


Magnitude of Medicine Wastage and Perceived Contributing Factors Among Public Health Facilities in Dire-Dawa City Administration, in Mid COVID-19 Pandemic in Ethiopia: Retrospective, Cross-Sectional Study

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Background: World Health Organization refers medication waste as expired, unused, spilled, and contaminated pharmaceutical items, medications, vaccines, and sera. Budget constraints in financing the health care system together with huge amount of wastage and disposal costs of unused medications at LMIC create a serious risk to the economy, health care system and environment. Thus, the aim of this study was to assess the rate of medication waste and to identify contributing factors in public health facilities in Dire-Dawa city.

Methods: An institution-based retrospective, cross-sectional study was supplemented by a qualitative study design from May 10 to June 10, 2021, at 2 public hospitals and 14 health centers. Qualitative data were collected by self-administered questionnaires and 2 years record review. In-depth interviews were used to obtain qualitative data. Excel sheets and SPSS version 20 and thematic analysis were used to analyze quantitative and qualitative data.

Results: An average medicine wastage rate was 3.07% between 2010 and 2012 EFY, in Dire-Dawa public health facilities that worth 4,048,594.0 ETB. The most wasted class of medication was anti-infectives, accounting for 2,360,330 ETB (58.3%), while tablets 2,615,391 ETB (64.6%). Medical waste has been linked to several issues, including pushing nearly expired medications to healthcare institutions, lack of clinician involvement in medication selection and quantification, rapid changes in treatment regimens, and the existence of overstocked medication shelves.

Conclusion: The average rate of medication waste was higher than the allowed level of 2%. The only medications that should be accepted by medical facilities are those that can be used before they expire. All prescribers should receive lists of the drugs that are readily available from the pharmacy department, and clinicians should be involved in the quantification and drug selection processes to increase the effectiveness of the use of medications.

Keywords: medicine wastage, contributing factors

Background

International agreements and national governments worldwide recognize the right to health as a fundamental human right. Medication has long been a necessity in healthcare programs, and it has significantly improved population health over time.¹ The World Health Organization defines pharmaceutical or medication waste as products that are no longer in use, have been spilled, or are contaminated. These include drugs, vaccines, and sera.² Pharmaceutical waste has increased in volume as a result of an increase in the number of patients and prescriptions, the usage, and overproduction of medications.³

When medication is available and properly administered, it plays a critical role in the provision of healthcare and has been shown to increase patient attendance and client satisfaction.⁴ Pharmaceuticals that are out-of-date or past their expiration date endanger the environment and the healthcare system.⁵ Due to the healthcare system's financial limitations, as well as the enormous amounts of medication that are wasted and the associated disposal costs in low- and middle-income countries, both the healthcare system and the overall economy will be seriously threatened⁶ as worrying as the disposal of expired medications are the financial losses imposed on national healthcare systems and on particular patients. Pharmaceutical waste also poses a significant risk to the environment and has negative impact on public health if improperly disposed of.

In areas where unused medications were disposed of, numerous types of bacteria resistant to antibiotics were discovered.⁷ It has been shown that antibiotics that accumulate in aquatic environments worsen antibiotic resistance and affect the pathogenicity of microorganisms.⁸ Additionally, the number of necessary medications that patients have access to and the level of care they receive are both decreased as a result of prescription waste, putting human life in danger.⁹

The degradation of medicines can be brought on by unsanitary storage conditions, such as placing medicines directly on the floor, not organizing the stock in a systematic way, having dust and pests, not providing adequate protection from direct sunlight, and not having temperature control charts or facilities to monitor room temperature. Additionally, inadequate inventory control, which is blamed for losing 4–9% of the pharmaceuticals in overall supply systems, is cited as a contributing factor.^{10,11} More than half of all medicines are inappropriately prescribed, dispensed or sold. Such techniques are considered more common in healthcare settings in underdeveloped countries, where there are still weak routine monitoring procedures for medication use.¹²

