharmaceutical products necessitates strict control of storage and transportation conditions. As a critical component of drug management systems, proper storage requires regulated environmental factors including temperature, light exposure, humidity levels, sanitation standards, ventilation, and appropriate product segregation at all facilities where medications are housed(31). Medications stored outside required temperature ranges lose potency and efficacy, creating unnecessary economic burdens for populations. Minimizing pharmaceutical waste is essential to optimize the use of these limited resources, as improper drug disposal carries substantial public health consequences(32).

2.1.2.2. Inventory management practice

Effective medication management throughout the various stages of the supply chain is essential. Neglecting this can lead to shortages, medication waste, and financial losses, ultimately impacting healthcare delivery(32). The goal of pharmaceutical inventory management is to maintain an optimal balance between shortages and excess stock of essential medicines. Failure to achieve this balance can compromise patient care quality, lead to medication waste, and result in financial losses(33).

2.1.2.3. Poor Guideline & Policy changes and Facility practice

In Ethiopia, the main drivers of medical waste include weak governance, inadequate record-keeping, and a lack of auditing mechanisms, transparency, and accountability in pharmaceutical management. These inefficiencies raise healthcare expenditures and strain the country's limited health system. Additionally, the country faces critical gaps in pharmaceutical waste management, including insufficient regulations mandating medical facilities to monitor and report drug waste, a lack of automated data collection tools or software, and the absence of a standardized system for recording and reporting wastage to the relevant supply chain authorities. These systemic deficiencies contribute to significant inefficiencies in the healthcare system. These systemic shortcomings result in substantial pharmaceutical wastage across Ethiopia, underscoring the urgent need for comprehensive policy reforms and immediate corrective measures (14).

2.1.2.4. Supply chain management

Effective pharmaceutical supply chain management plays a crucial role in preventing stock outs, reducing losses from expired medications, and minimizing theft. Furthermore, it ensures consistent availability of medicines in appropriate quantities while enhancing overall healthcare service quality(34).

2.1.2.5. Drug shelf life

Expired medications pose serious risks, including loss of therapeutic efficacy, compromised safety, reduced potency, and potential formation of harmful compounds. Given these significant health implications and the scarcity of pharmaceutical resources, minimizing drug wastage is essential to ensure optimal utilization of these vital healthcare assets(33).

2.1.2.6. Health Commodity Management Information System

To make strategic and operational decisions, health supply chain managers need accurate and timely data, since distorted or delayed information can greatly reduce the supply chain's

effectiveness. Access to real-time logistics data is critical for effectively managing drug selection, demand forecasting, procurement, inventory control, distribution, and rational medicine use. Additionally, a well-designed Health Commodity Management Information System (HCMIS) is vital for accurate forecasting, financial planning, and the efficient distribution and procurement of health commodities, as it systematically collects and reports essential routine data(35). In 2020, Getahun Tefera and Bruck Messele assessed the impact of HCMIS at Tikur Anbessa Specialized Hospital. The results showed significant improvements in warehouse and inventory efficiency, with higher order and line fill rates, better inventory turnover, and reduced wastage (36).

2.1.3. Pharmaceutical Waste Management

Pharmaceutical waste consists of expired medications, unused or discontinued dispensed drugs, and contaminated pharmaceutical products (37). Effective waste management requires a systematic approach involving collection, packaging, storage, segregation, transportation, treatment, and disposal. Pharmaceutical waste must be separated from general waste, and accurate forecasting of waste generation is essential for budget planning and optimizing waste management processes(8).

Pharmaceutical waste demands specialized handling and controlled management throughout its entire lifecycle from generation to final disposal. Improper disposal methods, such as discarding it in regular trash bins, drainage systems, or uncontrolled dumping sites on city outskirts, present significant risks to public health and the environment(38). Healthcare systems worldwide generate approximately 3% of global pharmaceutical waste. The disposal of these materials has become a critical concern, as vast quantities of waste and by-products continue to accumulate. Of particular urgency is the improper disposal of unused medications, which has emerged as a significant and escalating global challenge(8).

Consequently, there is an urgent need to provide comprehensive training for pharmaceutical industry personnel, importers, and regulatory authorities on proper pharmaceutical waste disposal protocols. Such capacity building will ensure the implementation of safe medication waste management practices nationwide(8).

2.1.4. Impact of Pharmaceutical Wastage

Pharmaceutical wastage not only creates significant financial strain on national economies but also carries substantial environmental consequences from improper disposal (12).Pharmaceuticals wastage imposes direct financial costs on patients while creating broader economic impacts.

Addressing this challenge requires comprehensive public education initiatives targeting all stakeholders involved in pharmaceutical use and management (39). The accumulation of excess, expired, and improperly stored pharmaceutical has become a pressing global issue, contributing to drug shortages, escalating pharmaceutical waste volumes, and rising medication disposal expenditures(1).

Improper pharmaceutical disposal sites have become hotspots for antibiotic-resistant bacteria. When pharmaceuticals enter waterways, they create a dual threat: accelerating resistance while making microbes more dangerous. Additionally, Pharmaceutical wastage diminishes medication accessibility and compromises treatment efficacy, creating potentially life-threatening gaps in patient care. On the other hand, improper pharmaceutical waste management poses significant public health risks, potentially transmitting diseases such as salmonellosis and cholera to waste handlers and communities near disposal sites. Global data reveals alarming mortality rates, with waste-related illnesses claiming over 5.2 million lives annually - including 4 million children. Without immediate, evidence-based interventions, this crisis is projected to escalate further (4).

2.2. Empirical Literature Review

Both developed and developing nations face significant pharmaceutical waste challenges, driven by increasing drug availability and irrational medication use. Research indicates the scale of this problem is substantial - WHO data reveals hospitals generate 0.2–0.5 kg of waste per bed daily, with pharmaceutical waste accounting for 3% of this total(40).

Global medicine expenditures are projected to reach \$1.59 trillion by 2025, with the UK alone spending approximately £127 billion on healthcare in 2019. These substantial figures reveal significant inefficiencies in healthcare systems worldwide, particularly through medication waste stemming from inappropriate prescriptions and consequent overstocking of pharmaceuticals(1). Over the past ten years, annual medication waste was calculated to amount to £300 million in England, while in the United States, poor medication management led to \$418 billion in losses for consumers (41).

Poor oversight in drug distribution, weak supply chain controls, improper storage practices, and excessive stockpiling have all contributed to the global increase in expired medications, including essential life-saving drugs. A study in China found that 724.5 tons of medical supplies, 10 tons of medical equipment, and 20 tons of drugs were discarded due to being unusable—primarily because they had expired. Similarly, research in Sri Lanka showed that 50% of medication labels lacked

expiration dates, 67% of drugs expired within a year of arrival, and 6.5% were already expired upon delivery. Additionally, an Indian survey revealed that 72% of consumers fail to check expiration dates when purchasing or using medications.(42).

In developing countries, the full scope of medication wastage remains poorly understood, with limited documented evidence on the factors contributing to it in public healthcare facilities. Unused medicines often kept in households due to patient death, adverse effects, or prescription changes are typically stored for future use rather than being properly disposed of. A Tanzanian study highlighted that the extent of drug wastage, both within communities and healthcare settings, is still largely unmeasured(6).

Shortages of laboratory reagents and medical supplies directly hinder a facility's ability to conduct diagnostic tests. An assessment of 17 comprehensive healthcare facilities in Bauchi State, Nigeria, revealed that 14 (82.4%) had experienced expired HIV/AIDS laboratory commodities. Similarly, a 2003 study by Lijdsman et al. in Rwanda reported a 42% expiry rate for lab supplies(7), And in Uganda, it was 23%(43).These data affirm that there is a problem in wastage and stock management of laboratory commodities across the African continent.

Studies across Africa, particularly in East Africa, have highlighted substantial financial losses resulting from expired medicines. In Rwanda, research revealed that expired medications amounted to RWF 6,046,778,655, with major contributing factors including supply chain inefficiencies (90%), other systemic issues (73%), poor storage management (68%), and excessive drug supply (67%). Similarly, a South African study estimated financial losses at R 836,029 annually, representing 0.6% of total hospital expenditure a problem exacerbated by prescribers' insufficient knowledge of standard treatment guidelines(42).

Ethiopia faces significant challenges in its health supply chain due to pharmaceutical wastage, mirroring issues common across developing nations. An evaluation conducted during 2013/2014 as part of Auditable Pharmaceutical Transaction and Services (APTS) baseline data collection revealed troubling statistics: across eight federal and Addis Ababa city government hospitals, the three-year average (2012-2014) medication wastage rate reached 4.8%, representing a financial loss of 11,078,910.52 ETB(14). A study conducted in public hospitals of Jimma Zone, Ethiopia, revealed significant wastage of laboratory commodities, with a wastage rate of 27.2%. This substantial loss translated to approximately \$10,248.50 USD in financial losses (44).

2.3. Conceptual Framework and Proposed Hypothesis

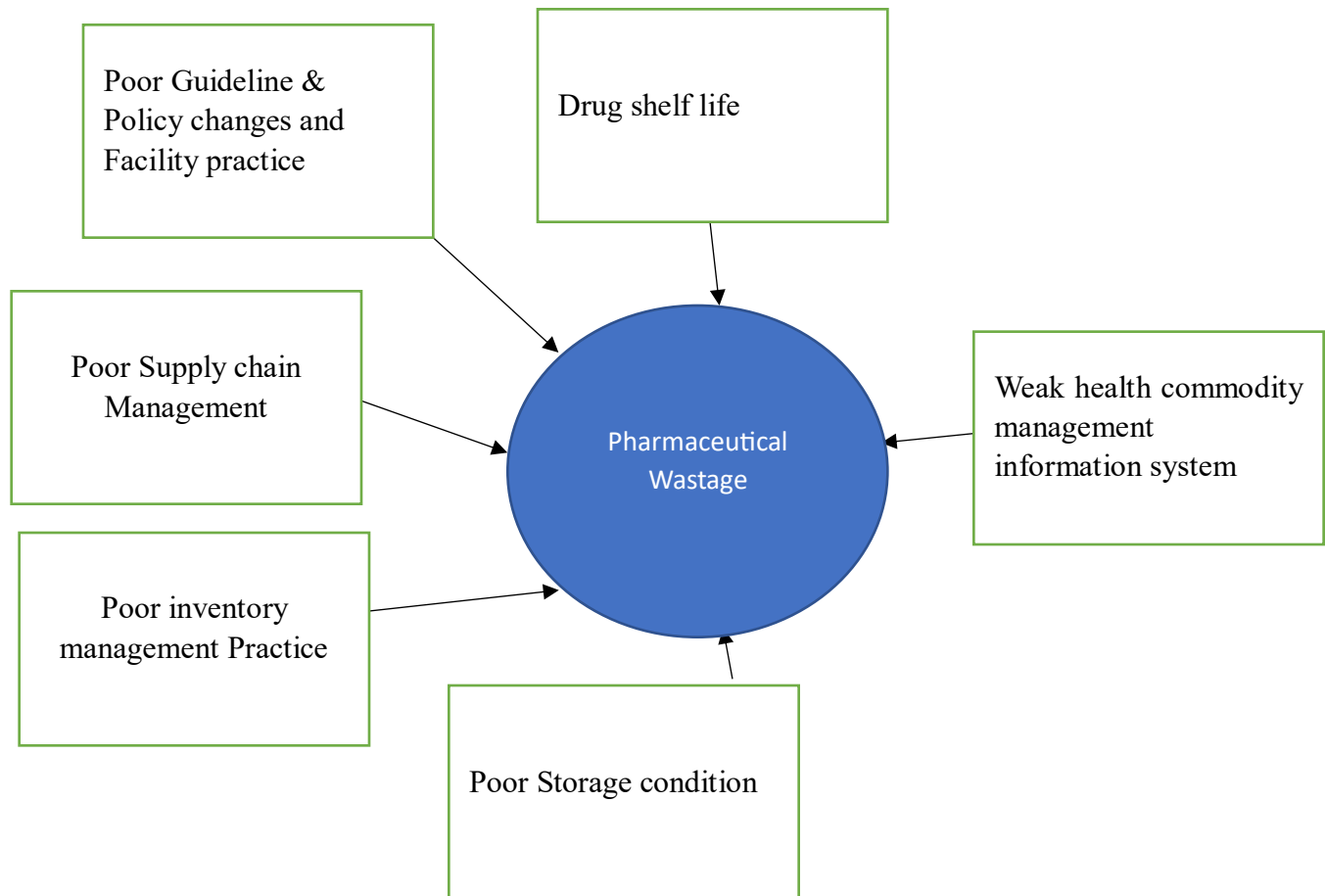


Figure 1: Conceptual Framework adapted from a review of literature author (2024)

Thus: the proposed hypothesis were the following

- H1: Poor storage conditions, have a significant relationship with pharmaceutical wastage
- H2: Poor inventory management practices, positively associated with pharmaceutical wastage
- H3: Poor Guideline & Policy changes and Facility practice, positively affect pharmaceutical wastage
- H4: Short drug shelf life is positively associated with pharmaceutical wastage
- H5: Poor supply chain management positively associated with pharmaceutical wastage
- H6: Weak health commodity management information system is positively associated with pharmaceutical wastage

3. Objectives of the study

3.1. General objective

- ❖ To assess the extent of pharmaceutical wastage and identify the contributing factors in selected public health facilities in four Wallaga Zone, Oromia Regional State, Ethiopia

3.2. Specific objective

- ✚ To assess the extent of pharmaceutical waste in selected public health facilities in the four Wallaga Zone.
- ✚ To identify the key factors contributing to pharmaceutical wastage within these facilities.
- ✚ To describe types of commonly wasted pharmaceutical in selected public health facilities in four Wallaga Zone.
- ✚ To examine the relationship between contributing factors and Pharmaceutical wastage across the selected Public health facilities.

