ASSESSMENT OF MEDICINES WASTAGE AND ITS CONTRIBUTING FACTORS IN SELECTED PUBLIC HEALTH FACILITIES IN SOUTH WEST SHOA ZONE, OROMIA REGIONAL STATE, ETHIOPIA

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Assessment of medicines wastage and its contributing factors in selected public health facilities in South West Shoa Zone, Oromia Regional State, Ethiopia

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This is to certify that the thesis prepared by Esayas Tadesse, entitled: *Assessment of medicines wastage and its contributing factors in selected public health facilities in South West Shoa Zone, Oromia Regional State, Ethiopia* and submitted in partial fulfillment of the requirements for the Degree of Master of Science in Pharmacoepidemiology and Social Pharmacy complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Advisor: _____ Signature _____Date _____

_____

Head of Department

DEDICATION

I dedicate this thesis to my beloved Mom

Xaye

To my beloved sisters and brother

Desta, Kidist and Fasil

And
To the loving memory of my second Mom

Zene (Etete)

You have successfully made me the person where I am today. Your support, encouragement, and endless love have sustained me throughout my life. I love you all.

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LIST OF ACRONYMS

APTS	Auditable Pharmaceutical Transactions and Services
ARHB	Amhara Region Health Bureau
CDC	Centers for Disease Control and Prevention
CEO	Chief Executive Officer
CNS	Central Nervous System
CSA	Central Statistics Agency
DTC	Drug and Therapeutic Committee
EFMHACA	Ethiopia Food, Medicine and Health Care Administration and Control Authority
EFY	Ethiopian Fiscal Year
ETB	Ethiopian Birr
FEFO	First-Expiry First-Out
FIFO	First-In First-Out
FMOH	Federal Ministry of Health
GDP	Gross Domestic Product
GIT	Gastrointestinal trucks
HFs	Health Facilities
HSDP	Health Sector Development Program
IPLS	Integrated Pharmaceutical Logistics System
LIAT	Logistics Indicators Assessment Tool
MOHG	Ministry of Health of Ghana
MOHSW	Ministry of Health and Social Welfares
MSH	Management Science for Health
PFSA	Pharmaceutical Fund and Supply Agency
PMI	President's Malaria Initiative
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
SWSZHD	South West Shoa Zone Health Department
TGE	Transitional Government of Ethiopia
UK	United Kingdom

USA	United States of America
USAID	United States Agency for International Development
WHO	World Health Organization

ABSTRACT

Assessment of Medicines Wastage and its Contributing Factors in Selected Public Health Facilities in South West Shoa Zone, Oromia Regional State, Ethiopia

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Medicines wastage occurs when medicines are damaged, obsoleted or expired and become unsafe for use. It is a burden to many health facilities and increases cost to the health care system. In Ethiopia, although there are reports that reveal the presence of wasted medicines in the country, there is limited objective evidence on the type and extent of medicines wastage as well as its contributing factors. Therefore, the objective of this study was to determine medicines wastage rate and to identify its contributing factors in the sampled public health facilities of South West Shoa Zone, Oromia Regional State, Ethiopia. The study employed a facility based cross-sectional survey and qualitative study in one hospital and nine health centers from May 2-27, 2016. Both quantitative and qualitative data collection methods were used in the study. The quantitative data was collected by data abstraction formats and self-administered questionnaires and analyzed using SPSS version 21.0. The analysis was performed in aggregate and included descriptive statistics. And the qualitative data was collected through in-depth interview with the heads of the health facility and pharmacy case team leaders and analyzed using thematic analysis. The total monetary value of wasted medicines in the surveyed health facilities in EFY 2005-2007 was 500,522.09 Ethiopian Birr, while in the same period all surveyed health facilities received medicines worth of 6,635,910.97 Ethiopian Birr, resulting wastage rate of 7.5%. Of the total value of wasted medicines, anti-infectives (39.1%), medicines used for correcting water, electrolyte and acid-base balance (12.9%) and GIT medicines (10.6%) were the top three therapeutic classes. Oral rehydration salt 245osml/l powder (6.3%), metronidazole 250mg capsule (4.1%), and tetracycline 250mg capsules (3.2%) were also the most commonly wasted medicines. More than half of the wasted medicines were in solid dosage forms (54.3%), followed by liquid dosage forms (40.8%) and nearly 96% of the source for wastage was expiry of medicines.

In both quantitative and qualitative study, delivery of near expiry date medicines by suppliers, lack of system to move nearly expired medicines from one facility to another, presence of over stocked medicines due to improper forecasting of need in the facilities, lack of electronic stock management tools and shortage of pharmacy professionals in the health facilities were identified as contributing factors for medicines wastage. In conclusion, the extent of medicines wastage in public health facilities of South West Shoa Zone was estimated to be 7.5%. It is recommended that the health facilities should document and maintain a written record of all medicines wastage. A mechanism of exchanging medicines from overstock to under stock areas should be created, and a strong partnership or a common plat forum should be established among key stake holders to have regular discussion on preventive strategies.

Key words: Medicines wastage, wastage rate, expired medicines, public health facility, Ethiopia

1. INTRODUCTION

1.1. Background

Medicines are substances intended for use in the prevention, diagnosis, cure, mitigation, or treatment of disease (WHO, 2008). They are indispensable products in the course of health care service delivery and when available and managed well have been shown to improve customer satisfaction and patient attendance (Fidler and Msisha, 2008). In the process of ensuring availability of medicines to the population, there is a possibility that these medicines may be damaged or expired and become unsafe for use. In addition, medicines left over from patients and those identified to be defective may accumulate over time adding to the stock of unsafe for use medicines. The resulting stock piling of these unfit for use medicines is usually called medicines waste (Braund *et al*., 2009; Tong *et al*., 2011).

According to World Health Organization (WHO), medicines wastage is defined as unwanted medications which include expired, unused, spilt and contaminated medicines that are no longer required and need to be disposed of appropriately (WHO, 1999a; WHO, 1999b). Medicines waste as defined by the Ethiopian Food, Medicine and Health care Administration and Control Authority (EFMHACA) disposal directive includes all expired, damaged, improperly sealed or labeled or stored, counterfeit, substandard and adulterated, prohibited or un authorized medicines (EFMHACA, 2011).

Factors such as improper management of medicines and lack of good governance for medicines lead to medicine wastage. Inefficiencies in medicines supply management at health facilities have resulted in significant wastage of resources due to deterioration, expiration, theft, etc. The lack of transparency and accountability in managing medicines and financial transactions has exposed the system to theft and pilferage (USAID, 2011; USAID and CDC, 2014).

Medicines wastage can also occur through pilferage and theft (ARHB, 2012). Stock loss rates often exceed 15% in most of public sector medical stores (Taryn, 2006).

Medicine wastage is one of the major problems of health care system in both developed and developing countries. For instance, in United States of America (USA) and in New-Zealand 23% and 22%, respectively of medicines were wasted (Braund *et al*.,2008; Law *et al*., 2015). It is also creating unnecessary burden on an already financially restrained health care system in developing countries. In Ghana, 10% of the public dispensaries had expired medicines and volumes of valuable medicines have expired at the national medical stores, in district and hospital stores of Uganda (MOHG, 2009; Nakyanzi *et al*., 2010).

Medicines wastage poses a significant health problem by endangering human life and health, environment and wastage of resources (Braund *et al*., 2009, Lorna *et al*., 2014). It reduces the quantity of medicines available to patients and therefore the quality of health care they receive (Kagashe *et al*., 2014).

Accumulated medicine wastes that are not disposed at appropriate time interval may lead to inefficient use of storage space in health facilities, limiting available space for inventory of usable medicine supplies (MOHSW, 2008; Nakyanzi *et al*., 2010). Improperly disposed medicines contribute to the loading of these medicines and their metabolites to the environment potentially posing significant risk both on environment and human (Braund *et al*., 2009). Moreover, it leads to ineffective use of resources, including finances and become a major burden on government budgets (Ali and Ibrahim, 2009; USAID, 2011).

The Ethiopian situation is not different from the rest of the world and there are large volumes of medicines waste accumulation across the medicine supply chain. In many of the public health facilities, quite a large proportion of the space at the medicines store is occupied by expired and unfit for use medicines (Tadeg *et al*., 2014). In addition to this, execution of medicine transactions and services in public health facilities of Ethiopia lacks transparency and accountability; thus vulnerable for theft (ARHB, 2012).

1.2. Statements of the problem

Medicines are one of the key elements of well-functioning healthcare system. However, one third of the global populations do not have regular access to medicines. In some of the lowest-income countries in Africa and Asia, more than half of the populations have no regular access to essential medicines (WHO, 2004a). One of the reasons for such high inaccessibility of medicines is wastage due to expiry and damage (ARHB, 2012; Lorna *et al*., 2014).

In addition to causing inaccessibility of medicines, continued accumulation of medicines waste create administrative burdens and can be a threat to the environmental and health of the public. For instance, improper disposal of expired medicines may contaminate water supplies; may come into the hands of scavengers and children or being diverted to the market for resale and misuse. Most medicines after expiry become less effective and a few may cause a different adverse drug reaction profile (Braund *et al*., 2009; Glassmeyer *et al*., 2009).

Apart from hampering therapeutic benefit, medicines wastage also has financial implications. On average medicines spend about 25% of total health expenditure, it is estimated that about 70% of funds invested in essential medicines are wasted in normal supply system (MSH, 2010).

A report of the President's Malaria Initiative (PMI) to congress of the USA government indicated that until April 2014, the stealing is continuing and there was no solution solicited in Africa. For example the total reported theft of PMI commodities in Angola amounted to over $642,000 since January 2008. The effects of the loss are not simply monetary- more significantly, due to these thefts, the medicines required to relieve the suffering of 534,733 people from malaria were not available for distribution through the PMI program (USAID, 2009; USAID and CDC, 2014).

Medicines wastage is one of the challenges of the medicine supply chain management in Ethiopia (FMOH, 2015a). For instance, according to national assessment done in 2003, 8% of medicines were found to be expired in the same year (FMOH and WHO, 2003).

There is also poor documentation of wastage and pilferage due to absence of accountability on the part of health facilities to properly document and report wastage, lack of tools that automatically capture wastages and lack of system that obligates health facilities to document and report medicine wastage in the country. All these result in a very large amount of medicine wastage in Ethiopia that requires urgent attention and action (Tadeg *et al*., 2014).

Over all, although there are reports that reveal the presence of wasted medicines in Ethiopia, there is lack of objective evidence on the type and extent of medicines waste as well as its contributing factors. Therefore, the aim of this study is to determine the extent, identify types of wasted medicines and its underlying causes in selected public health facilities of South West Shoa zone, Oromia Regional State, Ethiopia. This helps policy makers to make informed decisions so as to reduce wastage of medicines and to promote appropriate utilization of finite resources.

2. LITERATURE REVIEW

2.1. Medicine supply chain in Ethiopia

Ethiopia is the second most populous (96.9 million) country in Africa. Over the last ten years (2004-2015), the country has shown impressive economic growth with real gross domestic product (GDP) of 10.9% (Moller, 2015). According to the World Bank, the 2015 GDP of the country was estimated to be $55 billion. Of this, it spent 5.06% on health (The World Bank, 2016). The pharmaceutical market has an estimated compounded annual average growth of 14.3% (Frost & Sullivan, 2012).

In 1993, Ethiopia prepared a national medicine policy which guides the pharmaceutical sector of the country. One of the major objectives of this policy is to systematize the medicine supply and distribution and ensure accessibility of essential medicines. The policy also identified establishing new medicine manufacturing plants, creating favorable conditions and incentives for private investors (importers and distributors), and establishing government owned enterprise that supplies medicines, as strategies to meet policy objectives (TGE, 1993).

The medicine supply chain is the means through which medicines are delivered to patients. It is heavily regulated and hugely complex as it involves many stakeholders. Some of these actors in Ethiopia are Federal Ministry Of Health (FMOH), particularly the Pharmaceutical Logistics Management Unit, the regulatory authority, developmental partners, importers (private and public), wholesalers, retailers, customs authority, bank and insurance, Ethiopian shipping lines, Ethiopian airlines, and freight forwarders (PFSA, 2011).