According to Variant Market Research, an Indian data mining and information Analysis Company, the global over-the-counter drug (OTC) market is expected to grow from USD 125 billion in 2016 to USD 273 billion by 2024. Only a small portion of this is currently being used, and the majority will eventually be wasted or expire, generating a sizable amount of pharmaceutical waste.¹³ The annual costs associated with unused prescription medications are estimated by the National Health Service of the United Kingdom to be £300 million.¹⁴

Despite a significant sum of money spent on drug procurement, one-third of the world's population lacks access to medicines, which rises to one-half in Asia and Africa. This explains a poor medicine management system, up to 70% of the resources have been wasted.¹⁵ A Tanzanian study found that up to 51.1% of the total amount of prescribed medications were wasted.¹⁶

Drug waste in low-income countries is a result of inadequate supply chain management systems. In addition to patient-related considerations (patient death, switching medications, discontinuing therapy, side effects, and low patient compliance), it includes tactics that might lead to medication over- or under-stocking as well as the selection and quantification of medications without the use of reliable data or supporting evidence.¹⁷

One of the difficulties in managing Ethiopia's medical supply chain is drug waste.¹⁸ The Health Sector Development Program (HSTP II) has as its national objective to reduce the wastage rate of medicines to below 2%, but the reality is very different.^{19,20} Ethiopia, like other developing countries, must pay close attention to a problem with the health supply chain caused by drug waste. According to an evaluation carried out in 2013/2014 during the collection of Auditable Pharmaceutical Transaction and Services (APTS) baseline data in Federal and Addis Ababa city government hospitals, the 3-year (2012, 2013, and 2014) average medicine wastage rate in 8 hospitals was 4.8%, amounting to 11078910.52 ETB.⁹

The primary causes of medical waste in Ethiopia are poor governance, poor documentation, a lack of auditing procedures, transparency, and accountability in the pharmaceutical system, which increases healthcare costs and depletes the nation's meager health system resources.²⁰ Additionally, there are not enough regulations requiring medical facilities to monitor and report drug waste across the country, a lack of tools or software that automatically collect data, and a lack of a system requiring health facilities to record and report wastage to the body in the supply chain that is directly affected. Due to all of these factors, Ethiopia wastes a significant amount of medicine, necessitating immediate attention and action.^{9,19}

According to a study conducted in the Awi zone, showed that pushing items that were near-expiry by Ethiopian Pharmaceuticals Supply Agency (PFSA), quantification problems poor data quality, poorly functional Drug and Therapeutics Committee (DTC), lack of data during service expansion, problems with reporting consumption data

from wards, lack of inventory management skills by store man, ineffectiveness of medications, change of root of administration, patient leave medications behind when discharged, referred to higher level were the main reason for non-utilization of medications in ward.²¹

In Dire-Dawa city administration, medications are regularly discarded by the Dire-Dawa Regional Health Bureau from public health facilities; however, the type and extent of medicine waste as well as its contributing factors were not investigated. Therefore, this study provides information about the extent, identifies the types of wasted medicines and their underlying causes and fills the gaps in how to properly utilize medicines and minimize the wasted cost of money by developing different strategies in the public health facilities of Dire-Dawa city administration.

Methods and Materials

Study Area and Period

The study was conducted in the Dire Dawa Administrative city, which is located 515 km away from Addis Ababa. The current projected the Metro area of Dire Dawa in 2020 was 408,000 a 4.35% increase from 2019. According to the report by the Dire-Dawa health bureau, during the surveying time the city administration had 2 public hospitals (Dill Chora Hospital and Sabian Hospital), 15 health centers and 35 health posts. Apart from these, there were 1 Hospital, 3 primary Hospital, 32 medium clinics, 7 primary clinics, 17 pharmacy, 53 drug stores, 3 diagnostic laboratories possessed by private owners. An institution-based retrospective, cross-sectional study was conducted by supplemented qualitative study design that was employed from May 10 to June 19, 2021.

