

Unused and Expired Medications: Are They a Threat? A Facility-Based Cross-Sectional Study

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Abstract

Background: A significant amount of potentially effective and lifesaving medications were wasted at the health facilities due to lack of a system for checking their effectiveness and returning them to the system. **Objectives:** To assess the prevalence of unused medications and related consequences in selected health facilities of Awi zone, Amhara regional state, Ethiopia. **Methods:** A facility-based cross-sectional study design supplemented by a qualitative approach was employed. Descriptive data were collected using checklists while interviews were conducted with respective personnel at the health facilities. **Results:** A total of 4 health facilities were included in the study. During the 1 month of study period, 56 types of medications were found unused at the health facilities. Anti-infective medications were the most commonly unused medications 36.4%. At the in-patient departments of the 4 hospitals, a total of 173 medications were found unused. Similarly, 605 medications were found wasted at the pharmacy stores of those hospitals in the 2009 fiscal year. **Conclusion:** A significant amount of unused medications were present at the health facilities. Health facilities need to monitor health professionals strictly follow national and international treatment guidelines and monitor the rational use of medications.

Keywords

unused medications, reverse logistics, disposal practice

Introduction

Besides their substantial lifesaving importance, medications can also be disastrous when inappropriately taken and managed. Medications waste management is of a great importance because of the potential environmental hazards and public health risks. Evidences showed that more than half of all medications are inappropriately prescribed, dispensed, or sold¹ and that globally only about 50% of patients take their medications correctly.² The World Health Organization (WHO) has reported that there is only 50% global adherence to medications taken for a long period of time.³

In this article, unused medications and wasted medications refer to the same thing and they were defined as medications that were expired, discontinued, and deteriorated, which may be usable or not intended for any future use. Among the many reasons that contributed to patients not using all of the medications dispensed to them and thus medications wastage include; medication side effects, progression in illness, change of treatment, discontinuation of the medication, or medications reaching the expiration date.^{4,5}

In addition, dispensing of an extra quantity of medication, switching from intravenous therapy to oral, patient discharge, refill order, patient expiration (death), and patient objection to take the dose were the most common reasons for the nonutilization of medications in the inpatient wards of health facilities.^{6,7}

Medication wastage at the health facilities is a huge concern due to wastage of potentially useful medications as well as the costs associated with disposal of those medications.⁸ A study conducted at King Abdulaziz Medical City (KAMC), Riyadh, Saudi Arabia, showed that during 1 month of study period a total of 2061 items of intravenous medications were left unused and thus

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returned to the pharmacy. The most common reasons for returning intravenous medications were drug discontinuation (933 items, 45.3%), dispensing of an extra quantity (396 items, 19.2%), patient deaths (173 items, 8.4%), dose changes (171 items, 8.3%), and drug being held (150 items, 7.3%). The total cost of all the returned intravenous medications was US\$26805.80, which accounts for 13.65% of the total pharmacy's budget. The study has also revealed that the most frequently returned classes of medications were antibiotics 47.11%, electrolyte replacement preparations 17.27%, gastrointestinal drugs 6.55%, analgesics and antipyretics, 5.19%, and blood derivatives 4.51%.⁷

A similar study conducted at King Khalid University Hospital of King Saud University, Riyadh, Saudi Arabia, found that during 1 month of study period a total of 265 items out of 1218 (21.75%) intravenous medicine preparations were returned from the different wards to the inpatient pharmacy. The study also showed that antibiotic preparations were the most common unused and wasted preparations (77%) followed by antigastric agents (9%). Medication discontinuation was reported as the main reason for such wastage (60%).⁶

A study conducted at a tertiary hospital in Dar Es Salaam, Tanzania, identified the existence of medications wastage at medical wards. 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. The common factors contributing to medicines wastage as identified by the study were, excess supply of medicines for a patient (44%), pilferage (26.5%), patient death, and change/stop of medicines.⁹

Unused/expired pharmaceuticals pose a threat to both the health care system and to the environment.¹⁰ Given the budget constraints in financing the health care system together with the huge amount of wastage and disposal costs of those unused medications at low- and middle-income countries will pose a huge threat to the health care system and to the total economy in general.¹¹ Besides, multiple strains of antibiotic resistant bacteria's were detected in unused medications disposal sites.¹²

Practically, medications wastage cannot be completely eliminated. However, carefully examining contributing factors and identifying the most common and expensive medications involved, is certainly worthwhile, and may help in recognizing the most suitable measures to reduce medication wastage.¹³ Effective communication among health care professionals, pharmacist training, and adherence to standard practice guidelines might be the most vital strategies to reduce medication wastage at health facilities.⁷

The exact extent of the problem of unused medications is not fully known in Ethiopia. The major research questions to be answered by this study were the following: what is the magnitude of unused medications at the health facilities? What are the major contributing factors for the presence of unused medications at the health facilities? Which types of medications are most frequently wasted at the health facilities? What types of disposal methods of unused medications are practiced at the health facilities? How much did unused medications cost the health facilities? Results of this study will be of importance to policy makers, donor agencies, and program supporting agencies in order to design an appropriate system for the proper management of unused medications and thereby improve the whole supply chain productivity. The results of this study will also be used as baseline data for future studies in the area by providing an insight to the problem.