Ethiopia is heavily dependent on the import (80%) of medicines (Ministry of Health and Ministry of Industry, 2015). As part of medicine policy implementation process, the country has prepared a comprehensive Pharmaceutical Logistics Master Plan in 2006 with the support of stakeholders. The aim of this plan was to integrate all vertical programs' health commodities management into one supply chain (FMOH, 2006). Following this, Pharmaceutical Fund and Supply Agency (PFSA) was established by proclamation (Proclamation No. 553/2007) with a view to ensure constant and uninterrupted supply of vital and essential medicines for all public health facilities.

It also, supplies essential medicines to private and non-governmental health institutions in accordance with directives of the board of the agency (Shewarega *et al*., 2015).

Currently, PFSA is responsible for the whole supply chain management (forecast, procurement, storage and distribution of health commodities). It covers almost 70% of the country's need. While, Private importers cover 30% of the total import needs. They import medicines which are registered and permitted by the regulatory authority in the country (EFMHACA, 2013; FMOH, 2014a).

Both public and private importers are estimated to serve more than 311 hospitals, 3,547 health centers, 16,440 health posts and 4,000 private clinics (FMOH, 2015a). More than 780 community pharmacies, 3,266 drug stores, 1,090 rural drug vendors in the country (FMOH, 2015b).

Local pharmaceutical manufacturers cover 20% of the total demand of the country (FMOH, 2015c). Although the first manufacturing of medicines was started in 1964, the development of the industry is not as such satisfactory. Today, there are fifteen pharmaceutical manufacturers of which only nine produce medicines (Gebre-Mariam, 2015).

Medicine supply chain in Ethiopia has numerous challenges that need to be addressed strategically. Some of these are the stock out of medicines; wastage of medicines due to expiry, theft, damage; lack of transparent, accountable medicine transaction and services; poor performance of suppliers; long procurement lead time for some medicines; poor record keeping and data quality; shortage of vehicles to distribute medicines from health centers to health posts; inadequate follow-up and support, lack of performance monitoring and evaluation systems, training gaps, and high staff turnover (Shewarega *et al*., 2015; FMOH, 2015c).

Currently, the government of Ethiopia has developed and implemented different strategic initiatives such as health sector transformation plan to improve the aforementioned challenges (FMOH, 2015d).

2.2. Extent and types of medicines wastage

Globally the prevalence of medicine wastage is enormous. Literature explored medicine wastage in different kinds but to large extent investigated medicines wastage in community settings either as home storage or returns to pharmacies (Al-azzam *et al*, 2012; Ali & Ibrahim, 2009; Ekedahl, 2006; Law, 2015). Essentially there are few studies examining general issues of medicine wastage in hospital settings.

A number of studies done in developed countries to investigate the extent of medicine wastage have verified medicine wastage is a big problem to healthcare delivery systems. For instance, in Sweden and Austria, 2.3- 4.6% and 10%, respectively of the total volume dispensed were returned to pharmacies (Ekedahl, 2006; Vogler *et al*., 2014).

Different studies conducted in Middle East and Gulf countries, found that the mean medication wastage was estimated to be 19.2% to 38.8 % on the basis of medication costs (Abou-Auda, 2003; Zargarzadeh *et al*., 2005; Al-azzam *et al*., 2012).

Categories of medicines wasted in developed countries also differ significantly with that of developing countries. Trueman *et al* (2010) reported the leading wasted medicines categories in UK were gastrointestinal medicines (12.4%), medicines for skin (11.2%), pain medications (10.5%) and cardiovascular medicines (10.3%) while in USA painkillers (15%), antibiotics (6.7%), medications for cardiovascular diseases (9.7%) and medications for gastrointestinal problems and skin infections (5.2%) were the most common unused medications (Law *et al*., 2015).

In Africa, the majority of wasted medicines were anti-infectives. For example, a study conducted in Tanzania showed that out of the dispensed medicines, anti-infectives medicines wastage was 18.9%, followed by cardiovascular medicines (8.9%), analgesics (6.8%) and vitamins & minerals (5.9%) (Kagashe *et al*., 2014).

In Ethiopia, few Studies have highlighted the magnitude of medicine wastage in health facilities and none of the reviewed studies investigated the pattern of pharmaceutical categories of wasted medicines. In 2003, FMOH and WHO reported that the national averages expiry rate of medicines was found to be 8%, 2% and 3% in health facilities, regional drug stores and private drug retail outlets, respectively (FMOH and WHO, 2003). Different studies also documented average medicines wastage rate of 1% to 24% in public health facilities (FMOH, 2014a; Tadeg *et al*., 2014; Gedif *et al*., 2016).

2.3. Consequences of medicines wastage

Medicines wastage is a burden to many health facilities. It increases health care costs and jeopardize human life and health which results to sub optimal utilization of resources (Lorna *et al*., 2014).

The financial burden resulting from medicine waste is very huge. In UK the value of dispensed medicines which are discarded each year is about £3 billion (Trueman *et al*, 2010). A survey undertaken by the Viennese Sickness Fund revealed the value of returned medicines to be € 8.1 million (Vogler *et al*., 2014).

In developing countries, where budgets for medicines are often tight, and many people are unable to access essential medicines, medicine wastage reduces the quantity of medicines available to patients and therefore the quality of health care they receive (Ali and Ibrahim, 2009; Nakyanzi *et al*., 2010). For instance, a study conducted in Saudi Arabia and gulf countries indicated that the total dollar value of medication waste was estimated to be in the close vicinity of 150 million dollars a year from the budget allocated to health care (Abou-Auda, 2003), while in Iran, the total value of all medicines wasted was estimated to be 15 billion riads (approximately US$1.8 million) (Zargarzadeh *et al*., 2005). In Uganda, about US$550 000 worth of antiretroviral medicines were expired (Nakyanzi *et al*., 2010).

In Ethiopia, a study conducted by respective Ethiopian regional health bureaus and FMOH in collaboration with non-governmental stakeholders indicated that the value of wastage was estimated to be 11,078,910.52 Ethiopian Birr (ETB) (Tadeg *et al*., 2014). Another study conducted in Gondar Town, North West Ethiopia also showed that the total loss of money due to medicines expiry over six months period was 1337.6 dollars (Fentie *et al*., 2015).

2.4. Factors contributing to medicines wastage

Factors contributing towards medicine wastage are diverse. They depend upon the form of the medicine wastage investigated and feature of the healthcare delivery system (Kagashe *et al*., 2014).

In low income countries, factors associated with medicine wastage in health care settings are not well documented (Kagashe *et al*., 2014). However, weak capacity of medicines supply management system takes the lion share for deterioration and expiration (USAID, 2011).

Selection and quantification of medicines without proven data/evidence and techniques result in wastage due to expiry. Poor quantification and forecasting of medicines will lead to overstocking of the medicines. Overstocking of medicines normally leads to high number of expired medicines, high cost of storing excess stock and high incidences of pilferage of high potent medicines (MSH, 2012). Poor medicine storage conditions such as storage on the floor; lack of systematic arrangement of stock; presence of dust and pests; inadequate protection from direct sunlight; and lack of provision of temperature monitoring charts and facilities to monitor room temperature can lead to degradation of medicines. Poor inventory management also leads to expiry and theft of medicines. It contributes between 4 to 9% of overall waste in supply systems (MSH 2010; MSH, 2012).

Studies conducted in Uganda revealed that the main contributing factors for expiry medicines in the supply chain included, irrational procurement and provision of medicines not based on needs and requisition, neglect of stock monitoring, lack of knowledge of basic expiry prevention tools, non-participation of clinicians in medicine selection and quantification in hospitals, profit- and incentive-based quantification, third party procurement by vertical programmes and overstocking (Nakyanzi *et al*., 2010; Tumwine *et al*., 2010).

While a study conducted in Tanzania showed that the two top factors contributing to medicines wastage were over stocking and pilferage (Kagashe *et al*., 2014).

Lack of transparency in the medicine supply chain also causes the wastage of limited resources due to theft, bribery and fraud. Various factors contribute to the theft of medicines, including poor record-keeping, ineffective monitoring and accounting mechanisms, corruption, and the lack of financial, technical and other resources in developing countries to ensure the security of medicines supply chains (MSH, 2012; USAID and CDC, 2014).

A study done in Ethiopia stated that poor documentation of wastage and pilferage, absence of accountability on the part of health facilities to properly document and report wastage, lack of tools that automatically capture wastages and lack of system that obligates health facilities to document and report medicine wastage in the pharmaceutical sector is believed to significantly contribute to most of the challenges in medicine management at different levels of the health system which have resulted in multiple forms of irrational practices and waste (Tadeg *et al*., 2014).

3. OBJECTIVES OF THE STUDY

3.1. General objective

- To determine medicines wastage rate and to identify its contributing factors in the selected public health facilities of South West Shoa Zone, Oromia Regional State, Ethiopia.

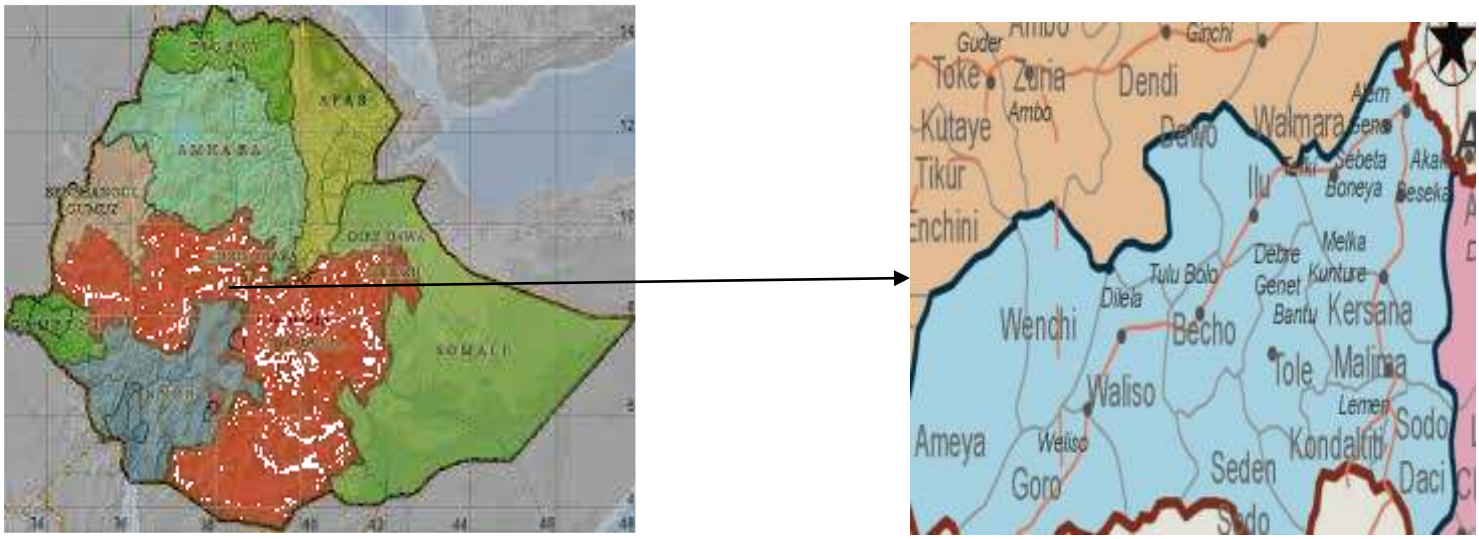
3.2. Specific objectives

- To determine medicines wastage rate in the sampled health facilities, South West Shoa Zone, Oromia Regional State, Ethiopia.
- To describe types of commonly wasted medicines in the sampled health facilities, South West Shoa Zone, Oromia Regional State, Ethiopia.
- To identify factors contributing for medicines wastage in the sampled health facilities, South West Shoa Zone, Oromia Regional State, Ethiopia.