Sampling Size Determination and Sampling Technique

All public health facilities which had more than 3 years in operation and health professionals involved in pharmaceutical management in Dire-Dawa city administration were included in the study. No sampling method was used because all 17 health facilities (2 Hospitals and 15 health centers) were included in the study and except one health center was excluded and selected for pretest. For quantitative study, the total number of study population working in 16 health facilities in Dire-Dawa city administration (all health professional engaging in Drug and therapeutic committee (DTC) that comprises midwives, nurses, health officers, laboratory technologist and all pharmacy professionals who were not participated in qualitative study were participated. For qualitative study the number of study population, 3 individuals from each health facilities (the chief executive officers (CEOs)/Health center head, pharmacy store manager and pharmacy departments head working in 16 public health facilities of Dire-Dawa city administration) were 48. They were purposively selected as a key informant because they were supposed to be information rich than other health professionals.

Data Quality Control

The study questionnaire was developed after reviewing different literature and made available in English to be read and a pretest study was performed in one of public health facilities.

Two pharmacists were recruited for data collection and trained for 1 day. They collected data by using data record review by recording each pharmaceutical on the data abstraction formats to calculate medicine wastage rate and distributing self-administered questionnaires for the participants. The principal investigator performed in-depth interview with the CEOs/health facility head, pharmacy store manager and pharmacy department head by using the IDI guide to understand the perceptions of participants about the medication wastage. Tape recorder was used to record the interview and filed notes on important points. Appropriate personal protective equipment (PPE), such as sanitizer and a face mask, was used by the data collectors and the study participants before undergoing data collection.

Data Instrument and Processing

Quantitative Study

Data were collected through record review by recording each pharmaceutical on the data abstraction form. Records that were reviewed include physical inventory report, records of medicines wastage, disposal reports,

model 19 and HCMIS (DAgu2) were used to measure extent of medicines wastage and to identify the classes of wasted medicines.

Medicines wastage recording format and wasted value recording format were prepared based on pharmaceutical monitoring and evaluation framework²² and EFMHACA medicines waste management and disposal directive, the recording formats clearly stating trade name and/or generic name, strength (where applicable), dosage form, pack type and size, quantity, batch number, expiry date, manufacturer, supplier, country of origin, and product price.²³

Self-administered questionnaire which has perceived contributing factors of medicines wastage was amended from literature. Every point is score on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).²⁴

Qualitative Study

Data were collected by a semi-structured interviewer-administered questionnaire about condition of medicines wastage, contributing factors, concerns and efforts in preventing or minimizing the problem for store personnel, pharmacy heads, and medical directors were developed after literature search.^{16,25}

Data Entry Analysis For Quantitative Study

Self-administered questionnaires were entered in to Epi Data version 3.1 then exported to SPSS version 20 for analysis of descriptive statistics (frequency, mean, standard deviation (SD), percentage and graph) were used to summarize the results. Self-administered questionnaire with a 5-point likert scale ranging from 1 (strong disagree) to 5 (strong agree) was used to identify perceived contributing factors for medicine wastage. The perceived factors which had highest mean score (mean± SD) ≥ 4 were the most commonly perceived factors contributing to medicine wastage.

Excel sheet was used for calculating medicine wastage for each public health facilities through dividing total cost of medicines wasted from medicines wastage registration and disposed medicines lists by total cost of medicine available for sale during review period (EFY 2010–2012). The value of wasted medicine was grouped by dosage form and pharmaco-therapeutic classes.

For the Qualitative Study

The principal investigator performed in-depth interview to understand the perceptions of participants about the medication wastage to strengthen data obtained by self-administered questionnaire. The investigator transcribed the audio recorded in-depth interviews and discussions verbatim. Audio-recordings and notes were translated into English. Then, codes were given and issues were discussed and themes were developed. Later, the text relating to each code/theme was discussed and summarized in sub themes and presented the findings using quotes. The codes were developed from the texts, and it was categorized as the following terms: current situation of medicines wastage, medicine wastage and its contributing factors. The themes that developed from the codes would be supplemental for reasons for medicine wastage and factors leading to medication wastage. Each transcript was carefully screened and triangulated with the quantitative result.