Methods and Materials

Study Area and Period

The study was conducted from 23 April to May 22, 2018 on selected health facilities and communities in Awi zone. Awi zone is 1 of the 15 zones (including the 3 special [city] zones) found in the Amhara National, Regional State. Based on the 2007 national census data and using a conversion factor, its population in 2010 EC is estimated to be around 1 264 203 of whom 1 057 604 are rural residents and 206 599 are urban residents. The male to female ratio is 50.1% male and 49.9% female residents.¹⁴

Currently, there are 4 primary and 1 general hospitals in the zone with one of the primary hospitals started providing service 2 months prior to the data collection period. In addition, there are 46 health centers and 185 health posts providing primary health care services. The facility to people proportion in the zone is 1 health post for 5717 rural people, 1 health center for 28 093 people, 1 primary hospital for 316 000 people, and 1 general hospital for 1 264 203 people in the area. Apart from these, there are 22 medium clinics, 92 lower clinics, 71 drug stores, 4 rural drug vendors, and 1 diagnostic laboratory owned by private owners in the zone. The zonal health service coverage based on public health centers calculation is 91%. There are 2043 health professionals working in the zone and 1 physician serves for 30 100 people and 1 public health officer serves for 7661 people in the zone.¹⁵

Study Design

A facility-based cross-sectional study design supplemented by a qualitative approach was employed. Descriptive data were collected using checklists while interviews were

conducted with respective personnel at the health facilities. The following formula was used to calculate the pharmaceuticals wastage rate at the hospitals.

$$\frac{\text{Total value of pharmaceutical wasted during the period}}{\text{Total stock available for sale in the period}} \times 100$$

Source Population

The source population includes all health facilities in Awi zone, Amhara regional state.

Study Population

The study populations are those selected health facilities who fulfill the inclusion criteria for the study.

Inclusion Criteria. The inclusion criteria include health facilities which provided in-patient health services and those health facilities that were providing health services for at least the past 1 year before the data collection period.

Exclusion Criteria. Health facilities owned by private owners (private hospitals and clinics) were not included to the study.

Sample Size Determination

All health facilities that fulfilled the inclusion criteria were included in the study.

Sampling Techniques

No sampling method was used. This was because of the few numbers of eligible health facilities present in the zone (4 of the hospitals out of the total 5 fulfilled the inclusion criteria) and thus all of them were included in the study. Health centers were not included in the study hence they basically provide outpatient health services with additional emergency and delivery services¹⁶ and hence does not basically have inpatient health services. Besides, in the country's context, hence, other than the types of services provided and the number and types of medications managed, the health care system and management system of pharmaceuticals at the hospitals and health facilities are the same thus studying the practices in the hospitals will provide an insight into the practices in health centers. Private health facilities were also not included in the study; hence as the name implies they are owned by private owners and thus some of their systems, including their supply chain system, are different from the public health facilities and thus analyzing them with

public health facilities and putting recommendations to differently managed facilities was inappropriate. As such together with the constraints in resources for data collection, health centers and private health facilities were not included in the study. All unused medications found during the data collection period, April 23 to May 22, 2018, were studied together with unused medications for the 2009 EC fiscal year and respective health professionals were contacted and interviewed.

Data Collection Procedure

Data were collected by 4 adequately trained data collectors. Four nurses at health facilities were participated in the data collection. Two days of training on the general aim of the research and the data collection tools was given to those data collectors prior to the data collection. Unused medications found at in-patient departments of those health facilities were studied for their type, quantity, dosage, and reasons for being unused. Further information about those unused medications was collected by interviews with heads of the wards at each of the health facilities. A checklist was used for collecting data at the pharmacy stores to assess the layout and storage practice of medications at the store and additional information on number and types of medications wasted, wastage rate, reasons for wastage of pharmaceuticals, and related information was collected. Interviews were conducted with the respective store man/woman and pharmacy heads of the respective hospitals.