4. METHODS

4.1. Description of the study area

The study was conducted in South West Shoa Zone. It is one of the seventeen zones found in Oromia regional state. Woliso, the capital town of the zone, is located 114 KM, South-West of Addis Ababa. The administrative zone had 1 town administration, 11 woredas, and 269 kebeles (the lowest administration unit in government structure). The total population of the zone in the year 2015 was estimated to be 1,378,063 (CSA, 2015). According to the report by the zonal health department, during the surveying time the zone had 2 hospitals (1 private and 1 government hospital), 55 health centers, 268 health posts, 2 pharmacies, 16 drug stores and 8 rural drug vendors. Twenty two pharmacists and 53 druggists were working in the public health facilities in South West Shoa (SWSZHD, 2015).



(A) (B)

Figure 1. (A) Map of Ethiopia showing all regional states, (B) Map of South West Shoa Zone, showing administrative woredas, 2016.

4.2. Study design and period

A facility based cross sectional survey and qualitative study was conducted in selected public health facilities in South West Shoa Zone, in which the data collection was carried out from May 2 to May 27, 2016.

4.3. Source and study population

All the public health facilities found in South West Shoa Zone were the source facilities. All health professionals and all documents that were used for medicines wastage like medicines wastage registration/ disposal report and model 19 were also sources of information.

All health professionals involved in medicine supply management activities and all records of medicines wastage/ disposal report and model 19 of the year 2005EFY-2007EFY in the sampled health facilities were the study population.

4.4. Inclusion and exclusion criteria

4.4.1. Inclusion criteria:

- All public health facilities which had more than 3 years in operation
- Staffs who were available and volunteer during the study period
- Wasted medicines recorded with price in the year 2005EFY-2007EFY

4.4.2. Exclusion criteria:

- Wasted medicines recorded as free price such as program and donation medicines

4.5. Sample size determination and sampling techniques

The sample of health facilities was calculated by using Logistics Indicators Assessment Tool (LIAT) (USAID | DELIVER PROJECT, 2008). The document recommends a minimum of 15% of the targeted health facilities to be included in the survey. Accordingly, 10 health facilities were selected out of 45 health facilities which had more than 3 years in operation. Of these, a hospital was selected purposively and the remaining 9 health centers were selected by using multi stage sampling techniques. First, health centers were stratified into Type A and Type B health centers based on their level. Then, proportionate numbers of health centers from each level were chosen by using simple random sampling techniques (See annex 2).

For quantitative part of the study, health professionals engaging in Drug and Therapeutic Committee (DTC) and other medicines supply management activities of the facilities, who were at work at the time of the study and willing to participate were chosen using purposive sampling technique.

For qualitative study, the chief executive officers (CEOs) of health facilities and pharmacy departments in selected health facilities were purposively selected as a key informant because they are supposed to be information rich than other health professionals.

4.6. Data collection and management

4.6.1. Data collection

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 interview with the CEOs and pharmacy case team

4.6.2. Data collection instrument

Quantitative study

Records of medicines wastage, disposal reports and model 19 were reviewed to abstract secondary data value and types of wasted medicines. For medicines wastage value data collection sheet was developed from Logistics Indicator Assessment Tool (LIAT) (USAID | DELIVER PROJECT, 2008) and for medicines waste, the data collection sheet was prepared based on the EFMHACA medicines waste management and disposal directive (EFMHACA, 2011b).

Self-administered questionnaire which contains questions about socio-demographic characteristics (age, sex, level of education and average income) and perceived contributing factors of medicines wastage was adapted from Nakyanzi *et al*., (2009). Questions from this data collection tools which were not practical to the study situation were excluded and some modifications were made in the language used in some of the questions in a way that facilitates easier understanding for the study participants. Each item was scored on a 5 point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Qualitative study

A semi structured interview guide was prepared to explore ideas of key informants about situation of medicines wastage, contributing factors, consequences and efforts in preventing or minimizing the problem. The interview guide was developed after literature search (Abou-Auda, 2003; Braund *et al*., 2008; Tumwine *et al*., 2010; Kagashe *et al*., 2014) (See annex 1- section III &IV).

4.6.3. Data quality assurance

The questionnaire for the quantitative study was pre-tested in two health centers (1 type A and 1 type B) which were not included in the study. Data collectors were trained for half a day on the data collection instruments and processes prior to data collection. Supervision was made by the principal investigator during the data collection process and any inconsistencies amended on time.

For an in depth interview, the interview guide was tested for its face and content validity by two experts from social and administrative pharmacy group. It was prepared in the English language, and translated into Amharic and then to English to check message consistency. The Amharic version was used for the interview with key informants. Digital voice recorder was also used for the interview and the information was transcribed after the interviews.

4.6.4. Data entry and analysis

Responses to each question were coded individually, and the quantitative data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 21. The analysis was performed in aggregate and included descriptive (Frequency, Mean, Standard Deviation (SD), percentage and graph). For the study of estimating the value of medicines wastage rate and describing the types of wasted medicines, the medicines wastage in each health facility studied were recorded and its selling cost was calculated. Medicines were classified according to their pharmacotherapeutic classes using the classification of medicines adopted in the Ethiopian national essential medicine list (EFMHACA, 2014). Similar medicines with different dosage forms and strength like amoxicillin 250 mg suspension and amoxicillin 250 mg capsules or amoxicillin 250 mg capsule & amoxicillin 500 mg were considered and counted as two different medicines. Values of wasted medicines were calculated based on selling prices which were shown on medicines wastage registration and disposed medicines lists. The total value of received/ purchased medicines was calculated using the recorded price on model 19. And for the qualitative aspect of the study, data were analyzed using a thematic analysis approach. Initial categories for analyzing data were drawn from the interview guide and themes and patterns emerged after reviewing the data. Key themes to emerge were: situation of medicines wastage; contributing factors; consequences and suggestion for improving medicines wastage. For this part of the study, data was handled manually.

4.7. Ethical considerations

Ethical approval was obtained from the Ethics Review Committee of the School of Pharmacy, Addis Ababa University. Then, a formal letter was written from the department of Pharmaceutics and Social Pharmacy to South West Shoa Zone health department to get permission for conducting the study. Official letters were written from South West Shoa Zone health department to the selected health facilities to get permission for conducting the data collection. Then, the study was conducted in the selected health facilities after securing permission from the health institution.

For the purpose of confidentiality and ethical issues, names of health facilities from which information obtained were recorded and analyzed using uniquely identifying codes. Participants of the study were asked for consent before participating in the study. During the consent process, they were provided information regarding the purpose of the study, why and how they were selected to be involved in the study, and what was expected of them and that they can withdraw from the study at any time. Participants were also assured about confidentiality of the information obtained in the course of the study by not using personal identifiers.

4.8. Operational definitions

Medicines wastage- in this study indicates medicines expired, damaged, lost, obsoleted and unsafe for use.

Medicines wastage rate- It is the percentage calculated by dividing the wasted value in monetary forms to the total value of medicines received during the period 2005-2007EFY.

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

5. RESULTS

A total of ten public health facilities (1 hospital and 9 health centers) were surveyed. The average year of operation of the facilities was 12.1 (SD=15.18). The minimum year since the facilities became operational was 6 years and the maximum was 55 years.

5.1. Quantitative findings

5.1.1. Extent of medicines wastage

The total monetary value of wasted medicines in the surveyed health facilities in EFY 2005-2007 was 500,522.09 ETB, while in the same period all surveyed health facilities received medicines worth of 6,635,910.97 ETB, resulting wastage rate of 7.5%.

In EFY 2005, there was an overall wastage of 149,774.17 ETB; accounting for an average of 10.6% of the total value of medicines received by seven health facilities. In 2006 EFY, the value of wastage was estimated to be 198,130.05 ETB, indicating an annual wastage rate of 9.2% for nine of the study facilities, while in 2007EFY, there was an overall wastage of 152,617.87 ETB , in which the annual wastage rate was estimated to be of 5%.

If the results from the hospital are excluded from the analysis, the average rate of wastage in the remaining nine health centers would be 8.5% amounting to 352,424.47 ETB. In the hospital (n=1), the total medicines wastage rate was estimated to be 6% with a value of 148,097.62 birr (Table 1).

Table 1. The value of medicines (received and wasted) and estimation of total medicines wastage rate in the facilities (EFY2005-2007), South West Shoa Zone, Ethiopia, May 2016 (n=10)

s. no	HF CODE	2005EFY			2006 EFY			2007EFY		
		Received Birr	Wasted Birr	%	Received Birr	Wasted Birr	%	Received Birr	Wasted Birr	%
1	GUHC*	-	-	-	175,068.35	29,659.13	16.94	246,857.80	24,463.22	9.91
2	GOHC*	-	-	-	105,049.05	16,905.22	16.09	180,671.20	20,835.08	11.53
3	DHC*	-	-	-	-	-	-	225,664.15	21,388.54	9.47
4	CHC	131,137.8	15,859.66	12.09	222,233.29	30,402.55	13.68	246,531.08	17,557.02	7.12
5	THC	157,011.5	24,006.29	15.29	193,811.50	23,319.12	12.03	197,579.50	7114.48	3.60
6	ASHC	134,716.2	20,116.46	14.93	179,522.00	24,299.10	13.54	193,420.00	4,813.71	2.48
7	AWHC	89,970.85	11,625.22	12.92	116,009.00	17,083.31	14.73	125,825.64	7,407.88	5.88
8	OHC	78,067.15	8,572.88	10.98	124,553.99	11,616.54	9.33	153,921.12	5392.41	3.50
9	WHC	229,584.0	6,359.75	2.77	271,845.13	1,866.16	0.68	369,883.10	1,760.74	0.47
10	TBHSP**	591,194.1	63,233.91	10.69	768,874.10	42,978.92	5.59	1,126,909.4	41,884.79	3.72
	Average	**1,411,681.6**	**149,774.17**	**10.61**	**2,156,966.41**	**198,130.05**	**9.18**	**3,067,262.9**	**152,617.87**	**4.97**

*Health centers with incomplete data

** Hospital data

An overall decreased in average wastage rate was observed for all selected health facilities. In EFY 2007, the medicine wastage rate showed a decrease from 9.2% in EFY 2006 to 5% for all sampled health facilities (Figure 2).

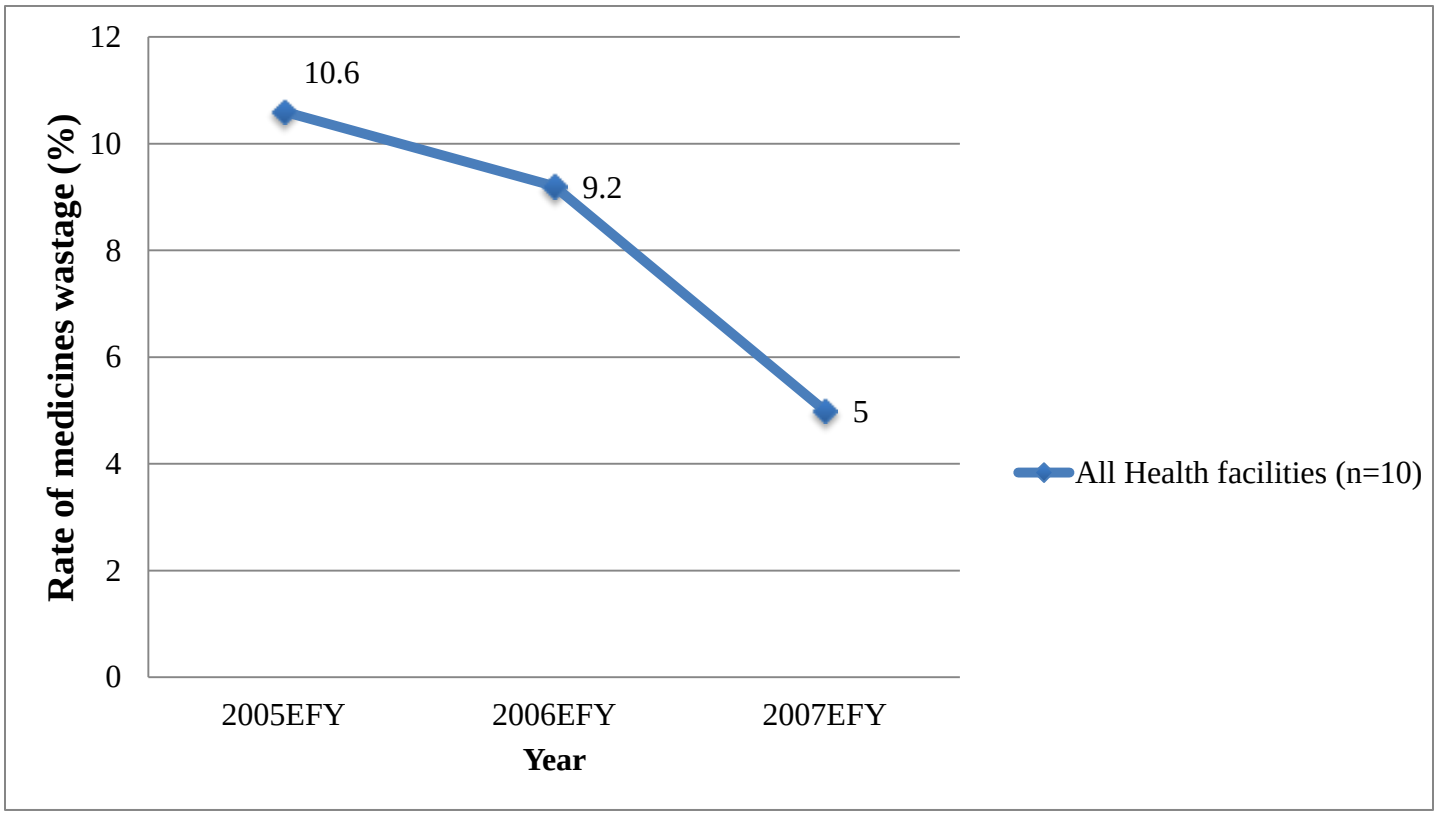


Figure 2. Average medicines wastage rate of all sampled public health facilities in South West Shoa Zone, Ethiopia (EFY 2005 - 2007), May 2016