4. Methods

4.1. Study setting and period

The study was conducted at the public health facilities of the four Wallaga zones of the Oromia region, Ethiopia. These zones are East Wallaga, West Wallaga, Kellem Wallaga, and Horo Guduru Wallaga zones. As per zonal health department reports, there are 235 health centers, and 18 hospitals totaling 253 health facilities (East Wallaga 71, west Wallaga 74, Kellem Wallaga 55, Horo Guduru Wallaga 53)(45). The study was conducted from February 1 to March 30, 2025.

4.2. Study Design

An analytical cross-sectional study design was employed with a mixed-method approach and a three years retrospective data (2014-2016EFY) was taken to investigate the Assessment of Pharmaceutical Wastage and its contributing factors in selected public health facilities of four Wollega zones.

4.3. Population

4.3.1. Source Population

The source population for this study consists of all public health facilities found in the four Wollega Zones: All health professionals and all documents that are used for pharmaceutical wastage like pharmaceutical wastage registration/ disposal report and model 19 were also sources of information.

4.3.2. Study population

All health professionals involved in pharmaceutical supply chain management activities including medicine, laboratory reagents, and medical supplies and all records of pharmaceutical wastage/ disposal reports and model 19 of the year 2014EFY-2016EFY in the sampled health facilities were study population.

4.4. Eligibility Criteria

4.4.1. Inclusion Criteria

All public health facilities that had more than 3 years in operation, Health Professionals who were available and volunteer during the study period, and wasted pharmaceuticals including medicine, laboratory reagents, and medical supplies recorded with price in the year 2014EFY-2016EFY.

4.4.2. Exclusion Criteria

Wasted pharmaceuticals including medicines, laboratory reagents, and medical supplies recorded as free prices were excluded. Areas that are severely affected by recent security problems and Individuals could do not provide informed consent was also excluded. Non-governmental pharmaceutical supply chains such as the Red Cross, private and wholesale pharmacies, as well as drug stores, and public health facilities those were involved in the pilot study were excluded

4.5. Sample size determination

The size of public healthcare facilities to be included in the study were determined by applying the Logistics Indicators Assessment Tool (LIAT)(46). The document recommended that at least 15% of the targeted health facilities shall be included in the survey, accordingly, 38 health facilities were selected out of 253 health facilities, which had more than 3 years in operation. Considering the availability of enough data and human resources as compared to health centers, all 18 hospitals were included in the survey, from the health centers 20 health centers were included by using random sampling, thus a total of 38 public health facilities were included. As per the Zonal Health Department report by phone call, there are 384 health professionals who are actively involved in the drug therapeutic committee (DTC) and pharmaceutical supply chain management. These include pharmacists, druggists, laboratory technicians, pharmacy heads, store managers, CEO, and PHCU directors(45). 106 from West Wollega, 100 from East Wollega, 91 from Kellem Wollega, and 87 from Horo Guduru Wollega. A simplified formula for determining sample sizes was provided by Yamane (1967)(45).Therefore, the sample size for this study was determined using the following formula

$$n = \frac{N}{1 + (N)(e^2)}$$

Where: - n= is the sample from the population

N= Total populations

e= level of precision which is 5%

95 confidence interval and p = 0.05 are assumed

$$n = 196$$

Considering a 10% contingency for non-respondents, the final sample size was **215**.

For key informants, a non-probabilistic purposive sampling technique was utilized. 5 individuals from each respective zone considering hospitals and health centers (CEOs ,PHCUD and heads of the pharmacy case team) a total of 20 individuals were included as they are supposed to be more information-rich than other health professionals. Data collection was ceased when information redundancy or data saturation was observed.

4.6. Sampling technique and procedure

The sampling procedure that was adopted in this study was the probability sampling method, ensuring that each member of the target group has an equal, non-zero chance of being selected for the sample. A stratified sampling technique was used to classify the public health facilities into different strata according to their type: hospitals and health centers. This stratification guarantees the representation of both types of facilities and enables a comparison of factors contributing to Pharmaceutical wastage in hospitals and health centers. All 18 hospitals were included for comprehensive data, while 20 health centers were randomly selected from each zone. Hospitals were prioritized due to higher pharmaceutical turnover and documentation completeness. In addition, health centers were categorized based on their respective zones. There are 68, 69, 49, and 49 health centers in East Wallaga, West Wallaga, Kellem Wallaga, and Horro Guduru Wallaga, respectively(45). Proportionately 6 health centers from East Wollega, 6 health centers from West Wallaga, 4 health centers from Kellem Wallaga, and 4 health centers from Horro Guduru Wallaga were randomly selected from the zones. The facilities in each stratum were selected by simple random sampling. By employing this sampling process, the investigator was adopt a comprehensive and systematic approach to data collection. This was facilitate the gathering of significant scientific information from various types of public health facilities within the designated Wallaga Zones. Within the selected facilities, pharmaceutical records were systematically sampled to cover all dispensed, expired, and disposed pharmaceuticals within the past three years.

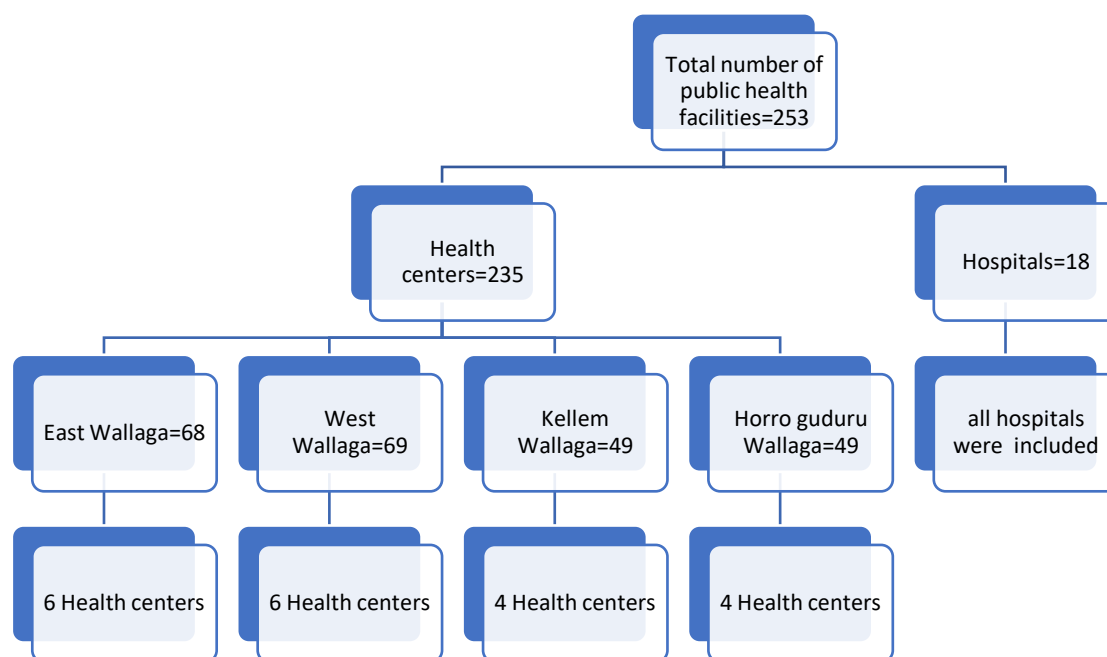


Figure 2: Classification of Health Facilities in the Four Wallaga Zones and its Sampling Technique

4.7. Study variable

4.7.1. Dependent Variable

Pharmaceutical Wastage- is the term used to describe the loss of pharmaceuticals due to, overstocking, expiration, or mistreatment, which results in inefficiencies in the provision of healthcare. Additional indicators include discrepancies between procurement and actual demand and inappropriate storage conditions that reduce drug potency. When taken as a whole, these indicators point to deficiencies in supply chain management, inventory management practice, drug shelf life, and storage procedures highlighting the necessity of focused interventions to cut wastage and maximize resource use.

4.7.2. Independent Variables

In this study independent variables were, Storage conditions, supply chain management, Inventory management practices, drug shelf life, regulatory and policy factors, and health commodity management information system.

4.8. Operational definitions

Pharmaceutical wastage- refers to the loss of medications and pharmaceutical products that are not used for their intended purpose and are discarded or rendered unusable. In this study, it indicates pharmaceuticals expired, damaged, lost, obsoleted, and unsafe for use.

Extent of Pharmaceutical Wastage- The extent of pharmaceutical wastage refers to the quantity or proportion of medications that go to waste within a given healthcare facility, system, or supply chain. It is typically expressed as a percentage of the total pharmaceuticals procured, dispensed, or used.

Pharmaceuticals- in this study, it indicates medicines, laboratory reagents, and medical supplies

Supply chain management- in this study, supply chain management indicates demand forecasting and procurement at public health facilities.

Health Commodity Management Information System (HCMIS) -is a digital or manual system used to manage the supply chain of pharmaceuticals in healthcare facilities. It improves transparency, reduces wastage, and prevents stock outs. In this study HCMIS includes dagu.

Public health facilities-in this study, public health facilities include hospitals and health Centers.

$$\text{Medicine wastage rate (\%)} = \frac{\text{Value of wasted medicines in a year} * 100}{\text{Value of Beginning balance} + \text{Value of medicine received during the same calendar year}}$$

4.9. Data Collection tools and procedure

Structured questionnaires were adapted from study conducted at South West Shoa Zone and Hadiya zone medicine wastage assessment tools(5,47). Semi-structured interview guides were developed based on supply chain management frameworks. Data was collected from study participants using the interviewer-administered structured and pretested questionnaire. The quantitative data was collected by two pharmacists using data abstraction formats and self-administered questionnaires. And the qualitative data was collected by the principal investigator through in-depth interviews with the CEOs, PHCUD and pharmacy case team.

The questionnaire was divided into three sections. Part 1 was about data abstractions from secondary data sources. Review and extract secondary data from the facility's pharmaceutical records, such as medicine waste registration, disposal registration (when wasted medicines were disposed), and Model 19 health documents whereas part 2 asks about the respondent's demographics and the research objectives. Part 3 is about Semi-structured guide for key informant interviews.

The questionnaires was directly administered to members of the DTC committee which includes chief executive officers (CEOs) of hospitals, PHCU directors of health centers, pharmacy heads, pharmacists, druggists, store managers, procurement officers, and laboratory technicians to reduce response time and allow for immediate clarification of any doubts that respondents might had about any questions. However, for respondents who had lack of time, the questionnaire was delivered through email and a drop-and-pick approach, allowing respondents to complete the questionnaire at their convenience time.

4.10. Data Processing and Analysis

The data collected was entered into a computer and analyzed using Microsoft excel and Statistical Package for Social Sciences (SPSS Version 26). The results were compiled by using descriptive and inferential statistical analysis. The descriptive findings were presented in frequency, mean, and percentages. The inferential statistical analysis was done using multiple linear regression. Hence, the assumptions underlying the linear regressions including normality, linearity, multicollinearity, homoscedasticity, and correlations were checked before running the final analyses. Normality was assessed using the Shapiro-Wilk test and a histogram. The results indicated that $p > 0.05$, and the data observed a symmetric distribution(48). The linearity among pairs of variables was examined by inspections of scatter plots of residuals plot fall on the diagonal regression line(49). Multicollinearity among independent variables was checked by using tolerance and VIF (Variance Inflation Factor) with cut points of >1 and < 10 , respectively(50).

The qualitative data was analyzed using the thematic analysis technique. The analysis followed the steps of coding, transcribing, translating, and retrieving the data (organizing similar data together) namely; supply chain management-related issues, inventory management-related issues,

policy and regulatory-related issues, storage condition-related issues, drug shelf life, health commodity management information system related issues and ways forward and quotation (51).

4.11. Data Quality Assurance

The data collection instrument format was developed in English and was checked by the advisor for its content validity and desired results. To ascertain the degree to which the data collection instruments measure what it is supposed to measure (validity), a review of the literature and adopted instruments was used in previous research then the collected data was checked for completeness and consistency of information. A pilot study in 4 facilities (10% of sample) tested instrument reliability, yielding Cronbach's α of 0.74. The data collectors (pharmacy professionals) was trained on data collection tools. The training was emphasize on how to collect valid data. During data collection, supervision and discussion was made by the investigator on a regular basis and the collected data was also reviewed for completeness and summarized on the same day of the data collection. Qualitative data was collected by investigator to increase the consistency of the information.