Ethical Consideration

Ethical clearance was obtained from the Ethics Review Committee of Dire Dawa University, and a formal letter of cooperation was written to the Dire-Dawa City Administration Health Bureau and to each respective public health facilities. Data collectors were trained how to handle sensitive issues and on the importance of keeping confidentiality. Informed voluntary written and signed consent was obtained from all study participants prior to undertaking interview. During the consent process, the respondents were informed about the purpose, procedures, potential risk and benefit of the study and what was expected from them, their rights to participate or not in the study. Information provided by respondents was not transferred to a third party or was used for any other purpose other than academic purpose or publication. Thus, they were assured of utmost confidentiality and anonymity of their responses. In this regard, the names of the respondents were not disclosed. The room and the environment were made conducive to maintain their privacy and to prevent COVID-19 transmission.

Result

The data were gathered from primary sources using data abstraction formats, self-administered questionnaires and semi-structured interview questionnaires. A total of 16 public health facilities (14 health centers and 2 general hospitals) were included in the studies. Of these facilities, 13 (2 general hospitals and 11 health centers) executed HCMIS initiatives, while APTS initiatives were implemented only in town health facilities. The results presented include the magnitude of the medicine wastage rate in each public health facility and Dire-Dawa city administration, therapeutic class of wasted medicine, dosage form of wasted medicines, reason for medicine wastage, perceived factors contributing to medicine wastage and the qualitative data presented thematically by narration.

Quantitative Findings

Magnitude of Medicine Wastage

The average wastage rate of medicines from the budget and program between 2010 EFY and 2012 EFY in 2 public hospitals and 14 health centers in Dire-Dawa were found to be within a range of 0.36% to 5.8%. The highest average wastage rate was identified in Sabian General Hospital, which was 5.8%. Within the above specified time, the overall city administration wastage was 4048594.00ETB, accounting for an average wastage rate of 3.07% of the total value of medicines available for sale at 16 public health facilities. Similarly, the medical supply and laboratory reagent amount to 275335.00 ETB and 559618.80 ETB, respectively, were wasted (Table 1).

Table 1 The Value of Medicines (Available for Sale and Wasted) and Estimation of Total Medicine Wastage Rate in the Facilities (EFY2010-2012), Dire-Dawa City Administration, Ethiopia, June 2021 (n=16)

Health Facility Code	2010 EFY			2011 EFY			2012 EFY		
	Medicine Available for Sale in Birr	Wasted in Birr	Wastage Rate (%)	Medicine Available for Sale in Birr	Wasted in Birr	Wastage Rate (%)	Medicine Available for Sale in Birr	Wasted in Birr	Wastage Rate (%)
AKHC	2192082	46,925	2.1	2,481,882	80,517	3.2	2,831,765	60,601	2.1
BAHC	1008172	28,764	2.9	885,406	35,595	4.0	1,080,267	8346	0.8
DaHC	1586114	33,819	2.1	1,391,152	28,198	2.0	1,850,782	33,070	1.8
DCRH	16140258	811,056	5.0	23,599,043	604,186	2.6	19,011,787	627,389	3.3
DDHC	2064095	20,684	1.0	2,250,357	37,088	1.6	2,297,609	75,897	3.3
GaKHC	1885183	37,017	1.9	1,574,517	38,284	2.4	3,421,475	104,116	3.0
GGHC	1627348	12,568	0.8	1,614,622	36,656	2.3	2,068,214	21,309	1.0
GHC	1551755	95,800	6.2	1,640,247	74,720	4.6	2,846,653	84,684	2.9
LHHC	3043648.	77,682	2.6	3,905,557	23,152	0.6	4,403,320	207,345	4.7
SGH	7732853	166,545	2.1	2,183,006	172,878	7.9	1,843,078	138,484	7.5
WHC	707911	1946	0.3	794,384	2807	0.4	917,392	3792	0.4
JHC	448464	19,059	4.3	407,946	17,902	4.4	539,817	14,573	2.6
KHC	584476	18,047	3.0	672,366	15,431	2.3	601,123	22,992	3.8
MKHC	477920	16,503	3.5	351,217	14,696	4.2	356,437	11,992	3.4
LOHC	722379	3916	0.6	497,691	4980	1.0	647,632	6058.8	0.9
JBHC	410900	14,649	3.6	420,630	17,098	4.0	551,500	18,763	3.4
Wastage rate	42,183,564	1,404,987	3.3	44,670,031	1,204,188	2.7	45,257,064	1,439,418	3.2