5.1.2. Types of wasted medicines

The types of wasted medicines in terms of classes, dosage forms and sources were also investigated on the basis of their value.

5.2.1. Classes of wasted medicines

Overall, 144 types of wasted medicines were recorded in all health facilities assessed in the period EFY2005- 2007. The most common therapeutic classes of wasted medicines in terms of value were anti-infectives (39.1%), medicines used for correcting water, electrolyte and acid-base balance (12.9%), medicines acting on gastrointestinal tract (10.6%) and central nervous system (10.2%) (Table 2).

Table 2. Estimated value of wastage of medicines by classes in the study facilities (EFY2005-2007), South West Shoa Zone, May 2016

Classes of medicines	Value of wasted medicines (ETB)	
	n	%
Anti-infectives	195,788.30	39.12
Water, electrolyte and acid-base balance correcting	64,970.37	12.98
Gastrointestinal	52,864.84	10.56
Central nervous system	51,239.39	10.24
Vitamins	31,152.58	6.22
Respiratory	21,721.10	4.34
Obstetric/ Gynecological	19,285.76	3.85
Ophthalmic agents	13,442.24	2.68
Dermatological agents	12,311.61	2.46
Anaesthesia medicine	11,598.62	2.32
Immunological preparation	6,384.82	1.27
Water for injection	5,584.98	1.12
Cardiovascular	4,646.56	0.93
Endocrine	3,345.69	0.67
Anti-histamines	2,553.30	0.51
Musculoskeletal	2,295.54	0.46
Blood products/ Anti anemic	1,189.28	0.24
Ear-Nose- Throat preparations	147.15	0.03
Total	**500,522.10**	**100%**

The top three wasted medicines by value were oral rehydration salt 245osml/l powder (6.3%), followed by metronidazole 250mg capsule (4.1%), and tetracycline 250mg capsule (3.2%) (Figure 3).

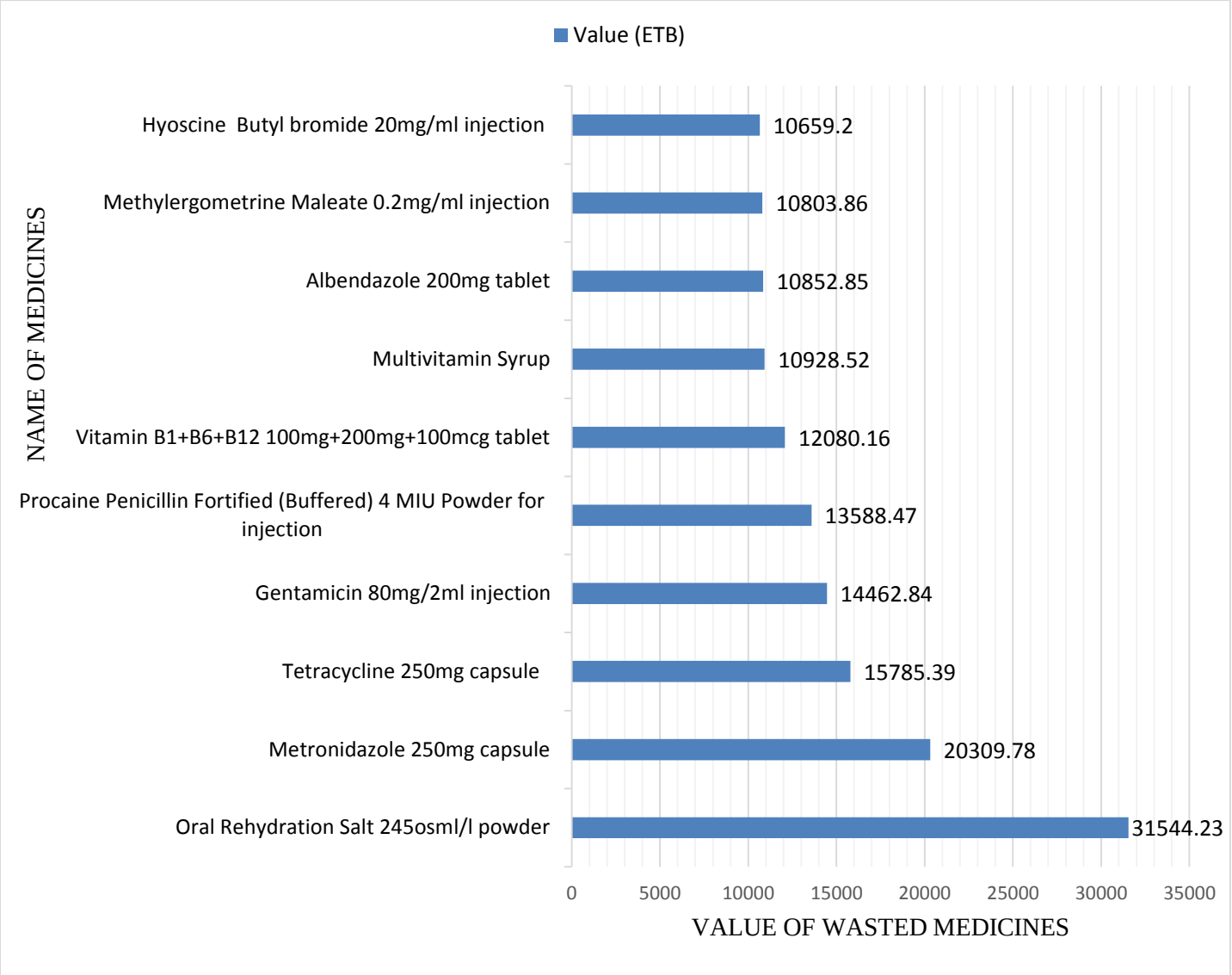


Figure 3. Top ten medicines wasted (value) in sampled public health facilities from 2005-2007 EFY, South West Shoa Zone, Ethiopia, May 2016

5.1.2.2. Medicines wastage by dosage form

All types of dosage forms (solid, semisolid, liquid and gaseous) of medicines wastage were found in the studied health facilities. Out of the total value of wasted medicines (500,522.1 ETB), more than half of the wasted medicines were solid dosage forms 54.3% (271,479.40 ETB), followed by liquid dosage forms 40.8% (204,258.10 ETB), semisolid dosage forms 4.7% (23,232.34 ETB) and gaseous dosage forms 0.3% (1,552.26 ETB). In specific, of the total value of wasted medicines, 28.3% (141,504.60 ETB) were found in the form of injectables, 26.3% (131,339.20 ETB) were in the form of tablets and 14.2% (71,225.52 ETB) of the wasted medicines were capsules.

Table 3. Frequency &estimated value of wastage of medicines by dosage forms in the study facilities (EFY2005-2007), South West Shoa Zone, Ethiopia, May 2016

Type of dosage form	Value in ETB	%
Injection	141,504.60	28.3
Tablet	131,339.20	26.2
Capsule	71,225.52	14.2
Powder	68,914.64	13.8
Suspension	30,557.29	6.1
Syrup	21,124.58	4.2
Ointment	14,043.66	2.8
Drop	9,008.66	1.8
Suppository	6,092.80	1.2
Cream	2,233.30	0.5
Elixir	2,063.00	0.4
Aerosols/ inhalation	1,552.26	0.3
Gel	862.58	0.2
Total	**500,522.1**	**100**

5.1.2.3. Reasons of medicines wastage

Medicines were found to be wasted due to expiry, damage and obsolete (out of market before its expiry date). In the present study, nearly 96% of the total value of wasted medicines was due to expiry. It costs 478,878.54 ETB in EFY 2005-2007. The total cost of damaged / deteriorated medicines and obsoleted medicines in the same period was 15,433.56 ETB and 6,210.00 ETB, respectively. None of the sampled health facilities documented theft and pilferage as a source of medicine wastage (Figure 4).

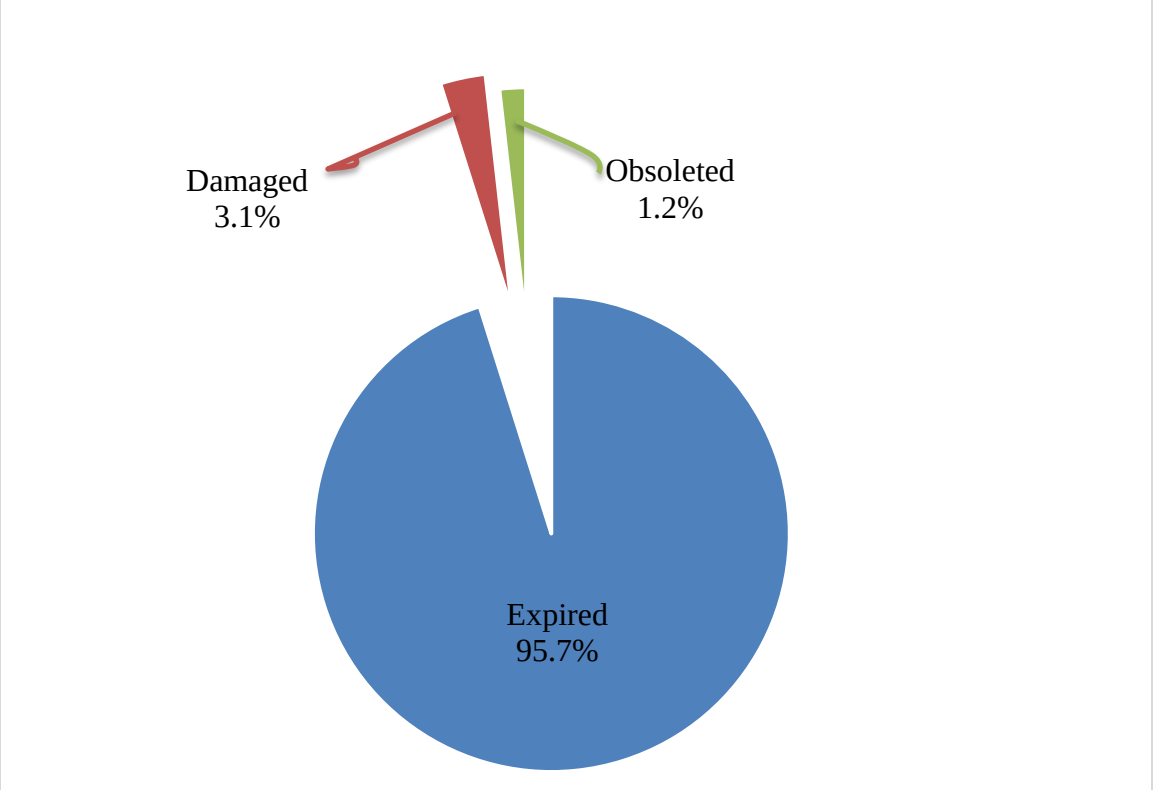


Figure 4. Percentage of wastage of medicines by reasons in the study facilities (EFY2005-2007), South West Shoa Zone, May 2016

5.1.3. Factors contributing to medicines wastage as perceived by health professionals

Information about factors contributing to medicines wastage was collected using self administered questionnaire.