4.12. Ethical Issues Consideration

Ethical clearance obtained from Wollega University IRB under issued letter with Ref: WU/PHARM/012/2025) number. And a supporting letter was obtained from Woreda Health Office. The purposes of the study was explained and informed consent was obtained from all participants. Respondents were not identified by name in the questionnaire. Participants were willing to take part in the study was given full right not to participate. At the end all facility identifiers were removed during data analysis to maintain confidentiality

4.13. Dissemination plan

The study's findings will be presented at Wallaga University's Institute of Health Science during the final thesis defense then it will be presented in national and international forums. In addition, manuscripts will be submitted for publication in reputable peer-reviewed scientific journals.

5. RESULT

5.1. Sociodemographic characteristics of respondent

A total of 215 self-administered questionnaires were provided to health professionals involved in DTC and other pharmaceutical management activities at the studied health facilities; 211 questionnaires were completed and returned to the investigator, obtaining a response rate of 98%. The mean age of the respondents was 33.79 years (SD = 4.930). The minimum age was 23, while the maximum age was 50. The majority (69.9%) of respondents were male. In terms of field of study, 100 (47.4%) of the total respondents acquired a BSc degree in pharmacy. Respondents included 36 (17.1%) BSc nurses and 36 (17.1%) druggist professionals. The majority of the respondents had 6-10 years of work experience (See Table 1).

Table 1: Distribution of Socio-demographic characteristics of respondent in Wallaga Zone's health facilities, 2014-2016EFY (N=211)

variables	Category	Number	Percentage
Age	20-25	10	4.7
	26-30	56	26.5
	31-35	71	33.6
	36-40	56	26.5
	41-45	17	8.1
	46-50	1	.5
Mean	33.79		
SD	4.930		
sex	Male	137	64.9
	Female	74	35.1
Profession	Pharmacy (MSc)	10	4.7
	Diploma pharmacy	36	17.1
	Health officer (BSc)	28	13.3
	Nurse (BSc)	36	17.1
	pharmacist (BSc .Pharm)	100	47.4
	other(specify)	1	0.5
Work experience	0-5	54	25.6
	6-10	97	46.0
	11-15	49	23.2
	16-20	11	5.2

5.2. Extent of pharmaceutical wastage

Thirty-eight health facilities were evaluated for pharmaceutical wastage, with a 100% response rate. Out of thirty-eight healthcare facilities, eighteen were hospitals and twenty were health centers. The overall pharmaceutical wastage rate across 38 facilities was 3.15% (95% CI: 0.05-7.4) exceeding Ethiopia's 2% target (see Fig. 3). In the 2014 EFY, the total wastage amounted to 6,598,294.8 ETB. Both beginning balance and received funds totaled 146,838,444.87 ETB, resulting in a wastage rate of 4.5%. In the 2015 EFY, the estimated value of pharmaceutical wastage was 5,494,158.675 ETB. Both beginning balance and received funds for this year were 165,022,924.2 ETB, which indicated an annual wastage rate of 3.3%. In the 2016 EFY, the overall wastage reached 5,006,859.62 ETB, with both beginning balance and received funds of 230,921,853.7 ETB. 2016 EFY, the annual wastage rate was estimated at 2.1 % (see table 2,3 & 4).

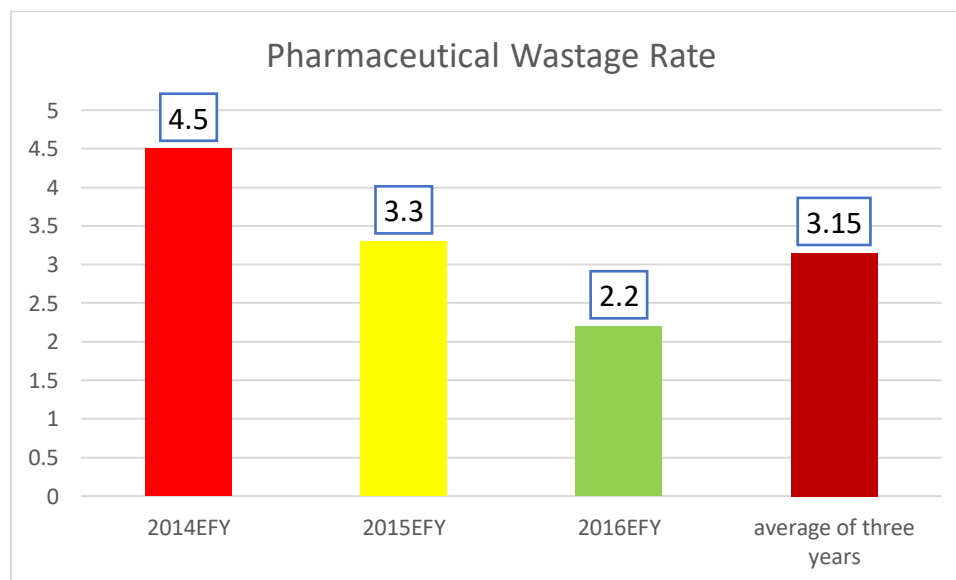


Figure 3: Trend of pharmaceutical wastage rate in Wallaga Zone's public health facilities, 2014-2016EFY

Table 2: Distribution of pharmaceutical wastage in the Wallaga Zone's public health facilities, 2014EFY

Code	budget wasted	Received	Beginning	%	Code	budget wasted	Received	Beginning	%
HF1	16514.39	18070743.00	916914.70	0.09	HF21	48113.96	516317.12	34116.72	8.74
HF2	152146.535	2783018.08	280398.54	4.97	HF22	175171.42	1864254.34	719813.09	6.78
HF 3	438182.2	5315663.68	1282628.04	6.64	HF23	169113.67	1614946.56	846465.91	6.87
HF4	147184.23	2512314.2	18763.26	5.82	HF24	148413.26	1994434.24	613417.61	5.69
HF5	297617.17	6997617.348	1894347.95	3.35	HF25	178941.74	2418617.42	618712.48	5.89
HF6	497190.93	16222043	1317613.19	2.83	HF26	53115.32	614518.42	56118.43	7.92
HF7	267123.76	6318913.03	611217.14	3.85	HF27	52618.96	819613.54	74313.27	5.89
HF8	31618.96	432421.62	28117.17	6.87	HF28	49864.45	814413.69	61213.52	5.69
HF9	159619.25	2349679.51	36718.93	6.69	HF29	54415.39	513718.49	43114.78	9.77
HF10	143663.06	1997647.16	113214.96	6.81	HF30	53672.29	614718.42	68172.15	7.86
HF11	42996.34	415116.26	31416.03	9.63	HF31	58116.13	814542.63	96128.45	6.38
HF12	48112.11	617186.09	72617.13	6.97	HF32	62231.58	873619.72	96123.96	6.42
HF13	298123.89	4500000	68713.56	6.53	HF33	63634.89	714316.14	54542.31	8.28
HF14	67927.99	705744.15	55613.45	8.92	HF34	62613.27	672814.51	42613.52	8.75
HF15	205994.74	21696955.58	1522113.026	0.89	HF35	76178.89	913415.26	116614.43	7.40
HF16	39819.34	443718.96	24226.06	8.51	HF36	1356846.27	9867914	2619317.4	10.87
HF17	296217.26	4613211.6	67817.14	6.33	HF37	367623.57	3498761.54	458972.76	9.29
HF18	44045.2	715634.76	61534.96	5.67	HF38	43478.76	518913.42	68172.09	7.41
HF19	241116.26	3411517.7	796213.14	5.73	Total	6598294.815	130492606.45	16345838.42	4.49
HF20	88917.38	713611.26	457697.17	7.59					

Table 3: Distribution of pharmaceutical wastage in the Wallaga Zone's public health facilities, 2015EFY

Code	budget wasted	Received	Beginning	%	Code	budget wasted	Received	Beginning	%
HF1	5497.29	17071834	1758186	0.03	HF21	42317.31	612113.91	30166.51	6.59
HF2	98404.858	4263939.947	150089.6	2.23	HF22	211314.63	1942314.2	457163.11	8.81
HF 3	379178.17	7893273.57	1485527.97	4.04	HF23	141431.56	1842413.41	616572.28	5.75
HF4	93184.13	2812343.97	21289	3.29	HF24	139613.47	2417618.54	814916.73	4.32
HF5	112177.15	766314.63	2395050.6	3.55	HF25	142618.91	2918413.61	518112	4.15
HF6	394954.56	18443487	996451.4	2.03	HF26	39518.71	518171.96	72813.34	6.69
HF7	251131.26	8114316.61	312617.34	2.98	HF27	61413.14	876416.16	51413.72	6.62
HF8	71118.13	693716.21	31717.02	9.80	HF28	40114.26	913618.72	84516.78	4.02
HF9	166613.78	3619718.09	85899.64	4.50	HF29	41645.06	594615.19	58413.84	6.38
HF10	121419.78	2419413.18	78419.43	4.86	HF30	48143.17	670174.52	72182.19	6.49
HF11	37117.34	596316.11	41217.13	5.82	HF31	67154.62	882446.93	72516.46	7.03
HF12	41416.22	763166.03	86774.31	4.87	HF32	49416.43	826554.54	72613.16	5.50
HF13	532476.87	5476298.54	161731.47	9.44	HF33	51321.07	702651.12	68143.51	6.66
HF14	46341.15	798734.54	60395.67	5.39	HF34	49416.12	631513.14	58614.76	7.16
HF15	187046.477	24753247.92	4650357.17	0.64	HF35	69142.74	978143.5	164548.42	6.05
HF16	48114.48	691413.82	37517.61	6.60	HF36	617448.89	11913768.02	1117613.47	4.74
HF17	342166.24	5611412	833413.21	5.31	HF37	378356.74	4124986.43	897634.78	7.53
HF18	39566.12	795504.3	65789.25	4.59	HF38	38,149.35	592114.00	96114.66	5.54
HF19	238317.47	4917612.2	876653.12	4.11	Total	5494158.68	145356344	19666580.2	3.33
HF20	59381.02	896233.4	213413.56	5.35					

Table 4: Distribution of pharmaceutical wastage in the Wallaga Zone's public health facilities, 2016EFY

Code	budget wasted	Received	Beginning	%	Code	budget wasted	Received	Beginning	%
HF1	11899.01	28396757	1432432.78	0.04	HF21	39193.76	696317.91	40346.26	5.32
HF2	191774.03	6172907.4	199859	3.01	HF22	194457.03	3812491.3	918313.57	4.11
HF 3	374894.39	8207292.5	1736869.67	3.77	HF23	92413.72	1341611.3	714617.81	4.49
HF4	101430.26	3200780.3	120140.89	3.05	HF24	62713.13	2913372.5	516112.22	1.83
HF5	262162.12	10002398	1557369.47	2.27	HF25	91413.72	2561714.5	49613.72	3.50
HF6	397059.78	24263277	3650866	1.42	HF26	48413.43	711213.42	85413.16	6.08
HF7	234219.49	11154207	1364081.51	1.87	HF27	39413.41	912613.18	69618.26	4.01
HF8	38116.42	712318.3	40652.31	5.06	HF28	35161.22	943114.25	96176.13	3.38
HF9	157449.66	5131317.8	81314.33	3.02	HF29	38719.25	618451.78	67681.16	5.64
HF10	153891.04	3678998.1	163681.11	4.00	HF30	39617.58	715814.12	112814.62	4.78
HF11	28116.18	621418.07	39113.22	4.26	HF31	54243.55	916718.06	112114.34	5.27
HF12	34116.96	813996.24	54213.27	3.93	HF32	47117.54	903415.17	216123.13	4.21
HF13	396431.54	8775862.9	2619418.34	3.48	HF33	49143.25	768164.18	162543.48	5.28
HF14	41930.31	830696.78	63504.72	4.69	HF34	51416.13	711713.12	69554.88	6.58
HF15	75795.67	33464419	5277803.715	0.20	HF35	61716.43	1216113.3	317416.26	4.02
HF16	46262.63	996451.78	37517.61	4.47	HF36	411576.2	15674268	2334515.6	2.29
HF17	467113.67	7217312.6	976418.13	5.70	HF37	285934.34	4897423.8	1234564.89	4.66
HF18	41913.75	829652.78	70394.03	4.66	HF38	31515.53	535614.78	52413.16	5.36
HF19	198163.26	6312511.3	1121413.3	2.67	Total	5006859.62	202745333	28176520.56	2.17
HF20	79940.23	1112613.5	399504.5	5.29					

5.3. Types of Commonly wasted pharmaceuticals

Out of the monetary value of pharmaceutical wastage (17099313.11 ETB), medicinal, laboratory reagents, and medical supplies wastage accounted for 9,637,416.23ETB (56%), 4,168,925.41ETB (24%), and 3,292,971.47 ETB (20%), respectively (see fig. 4).