Qualitative data was collected by using an in-depth interview method with heads of in-patient departments, heads of pharmacy departments, and store men/women at each of the sampled health facilities. Tape recorders were used for an in-depth interview and important notes were also taken.

Cost was determined by multiplying the unit cost of the medications to the actual number of pills remaining in the container according to the list of drug prices provided by the Ethiopian Ministry of Health (EMOH). For medications wasted at pharmacy stores and dispensing units at health facilities, cost data were taken from the respective pharmacy records/ reports and data for 1 fiscal year (2009) was taken. Cost of medications include only price of medicines not costs associated to handling the medicines, disposing them or any other related activity. Cost was defined using Ethiopian Birr (ETB) in which ETB1 was equivalent to USD0.035 at the time of data collection.

Data Quality Assurance

Two days of training was provided for the data collectors and supervisors by the principal investigator on the objective

of the study and data collection tools. Two supervisors had supervised the overall data collection procedure. Pretest of the data collection instrument was conducted at 1 health facility (Jawi hospital) prior to the actual data collection began in order to check the applicability of the instrument and make necessary adjustments. The pretested health facility was excluded from the study. The collected data were checked for its completeness, consistency, and accuracy before entered into software for analysis. After data entry into software, data were cleaned for inconsistencies and missing values.

Data Processing and Analysis

The collected data were checked for its completeness every day and each questionnaire was given a unique code by the principal investigator. A template for data entry was prepared and data were entered using Epi Data version 3.1 then exported to SPSS version 21. Epi Data V.3.1 was used for data entry and SPSS version 21 was used for analysis. Five percent of the entered data was rechecked by comparing the entered data with the actual questionnaire. Data were explored using SPSS to check for missed values and outliers. Any errors identified at that time were corrected after revision of the original data using the code numbers. Cross-tabulation was used in bivariate analysis.

For qualitative data: after data were collected, each of the recordings and notes were given a code. Data were transcribed into text by the principal investigator from the written note and by replaying the tape recorder. Different ideas in the text were merged in their thematic areas and thematic framework analyses were employed to extract meanings out of the texts manually. Results were finally presented together with similar results from the quantitative data.

Results

Medication-Related Outcomes

A total of 56 types of medications with different dosage forms were found at inpatient departments of the 4 hospitals during the 1-month study period (April 23 to May 22 2018). Anti-infective medications were found to be the most frequently unused medications 63 (36.4%) followed by anti-pain medications 37 (21.4%) and cardiovascular medications 19 (11%) (Figure 1). Among the total 173 medications found unused, 14 (8.1%) of the medications had already expired at the time of the data collection while the remaining 159 (91.9%) were usable (were not expired).

Number of medications wasted at the pharmacy store, including the dispensing units for 1 fiscal year (2009) was also assessed at each of the 4 hospitals. A total of 605 medications were wasted at the 4 hospitals. The calculated wastage rates at the 4 hospitals were; 1.53% at hospital 1, 2.38% at hospital 2, 2.5% at hospital 3, and 11.2% at hospital 4. Program medications and antibiotics were the most frequently wasted medications at all the studied hospitals.

Visual inspection of the pharmacy stores was also conducted using a checklist. (Table 1) Percentage fulfillment of the storage conditions by a health facility was calculated by multiplying the number of “yes” by 100% and dividing with the total number of storage conditions considered.¹⁷ Desirable or acceptable storage condition was defined as facilities that fulfilled at least 80% of the storage conditions defined in the checklist. Using such criteria, only 2 hospitals had fulfilled the desirable storage conditions one hospital 100% and the other one 82%, while the remaining 2 hospitals had only fulfilled 65% of the storage conditions.