5.1.3.1. Socio-demographic characteristics of respondents

A total of 54 self-administered questionnaires were distributed to health professionals engaged in DTC and other medicine management activities of the study health facilities; from these 49 questionnaires were completed and returned to the investigator; resulting in the response rate of 90.7%. The mean age of the respondent was 28.3 years (SD = 3.49). The minimum age was 21 and the maximum was 40 years. In terms of field of study, 19 (38.8%) of respondents were pharmacy professionals (pharmacists/druggists) and 30 (61.2%) were medical doctors, health officers, nurses or laboratory technologists. Most of the respondents, 27 (55.1%) were having 5-10 years of work experience as shown (Table 4).

Table 4. Socio demographic characteristics of health professionals working in the selected public health facilities in South West Shoa Zone, Ethiopia, May 2016 (n=49)

Socio-demographic Profile		Number	Percentage
Sex	Male	37	75.5
	Female	12	24.5
Age	20-29	36	73.5
	30-39	12	24.5
	≥ 40	1	2.0
Profession	General practitioner	3	6.1
	Pharmacist	10	20.4
	Druggist	9	18.4
	Health officer	8	16.3
	Nurse	18	36.7
	Laboratory technologist	1	2.1
Level of education	Diploma/ Level IV	22	44.9
	Bachelor/ First Degree	27	55.1
Work experience	<5 years	20	40.8
	5-10 years	27	55.1
	> 10 years	2	4.1

5.1.3.2. Perceived factors contributing to medicine wastage

Health professionals involved in DTC and medicines supply management activities were asked for their feelings about factors contributing to medicines 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 medicine wastage by health professionals were delivery of nearly expired medicines to the health facilities by the suppliers (4.31±0.79) (mean ± SD), lack of system to exchange nearly expired medicines between facilities (4.00±0.89), presence of over stocked medicines due to improper forecasting of need in the facilities (3.88±0.90), lack of electronic stock management tools (3.84±1.11) and shortage of pharmacy staffs in the facilities (3.78±1.34).

Similarly, more than two-thirds of the respondent either strongly agreed or agreed that delivery of nearly expired medicines by the suppliers, lack of system to exchange nearly expired medicines, presence of over stocked medicines due to improper forecasting of need in the facilities, lack of electronic stock management tools and shortage of pharmacy staffs in health facilities were contributing highly to medicines expiry (Table 5).

Table 5. The perceived factors contributing to medicines wastage by health professionals in selected public health facilities of South West Shoa Zone, Ethiopia, May 2016 (n=49).

Contributing Factors	Strongly disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly agree n (%)	Mean*
Near expiry medicines (< 6months) are being delivered to the health facility	1(2.0)	0 (0)	4 (8.2)	22 (44.9)	22(44.9)	4.31
Lack of system to move nearly expired medicines facility to facility to ensure timely use of medicines	0(0)	5 (10.2)	4 (8.2)	26 (53.1)	14(28.6)	4.00
Presence of over stocked medicines due to poor quantification in the facility	0(0)	0 (0)	5 (10.2)	27 (55.1)	11(22.4)	3.88
Lack of electronic stock management tools in the health facility	3(6.1)	3 (6.1)	7 (14.3)	22 (44.9)	14(28.6)	3.84
The shortage of pharmacy human resources in the facility	2(4.1)	12(24.5)	2 (4.1)	12 (24.5)	21(42.9)	3.78
Poor communication and coordination with key stake holders (health bureau/office, suppliers, NGO's)	2(4.1)	13 (26.5)	7 (14.3)	19 (38.8)	8(16.3)	3.37
Weak or no mechanisms for medicine wastage monitoring and evaluation in the health facility	4(8.2)	10 (20.4)	8 (16.3)	19 (38.8)	8(16.3)	3.35
Poor stock management like using neither FIFO nor FEFO in stock management	6(12.2)	10 (20.4)	6 (12.2)	20 (40.8)	7(14.3)	3.24
No accurate data available in the health facility to facilitate quantification of medicines	4(8.2)	11 (22.4)	13 (26.5)	13 (26.5)	8(16.3)	3.20
Absence of functional DTC in the health facility	8(16.3)	8 (16.3)	5 (10.2)	24 (49.0)	4(8.2)	3.16
Lack of accountability for stock-outs and wastage of medicines in the facility	2(4.1)	13 (26.5)	16 (32.7)	15 (30.6)	3(6.1)	3.08
Medicines are purchased without procurement plan/policy in the facility	8(16.3)	9 (18.4)	13 (26.5)	13 (26.5)	6(12.2)	3.00
Selection of medicines are not based on available essential medicines list in the health facility	5(10.2)	15 (30.6)	13(26.5)	15 (30.6)	1(2.0)	2.84
Nonparticipation of clinicians in medicine selection and quantification of the facility	8(16.3)	14 (28.6)	12 (24.5)	8 (16.3)	7(14.3)	2.84
Paying staff members' salaries that are significantly lower than necessary for self-support	2(4.1)	23(46.9)	14 (28.6)	5 (10.2)	5(10.2)	2.76
Lack of knowledge and skills of pharmacy professionals in medicine supply management	3(6.1)	18(36.7)	22 (44.9)	5 (10.2)	1(2.0)	2.65
Abrupt changes of treatment practices results medicines wastage in the facility	6(12.2)	21 (42.9)	11 (22.4)	7 (14.3)	4(8.2)	2.63
Weak physical security in the vehicle during transportation of medicines	9(18.4)	24 (49.0)	7 (14.3)	6 (12.2)	3(6.1)	2.39
Medicines are stored on floor, and not arranged systematically on shelves in the facility store	9(18.4)	28 (57.1)	2 (4.1)	8 (16.3)	2(4.1)	2.31
Medicines that need cold temperature are not stored in a functional refrigerator in the health facility	17(34.7)	22 (44.9)	1 (2.0)	4 (8.2)	5(10.2)	2.14

** Responses ranged from strongly agree (5) to strongly disagree (1)*

5.2. Qualitative findings

In-depth interviews were held with chief executive officers of the health facilities and pharmacy case team (a total of twenty). Except one, all of the key informants were males. Majority of them were in the age group of 30 to 35 (29.6±2.9) years with bachelor degree. The work experiences of the respondents ranged from 1 to 7 (6.4±1.8) years.

In-depth interviews were conducted to gather information about the current situation of medicines wastage in their facilities, factors that contribute for medicines wastage, the effect of medicines wastage on service provision and suggestions for improving medicines wastage.

The situation of medicines wastage in public health facilities

Almost all key informants agreed that medicines wastage is a problem in their facility. In addition, they felt that it is decreasing from time to time. Some also said it is increasing compared to the past.

One respondent said that:

"I feel that the medicines wastage rate is decreasing which is mostly due to strong implementation of IPLS in recent years."(Pharm.02)

However, some of respondents do not agreed with the above. They argued that medicines wastage rate has not showed any improvement. One key informant explained that:

".... Though the distribution of medicine was supposed to be a 'pull' system, in which we order medicines through PFSA's IPLS based on our need, still medicines had been supplied to the facility as 'Push' system, which contribute for increased of wastage."(Pharm.03)

Factors contributing for medicines wastage

Several reasons were mentioned by the key informants as contributing factors for medicines wastage in their facilities. Provision of medicines without needs and requisition, lack of an electronic stock management tool, absence of functional DTC, poor storage facility, lack of communication between the PFSA and health facilities, insufficient pharmacy personnel and weak monitoring system for medicines wastage were among the factors mentioned by the key informants. A statement made by one key informant demonstrated this fact:

"I don't think one factor could be contributing to medicines wastage in our facility; it was a result of various internal and external factors such as shortage of staffs, lack of administrative support, supplier challenges and etc…"(Pharm.04)

All of key informants mentioned supplier challenges such as provision of medicines not based on needs and requisition, and delivery of nearly expired medicines as a major cause of medicines wastage. One of the respondents mentioned:

"PFSA sometimes provide medicines that have short expiry date. If you refuse to receive these medicines, it will not give you other required medicines listed on the same voucher… [So,] we are forced to receive the medicines, knowing that it will expire before it is consumed. "(Pharm.03)

Another one added on this:

"PFSA did not provide the medicines we requested in type and quantity. For example, we recently got several tins of phenobarbital but we had not ordered for them. Most of the time to compensate the budget, they themselves adjust the quantity and provide over stock medicines.... these practice led to wastage of medicines."(Pharm.07)

Inadequate availability of pharmacy professionals was also mentioned as a reason. This results high work load on the available staffs, resulted in lack of dedicated persons to take charge of medicine supply management and clinical nurses led medicine management which contributed for medicines wastage. One key informant said that

"Because of shortage of pharmacy professionals in the facility, the available staffs are not primarily focusing on medicines management function due to high work load and clinical nurses became responsible for store management in addition to their routine nursing functions. [So] there's no one dedicated for medicines supply management and because clinical nurses lack training in medicines logistics management, inefficiencies which result medicine wastage occurs in medicines management practice." (Manager.01)

Some key informants mentioned that poor attitude of health facility administrators to the pharmacy service, absence of medicines wastage controlling mechanisms such as reporting and auditing, weak supportive supervision of inventory management, lack of accountability for wasted medicines and lack of regular discussion with key stake holders on issues were responsible for medicines wastage. One key informant said that

"For me, I think the health facility administrators have no good attitude for the pharmacy service. Especially, if you are working at health center, anything that you propose to work will not get support from the management. We can't at least discuss on medicine provision problems….. I think this has its own contribution on medicines wastage." (Pharm.05)

The consequence of medicines wastage on service delivery

Key informants were asked for their opinion on the effect of medicines wastage on their service provision. Financial burden (budget constraint) and shortage of storage size (space limitation) were among the consequences mentioned by key informants.

All key informants revealed that the major challenge in medicines wastage was congested storage. According to the key informants a large proportion of the space at the medicines store is occupied by wasted medicines. For example one respondent said that:

"Expired and damaged medicines congested storage and occupy scarce space that could be used for other medicines. So customers can not be assured that they have received a high quality medicine because these medicines are resulted poor storage conditions."(Pharm.01)

Suggestions for improving medicine wastage

The respondents were asked to provide suggestions on how to improve medicine wastages in the public health facilities. Employing additional pharmacy professionals, conducting regular discussion on medicines supply management with key stakeholders and improving communication of the health facility with other health facilities and supplier were among the suggestions made to improve medicines wastage. They also suggested that there should be an electronic medicine supply management tool to allow for monitoring of stock levels and expiry dates. In relation to supplier challenges, all respondents recommended PFSA should provide medicines with long expiry date based on their need. Explaining this, the one key informant said:

"…. I think this situation can only be improved if PFSA supplies what I order."

6. DISCUSSION

Ethiopia, like many other countries around the world, is seeking ways to reduce medicines wastage. In recent years, FMOH has made tremendous efforts in reducing wastage rates (FMOH, 2010). However; there is limited information on the extent of wastage and type of medicines commonly wasted as well as its contributing factors. The present study focused on the determination of medicines wastage rate, major types of wasted medicines and contributing factors using mixed data collection methods and attempted to give the full picture of medicines wastage in public health facilities found in South West Shoa Zone, Oromia Regional State, Ethiopia.

In the present study, nearly a third of all the health facilities visited did not continuously document wastage of medicines between EFY 2005-2007. The reason given was increased workload of the pharmacy professionals. Poor recording of medicines wastage is an indication of a lack of transparency and accountability on the part of health facilities that exposed the system to theft and pilferage (Tadeg *et al*., 2014).