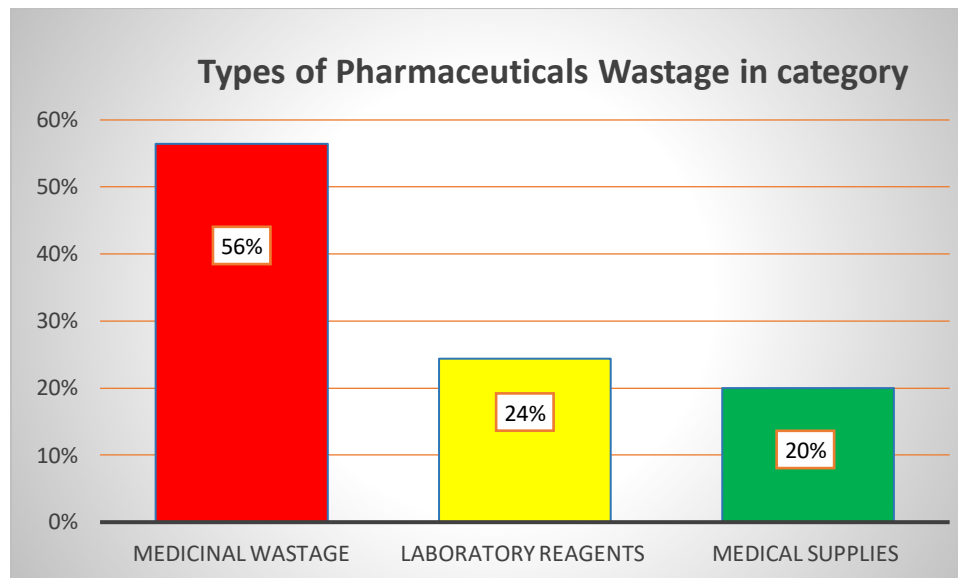


Figure 4: Pharmaceutical wastage in category in Wallaga Zone's health facilities, 2014-2016EFY

5.3.1. Medicine wastage

All types of wasted medicines, including classes, dosage forms, and sources, have been assessed based on their value.

5.3.1.1. Classes of wasted medicine

During the period of EFY 2014 to 2016, a total of ninety seven types of wasted medicines were recorded across all assessed health facilities. The most significant wasted therapeutic class in terms of monetary value was anti-infective, accounting for 2,602,102.38 ETB (27%). Other commonly wasted classes of medicine were anesthesia medicines: 1,734,734.92 ETB (18%), gastrointestinal drugs: 1,252,864.10 ETB (13%), central nervous system medications: 963,741.62 ETB (10%), and blood products/anti-anemic drugs: 674,619.14 ETB (7%) (See table 5).

Table 5: Estimated value of medicines wastage by classes in Wallaga Zone's health facilities, 2014-2016EFY

S/No	Classes of medicines	Value of wasted medicines (ETB)	% (From total wastage)
1	Anti-infective	2,602,102.38	27%
2	Anesthesia medicine	1,734,734.92	18%
3	Gastrointestinal	1,252,864.10	13%
4	Central nervous system	963,741.62	10%
5	Blood products/ Anti anemic	674,619.14	7%
6	Water, electrolyte and acid-base balance correcting	578,244.97	6%
7	Respiratory	481,870.81	5%
8	Musculoskeletal	385,496.65	4%
9	Vitamins	289,122.49	3%
10	Ear-Nose- Throat preparations	240,935.40	2.50%
11	Dermatological agents	192,748.32	2%
12	Immunological preparation	144,561.24	1.50%
13	Ophthalmic agents	96,374.16	1%
Total		9,637,416.23	100%

Out of wasted medicines: Gentamycin 1367416ETB (14%), meropenem: 1173624 ETB (12.20%) and Fluconazole 835154 ETB (8.67%) were three most common wasted drugs (see table 6).

Table 6: Distribution of top ten medicinal wastage in Wallaga Zone's public health facilities, 2014-2016EFY

s/no	Description of Wasted Medicines in Generic Name	Value in ETB	% (From total wastage)
1	Gentamycin - 40mg/ml in 2ml Injection	1367416	14
2	Meropenem -1gm injection	1173624	12.2
3	Fluconazole - 200mg – Tablet	835154	8.67
4	Miconazole - 2% - Oral Gel	758352	7.86
5	Acyclovir - 500mg - injection with Diluent	671825	6.97
6	Phenytoin Sodium - 50mg - Tablet	609532	6.30
7	Chlorpromazine Hydrochloride - 25mg - Tablet	511269	5.30
8	Oral Rehydration Salt -	396149	4.10
9	Atropine Sulfate - 1% - Eye Drop	273476	2.85
10	Clotrimazole - 1% - Cream	203721	2.11

5.3.1.2. Medicines wastage by dosage form

All dosage forms of pharmaceutical wastage had been identified in the studied health facilities. Injection dosage forms accounted for 2,794,850.70 ETB (29%) of the total value of wasted pharmaceuticals, followed by tablet dosage forms 2,602,102.3 ETB (27%) and powder dosage forms 1,734,734.92 ETB (18%). Capsule and ointment dosage forms accounted for 1,349,238.28 ETB (14%) and 385,496.64ETB (4%), respectively. (See Table 7).

Table 7: Frequency and estimated value of medicines wastage by dosage forms in Wallaga Zone's public health facilities, 2014-2016EFY

S/No	Dosage Forms	Value	% (From total wastage)
1	Injection	2,794,850.70	29
2	Tablet	2,602,102.38	27
3	Powder	1,734,734.92	18
4	Capsule	1,349,238.28	14
5	Ointment	385,496.64	4
6	Suspension	192,748.32	2
7	Syrup	192,748.32	2
8	Lotion	144,561.24	2
9	Gels	96,374.16	1
10	Sachets	77,099.33	0.8
11	Cream	67,461.91	0.7
Total		9,637,416.23	100

5.3.2. Laboratory reagents wastage

Out of laboratory reagents, wastage was 4,168,925.41 ETB (24%): acetone alcohol, serology-hepatitis C antibody test, and Salmonella Typhi "H" + Salmonella Typhi "O" antigen test, 424,966 ETB (10.10%), 415132 ETB (9.95%), and 384256 ETB (9.20%) were the three commonly wasted laboratory reagents, respectively (see table 8).

Table 8: Distribution of most common Laboratory reagents wastage in Wallaga Zone's health facilities, 2014-2016EFY

s/no	Description of Wasted Laboratory reagents	Value in ETB	% (From total wastage)
1	Acetone Alcohol	424966	10.1
2	Hepatitis C Antibody	415132	9.95
3	Salmonella Typhi "H" + Salmonella Typhi "O" Antigen	384256	9.20
4	Immersion Oil	321725	7.70
5	Methanol Absolute Acetone	252421	6
6	Proteus OX-19 (weil-felix) Antigen	178961	4.2
7	Gram's Iodine	151634	3.6
8	Gentian Violet	124741	2.99
9	Filter Paper Qual	98279	2.35
10	Anti-A, Anti-B, Anti-D Monoclonal Antibody	74679	1.79

5.3.3. Medical supplies wastage

Out of wasted medical supplies, 3,292,971.47 ETB (20%): catgut chromic, plaster of Paris, and oxygen face masks for adults were three common wasted medical supplies, 391,674 ETB (11.90%), 347,142 ETB (10.50%), and 274695 ETB (8.30%), respectively (see Table 9).

Table 9: Distribution of most common Medical supplies wastage in Wallaga Zone's health facilities, 2014-2016EFY

s/no	Description of Wasted Medical supplies	Value in ETB	% (From total wastage)
1	Cat Gut Chromic	391674	11.90
2	Plaster Of Paris	347142	10.50
3	Oxygen Face Mask	274695	8.30
4	Mersilk Braided Black	261721	7.90
5	Surgical Scalpel Blade	237487	7.20
6	Polyglycolic Acid	178489	5.40
7	Glove Examination Latex	154391	4.60
8	Syringe Insulin	127278	3.80
9	Mask N95	81498	2.70
10	Catheter Suction	74147	2.20

5.4. Reason of pharmaceutical wastage

Pharmaceuticals were found to be wasted due to expiration, damage, or being obsolete (off the market before their expiry date). In the present study, about 16789045 ETB (98.2%) of the total value of wasted pharmaceuticals was due to expiration. The overall cost of damaged/deteriorated pharmaceuticals and obsolete pharmaceuticals in the same period was 205191.7573 ETB (1.2%) and 105076.3527 ETB (0.6%), respectively. None of the studied health facilities documented pharmaceutical theft and pilferage (refer to Figure 5).



Figure 5: Reason of pharmaceutical wastage rate in Wallaga Zone's health facilities, 2014-2016EFY

5.5. Health care professionals Perception on the presence of pharmaceutical wastage

About 65(30.8%) and 77(36.5%) respondents were strongly agreed and agreed respectively that there was pharmaceutical wastage due to expiration in their facility, while only 14(6.6%) and 32(15.2%) respondents were strongly disagreed and disagreed respectively, with a mean score of 3.7 and a standard deviation of 1.24. Additionally, about 52(24.6%) and 72(34.1%), respondents were strongly agreed and agreed respectively, the presence of pharmaceutical wastage due to damage and around 23(10.9%) and 26(12.3) respondents were disagreed and strongly disagreed respectively, resulting in a mean score of 3.49 and a standard deviation of 1.28 . Furthermore, 58(27.5%) and 70(33.2%) of the respondents were strongly agreed and agreed respectively that there was pharmaceutical wastage due to obsolete in their facility, while only 19(9%) and 31(14.7%) respondents were strongly disagreed and disagreed respectively, with a mean score of 3.55 and a standard deviation of 1.28 (see table 10).

Table 10: Distribution of Health care professionals Perception on the presence of pharmaceutical

No	Pharmaceutical wastage	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	SD
1	Do you think your facility experiences a high rate of pharmaceutical wastage due to expiration?	14(6.6)	32(15.2)	23(10.9)	77(36.5)	65(30.8)	3.7	1.239
2	Do you think your facility experiences a high rate of pharmaceutical wastage due to damage?	23(10.9)	26(12.3)	38(18)	72(34.1)	52(24.6)	3.49	1.285
3	Do you think your facility experiences a high rate of pharmaceutical wastage due to obsolete?	19(9)	31(14.7)	33(15.6)	70(33.2)	58(27.5)	3.55	1.28

wastage in Wallaga Zone's health facilities, 2014-2016EFY

5.6. Health care professionals perception on the contributing factors of pharmaceutical wastage

Health professionals involved in DTC and medicines supply management activities were asked for their feelings about factors contributing to pharmaceutical wastage at their facilities using 5 point likert scale. The factors which had the highest mean score and thus showed the most commonly perceived factors contributing to pharmaceutical wastage by health professionals were Weak health commodity management information system (3.7 ± 1.2), Poor storage condition (3.64 ± 1.43), Poor supply chain management (3.62 ± 1.5) (mean $\pm$ SD), Drug shelf life (3.43 ± 1.41), Poor inventory management (3.32 ± 1.52) and Poor Guideline & Policy changes and Facility practice (3.30 ± 1.30). Similarly, about 92 (43.6%) of the respondents strongly agreed, and 43 (20.4%) agreed that poor supply chain management is a contributing factor to pharmaceutical wastage. Additionally, 62 (29.4%) of the respondents strongly agreed, while 64 (30.3%) agreed that poor inventory management contributes to pharmaceutical wastage. Furthermore, 52 (24.6%) of the respondents strongly agreed, and 83 (39.3%) agreed that poor storage conditions are contributing factors to pharmaceutical wastage (see table 11 and annex 2)

Table 11: Distribution of Health care professionals perception on the contributing factors of pharmaceutical wastage in Wallaga Zone's health facilities, 2014-2016EFY

No	Contributing factors	SD (%)	D (%)	N (%)	A (%)	SA (%)	G.Me an	SD
1	Poor supply chain management	38(18)	20(9.5)	18(8.5)	43(20.4)	92(43.6)	3.62	1.54
2	Drug shelf life	35(16.6)	18(8.5)	41(19.4)	55(26.1)	62(29.4)	3.43	1.41
3	Weak health commodity management information system	15(7.1)	23(10.9)	35(16.6)	72(34.1)	66(31.3)	3.7	1.2
4	Poor inventory management	43(20.4)	25(11.8)	17(8.1)	62(29.4)	64(30.3)	3.37	1.52
5	Poor storage condition	25(11.8)	32(15.2)	19(9)	52(24.6)	83(39.3)	3.64	1.43
6	Poor Guideline & Policy changes and Facility practice	35(16.6)	18(8.5)	39(18.5)	85(40.3)	34(16.1)	3.30	1.30

5.7. Assumption of linear regression

5.7.1. Normality test

Normality distribution of data was analyzed and shapiro-wilk p-value ($p > 0.05$) and histogram graph indicated data was normally distributed that showed the assumption is satisfied (see table 12)