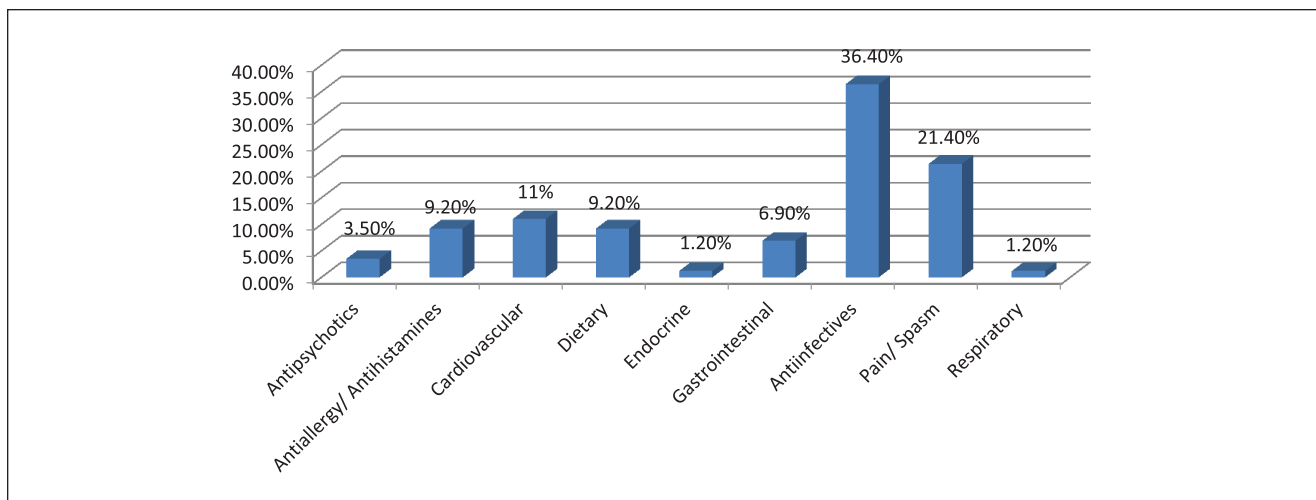


Figure 1. Types of unused medications based on therapeutic categories at selected health facilities in Awi zone, Amhara regional state, Ethiopia, 2018 (N = 173).

Table 1. Visual Inspection of the Pharmacy Store at Selected Health Facilities in Awi Zone, Amhara Regional State, Ethiopia, 2018.

Description	Hospital 3		Hospital 2		Hospital 1		Hospital 4	
	Yes	No	Yes	No	Yes	No	Yes	No
Products are arranged identification labels visible	✓		✓		✓		✓	
Products are arranged in first expiry first out manner	✓		✓		✓		✓	
Cartons and products are in good condition	✓		✓		✓		✓	
Separate damaged products from usable	✓		✓			✓	✓	
Products are protected from direct sunlight		✓	✓			✓	✓	
Cartons and products are protected from water and humidity	✓		✓		✓		✓	
Storage area is free from rodents and insects	✓		✓		✓		✓	
Storage area is secured with lock and key	✓		✓		✓		✓	
Products are stored at appropriate temperature		✓	✓		✓		✓	
Roof is always maintained in good condition	✓		✓		✓		✓	
Storeroom is maintained in good condition	✓		✓		✓		✓	
Current space sufficient for the current products and expansion		✓	✓			✓	✓	
Products are stacked at least 10 cm off the floor		✓	✓			✓	✓	
Products are stacked at least 30 cm away from the walls		✓		✓		✓	✓	
Products are stacked no more than 2.5 m high	✓		✓		✓		✓	
Fire safety equipment is available and accessible		✓		✓		✓	✓	
Products are stored separately from insecticides and chemicals	✓			✓	✓		✓	

Finding of Qualitative Study

At Inpatient Departments. Interviews were conducted with heads of inpatient wards at each of the 4 hospitals to identify the major reasons for the nonutilization of the medications. Three of the heads were male and one was a female. All of them were BSc nurses with a work experience of a minimum of 4.6 and a maximum of 8 years.

All of the studied hospitals follow a daily dose dispensing (DDD) system. Most of the respondents reported ineffectiveness of medications/lack of response and a consequent change of treatment, change of route of administration, and thus change of dosage form, patient leave medications behind when discharged and sometimes leave medications behind as the main reasons for the nonutilization of medications. Physicians, nurses as well as the patients were identified to be responsible for the nonutilization. Knowledge-related gaps were also reported. As stated by a male respondent code 4 said that

Sometimes some of the nurses assume medications once prescribed by the physician as daily basis (q.d), as to be taken two/three times a day and they order more medications which will then be left unused.

One other male respondent code 3 has also said that

There are sometimes situations in which if a patient was admitted at “noon (night)” and medications were prescribed to be taken more than once a day, some nurses order medications for that full day including the time before admission and

another full dose for the next day and some of the medications will be left unused.

At Pharmacy Stores. Interviews were also conducted with heads and store man/woman of the pharmacy departments at each of the 4 hospitals to identify the reasons for the medication wastage. All the pharmacy heads were male and degree holders with a minimum experience of 4 years and maximum experience of 8 years. A total of 3 store women and 1 store man were interviewed. All the store men/women were diploma holders with a work experience of a minimum of 4 years and a maximum of 8 years. All the store men and women were trained in Integrated Pharmaceuticals Logistics System.

The most common problem reported by all of the respondents was with regard to Pharmaceuticals Fund and Supply Agency (PFSA) pushing program products and sometimes Revolving Drug Fund items that were near-expiry and sometimes unnecessary at the health facilities were pushed.