The extent of medicines wastage

In this study, the estimated medicines wastage rate (in terms of value) was found to be 7.5%, which is slightly lower than the nationally reported figure, (8.3%) (FMOH and WHO, 2003). However, this result is higher than what was found in Addis Ababa (Tadeg *et al*, 2014). This could be due to differences in the level of health facilities included, where previous study considered only hospitals. It also shows that the ability of pharmacy case team to properly manage medicines and provide quality of medicines is relatively best in hospital than health centers.

The study also showed that the average rate of medicine wastage (7.5%) was higher than national target of below 2% set on HSDP IV (FMOH, 2010b). On the contrary, findings of studies on implementation of Auditable Pharmaceutical Transactions and Services (APTS) in Ethiopia reported much lower figures of 0.27% and 1.1% wastage rate (FMOH, 2014b; Gedif *et al*., 2016). This higher figure of medicine wastage rate might be due to APTS was not implemented in public health facilities of South west Shoa Zone.

An overall decreased in average wastage rate was observed for all selected health facilities. It showed a decrease from 10.6 % in EFY 2005 to 9.2% and 5% in EFY 2006 and 2007, respectively. The key informant interview showed that strong implementation of IPLS in recent years might be the reason for the reduction. Impact evaluation report showed that IPLS is improving wastage of medicines (PFSA, 2014).

Types of commonly wasted medicines

The present study revealed that out of the total value of wasted medicines about 40% were anti-infectives. However, the study settings were different for making comparisons; this proportion was much higher than what was found from the study in Tanzania, Egypt and Jordan (Ali and Ibrahim 2009; Al-azzam *et al*., 2012; Kagashe *et al*., 2014). This might indicate the presence of over stocked class of medicines due to the higher occurrence of infectious disease in the studied area. It is well known that infectious diseases are the major causes of morbidity and mortality in developing countries, including Ethiopia (FMOH, 2010b; Kagashe *et al*., 2014).

The study also showed that the top ten wasted medicines (in terms of value) were essential medicines. These medicines were also in tracer medicines list of Ethiopia, according to 2014 essential medicines list (EFMHACA, 2014). Wastage of vital and essential medicines raises concerns about the management of severe diseases in the facilities. This problem would likely have affected the quality of care provided at the health facilities.

On the other hand, these classes of essential medicines were not adequately available in most of the public health facilities on continuous basis due to delivery of near expiry medicines. Findings showed that essential medicines availability in Ethiopia was less than 65% (FMOH and WHO, 2003; WHO, 2008). Therefore there is a need to have a system of moving medicines from overstock to under stock areas to minimize both stock out and expiry.

Apart from hampering therapeutic benefits, the financial burden resulting from medicines wastage is also very huge (MSH, 2010). In this study the total monetary value of wasted medicines in EFY 2005- 2007 was found 500,522.10 ETB. This was higher than what was reported in Kilembe, Uganda (Tumwine *et al*., 2010). But, the figure was very much lower compared to the figure reported in Addis Ababa (Tadeg *et al*., 2014). This variation may occur as a result of differences in sample size, duration of study period, level of health facilities (settings) and variation in medicines price.

The average value of medicines wastage per year was estimated to be 213,963.10 ETB, 220,144.45 ETB and 152,617.80 ETB in 2005 EFY, 2006 EFY and 2007 EFY, respectively. This indicated the financial burden of medication wastage would be enormous in the facilities. Expired medicines stock is clearly a waste of resources which cannot be afforded in a resource-constrained nation (Tumwine *et al*., 2010). It is important to take the necessary preventive strategies by the health facilities in turn to optimize over all financial loss incurred to them.

Factors contributing to medicines wastage

The current study found that delivery of nearly expired medicines (< 6months) to the health facilities by the suppliers, lack of system to move nearly expired medicines from one facility to another, presence of over stocked medicines due to improper forecasting of need in the facilities, lack of electronic stock management tools and shortage of pharmacy staffs in the health facilities as major contributing factors for medicines wastage. Similar findings were also reported that short shelf life, improper forecasting of need that leads to overstock, poor storage practices and poor inventory control were the major factors for high wastage rates of medicines (Nakyanzi *et al*., 2010; PFSA, 2014). In contrast to the above findings, a study conducted in developed countries showed that poor compliance of medicines, stop or change of medication, side effect and patient death were the major contributing factors for medicines wastage (Braund *et al*., 2008; Trueman *et al*., 2010). This could be due to differences in the settings and sources of medicines investigated, where the former studies in developed countries assessed medicines wastage in community and medicines returned to pharmacy by patients. Factors contributing towards medicines wastage depend upon the forms of medicine wastage investigation and feature of the healthcare delivery system (Kagashe *et al*., 2014).

The present study identified delivery of nearly expired medicines (< 6months) to the health facilities by the suppliers as one of the contributing factors for medicines wastage. The results of this study is similar to the study conducted in Uganda, and reported that almost half of the expired medicines was due to provision of medicines that were about to expire (Tumwine *et al*., 2010). This study suggests that supplier should provide medicines with long expiry date based on the health facilities need.

This study also identified the presence of over stocked medicines due to improper forecasting of need in the health facilities was the major cause of medicines wastage. The key informant interview showed that provision of medicines without needs by suppliers resulting over stocking of medicines. Similarly a study done in Uganda and Tanzania showed that over stocking of medicines was one of major contributing factors for expiry of medicines (Nakyanzi *et al*., 2010; Kagashe *et al*., 2014). Overstocking of medicines normally produce high number of expired medicines and high cost of storing excess stock (MSH, 2012). Therefore there is a need to have a system of proper quantification and forecasting of medicine requirements using reliable consumption data from health facilities and provision of medicines through demand-based approach from suppliers

The other identified factor for medicines wastage was lack of electronic stock management tool in the health facilities. Effective inventory control system provides timely and accurate information which helps to reduce incidence of stock outs as well as controlling wastage (Baghdadi Sabeti *et al*., 2009). Electronic logistic management information system is more reliable system in generating accurate information than other systems (Baghdadi Sabeti *et al*., 2009). However it is highly recommended to apply both computerized and paper based systems for excellent reconciliation of stock data. When used effectively, automation eases the tedious work of medicine inventory management, save personnel time and promotes quality of services (Awaya *et al*., 2005). Therefore emphasis should be made to ensure that the use of electronic tools and other systems of stock recordings are well established and applied effectively.

Shortage of pharmacy staffs in the facilities was also cited as one of the contributing factors for medicines wastage, both in the survey and in-depth interview. This finding is similar to what was found in assessment report undertaken in South Africa where inadequate availability of pharmacists in the facilities was identified as possibly contributing to medicines wastage (MSH/SPS, 2008). Human resources are a key performance driver within medicine supply chains. Shortage of human resources could play a role in medicines wastage due to increased workload and hence decreases stock level monitoring and other management of medicines (King and Fomundam, 2010; USAID, 2011). Thus, the number of pharmacy staffs should be increased to reduce workload and in return to improve medicine supply management.

It is evident a certain amount of medicines wastage is inevitable, but it is also estimated that about 50% of medicines wastage is likely to be preventable (Braund *et al*., 2008). And all key informants suggested that having adequate number of pharmacy professionals, strengthening DTC, conducting regular supervision, having regular discussion on medicines supply management activities with key stakeholders and improving communication of the health facility with other health facilities and supplier were among the suggestions made to improve medicines wastage

7. STRENGTH AND LIMITATION OF THE STUDY

The strengths of this study include that the study used both quantitative and qualitative methods to supplement each other.

The limitations include the study covered only wasted medicines with price list and it did not show the wastage rate of program and donation medicines due to absence of price record. And the findings of this study were from only health facilities perspective and did not include other stakeholders such as; PFSA, Oromia regional health bureau, zonal and woreda health offices and partners.

8. CONCLUSION AND RECOMMENDATIONS

8.1. Conclusion

The study identified that the extent of medicines wastage in public health facilities of South West Shoa Zone was high. The medicines wastage rate was estimated to be 7.5%. The top three classes of wasted medicines in terms of value were anti-infectives, medicines used for correcting water, electrolyte and acid-base balance and medicines acting on gastrointestinal truck. Oral rehydration salt 245osml/l powder, metronidazole 250mg capsule, and tetracycline 250mg capsule, were also the three top medicines wasted. Delivery of near expiry date medicines by PFSA, lack of system to exchange nearly expired medicines between facilities, presence of over stocked medicines due to improper forecasting of need in the facilities, lack of electronic stock management tools and shortage of pharmacy professionals in the health facilities were identified as major contributing factors for medicines wastage.

8.2. Recommendations

Based on the findings of this study the following recommendations can be made:

- Health facilities should document and maintain a written record of all medicines wastage
- A mechanism of exchanging medicines from overstock to under stock areas should be created
- Computerized/ electronic inventory management tools should be used by health facilities to allow for proper quantification, monitoring of stock levels and expiry dates
- The number of pharmacy professionals should be increased to reduce workload and in turn to improve pharmaceutical management
- A strong partnership or a common plat forum should be established among key stake holders (HFs, woreda /zonal health offices, health bureau, FMOH, EFMHACA, PFSA and partners) to have regular discussion on preventive strategies of medicines wastage.

Suggestions for Future Work

- Similar studies should be done in different parts of the country in public as well as private health facilities to have a general picture of medicines wastage in Ethiopia.

REFERENCES

Abou-Auda HS (2003). An Economic Assessment of the Extent of Medication Use and Wastage among Families in Saudi Arabia and Arabian Gulf Countries. *Clin Ther***25**:1276-1292.

Al-azzam S, Khader Y, Rawashdeh S, Hijazi S (2012). An assessment of the Extent of Medication Wastage among Families in Jordan. *JJPS***5**: 65–73.

Ali SE, Ibrahim MI (2009).Extent of Medication Wastage and Cost among Female Students in a University Setting. *J Pharm Sci***36**: 34-43.

ARHB (2012). Auditable Pharmaceuticals Transactions and Services (APTS): A Guide for implementation.Amhara Region Health Bureau, Bahir Dar, Ethiopia.

Awaya T, Ohtaki K, Yamada T, Yamamoto K, Miyoshi T, Itagaki Y, Tasaki Y, Hayase N, Matsubara K (2005). Automation in drug inventory management saves personnel time and budget. *Yakugaku Zasshi***125**: 427-432.

Baghdadi-Sabeti G, Cohen-Kohler JC, Wondemagegnehu E (2009). Measuring transparency in the public pharmaceutical sector: Assessment instrument. World Health Organization, Geneva, Switzerland

Braund R, Chuah F, Gilbert R, Gn G, Soh A, Tan L (2008). Identification of the reasons for medication returns. *NZ Fam Physician***35**: 248-252.

Braund R, Peake BM, Shieffelbien L (2009). Disposal practices for unused medications in New Zealand. *Environ Int***35**: 952–955.

CSA (2015). Central Statistical Agency of Ethiopia: population projection for 2015/16. Available at: http://www.csa.gov.et/images/banners/csa2. [Accessed on 07 January 2016]

EFMHACA (2013). Publications: List of Human Medicine and Medical Equipments/Supplies Exporter, Importer and Wholesalers. Available: http://www.fmhaca.gov.et/publications.html[Accessed on 4 March 2016].

EFMHACA (2014). National Essential Medicine List, 5th edn, FMHACA, Addis Ababa, Ethiopia.

Ekedahl AB (2006). Reasons why medicines are returned to Swedish pharmacies unused. *Pharm World Sci***28**: 352-8.

Fentie M, Fenta A, Moges F, Oumer H, Belay S, Sebhat Y, Atinafu T, Mekonnen T, Somasundaram J (2015). Availability of Essential Medicines and Inventory Management Practice in Primary Public Health Facilities of Gondar Town, North West Ethiopia**.** *J Pharma Sci Tech***4**: 54-56.

Fidler A, Msisha W (2008). Governance in the pharmaceutical sector. *Euro health***14**: 25.