Table 12: Data normality test in Wallaga Zone's health facilities, 2014-2016EFY

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Studentized Residual	.038	211	.200*	.995	211	.709

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

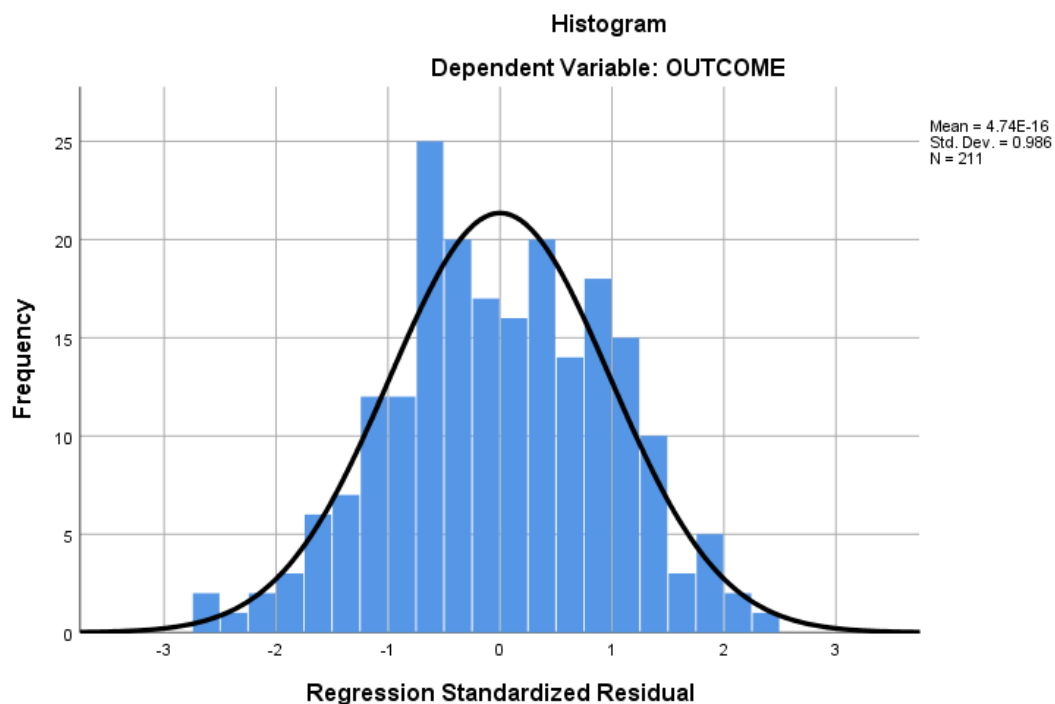


Figure 6: Histogram data normality test assumption in Wallaga Zone's health facilities, 2014-2016EFY

5.7.2. Linearity test

The relationship between the dependent variable and the independent variable is linear, as indicated by the normal P-P plot, which shows no deviation from the 45-degree line that showed the assumption is satisfied (see Fig.7).

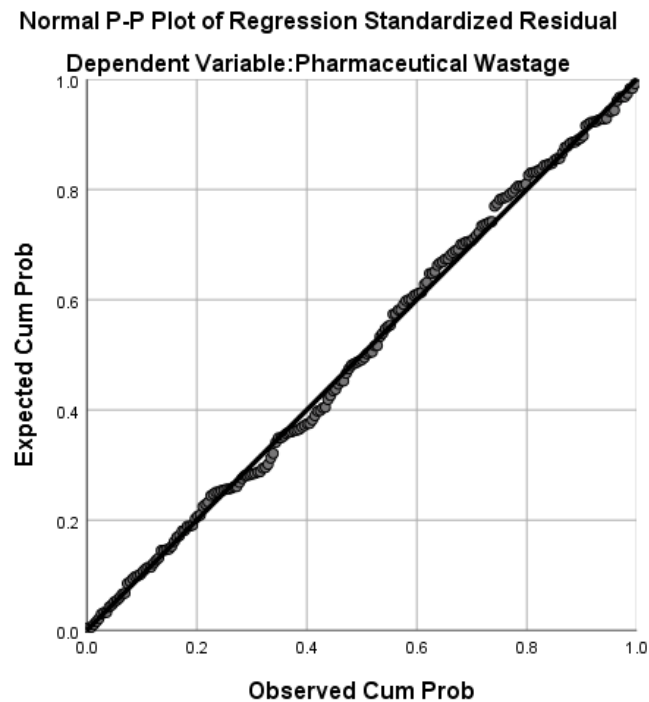


Figure 7: Normality P-P plot assumption in to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY

5.7.3. Multicollinearity test

Data was analyzed to detect collinearities between independent variables those can be contributing factors of pharmaceutical wastage and multicollinearity test revealed that the collinearity between independent variable is found in acceptable range ($VIF < 10$) which showed the assumption is satisfied (see table 13)

Table 13: Multicollinearity test assumption to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY

Variables	Tolerance	VIF
Poor supply chain management	0.700	1.429
Drug shelf life	0.730	1.371
Weak health commodity management information system	0.724	1.381
Poor inventory management	0.787	1.270
Poor storage condition	0.598	1.671
Poor Guideline & Policy changes and Facility practice	0.642	1.557

5.7.4. Correlations test

The correlation analysis revealed statistically significant and positive relationships among all independent variables; poor supply chain management, poor inventory management, poor storage condition and pharmaceutical wastage variable. The moderate correlation was observed between poor supply chain management and pharmaceutical wastage variable ($r = 0.584$, $p < 0.01$), indicating that effective supply chain management play a crucial role in the successful reduce pharmaceutical wastage. Also poor inventory management and poor storage condition also showed moderate correlations with the pharmaceutical wastage ($r = 0.572$ and $r = 0.554$ respectively), suggesting their meaningful contribution. However, poor guideline & policy changes and facility practice, weak health commodity management information system and drug shelf life had low degree correlation with pharmaceutical wastage ($r = 0.415$ and $r = 0.300$ and 0.293 respectively, p -value of all contributing factors were < 0.01). Furthermore, inter-correlations among the independent variables were also significant but within acceptable limits, with no indication of severe multicollinearity, as confirmed by collinearity statistics (see table 14).

Table 14: Correlation test assumption to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY

		Correlations						
		Pharmaceutical Wastage	Poor supply chain management	Poor storage condition	Poor Guideline & Policy changes and Facility practice	Poor inventory management	Drug shelf life	Weak health commodity management information system
Pharmaceutical Wastage	Pearson Correlation	1						
Poor supply chain management	Pearson Correlation	.584**	1					
Poor storage condition	Pearson Correlation	.554**	.513**	1				
Poor Guideline & Policy changes and Facility practice	Pearson Correlation	.415**	.347**	.473**	1			
Poor inventory management	Pearson Correlation	.572**	.326**	.354**	.399**	1		
Drug shelf life	Pearson Correlation	.293**	.271**	.366**	.395**	.203**	1	
Weak health commodity management information system	Pearson Correlation	.300**	.290**	.375**	.392**	.184**	.438**	1

**. Correlation is significant at the 0.01 level (2-tailed).

5.7.5. Autocorrelation

Durbin-Watson indicated there is no relationship between residual variables and independent variable that showed the assumption is satisfied (see table 15).

Table 15: Autocorrelation test assumption to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.743 ^a	0.551	0.538	0.53652	2.076

a. Predictors: (Constant), Poor Guideline & Policy changes and Facility practice, poor inventory management, poor supply chain management, Weak health commodity management information system, Drug shelf life, poor storage condition

b. Dependent Variable: pharmaceutical wastage

5.7.6. Outlier

There were no circle at either end of the box plot this indicated there is no outlier (see fig.8).

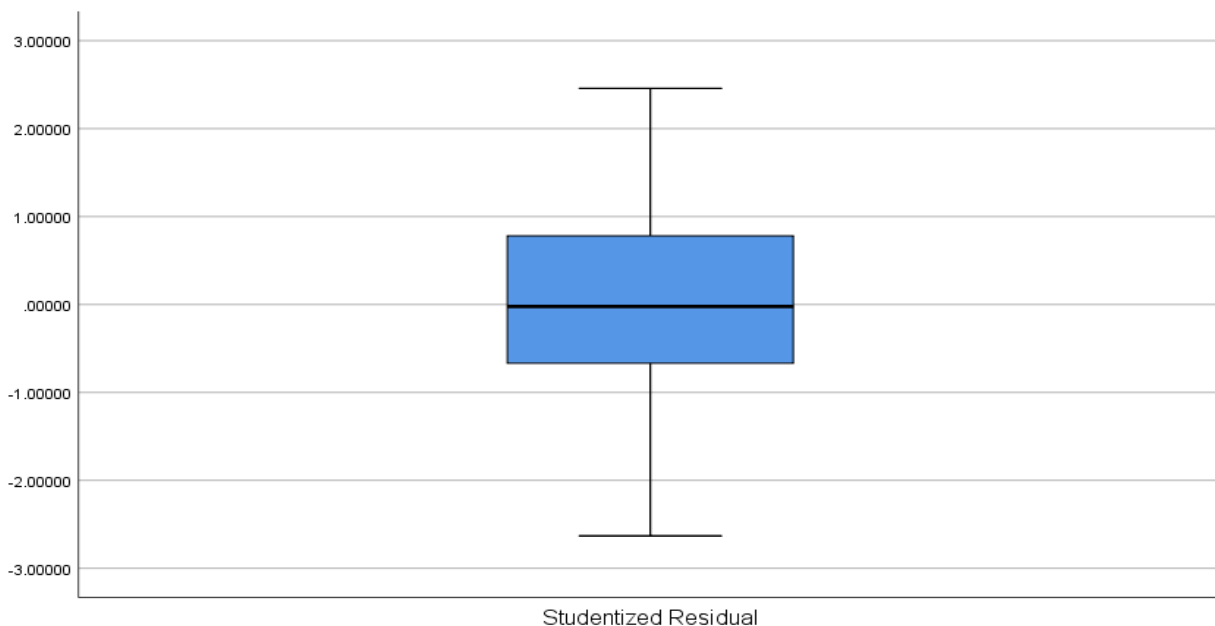


Figure 8: Outlier data assumption test to assess pharmaceutical wastage and contributing factors in Wallaga Zone's health facilities, 2014-2016EFY

5.7.7. Model fitness

ANOVA table indicated $p\text{-value} < 0.001$ this showed that model is fit (see table 16).

Table 16: Model fitness test to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	72.184	6	12.031	41.795	0.000 ^b
	Residual	58.721	204	0.288		
	Total	130.906	210			

a. Dependent Variable: pharmaceutical wastage

b. Predictors: (Constant), Predictors: (Constant), Poor Guideline & Policy changes and Facility practice, poor inventory management, poor supply chain management, Weak health commodity management information system, Drug shelf life, poor storage condition

5.7.8. Homoscedastic assumption

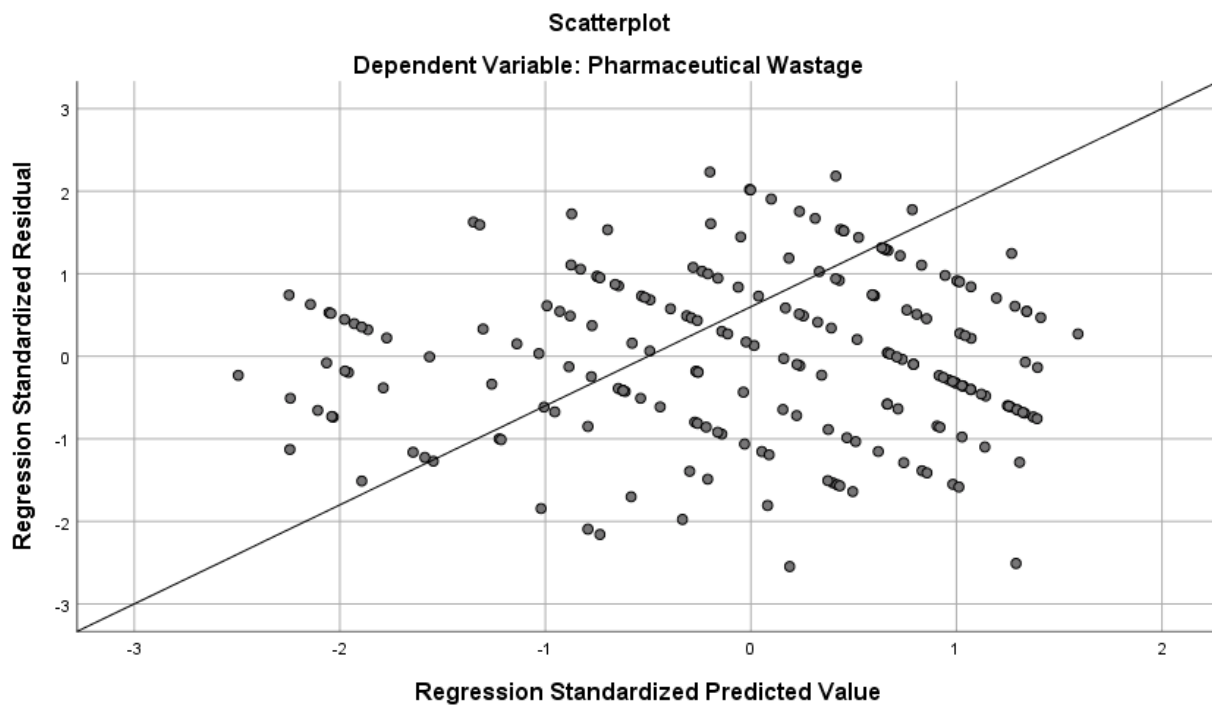


Figure 9: Homoscedacity test assumption to assess pharmaceutical wastage contributing factors in Wallaga Zone's health facilities, 2014-2016EFY

5.8. Multiple linear regressions of contributing factors for Pharmaceutical wastage

5.8.1. Hypotheses test results

After analyzing the assumption of linear regression, multiple linear regressions were carried out to identify contributing factors of pharmaceutical wastage at selected public health facilities, including poor supply chain management, drug shelf life, Weak health commodity management information system, poor inventory management, poor storage condition and poor guideline & policy changes were analyzed. The hypothesis was tested using multivariate linear regression.