Other common reasons reported by the respondents were different prescription patterns by prescribers, quantification problems (specially for seasonal products), poor data quality, poorly functional Drug and Therapeutics Committee (DTC), lack of data during service expansion and problems in reporting consumption data from wards, not considering quantity on order were mentioned. Lack of inventory management skill by the store man/woman was also mentioned.

One male respondent code 2 said that

Some reagent dependent products were frequently wasted when their reagents were not available.

The other reason mentioned by the respondents was miscommunication between the facilities and PFSA with regard to certain products (misoprostol and combined oral contraceptives [COC]) which does not have a common unit of measure that sometimes resulted in overprocurement of those products than the ordered quantity.

All the store men and women reported that they took physical inventory check every 2 weeks when the Internal Facility Report and Resupply Form was filled and besides the same reasons mentioned by the pharmacy heads they reported that there were shortage of pallets and refrigerators at the facilities.

Disposal Method for Unused Medications

At all the studied health facilities, medications at inpatient departments, including those being taken by patients except orally taken medications, were stored in cabinets at nurse rooms. Medications left unused were also returned to those cabinets. Unexpired medications were given to the poor who cannot afford them by themselves and the expired ones were discarded.

Expired and damaged medications were disposed based on disposal guidelines provided by Ethiopian Food Medicine and Healthcare Administration and Control Authority (FMHACA). Medications, laboratory reagents, and chemicals were all disposed at the same place similarly at all the health facilities studied.

Cost of Unused Medications

At Inpatient and Emergency Departments. Cost was calculated by multiplying the number of medications left unused with the unit cost of medications. Cost was calculated only for solid dosage forms and parenteral preparations because of the difficulty to determine the amount left in oral liquid preparations (syrups). A total of about ETB10101 (USD360.8) worth of medications, which is ETB2525 (USD90.2) per health facility were found unused at the inpatient departments of the 4 hospitals during 1 month of the study period (Table 2).

At Pharmacy Store. A total of about ETB606545 (USD21662.30) worth of medications were found wasted at the 4 hospitals for the year 2009 EC. The minimum wastage was at hospital 1 (ETB46540.7, USD1662.20) and the maximum wastage was at hospital 4 (ETB223856.50, USD7994.90) at hospital 4 (Table 3).

Discussion

During the 1 month of study period, 173 encounters of 56 types of medications with different dosage forms were

found at the 4 hospitals. These findings were less with regard to the total quantity of medications but greater in types of medications unused when compared with a study conducted in Baptist Memorial Hospital–North Mississippi (BMH-NH), Oxford, in which there were 285 bags of intravenous solution wasted from 46 different types of drugs.¹⁷ Based on this finding, it is possible to say that the wastage is not that much bad compared with that of a single hospital, but as hospitals found in a developing country, which has not yet fulfilled its pharmaceuticals need by itself and considering the scarcity of pharmaceutical resources and budget, the wastage is still significant compared with a hospital in the United States, which can deal with the situation with enough budget and resources.

Anti-infective medications were the most frequently unused medications (36.4%) followed by anti-pain medications (21.4%) and cardiovascular medications (11%). Similar findings were reported by a study conducted at a tertiary hospital in Dar Es Salaam, Tanzania, in which anti-infective medicines wastage was 18.9%, cardiovascular medicines 8.9%, and the other categories was 23.7% of the total medicines dispensed.⁹ Another study conducted in King Khalid University Hospital and King Abdulaziz Medical City in Riyadh, Saudi Arabia also found that, antibiotics were the most frequently unused medications (77%) followed by anti-gastric agents (9%) at King Khalid University Hospital and antibiotics (47.11%) followed by electrolyte replacement preparations (17.27%) at King Abdulaziz Medical City, respectively.^{6,7} The differences in the percentage and second prevalent medications between the current study and the other 2 studies in Riyadh could be attributed to the differences in the types of diseases prevalence (morbidity) in the areas and types of services provided by the facilities. In the current study area, communicable diseases are the most prevalent diseases and antibiotics are the main stay of treatment. Therefore, their prevalence in wastage may also show that they are the most commonly utilized/consumed and most commonly abused medications at the health facilities.