FMOH (2006). Health Commodities Supply System Master Plan. Federal Ministry of Health, Addis Ababa, Ethiopia

FMOH (2010). Federal Ministry of Health of Ethiopia plan and program directorate, Health Sector Development IV (HSDP IV /2010-2015) plan.Federal Ministry of Health, Addis Ababa, Ethiopia

FMOH (2014a). Auditable pharmaceutical transaction and service (APTS) scaling up and making it functional, status ways forward: 16th National annual review meeting group discussion. Federal Ministry of Health, Addis Ababa, Ethiopia

FMOH (2014b). Health Sector Development Programme IV: Annual Performance Report (2013/14). Federal Ministry of Health, Addis Ababa, Ethiopia

FMOH (2015a). Fact Sheet- Ethiopia 2015. Available: http://www.moh.gov.et/factsheets [Accessed on 4 March 2016]

FMOH (2015b). Health and Health Related Indicators 2007 E.C (2014/2015). Federal Ministry of Health, Addis Ababa, Ethiopia

FMOH (2015c). Health Sector Development Programme IV Annual Performance Report EFY2007 (2014/15). Federal Ministry of Health, Addis Ababa, Ethiopia

FMOH (2015d). Health Sector Transformation Plan 2015/16-2019/20. Federal Ministry of Health, Addis Ababa, Ethiopia

FMOH, WHO (2003). Assessment of the Pharmaceutical Sector in Ethiopia. Ministry of Health, Addis Ababa, Ethiopia

Frost M, Sullivan L (2012). Health Care Industry Overview in Ethiopia. Available at: http://www.frost.com/prod/servlet/reportb. [Accessed on 25February 2016].

Gebre-Mariam T (2015). The State of Pharmaceutical Industry in Ethiopia and a Glimpse into the Future. 40th Anniversary Special Publication. Ethiopian Pharmaceutical Association.

Gedif T, Teshome D, Sebsibie F, Assefa T, Gulelat B, Beedmariam G, Abdulber S, Bayissa R, Adinew A, Tadeg H (2016). Implementation of Auditable Pharmaceutical Transaction and Services in Ethiopia: Assessment Report. Special Bulletin 18th Annual Review meeting, Federal Ministry of Health, Addis Ababa, Ethiopia

Glassmeyer ST, Hinchey EK, Boehme SE, Daughton CG, Ruhoy IS, Conerly O, Daniels RL, Lauer L, McCarthy M, Nettesheim TG (2009). Disposal practices for unwanted residential medications in the United States. *Environ Int***35**: 566–572.

Kagashe GA, Makenya FB, Buma D (2014). Medicines Wastage at a Tertiary Hospital in Dar Es Salaam Tanzania. *J Appl Pharm Sci***4**: 098-102.

King RC, Fomundam HN (2010). Remodeling pharmaceutical care in Sub-Saharan Africa (SSA) amidst human resources challenges and the HIV/AIDS pandemic. *Int J Health Plann Manage***25**: 30–48.

Law AV, Sakharkar P, Zargarzadeh A, Tai B, Hess K, Hata M, Mireles R, Ha C, Park TJ (2015). Taking stock of medication wastage: Unused medications in US households. *Res Social Adm Pharm***11**: 571–578

Lorna MW, Lesley D, Maria C, Derek S (2014). A systematic review of the literature on 'medication wastage': an exploration of causative factors and effect of interventions. *Int J Clin Pharm* **36**: 873–881.

Ministry of Health, Ministry of Industry (2015). National strategy and plan of action for pharmaceutical manufacturing development in Ethiopia (2015–2025): Developing the pharmaceutical industry and improving access. Addis Ababa, Ethiopia.

MOHG (2009). WHO pharmaceutical situation Assessment – level II: Health Facilities Survey in Ghana. Ministry of Health, Accra, Ghana

MOHSW (2008). In-depth Assessment of the Medicines Supply System in Tanzania. Ministry of Health and Social Welfare, Dar ea salaam, Tanzania

Moller LC (2015). Ethiopia's great run: the growth acceleration and how to pace it. Washington, D.C.: World Bank Group.

MSH (2010). Health system in action: An e Hand book for leaders and managers. Cambridge, MA:Mangement Sciences for Health. Available at: http:// www.msh.org/resources/center/health-system-in action.cfn[Accessed on 30 October 2015].

MSH (2012). MDS-3: Managing access to medicines and other health technologies. Arlington, VA: Mangement Sciences for Health

Nakyanzi JK, Kitutu FE, Oria H, Kamba PF (2010). Expiry of medicines in supply outlets in Uganda. *Bull World Health Organ***88**: 154–158.

PFSA (2011). Standard operating Procedure Manual for The Pharmaceuticals Logistics System in Health facilities of Ethiopia. Pharmaceutical Fund and Supply Agency, Addis Ababa, Ethiopia

PFSA (2014). The Ethiopian Pharmaceuticals Supply Chain Management System Monitoring and Evaluation Training Manual. Pharmaceutical Fund and Supply Agency, Addis Ababa, Ethiopia

Shewarega A, Paul D, Welelaw N, Sami T, Yared Y (2015). Ethiopia: National Survey of the Integrated Pharmaceutical Logistics System. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 4, and Pharmaceuticals Fund and Supply Agency (PFSA).

South West Shoa Zone Health Department (2015). Annual Report for 2014/15. Wolisso, Ethiopia

Tadeg H, Ejigu E, Geremew E, Adinew A (2014). Auditable Pharmaceutical Transactions and Services (APTS): Findings of the Baseline Assessment at Federal, Addis Ababa, and Teaching Hospitals. Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

Taryn V (2006). Anti-corruption in the health sector: preventing drug diversion through supply chain management. U4 Brief 4, Chr. Michelsen Institute, Bergen, Norway.

TGE (1993). National Drug Policy of the Transitional Government of Ethiopia. Transitional Government of Ethiopia, Addis Ababa, Ethiopia

The World Bank (2016). Data: Ethiopia. Available at: http://data.worldbank.org/indicator/SH.XPD.TOTL.ZS/countries/ET?display=graph. [Accessed on 24 February 2016].

Tong AY, Peake BM, Braund R (2011). Disposal practices for unused medications around the world. *Environ Int***37**:292–298.

Trueman P, Taylor DG, Lowson K, Bligh A, Meszaros A, Wright D (2010). Evaluation of the scale causes and costs of waste medicines. Report of DH funded national project 2010. Available at: http://discovery.ucl.ac.uk/1350234/1/Evaluation_of_NHS_Medicines_Waste__web_publication_version.pdf. [Accessed on 25 October, 2015]

Tumwine Y, Kutyabami P, Odoi RA, Kalyango JN (2010). Availability and Expiry of Essential Medicines and Supplies during the 'Pull' and 'Push' Drug Acquisition Systems in Rural Ugandan Hospital. *Trop J Pharm Res***9***:* 557-564

USAID (2009). Audit of USAID/Angola's Procurement and Distribution of Commodities under the President's Malaria Initiative (Report No. 4-654-10-001-P). Office of Inspector General, Pretoria, South Africa

USAID (2011). The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities, 2nd edn, Arlington, USA.

USAID, CDC (2014). The president's malaria initiative (PMI): The eighth annual report to congress USA. Available at:http://www.pmi.gov/resources/reports/pmi_annual_report12.pdf [Accessed on 28 October 2015].

Vogler S, Leopold C, Zuidberg C, Habl C (2014). Medicines discarded in householdgarbage: analysis of a pharmaceutical waste sample in Vienna. *J Pharm Policy Pract***7:** 6

WHO (1999a). Guidelines for safe disposal of unwanted pharmaceuticals in and after emergencies. World Health Organization: Geneva, Switzerland

WHO (1999b). Safe management of wastes from healthcare activities. World Health Organization: Geneva, Switzerland

WHO (2004a). Medicines strategy 2004–2007. World Health Organization: Geneva, Switzerland

WHO (2004b). The world medicines situation. World Health Organization: Geneva, Switzerland

WHO (2008) "Essential Medicines" Biennial Report 2006-2007. Available at: http://www.who.int/medicines/areas/access/EssentialMedsBiennialReport06_07.pdf[Accessed on November 22, 2012]

Zargarzadeh AH, Tavakoli N, Hassanzadeh A (2005).A Survey on the Extent of Medication Storage and Wastagein Urban Iranian Households. *Clin Ther***27**: 970-978.

ANNEXES

Annex 1: 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	Hospital ……1 Health Center ……2	If Health Center, go to 1.6
1.4. Level of health facility (if health center)	Type A ……1 Type B …… 2	
1.5. When the health facility was established (E.C)? _____		

Section I: Data Abstraction formats

Instruction:

Communicate 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)**			
		2007	2006	2005	
3.1	Total Value (in ETB) of Budget Medicines Received				
3.2	Value of Budget Medicines wasted (in ETB)				
	- Expired				
	- Damaged				
	- Obsolete				
	- Theft and pilferage				
	- Others (Specify)_____				
	- Total value				

2. Data Collection Sheet for Medicines wastage records (2005EFY- 2007EFY)

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

Section II. Self-administered questionnaire for data collection on factors contributing to medicine wastage

Addis Ababa University
College of Health Sciences
School of Pharmacy
Department of Pharmaceutics and social pharmacy

Information Sheet and Informed Consent

Purpose: this study is designed to determine the medicines wastage rate and to identify its contributing factors in selected public health facilities of South West Shoa Zone, Oromia region, Ethiopia. Your answers are very important and valuable to the successful completion of this study.

Please be honest in filling this questionnaire, as it will be solely used for research purposes. This survey will be confidential, anonymous, and data will be analyzed in aggregates.

For comments/questions please contact **Esayas Tadesse** (0921409489) 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 □
b. General practitioner □
c. Pharmacist (Msc) □
d. Pharmacist (B.Pharm) □
e. Diploma in Pharmacy □
f. Health officer (MSc) □
g. Health officer (BSc) □
h. Nurse (Msc) □
i. Nurse (BSc) □
j. Nurse (Diploma) □
k. Others (Specify)_____

2. Questions on Perceived factors contributing for Medicines wastage at the health facility

In this section, we ask your feelings about factors contributing to medicine wastage **(Expiry, Damage, Obsolete, Theft or others) <u>in your facility</u>**. For each statement on the left, please encircle one number 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)***)

No	Factors	SD	D	N	A	SA
2.1	Absence of functional DTC in the health facility	1	2	3	4	5
2.2	Selection of medicines are not based on available essential medicines list in the health facility	1	2	3	4	5
2.3	Nonparticipation of clinicians in medicine selection and quantification of the facility	1	2	3	4	5
2.4	No accurate data available in the health facility to facilitate quantification of medicines	1	2	3	4	5
2.5	Medicines are purchased without procurement plan/policy in the facility	1	2	3	4	5
2.6	Near expiry medicines (< 6months) are being delivered to the health facility	1	2	3	4	5
2.7	Abrupt changes of treatment practices results medicines wastage in the facility	1	2	3	4	5
2.8	Medicines are stored on floor, and not arranged systematically on shelves in the health facility store	1	2	3	4	5
2.9	Medicines that need cold temperature are not stored in a functional refrigerator in the health facility	1	2	3	4	5
2.10	Weak physical security in the vehicle during transportation of medicines	1	2	3	4	5
2.11	Presence of over stocked medicines due to improper forecasting of need in the facility	1	2	3	4	5
2.12	Poor stock management like using neither FIFO nor FEFO in stock management	1	2	3	4	5
2.13	Lack of electronic stock management tools that automatically capture medicines wastage in the health facility	1	2	3	4	5
2.14	Weak or no mechanisms for medicine wastage monitoring and evaluation in the health facility	1	2	3	4	5
2.15	Poor communication and coordination with key stake holders (health bureau/office, suppliers, NGO's)	1	2	3	4	5
2.16	Lack of accountability for stock-outs and wastage of medicines in the facility	1	2	3	4	5

2.17	Lack of system to move nearly expired medicines facility to facility	1	2	3	4	5
2.18	The shortage of pharmacy human resources in the facility	1	2	3	4	5
2.19	Lack of knowledge and skills of pharmacy professionals in medicine supply management	1	2	3	4	5
2.20	Paying staff members' salaries that are significantly lower than necessary for self-support	1	2	3	4	5

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 Esayas Tadesse. I came from Addis Ababa University School of Pharmacy attending a post graduate study in Pharmacoepidemiology and Social Pharmacy. I am the principal investigator for the study entitled "*Assessment ofmedicines wastage and its contributing factors inselected public health facilities in South West Shoa Zone, Oromia Regional State, Ethiopia"*. And I would like to talk with you about medicines 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 medicines wastage rate and to identify its contributing factors in selected public health facilities of South West Shoa Zone,Ethiopia. Considering that the findings and recommendations emanated from this study will help the policy makers 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 guiding for key informant interview (English version)

1: Back ground 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 in-depth interview with head of pharmacy case team&health facility

2.1. How do you assess the current situation of medicines wastage in your health facility?

2.2. What are the factors that contribute for medicines wastage in your health facility?

2.3. How does medicines wastage in your health facility is affecting service provision of your facility?

2.4. Are there any efforts made so far by the facility to prevent/ reduced medicines wastage? What do you recommend to minimize for the future too?