H1: Poor storage conditions, have a significant relationship with pharmaceutical wastage:

This revealed that Poor storage condition had positive effect on pharmaceutical wastage at beta coefficients $\beta=0.13$ and $p=0.000$ (95% CI, 0.059-0.193). The null hypothesis is rejected.

H2: poor inventory management practices, positively affect pharmaceutical wastage:

poor inventory management had positive effect on pharmaceutical wastage with beta coefficients $\beta=0.191$ and $p=0.000$ (95% CI, 0.136-0.245).The null hypothesis is rejected.

H3: poor supply chain management positive effect pharmaceutical wastage

poor supply chain management had positive effect on pharmaceutical wastage with beta coefficients $\beta=0.188$ and $p=0.000$ (95% CI, 0.124-0.252).The null hypothesis is rejected (see table 17)

Table 17: Multiple linear regression for pharmaceutical contributing factors in Wallaga Zone's health facilities, 2014-2016EFY

		Coefficients ^a						
		Unstandardized Coefficients		Standardized Coefficients			95.0% CI for β	
Model		β	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	1.607	0.166		9.663	0.000	1.280	1.935
	Weak health commodity management information system	0.027	0.045	0.033	0.595	0.553	-0.062	0.115
	Poor supply chain management	0.188	0.032	0.325	5.788	0.000* **	0.124	0.252
	Poor storage condition	0.126	0.034	0.224	3.696	0.000* **	0.059	0.193
	Poor Guideline & Policy changes and Facility practice	0.020	0.041	0.029	.488	0.626	-0.061	0.101
	Poor inventory management	0.191	0.028	0.365	6.912	0.000* **	0.136	0.245
	Drug shelf life	0.016	0.038	0.024	.430	0.668	-0.059	0.092

*** very highly significant

Dependent variables: pharmaceutical wastage

The contributing factors with greatest beta value indicate the influence of variables on the dependent variable. The regression analysis formula with Beta coefficients is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + e$$

$Y = 1.6 + (0.325) \text{ Poor supply chain management} + (0.224) \text{ Poor storage condition} + (0.365) \text{ Poor inventory management} + (0.05) e$

When all variables set to zero (constant) the value of pharmaceutical wastage becomes 1.6, according to the above model (table 17). When other factors are held constant, a unit increase in Poor supply chain management determinants results in 0.188 increase in pharmaceutical wastage

And a unit increase in Poor storage condition result in 0.126 increase in pharmaceutical wastage, also a unit increase in Poor inventory results in 0.191 increase in pharmaceutical wastage

Indicating that these three contributing factors have a significant impact on pharmaceutical wastage. But Poor Guideline & Policy changes and Facility practice, Weak health commodity management information system and Drug shelf life have least impact on pharmaceutical wastage and they are excluded.

5.9. Qualitative Themes

In-depth interviews were conducted with the chief executives of the public health facilities, PHCUD and pharmacy case teams (seventeen). Except for one, all of the major informants were male. The majority of them were between 30 and 35 years old (33.9 ± 4.85) and held a bachelor's degree. The respondents' job experience ranged from 4 to 13 years (8.11 ± 2.9). In-depth interviews were performed to acquire information regarding the existing state of pharmaceutical wastage in their facilities, causes that lead to pharmaceutical wastage, the impact of pharmaceutical wastage on service delivery, and suggestions for improving pharmaceutical wastage (see table 18).

Table 18: Distribution of Sociodemographic characteristics of key informants in to assess pharmaceutical wastage in Wallaga Zone's health facilities, 2014-2016EFY

variables	Category	Number	Percentage
	26-30	3	17.6
	31-35	8	47.1
	36-40	4	23.5
	41-45	2	11.8
Mean age	33.9		
SD age	4.85		
sex	Male	16	94.1
	Female	1	5.9
Profession	Pharmacy	7	41.2
	CEO	5	29.4
	PHCUD	5	29.4
Work experience	1-5	2	11.8
	6-10	13	76.4
	11-15	2	11.8
Mean experience	8.11		
SD experience	2.9		

5.9.1. Thematic area

- ❖ Status of Pharmaceutical wastage
- ❖ Contributing factors of pharmaceutical wastage
- ❖ Effect of Pharmaceutical wastage
- ❖ Efforts made to prevent/reduce Pharmaceutical wastage

5.9.1.1. Status of Pharmaceutical wastage

Almost key informants agreed that pharmaceutical waste is a concern at their facility. Furthermore, they believed that it was declining over time. However, they agreed that it exceeds the national target (2%). Wastage was not only due to medicine wastage but also laboratory chemicals, reagents, and medical supplies were contributed to the pharmaceutical wastage within their health facilities.

One pharmacist respondents said that:

"There is significant wastage of pharmaceuticals in our health facility. This wastage is not only expired medications but also those that are damaged due to accidents, forgotten in storage, or destroyed by different chemical. Additionally, laboratory chemicals, reagents, and medical supplies contribute to the pharmaceutical wastage within our health facility."

A chief executive hospital also supported the above idea:

"Pharmaceutical wastage can be explained in various ways within our hospital. In the past, when we procured medicines, reagent and medical supply with hospital budget or NGO supply we assumed it would last for an extended period or it could be for disease outbreaks but they were wasted in our facility."

Another chief executive hospital also said that:

Currently, pharmaceutical wastage management in our hospital is in good condition. However, in past, particularly due to the COVID-19 outbreak, there was significant wastage of medical supplies such as face masks, surgical gloves, and examination gloves that procured in large quantities through EPSS."

Another chief executive hospital also explained the pharmaceutical wastage:

"Over the past two years, our hospital has experienced pharmaceutical wastage. While this year has seen a reduction compared to the previous year; the wastage is still above the standards that set by the World Health Organization."

5.9.1.2. Contributing factors of pharmaceutical wastage

The key informants identified several contributing factors to pharmaceutical wastage in their facilities. The key informants mentioned poor storage conditions, the provision of medicines without need or requisition, the lack of an electronic stock management tool, the absence of functional DTC, a lack of communication between the EPSS, a lack of storage room and health facilities, insufficient pharmacy personnel, near expire pharmaceutical wastage and a weak monitoring system for pharmaceutical wastage.

One CEO hospital stated his idea on the pharmaceutical wastage:

“Previously, pharmaceutical materials were damaged due to poor storage condition and medicines that require refrigeration were wasted due to inadequate refrigeration. Recently, we have constructed a standard storehouse with sufficient space to store pharmaceutical materials properly...”

A primary health care unit director said that:

“One of the primary reasons for medicine wastage in our health centers is overstocking, which often arises from procurement practices that do not reflect the actual needs of our facility. Additionally, some pharmaceutical supply were received as donations exceed our requirements, and there were even items that we do not utilize in our Health center. Furthermore, chemicals and reagents often have short expiries and are wasted in our hands before we can use them. On another hand, during the COVID-19 outbreak, our health center received an influx of medical supplies—both through purchases and donations—which has resulted in significant wastage since the outbreak subsided.”

Another primary health care unit director said that:

“According to our facility, the drug and therapeutic committee responsible for overseeing the procurement and storage of medications is ineffective, leading to increased wastage due to insufficient monitoring. Additionally, while our health center maintains an essential drug list, it is not regularly updated and does not align with the top ten diseases in our area.”

Another pharmacist said that:

“There is often an overload of medicines in our storage and dispensing units due to inadequate forecasting. This results in overstocking and loss of inventory, primarily because lack of actual data; for instance, bin cards are not consistently tracked and updated. There are instances when we purchase medicines, such as laboratory reagents, with less than six months until expiration, which increases the risk of wastage. Furthermore, poor communication with suppliers—such as regional health bureaus, various NGOs, and EPSS—contributes to this issue. They often provide us with more pharmaceutical materials than we can use without consulting us, leading to further wastage.”

Another CEO hospital said that:

“There are occasions when medications that are effective for only a limited number of diseases are purchased in large quantities, leading to wastage. Additionally, many drugs, including medical supplies and laboratory reagents, are often procured solely based on the pharmacist's decision, without consulting other healthcare professionals. Our medicine storage area lacks sufficient shelving, resulting in instances where medications are stacked on top of one another, which can cause damage to the products. Another issue is the wastage of medicines in our dispensary unit. Furthermore, our store house contains obsolete pharmaceutical materials due to the excessive quantity of stock we have.”

One CEO hospital said that:

“In recent years, our procurement system has faced challenges, leading to the over-purchase of certain medications and the acquisition of drugs that do not serve our hospital's needs, which has increased our wastage levels. Additionally, we previously lacked the expertise to conduct drug analysis (ABC/VEN analysis), resulting in inadequate drug management and further contributing to wastage. At our hospital there was a noticeable gap in basic knowledge among staff regarding effective strategies to reduce pharmaceutical wastage, making it difficult to address the issue effectively.”

Another CEO hospital mentioned:

“Another issue concerning laboratory reagents and chemicals is that our laboratory equipment has been out of service for various reasons, resulting in significant reagent wastage. Additionally, many medical supplies were wasted because they were not used appropriately after being allocated

to different wards. On the other hand, our hospital faced challenges in regularly tracking and updating the BIN card, which led to the discovery of expired medicines in the store house. Furthermore, some medications were purchased and subsequently forgotten in the store house for extended periods.”

One PHCUD said that:

“Contributing factor is that during outbreaks, pharmaceutical materials are purchased in large quantities, but once the outbreak is under control, these drugs often have no further use. Furthermore, due to the overwhelming number of medicines in the pharmacy, they are sometimes released without adhering to FIFO (First In, First Out) or FEFO (First Expiry, First Out) guidelines, leading to some medicines being forgotten and ultimately wasted.”

5.9.1.3. Impact of Pharmaceutical wastage

Key informants expressed their ideas on pharmaceutical wastage impact and they pointed pharmaceutical wastage could brought service delivery interruption, decrease patient satisfaction, economic loss and also wasted material can affect the environment that could be a problem for the health of the community.

One Hospital CEO mentioned that:

“The wastage of pharmaceutical has become a significant issue in our service delivery. Our pharmaceutical budget is allocated through the regional health bureau, and when we experience wastage, it leads to serious financial problems. This situation also exposes us to additional costs that include cost of the disposing wastage medicine.”

Another hospital CEO said that:

“Pharmaceutical waste has posed a significant challenge to our service delivery. For instance, unnecessary medications have been purchased, leading to patient complaints about the lack of essential medicines. Additionally, patients have expressed dissatisfaction with our laboratory services, following inadequate testing due to the wastage of many reagents resulting from the malfunction of certain laboratory equipment.”

5.9.1.4. Efforts made to prevent/reduce Pharmaceutical wastage

In different health facilities different efforts has been tried to minimize pharmaceutical wastage. Like revitalized drug therapeutic committee, implementing FEFO (First Expiry, First Out) principle, raising awareness among various support agencies about the importance of not supplying unnecessary medications to and providing training for the staffs.

One PHCUD said that:

“To minimize pharmaceutical wastage, we have initiated discussions with our staff at the health center. When these discussions have not yielded satisfactory results, we have held additional meetings to enhance our inventory management system. At times, we have collectively agreed to refrain from purchasing and supplying medicines that are not essential to our health center. We have also revitalized our drug therapeutic committee to ensure that only necessary pharmaceuticals are procured. Additionally, we have begun monitoring the release of pharmaceutical from our store houses in accordance with the FEFO (First Expiry, First Out) rule. Furthermore, we are raising awareness among our health professionals to encourage rational prescribing practices.

One Hospital CEO said that:

“To minimize this wastage, we are transferring infrequently used medications to other hospitals or health facilities. We are also revitalizing our previously ineffective Drug Therapeutic Committee (DTC) by meeting every two weeks to discuss strategies for reducing medicine waste. Additionally, we are working to raise awareness among various support agencies about the importance of not supplying unnecessary medications to our hospitals and are providing various training opportunities to support this effort.”