A total of 605 medications were found wasted at the pharmacy stores of the 4 hospitals in 1 fiscal year. From this finding, it is possible to say that although the wastage rate is different from one hospital to the other, given the fact that more than 80% of the pharmaceuticals need is still met by importing from outside the country and with fluctuations in availability of those medications, there is a significant wastage at the pharmacy stores of the 4 hospitals. Besides, health care budgets especially in low-income countries are limited and thus unused medications can be considered a waste of resources.¹¹ Hospital 1 was found to have the least number of wasted medications (88) and this could be attributed to the number of types of pharmaceuticals it holds. Hospital 1 area is relatively remote compared with the other 3 areas and thus the types of diseases in the area and the patient load at the hospital is relatively smaller than the other 3

Table 2. Cost of Unused Medications at Inpatient and Emergency Departments of Selected Health Facilities in Awi Zone, Amhara Regional State, Ethiopia, 2018 (N = 75).

Name of Medication	Frequency	Unit	Quantity Left	Unit Price (ETB)	Total Cost (ETB)
Adrenaline 1 mg/mL injection	1	Amp	1	3.1	3.1
Amoxicillin 500 mg capsules	3	Caps	25	1.03	25.75
Ampicillin 1 g injection	1	Vial	1	3	3
Ampicillin 500 mg injection	4	Vial	17	18	306
Artesunate 60 mg injection	4	Vial	32	33.2	1062.4
Atropine 1 mg/mL	1	Amp	4	3.15	12.6
Azithromycin 500 mg tablet	1	Tab	3	18.75	56.25
Benzathine penicillin G	2	Vial	5	7	35
Calcium gluconate 1 g/10 mL injection	1	Amp	1	5.7	5.7
Cefditoren 200 mg tablet	1	Tab	3	300	900
Ceftazidime 1 g injection	2	Vial	4	30.2	120.8
Ceftriaxone 1 g injection	7	Vial	17	11.65	198.05
Ceftriaxone 500 mg injection	3	Vial	3	8.8	26.4
Chloramphenicol 250 mg capsules	1	Caps	10	0.85	8.5
Chloramphenicol 1 g injection	6	Vial	18	11.5	207
Chlorpromazine HCl 25 mg	1	Vial	6	12	72
Cimetidine 200 mg/mL	6	Amp	29	4.3	124.7
Ciprofloxacin 200 mg/100 mL	1	Bott	3	10.5	31.5
Ciprofloxacin 500 mg tablet	2	Tab	12	1.05	12.6
Clarithromycin 500 mg tablet	1	Tab	9	5.75	51.75
Cloxacillin 250 mg capsule	1	Caps	4	0.5	2
Cloxacillin 500 mg capsule	2	Caps	47	1.05	49.35
Cloxacillin 500 mg injection	6	Vial	20	3.8	76
Crystalline penicillin G	4	Vial	41	7.1	291.1
Dexamethasone 4 mg/mL	5	Amp	17	6.8	115.6
Dexamethasone 8 mg/2 mL	3	Amp	8	6.8	54.4
Dexamethasone 4.37 mg/mL	1	Amp	3	4.8	14.4
Dextrose 40%	3	Amp	16	3.2	51.2
Diazepam 5 mg/mL	2	Amp	3	3.85	11.55
Diazepam 5 mg/2 mL	1	Amp	1	3.6	3.6
Diclofenac 50 mg tablet	1	Tab	9	0.2	1.8
Diclofenac 75 mg/3 mL	4	Amp	13	2.10	27.3
Dopamine HCl 200 mg/5 mL	2	Amp	4	15.4	61.6
Doxycycline 100 mg capsule	1	Caps	2	0.70	1.4
Erythromycin 500 mg tablet	1	Tab	10	2.4	24
Frusemide 20 mg/2 mL	3	Amp	7	4.4	30.8
Frusemide 40 mg tablet	3	Tab	36	0.4	14.4
Gentamycin 80 mg/2 mL	2	Amp	14	1.35	18.9
Haloperidol 5 mg injection	1	Amp	1	4.25	4.25
Hydralazine 20 mg/mL injection	3	Amp	8	71.5	572
Hydrochlorothiazide 25 mg tablet	1	Tab	10	0.5	5
Hydrocortisone 100 mg/2 mL	6	Vial	18	60	1080
Hydrocortisone-lidocaine-ZO-allantoin	1	Sup	53	3.8	201.4
Hyoscine butyl bromide 20 mg/mL	1	Amp	3	35	9.18
Insulin NPH	1	Vial	1	105.25	105.25
Lidocaine 2% w/v	1	Vial	1	11.75	11.75
Magnesium sulfate 5 g/10 mL injection	2	Amp	6	68.8	412.8
Mebo ointment	1	Amp	2	200	400
Metoclopramide 10 mg/mL	2	Amp	13	9	117
Metoclopramide 10 mg/2 mL	5	Amp	20	9	180
Metronidazole 500 mg/100 mL	4	Bag	35	7.65	267.75