Thank you for your time and cooperation

Section IV: Amharic version of verbal consent format for key informants

አዲስአበባዩኒቨርሲቲ
የፋርማሲትምህርትቤት
የፋርማሲዩቲክስናሶሻልፋርማሲዲፓርትመንት

በደቡብ ምዕራብ ሸዋ ዞን ውስጥ በሚገኙ የመንግስት ጤና ተቋማት ውስጥ ያለውን የመድኃኒት ብክነት በተመለከተ ከ ሚመለከታቸው ኃላፊዎች ጋር ለሚደረግ ቃለ-መጠይቅ የተዘጋጀ መመሪያ፡፡

መግቢያ

ጤና ይስጥልኝ ስሜ ኢሳያስ ታደሰ ይባላል፡፡ በአሁኑ ሰዓት በአዲስ አበባ ዩኒቨርሲቲ የፋርማኮኢፒዲሞሎጂ እና ሶሻል ፋርማሲ የሁለተኛ ዲግሪ ተማሪ ስሆን በደቡብ ምዕራብ ሸዋ ዞን ውስጥ በሚገኙ የመንግስት ጤና ተቋማት ውስጥ ያለውን የመድኃኒት ብክነት ሁኔታ ለሚገመግመው ጥናት ዋና ተመራማሪ ነኝ፡፡ በመጀመሪያ በ መድኃኒት ብክነት ዙሪያ ለመነጋገር ውዴ ጊዜዎን ሰውተው ፈቃደኛ ስለሆኑልኝ ከልብ አመሰግናለሁ፡፡

የዚህ ጥናት ዋና ዓላማ በደቡብ ምዕራብ ሸዋ ዞን ውስጥ በሚገኙ የተመረጡ የመንግስት ጤና ተቋማት ውስጥ ያለውን የመድኃኒት ብክነት መጠን ማወቅና ለብክነቱ መንስኤ የሆኑ ችግሮችን መለየት ነው፡፡ ይህ ደግሞ ወደፊት ፖሊሲ አውጪዎች እና ሌሎች ጉዳዩ የሚመለከታቸው አካላት አስፈላጊውን የማሻሻያ እርምጃ እንዲወስዱ ከፍተኛ አስተዋፅኦ ያደርጋል:: በመሆኑም በ ጤና ተቋማቹ ውስጥ ያለውን የመድኃኒት ብክነት ሁኔታ በሚመለከት ያሎትን የግል አስተያየት በግልፅ እንዲነግሩን በአክብሮት እንጠይቃለን፡፡
በቃለ-መጠይቁ ወቅት የሚያነሱዋቸውን ነጥቦች ሙሉ በሙሉ ለማስቀረት ይረዳን ዘንድ የርሶ ፍቃድ ከሆነ ይህ ቃለ- መጠይቅ በመቅረጸ-ድምጽ የሚቀዳ ይሆናል፡፡ ይህም በመሆኑ ድምፅዎን በሚሰማ መልኩ ጮክ ብለው እንዲናገሩ አሁንም በማክበር እጠይቃለሁ፡፡ ይሄም ከጊዜዎት ከአንድ ሰዓት ያነሰ ጊዜ ይወስዳል፡፡ በዚህ የቃለ-መጠይቅ ሂደት የሚገኙ ማናቸውም መረጃዎች በምስጢር የሚጠበቁ ይሆናል፡፡ ይህም ማለት የሚሰጡንን መረጃ ከጥናት ቡድኑ አባላት ውጭ ለማንም ግልፅ የማናረግ ሲሆን የሚዘጋጁ የቃለ መጠይቆች ዘገባዎችም እርስዎን እንደ መረጃ ሰጪ የማይጠቅሱ ይሆናል፡፡ እርስዎ መናገር ስለማይፈልጉት ነገር ለመናገር እንደማይገደዱ እና ቃለ-መጠይቁን በማንኛውም ጊዜ ማቋረጥ እንደሚችሉም ላስታውስዎት እወዳለሁ፡፡ በቃለ-መጠይቁ ለመሳተፍ ፈቃደኛ ነዎት?

አዎ _____ አይደለሁም _____

በቃለመጠይቁ ለመሳተፍ ፍቃደኛ ከሆኑ ቃለ-መጠይቁ ይቀጥላል::

Semi structured guiding for key informant interview (Amharic Version)

1. **የመነሻ መረጃ**

1.1. **እድሜ** _____

1.2. **ፆታ** _____.

1.3. **ትምህርትደረጃ** _____

1.4. **የስራልምድ** _____

1.5. **የስራ ድርሻ** _____

2: *ቃለ መጠይቅ መረጃ መሰብሰቢያ ነጥቦች / የመነሻ ጥያቄዎች (ለ ፋርማሲ ክፍል ኃላፊዎች ና ለ ጤናተቋማት ኃላፊዎች)*

2.1. **በጤና ተቋማቹ ውስጥ ያለውን የመድኃኒት ብክነት ሁኔታ እንዴት ይገመግሙታል**?

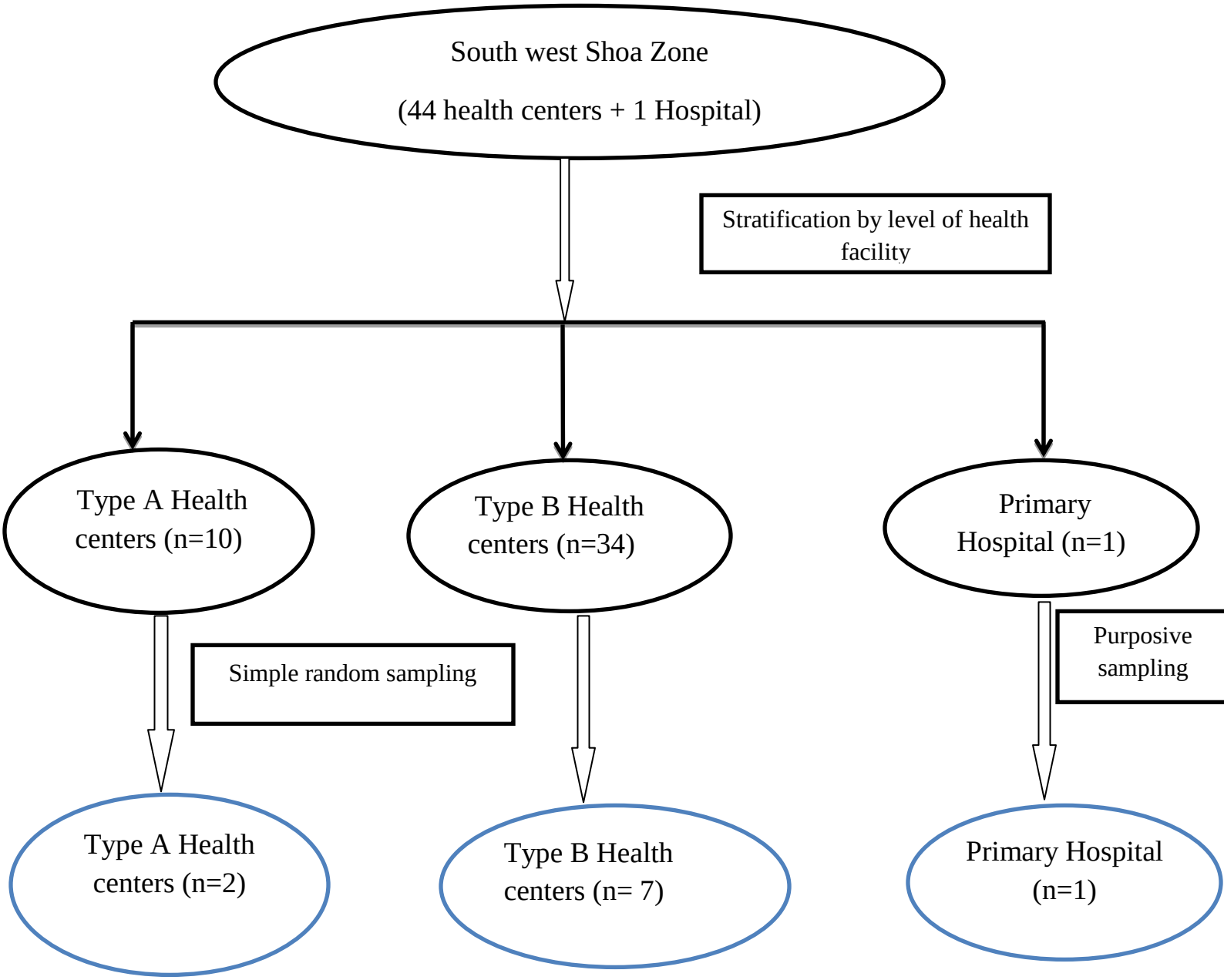
2.2. **በጤና ተቋማቹ ውስጥ ላለው የመድኃኒት ብክነት መንስኤ (ምክንያቶች) ምንድን ናቸው**?

2.3. **በመድኃኒት ብክነት ምክንያት በአገልግሎት አሰጠጥ ላይ የገጠሟችሁን ችግሮች ይጥቀሱ**?

2.4. **የችግሩን መጠን ለመቀነስ በፋርማሲ ክፍል / በጤና ተቋማቹ በኩል የተወሰደ እርምጃ ካለ ይጥቀሱ? ለወደፊትስ ምን መደረግ አለበት ብለዉ ያምናሉ**?

ስለ ትብብራችሁ ከ ልብ አመሰግናለሁ።።

Annex 2: Sampling frame for health facilities surveyed in South West Shoa Zone, Ethiopia, May 2016



Annex 3: List of health facilities included in the study

Facility code	Facility Name	Type & Level of Facility
ASHC	Asgori	Health Center (Type B)
AWHC	Awash bune	Health Center (Type B)
CHC	Chitu	Health Center (Type A)
DHC	Dilela	Health Center (Type B)
GOHC	Goro	Health Center (Type B)
GUHC	Gurura	Health Center (Type A)
OHC	Obi	Health Center (Type B)
TBHSP	Tulubolo	Hospital (Primary)
THC	Teji	Health Center (Type B)
WHC	Wolisso No1	Health Center (Type A)

Annex 4: Copy of ethical clearance letter

ዘ ፋርማሲ ትምህርት
የኢቲካል ሪቪው ቦርድ

Addis Ababa University

School of Pharmacy
Ethical Review Board

ቀን Date: November 02, 2015

ቁጥር Ref. No.: ERB/SOP/57/11/2015

To: Esayas Tadesse
School of Pharmacy

Subject: Ethical Clearance

It is to be recalled that you submitted a study proposal entitled, "Medicine Wastage Rate at Selected Public Health Facilities in South West Shoa Zone, Oromia Regional State, Ethiopia: Institutional Based Cross Sectional Study", for ethical approval by the School's Ethical Review Board (ERB). The Board thoroughly reviewed the proposal based on its operational guidelines and found it to fulfill all ethical requirements stipulated in the guidelines. This is, therefore, to inform you that the proposal is ethically approved for implementation.

With best regards,

Esubalew Adugna (BPharm, MSc)
Secretary, ERB

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Annex 5: Declaration sheet

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

Name: Esayas Tadesse
Signature: _____

This thesis has been submitted for examination with my approval as university advisor.

Name: Teferi Gedif (PhD)
Signature: _____

Place and date of submission: School Pharmacy, Addis Ababa, Ethiopia
June, 2017