Another CEO said that:

“At our hospital, significant efforts have been made to eliminate pharmaceutical wastage. One of the key initiatives involved assigning additional experts in consultation with the regional Health Bureau to address the shortage of expertise. Furthermore, we have worked to enhance the professional capacity of our staff. Additionally, the storage of pharmaceutical in our hospital has been standardized and optimized to improve efficiency.”

The key informant participants recommended as every one play is role to reduce pharmaceutical wastage. And they encouraged having strong DTC committee and conduct inventory regularly the pharmaceutical supplies in the facilities and also suppliers should minimize suppling of near expire pharmaceutical supply.

One PHCUD said that:

“Everyone has a role to play in preventing Pharmaceutical wastage. The drug therapeutic committee must be diligent in their efforts within the health center. Additionally, Pharmaceutical should be inventoried regularly to ensure that they are not overlooked in the store.”

Another CEO said that:

“In the future, I believe that pharmaceutical organizations, including EPSS, should ensure they do not supply us with expired medications. Additionally, it is essential to hold the Drug Therapeutic Committee (DTC) in the hospital accountable, ensuring that they work responsibly and take action against those who fail to fulfill their duties.

6. Discussion

This study is aimed to assess the extent of pharmaceutical wastage, commonly wasted pharmaceutical and identify the contributing factors public health facilities. This study was revealed 3.15% which ranged (0.05%-7.4%) of pharmaceutical wastage which is more than 2% that targeted by HSDP IV.

In this study, pharmaceutical wastage rate was lower than other studies that conducted in other parts of the country: public health facilities in Dessie (3.68%), teaching hospitals in Addis Ababa (4.8%), the Hadiya Zone study (5.24%), South Gondar Zone (6.3%), and South West Shoa Zone (7.5%)(4, 5, 8, 47). This discrepancy might be attributed to enhancements and implementation of various stock management interventions. Such as: electronic inventory management systems, Auditable Pharmaceutical Transactions and Services (APTS), and the Integrated Pharmaceutical Logistics System (IPLS). As the result, relatively lower pharmaceutical wastage rate was observed in the current study.

However, it is slightly higher than the results of Tikur Anbessa Specialized Hospital (2.86%) and Dire Dawa study (3.07%)(14, 52). These variations might be due to differences in the number and levels of health facilities included in the assessment. While the previous study only focused on medicine wastage, this study covered a wider scope of pharmaceutical wastage, including medicines, laboratory reagents, and medical supplies. As the result slightly wastage rate was observed in this study.

This finding was also greater than the findings of the study conducted in Serbia, Kabul, Nigeria, Tanzania, Egypt, and Jordan. (6, 11, 23, 53-57). This could be attributable to variations in disease prevalence (morbidity) among countries and types of services provided by health facilities.

The present study revealed that the most common pharmaceutical wastage was medicine wastage 9,637,416.23ETB(56%). From wasted medicines anti-infective, anesthesia medicine, and gastrointestinal drugs, were the most commonly wasted class of medicine. Out of the total value of wasted medicines, about 2,602,102.38 ETB (27%) was anti-infective. This finding was in line with the result from Southwest Shoa, South Gondar Zone, Dessie ,Hadiya zone and Tanzania, (4, 5, 8, 47). This is because anti-infective are the most commonly prescribed class of medicines in Ethiopia, and infectious diseases are the leading cause of morbidity and mortality in developing

countries including Ethiopia. The present study finding is not identical to study that indicated the main wasted pharmaceutical class in the UK were gastrointestinal medicines (58). This disparity could be attributed to socio-economic status of the countries.

This study show significant amount of medical supplies wastage which accounted for 20% and Catgut Chromic, Plaster Of Paris and Oxygen Face Mask for Adult were three common wasted medical supplies. The finding is less than a study done in public health facilities of Dessie town which accounts 37.1% from total 446 pharmaceutical assessed(8). The discrepancy may be attributed to the larger quantity of pharmaceuticals evaluated in the Dessie Town study.

The study revealed a significant wastage of laboratory reagents, which accounts 24% of the total pharmaceutical expenditure. The three most frequently wasted reagents were acetone alcohol, Hepatitis C antibody rapid test, and Salmonella Typhi "H" + Salmonella Typhi "O" Antigen Rapid Test. This finding is lower than a study done in Jimma zone public hospitals 27.2% and Rwanda 42%(59). This might be due variation in the number as well as the type of health facilities and the duration where the study gets reviewed.

However, this study finding is higher than a study done in Gambella region 12.94% (9). The observed variation between studies may be attributed to differences in sample size and study scope. While the Gambella region study was limited in scale and focused solely on laboratory reagents, the current study included a significantly larger number of public health facilities.

In this study, 98.2% of the sources of pharmaceutical wastage were related to expiration. This finding was in line with the result from the South Gondar Zone and Hadiya (5, 14, 47). This might be attributed to receiving of near expiry pharmaceuticals (<6 month) and over stoking of large number of pharmaceuticals due to improper inventory control management of the public health facilities.

This study finding revealed Poor storage condition had positive effect on pharmaceutical wastage with beta coefficients $\beta=0.13$ and $p=0.000$ (95% CI, 0.059-0.193), and poor supply chain management had positive effect on pharmaceutical wastage with beta coefficients $\beta=0.188$ and $p=0.000$ (95% CI, 0.124-0.252), as well as poor inventory management had positive effect on pharmaceutical wastage with beta coefficients $\beta=0.191$ and $p=0.000$ (95% CI, 0.136-0.245) were statistically significant for contributing factors of pharmaceutical wastage. This finding is in line

with studies that conducted at Dire dawa, south west Shoa and South Gondar Zone in which poor inventory, Poor storage practice and lack of accountability for stock out were reason of medicine wastage (4, 14, 47). This similarity might be due to the poor economic status that affect the storage of pharmaceutical products and lack of functional refrigerator.

This study result consistent with studies that conducted in South Africa, where poor inventory was contributing factors of pharmaceutical wastage and Rwanda where Supply chain management and Poor storage were contributing factors of pharmaceutical wastage (60-62). It might be due to inadequate training and Poor communication and coordination with key stakeholders in developing countries like Ethiopia.

This finding differs from the study conducted in Tanzania, where overstocking and pilferage were the top two Contributing factors to medicine wastage(6). This disparity could be attributed to the facilities' usage of different supply chain and inventory management systems.

The majority of the key informants in the current study agreed that pharmaceutical wastage is a problem at their facilities. Furthermore, they believed that it was declining over time. However, they agreed that it exceeds the national goal.

The key informants identified several contributing factors to pharmaceutical wastage in their facilities. The key informants mentioned poor storage conditions, the provision of medicines without need or requisition, the absence of functional DTC, a lack of communication between the EPSS, a lack of storage room and health facilities, insufficient pharmacy personnel, near expire pharmaceutical wastage and a weak monitoring system for pharmaceutical wastage. This is consistent with a study conducted in the South West Shoa zone of Oromia, which found that inadequate quantification processes and donors supply huge quantities of pharmaceuticals without assessing facility needs that lead to significant amounts of pharmaceutical wastage.(47, 62).

Key informants expressed their ideas on pharmaceutical wastage impact and they pointed pharmaceutical wastage could brought service delivery interruption, decrease patient satisfaction, economic loss and also wasted material can affect the environment that could be a problem for the health of the community. In different health facilities different efforts has been tried to minimize pharmaceutical wastage. Like revitalizing drug therapeutic committee, strengthening FEFO (First

Expiry, First Out) principle, raising awareness among various support agencies about the importance of not supplying unnecessary medications to and providing training for the staffs.

The key informant participants recommended that everyone has to play its role to reduce pharmaceutical wastage. And they encouraged having strong DTC committee and to conduct inventory regularly and also suppliers should minimize supplying of near expiry pharmaceutical. The study in Uganda suggests that many low- and middle-income countries should strengthen public systems for pharmaceutical waste management and improve inventory control and the reliability of procurement forecasts (27).

6.1. Strength of the study

Most previous studies have focused solely on medicinal wastage rather than pharmaceutical wastage as a whole. In contrast, this study evaluates the contributing factors using both qualitative and quantitative methods. Additionally, it identifies key factors influencing pharmaceutical wastage through inferential statistical tests.

6.2. Limitation of study

This study was only conducted at public health facilities (Hospitals and Health centers) in four Wallaga zones, excluding health posts and other relevant stock holders such as EPSS, Zonal and woreda health office due to financial constraints, making it difficult to generalize the results to all public health facilities. The other limitations was reliance on facility records' accuracy and inability to establish causality due to cross-sectional design.

7. Conclusion

Both quantitative and qualitative finding of this study revealed the pharmaceutical wastage rate is higher than acceptable range which is targeted by Health Sector Development Program. In this study the most common pharmaceutical wastage was medicine wastage. From wasted medicine class Anti-infective, Anesthesia medicine and gastrointestinal drugs were common wasted medicine. From Medical supplies Catgut Chromic, Plaster Of Paris and Oxygen Face Mask for adult were three common wasted and Acetone Alcohol, Hepatitis C Antibody rapid Test and Salmonella Typhi "H" + Salmonella Typhi "O" Antigen rapid test were three common wasted laboratory reagents. Almost the sources of pharmaceutical wastage were related to expiration. Variables like Poor inventory management, poor supply chain management and poor storage condition were statistically significant for the contributing factors for the pharmaceutical wastage.

The majority of the key informants in the current study agreed that pharmaceutical wastage is a problem at their facilities. The key informants identified several contributing factors to pharmaceutical wastage in their facilities. The key informants mentioned poor storage conditions, the provision of medicines without need or requisition, the lack of an electronic stock management tool, the absence of functional DTC, a lack of communication between the EPSS, a lack of storage room and health facilities, near expire pharmaceutical wastage and a weak monitoring system for pharmaceutical wastage. In different health facilities different efforts has been tried to minimize pharmaceutical wastage. Like revitalized drug therapeutic committee, implementing FEFO (First Expiry, First Out) principle, raising awareness among various support agencies about the importance of not supplying unnecessary medications to and providing training for the staffs. The key informant participants recommended as every one play is role to reduce pharmaceutical wastage. And they encouraged having strong DTC committee and conduct inventory regularly the pharmaceutical supplies in the facilities and also suppliers should minimize suppling of near expire pharmaceutical supply.

Generally. Pharmaceutical wastage is a significant issue that leads to economic losses, negatively impacts environmental health due to improper disposal, causes service interruptions, and reduces patient satisfaction. Therefore, responsible authorities should prioritize minimizing pharmaceutical wastage at all levels of healthcare facilities.

8. Recommendation

- ❖ All public health facilities should only purchase medicines from their own facility specific medicine lists to avoid purchasing medicines they do not need and that list should be prioritized by VEN and updated annually.
- ❖ All public health facilities should have to revitalize drug therapeutic committee (DTC) to timely address pharmaceutical wastage caused by poor supply chain management, poor inventory management and storage conditions.
- ❖ Regional health bureau and other stake holders should give adequate training for health professionals on how to minimize pharmaceutical wastage.
- ❖ Use of Computerized/ electronic inventory management tools should be strengthened in all public health facilities in order to monitor proper quantification, monitoring of stock levels and expiry dates.
- ❖ Use of standard operating procedures (SOP) for good pharmaceutical storage practice should be strengthened in all public health facilities in order to maintain good storage practice.
- ❖ A strong relationship or a common platform should be developed with key stakeholders (HFs, woreda /zonal health offices, regional health bureau, EFDA, EPSS, and other partners like NGO's) to hold regular discussions on preventive initiatives for pharmaceutical wastage.

Researcher: Similar study should be conducted by incorporating both the nongovernmental and public pharmaceutical supply chains in order to provide an overall picture of the magnitude of expired pharmaceuticals in Ethiopia.

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Annexes

Annex I: Assessment of Medicines Wastage Tools

Background information for health facility

facility Identification	Code Classification	Go To
1.1 Name of the health facility _____		
1.2. Facility Code: _____		
1.3. Type of health facility	Hospital1 Health Center2	
1.4. Level of health facility (if health center)	Type A1 Type B 2	
1.5. When the health facility was established (E.C)? _____		

Section I: Data Abstraction Formats

Instruction:

Communicate with the head pharmacist. Then being guided by store manager, review and take secondary data from the facility pharmaceutical records; such as medicines wastage registration, disposal registration (if wasted medicines were disposed), and Model 19 documents.