(continued)

Table 2. (continued)

Name of Medication	Frequency	Unit	Quantity Left	Unit Price (ETB)	Total Cost (ETB)
Misoprostol 200 µg tablet	1	Tab	2	Free	—
Morphine sulfate 10 mg/mL	3	Amp	6	25.85	155.1
N/S 0.9%	2	Bag	5	36.1	180.5
Nifedipine 20 mg tablet	3	Tab	21	0.92	19.32
Omeprazole 40 mg injection	2	Vial	4	172.5	690
Paracetamol 125 mg suppository	6	Sup	93	1.4	130.2
Paracetamol 500 mg tablets	1	Tab	8	0.2	1.6
Potassium chloride 1.5 g/10 mL	3	Vial	16	3.95	63.2
Procaine penicillin G	1	Vial	1	9.8	9.8
Pyloocaine ointment	1	Amp	1	24.5	24.5
Ranitidine 25 mg/5 mL	3	Amp	6	13.5	81
Salbutamol 100 µg inhalation	1	Vial	1	97.5	97.5
Salbutamol 2 mg/5 mL syrup	1	Bott	1	25.5	25.5
Sodium chloride 9 mg/mL injection	1	Vial	1	3.95	3.95
Spirolactone 25 mg tablet	2	Tab	56	1.03	57.68
Tetanus anti-toxin 1500 IU	1	Amp	2	64.6	129.2
Tramadol 100 mg/2 mL	2	Amp	6	4.2	25.2
Tramadol 50 mg capsules	1	Cap	10	0.91	9.1
Tramadol 50 mg/ mL injection	6	Amp	31	12.60	390.6
Tramadol HCl 50 mg/5 mL	1	Amp	9	12.57	113.13
Vancomycin 1 g intravenous	1	Vial	1	74.5	74.5
Vancomycin 500 mg/10 mL	2	Vial	2	70.53	141.06
Vitamin B complex	5	Tab	24	0.59	14.16
Vitamin K1 100 mg/mL	1	Amp	4	7.3	29.2
Total	173		940		ETB10100.7

Abbreviations: Amp, ampoule; Bott, bottle; Cap, capsule; ETB, Ethiopian Birr; NPH, neutral protamine Hagedorn; N/S, normal saline; Tab, tablet.

Table 3. Cost of Unused Medications at Pharmacy Stores of Selected Health Facilities in Awi Zone, Amhara Regional State, Ethiopia, 2018.

Name of Hospital	Number of Medications Wasted	Total Cost of Wastage (ETB)	Wastage Rate (%)
Hospital 3	177	179700.33	2.5
Hospital 2	186	156446.92	2.38
Hospital 1	88	46540.67	1.53
Hospital 4	154	223856.50	11.2
Total	605	606544.42	

hospitals. The huge wastage at hospital 2 could be due to the high variety and quantity of medications it holds. It is the first hospital established in the zone and it is also one of the hospitals with huge patient flow. However, a good management of medications at hospital 1 and a relatively poor management at hospital 2 could also be possible.

Similarly, only hospital 1 has a wastage rate within the normal target range set by the Auditable Pharmaceutical Transactions and Services (APTS) program of Ethiopia (1.53%; <2%).¹⁸ The huge wastage rate was at hospital 4 (11.2%), which could be attributed to the types of services it provides and quantity of medications it holds as it is higher when compared with the other 3 since it is a general hospital, though those reasons could not be

enough to justify the huge wastage rate noticed. Hence as depicted by head of the pharmacy of the hospital, ineffective/poorly functional DTC and irrational prescription patterns were identified. However, it could generally be noted that there exists a poor pharmaceuticals management in the hospital.

Program medications and antibiotics were the most frequently wasted types of medications. The possible explanation for these as explained by the pharmacy heads could be the push distribution system for program medications by PFSA, which sometimes push near expiry medications and unnecessary items by health facilities. For antibiotics it could be due to the irrational prescribing pattern by prescribers who only focus on certain medications and given

the fact that antibiotics are the most frequently prescribed medications, they are also the most frequently wasted ones.

Ineffectiveness of medications, change of route, patient leaving medications behind when leaving hospital, and patients being referred to higher level and leaving medications behind were the most common reasons for medications nonutilization at the hospital wards. Similar findings were reported by studies conducted in King Khalid University Hospital and King Abdulaziz Medical City, in Riyadh, Saudi Arabia.^{6,7} These could be due to physicians' nonadherence to national and international treatment guidelines regarding the use of medications, especially antibiotics and also due to patients' nonadherence to medications.

From the qualitative study it was identified that physicians were responsible for incorrect diagnosis they sometimes make due to not taking enough tests and for the ineffective/wrong medications selection which may contribute to the nonutilization of medications. Nurses were held responsible as they are the ones responsible for checking medication cabinets every day, follow their patients, and make sure they leave with their medications when discharged. Patients were held responsible for standing against treatment and leaving medications behind when discharged. In general, these findings showed that a cooperative approach involving all health professionals and patients on proper utilization of medications and minimization of medications wastage was necessary.

As depicted in the qualitative study, problems related to the supply system especially with PFSA supplying near-expiry products and pushing some products were also reported as the main reasons for medications wastage in the pharmacy stores. However, other reasons attributable to the hospitals by themselves such as the problems with the functionality of the DTC and quantification problems were also identified. The hospitals could have also minimized the wastage by distributing those unutilized medications to other nearby health facilities. Thus, health facilities should have focused on identifying their own gaps and take corrective measures to minimize their wastage rather than blaming others.

At all the 4 hospitals, unexpired medications that were left unused were given to the poor who cannot afford them by themselves. Based on this finding it can be said that the facilities were being generous and were doing the right thing with regard to helping the poor and minimizing wastage, but there needs to be a system for evaluating the effectiveness of those medications as their storage condition and handling practice may pose a problem to their potency/effectiveness. There also needs to be a system for returning those unused medications back to the system/pharmacy in order to regain value and for proper handling/storage. However, the risks associated with restocking of those usable unused medications should also be well addressed as it may further aggravate the wastage. In order to do this, the

expiry date and/or shelf life of those restocked medications should be well assessed and they should be stored in FEFO (first expiry first out) basis based on their situation. In addition, restocking of already dispensed medications may result in wastage of products in the store and thus care should be given in the quantification of pharmaceutical needs of the health facilities with due consideration of the restocking practice.

All the studied hospitals dispose expired and damaged medications based on disposal guidelines provided by Ethiopian FMHACA. However, it was reported that both medications and laboratory reagents were disposed at the same place, which may lead to unpredictable reactions with the medications and laboratory reagents that may bring further damage to the soil and the surrounding environment.

A total of ETB10 101 worth of medications were found unused at the inpatient wards of the 4 hospitals during 1 month of the study period. This cost was only for solid unused medications and fluids. However, if the cost of syrups and other liquid preparations was included it could further increase the wastage. Nevertheless, this wastage is still significant and showed a need for the health facilities to monitor the medication utilization pattern at the wards and implement strategies on educating their patients to adhere to their medications.

In the present study, a total of about ETB606 545 worth of medications were found wasted at the 4 hospitals in 1 fiscal year and the wastage at the primary hospitals was lower when compared with that of the general hospital. This could be attributed to the differences in the quantity and types of medications held by the general hospital and the primary ones, but it could also be due to poor pharmaceuticals management in the general hospital.

Limitation of the Study

For unused medications at in-patient departments of health facilities; due to the difficulty in determining the amount remaining for liquid preparations (syrups), cost was calculated only for solid dosage forms and parenteral (injection) medications thus may not accurately indicate the actual cost of unused medications.

Health centers and private health facilities were not included in the study and thus the results may be slightly different if those facilities were included.

Cost of medications was calculated using the unit price of the medications at the time of the study period and thus depending on when the medications were purchased there may be price fluctuation on the unit price of the medications between the current price and when it was at the time of purchase by patients, thus the total cost of unused medications may be slightly higher, lower, or the same as the calculated cost.

Conclusion

A significant amount of unused medications were present at inpatient departments of the health facilities. The study also identified that there was a significant amount of medications wastage at the pharmacy stores of health facilities. Health facilities need to monitor health professionals strictly follow national and international treatment guidelines and monitor the rational use of medications. There should also be a reverse logistics system in the pharmaceuticals supply system of the country for the proper management of unused medications at the health facilities.

Recommendation

Health facilities need to monitor health professionals strictly follow national and international treatment guidelines and monitor the rational use of medications. They also need to improve their procurement practice and follow modern inventory management practices, strengthen their DTC and pharmaceuticals management practice, separate disposal places for medications and other laboratory agents/chemicals. Health professionals should strictly adhere to national and international treatment guidelines. Patients should adhere to treatment and follow the advice of health professionals.

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Ethical Approval

This study was approved by the Institutional Review Board (IRB) Jimma University with an approval number of IHR-PGD/201/2018.

Informed Consent

Written informed consent from the participants of the qualitative study (heads of in-patient wards, store keepers, and pharmacy heads) was also obtained before conducting this study. Participants' information gained was kept confidential.

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