1. Data Collection Sheet for Medicines Wastage Value

No.	Question	Year (EFY)		
		2014	2015	2016
3.1	Total Value (in ETB) of Budget Pharmaceuticals Received			
3.2	Value of Budget Pharmaceuticals wasted (in ETB)			
3.3	Value of beginning balance (in ETB)			
	Expired			
	Damaged			
	Obsolete			
	Theft and pilferage			
	Others (Specify) _____			
	Total value			

2. Data Collection Sheet for Medicines wastage records (2014EFY- 2016EFY)

#	Drug Name	Strength	Dosage Form	Amount wasted	Source for wastage	Cost/sales value
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

3. Data Collection Sheet for Medical supplies wastage records (2014EFY- 2016EFY)

#	Medical supplies Name	Unit	Amount wasted	Source for wastage	Cost/sales value
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

4. Data Collection Sheet for Laboratory commodity wastage records (2014EFY- 2016EFY)

#	Drug Name	Strength	Dosage Form	Amount wasted	Source for wastage	Cost/sales value
1						
2						
3						
4						
5						
6						
7						
8						
9						

Section II. A self-administered questionnaire for data collection on factors contributing to pharmaceutical wastage

Wollega University
College of Health Sciences
School of Pharmacy

Department of Pharmaceutical supply chain management

Information Sheet and Informed Consent

Purpose: This study is designed to determine the pharmaceutical wastage rate and to identify its contributing factors in selected public health facilities in Four Wollega Zone, Oromia region, Ethiopia. Your answers are very important and valuable to the successful completion of this study. Please be honest in filling out this questionnaire, as it will be solely used for research purposes. This survey will be confidential, and anonymous, and data will be analyzed in aggregates. For comments/questions please contact Haileyesus Mulugeta (0921201119) principal investigator for the study.

1. Socio-demographic Characteristics of Respondents

This section contains questions that help us understand your answers to the other sets of questions in the next section. If you are unsure about how to reply to any of the questions, please give the best answer you can and write your comments beside the question

1.1. sex Male ____ Female ____

1.2. Age in years _____

1.3. Total work experience (in years & months) _____

1.4. Highest level of education

- | | |
|-------------------------|-------------------------|
| a. Specialist | g. general practitioner |
| B, pharmacist (MSc) | h. Pharmacist (Pharm) |
| c. Diploma in pharmacy | I. health officer (MSc) |
| d. Health officer (BSc) | j. Nurse (MSc) |
| e. Nurse (BSc) | k. Nurse diploma |
| f. Others specify _____ | |

2. Questions on Perceived factors contributing to Pharmaceutical wastage at the Public health facility

In this section, we ask your feelings about factors contributing to pharmaceutical wastage (Expiry, Damage, Obsolete, Theft, or others) in your facility. For each statement on the left, please tick one box which best describes the level of your agreement

(1=strongly Disagree (SD); 2=Disagree (D); 3=Neutral-N (Neither agree nor disagree); 4=Agree (A) and 5=strongly Agree (SA))

Perception of respondents to the status of Pharmaceutical wastage in the facilities

No	Pharmaceutical wastage	SD	D	N	A	SA
1	Do you think your facility experiences a high rate of pharmaceutical wastage due to expiry?					
2	Do you think your facility experiences a high rate of pharmaceutical wastage due to damage?					
3	Do you think your facility experiences a high rate of pharmaceutical wastage due to obsolete?					

NO	A. Poor Supply chain management	SD	D	N	A	SA
1	The selection of pharmaceuticals is not based on ABC/VEN analysis(Vital, essential, Necessary) which results in pharmaceutical wastage					
2	The presence of overstocked pharmaceuticals due to improper forecasting of needs in the facility results in pharmaceutical wastage					
3	Poor communication and coordination with key stakeholders (MOH, suppliers, NGOs) cause for pharmaceutical waste					
4	Medicines to treat rare diseases are procured in the facility which causes medicines wastage					
5	There is an oversupply of some pharmaceuticals which results in pharmaceutical wastage					

6	Weak physical security in the vehicle during the transportation of pharmaceuticals which results in product theft					
7	Procurement practice is causing pharmaceutical wastage					
	B. Poor Storage Condition					
1	Unable to maintain adequate shelf life of products results in pharmaceutical wastage					
2	pharmaceuticals are stored on the floor, and not arranged systematically on shelves in the facility which results in spoilage and damage of pharmaceuticals					
3	There is not enough space for handling and moving products in the store which results in pharmaceutical damage					
4	pharmaceuticals that need cold temperatures are not stored in a functional refrigerator in the facility resulting in spoilage of pharmaceuticals					
C	Poor Guideline & Policy changes and Facility practice					
1	Weak or no mechanisms for pharmaceutical wastage monitoring and evaluation in the facility					
2	Weak or Absence of functional DTC in the facility which results in pharmaceutical wastage					
3	Treatment or policy changes has led to the wastage of pharmaceuticals					
4	Non-participation of other professionals (other than pharmacists) in pharmaceutical selection and quantification of the facility contributes to medicines wastage					
5	Lack of accountability for stock-outs and wastage of pharmaceuticals in the facility					
D	Poor inventory management					
1	Poor stock management like using neither FIFO nor FEFO in stock management which results in pharmaceutical wastage					
2	There is a discrepancy between the physical count and stock cards					
3	There is a lack of knowledge of basic expiry prevention tools which results in pharmaceutical wastage					
E	Drug shelf life					
1	Near-expiry pharmaceuticals (< 6 months) are being delivered to the facility which causes medicine wastage					

2	Lack of system to move nearly expired pharmaceuticals facility to facility					
3	No bin cards are updated regularly to reflect drug expiration dates					
F	Weak health commodity management information system					
1	No accurate data is available in the hospital to facilitate the quantification of pharmaceuticals which results in pharmaceutical wastage.					
2	Lack of electronic stock management tools that automatically capture medicines wastage in public health facilities.					
3	No reports are produced other than RRF using HCMIS to monitor pharmaceutical stock					
4	Lack of training related to HCMIS					

Section III: Semi-structured guide for key informant interview (English Version)

Introduction

I want to thank you for taking the time to meet with me today. My name is Haileyesus Mulugeta. I came from Wollega University School of Pharmacy attending a post-graduate study in Pharmaceutical supply chain management. I am the principal investigator for the study entitled “Assessment of Pharmaceutical Wastage and its Contributing Factors- the Case of Selected Public Health Facilities in Four Wollega Zone, Oromia Regional State, Ethiopia”. I would like to talk with you about pharmaceutical wastage which poses a significant health problem and endangers human life and health, results in the non-optimal utilization of resources, and causes considerable loss of money. The aim of this study is to determine the pharmaceutical wastage rate and to identify its contributing factors in selected public health facilities of four Wollega Zone, Ethiopia. Considering that the findings and recommendations emanated from this study will help policymakers and other organizations to design intervention activities, you are kindly requested to participate in this study. The interview should take less than an hour. I will be taping the session because I don't want to miss any of your comments. Although I will be taking some notes during the session, I can't possibly write fast enough to get it all down. Because we're on tape, please be sure to speak up so that I don't miss your comments. All responses will be kept confidential. This means that your interview responses will only be shared with research team members and we will ensure that any information we include in our report does not identify you as the respondent.

Remember, you don't have to talk about anything you don't want to and you may end the interview at any time.

Are you willing to participate in this interview Yes____ No____?
If yes, the interview will be continued

Semi-structured guidance for key informant interview (English version)

1: Background information of the key informant

- 1.1 Age
- 1.2 Sex
- 1.3 Highest level of education
- 1.4 Total Work experience
- 1.5 Current position in the health facility.....

2: Guiding questions for an in-depth interview with the head of pharmacy case team & health facility

- 2.1. How do you assess the current situation of Pharmaceutical wastage in your health facility?
- 2.2. What are the factors that contribute for pharmaceutical wastage in your health facility?
- 2.3. How Pharmaceutical wastage does affect in your health facility the service provision of your facility?
- 2.4. Are there any efforts made so far by the facility to prevent/reduce Pharmaceutical wastage?
- 2.5. What do you recommend to minimize for the future too?

Thank you for your time and cooperation

Annex II: The perceived factors contributing to pharmaceutical wastage by health professionals in selected public health facilities

No	A. Poor Supply chain management	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	SD
1	The selection of pharmaceuticals is not based on ABC/VEN analysis(Vital, essential, Necessary) which results in pharmaceutical wastage	34(16.1)	23(10.9)	17(8.1)	74(35.1)	63(29.9)	3.52	1.429
2	The presence of overstocked pharmaceuticals due to improper forecasting of needs in the facility results in pharmaceutical wastage	29(13.7)	27(12.8)	19(9)	74(35.1)	62(29.4)	3.54	1.388
3	Poor communication and coordination with key stakeholders (MOH, suppliers, NGOs) cause for pharmaceutical waste	28(13.3)	27(12.8)	20(9.5)	71(33.6)	65(30.8)	3.56	1.387
4	Medicines to treat rare diseases are procured in the facility which causes medicines wastage	33(15.6)	23(10.9)	19(9)	73(34.6)	63(29.9)	3.52	1.419
5	There is an oversupply of some pharmaceuticals which results in pharmaceutical wastage	33(15.6)	24(11.4)	17(8.1)	74(35.1)	63(29.9)	3.52	1.422
6	Weak physical security in the vehicle during the transportation of pharmaceuticals which results in product theft	34(16.1)	24(11.4)	16(7.6)	72(34.1)	65(30.8)	3.52	1.439
7	Procurement practice is causing pharmaceutical wastage	34(16.1)	23(10.9)	20(9.5)	72(34.1)	62(29.4)	3.5	1.426
No	B. Poor Storage Condition	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	SD
1	Unable to maintain adequate shelf life of products results in pharmaceutical wastage	23(10.9)	34(16.1)	19(9)	54(25.6)	81(38.4)	3.64()	1.408
2	pharmaceuticals are stored on the floor, and not arranged systematically on shelves in the facility which results in spoilage and damage of pharmaceuticals	24(11.4)	32(15.2)	20(9.5)	53(25.1)	82(38.9)	3.65	1.414
3	There is not enough space for handling and moving products in the store which results in pharmaceutical damage	24(11.4)	33(15.6)	20(9.5)	55(26.1)	79(37.4)	3.63	1.41
4	pharmaceuticals that need cold temperatures are not stored in a functional refrigerator in	24(11.4)	31(14.7)	21(10)	54(25.6)	81(38.4)	3.65	1.408

	the facility resulting in spoilage of pharmaceuticals
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No	Poor Guideline & Policy changes and Facility practice	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	SD
1	Weak or no mechanisms for pharmaceutical wastage monitoring and evaluation in the facility	37(17.5)	28(13.3)	23(10.9)	73(34.6)	50(23.7)	3.34	1.423
2	Weak or Absence of functional DTC in the facility which results in pharmaceutical wastage	39(18.5)	39(18.5)	29(13.7)	78(37)	26(12.3)	3.06	1.338
3	Treatment or policy changes has led to the wastage of pharmaceuticals	30(14.2)	30(14.2)	31(14.7)	71(33.6)	49(23.2)	3.37	1.358
4	Non-participation of other professionals (other than pharmacists) in pharmaceutical selection and quantification of the facility contributes to medicines wastage	32(15.2)	32(15.2)	21(10)	82(38.9)	44(20.9)	3.35	1.366
5	Lack of accountability for stock-outs and wastage of pharmaceuticals in the facility	34(16.1)	33(15.6)	25(11.8)	72(34.1)	47(22.3)	3.31	1.396
No	Poor inventory management	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	SD
1	Poor stock management like using neither FIFO nor FEFO in stock management which results in pharmaceutical wastage	43(20.4)	24(11.4)	17(8.1)	63(29.9)	64(30.3)	3.38	1.518
2	There is a discrepancy between the physical count and stock cards	44(20.9)	25(11.8)	15(7.1)	64(30.3)	63(29.9)	3.36	1.526
3	There is a lack of knowledge of basic expiry prevention tools which results in pharmaceutical wastage	43(20.4)	25(11.8)	18(8.5)	64(30.3)	61(28.9)	3.36	1.509
No	Drug shelf life	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	SD
1	Near-expiry pharmaceuticals (< 6 months) are being delivered to the facility which causes medicine wastage	23(10.9)	44(20.9)	28(13.3)	73(34.6)	43(20.4)	3.33	1.306
2	Lack of system to move nearly expired pharmaceuticals facility to facility	26(12.3)	40(19)	30(14.2)	64(30.3)	51(24.2)	3.35	1.356

3	No bin cards are updated regularly to reflect drug expiration dates	28(13.3)	35(16.6)	24(11.4)	76(36)	48(22.7)	3.38	1.352
No	Weak health commodity management information system	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	SD
1	No accurate data is available in the hospital to facilitate the quantification of pharmaceuticals which results in pharmaceutical wastage.	25(11.8)	38(18)	23(10.9)	77(36.5)	48(22.7)	3.4	1.332
2	Lack of electronic stock management tools that automatically capture medicines wastage in public health facilities.	21(10)	42(19.9)	26(12.3)	76(36)	46(21.8)	3.4	1.296
3	No reports are produced other than RRF using HCMIS to monitor pharmaceutical stock	16(7.6)	25(11.8)	20(9.5)	96(45.5)	54(25.6)	3.7	1.192
4	Lack of training related to HCMIS	10(4.7)	28(13.3)	22(10.4)	96(45.5)	55(26.1)	3.75	1.125