Figure 1 Trend of the medicine wastage rate of Dire-Dawa administration public health facilities, Ethiopia (EFY2010-2012), June 2021.

Trends of Medicine Wastage

As shown in [Figure 1](#), the trends of medicine wastage rate in EFY 2010 and 2012 was nearly comparable than 2011. In EFY 2010, there was an overall wastage of 1404987.7 ETB, accounting for an average of 3.3% of the total value of medicines available for sale by 16 health facilities. In 2011 EFY, the value of wastage was estimated to be 1204188.00 ETB, indicating an annual wastage rate of 2.7% for 16 of the study health facilities, while in 2012 EFY, there was an overall wastage of 1439418.284 ETB, in which the annual wastage rate was estimated to be 3.2%.

Types of Wasted Medicines

Pharmaco-Therapeutic Classes of Wasted Medicines

A total of 237 types of medications were wasted at the 2 hospitals and 14 health centers in the period of EFY 2010–2012. Anti-infective medications were found to be the most wasted pharmaco-therapeutic classes of medications at 2360330.33ETB (58.3%), followed by endocrine medications at 647775.05ETB (16%) and gastrointestinal medications at 368422.06 ETB (9.10%) ([Table 2](#)).

Medicine Wastage by Dosage Form

Wasted medicine was categorized into different dosage forms. Out of the wasted medicines, oral medicines were the most wasted in terms of the monetary value 3348187.278 (82.7%), followed by parenteral 495952.7709 (12.25%) and Trans dermal 126720.9937 (3.13%) ([Table 3](#)).

Reasons for Medication Wastage

Reasons for medicine wastage were assessed during the study period. Expiration of medicine was found to be the major reason for medicine wastage, accounting for 3951427.791 ETB (97.6%) of the total value of medicine wasted, followed by damage 97166.25717ETB (2.4%). None of the health facilities under study recorded theft pilferage and obsolete as the reason for medicine wastage ([Figure 2](#)).

Medicine Wastage Perceived Contributing Factors

Demographic Characteristics of Respondents

The questionnaires were distributed to 163 health professionals, for a response rate of 161 (98.77%). The study included 92 (57.1%) males. The majority of the respondents 102 (63%) were between 31 and 40 years old. Regarding educational status, 42 (26.1%) were diploma pharmacy graduates, and 41 (25.5%) were pharmacists. The majority of respondents (104, 64%) had 5–10 years of work experience ([Table 4](#)).

Table 2 Estimated Value of Wastage of Medicines by Pharmaco-Therapeutic Classes in the Study Facilities (EFY 2010-2012), Dire-Dawa City Administration, June 2021 (n=16)

Pharmaco-Therapeutic Class of Medicines	Value of Wasted Medicines	
	Cost (Birr)	%
Anti-infective	2,360,330.33	58.3
Medicine used in endocrine disorder and contraceptives	647,775.05	16
Gastrointestinal medicine	368,422.06	9.1
Cardiovascular medicines	214,575.48	5.3
Central nervous system medicines	149,798.98	3.7
Vitamin and minerals	117,409.23	2.9
Analgesics/antipyretics	85,020.48	2.1
Medicine for corrective water electrolyte and acid–base disturbance	52,631.72	1.3
Antihistamine and anti-allergic	35,627.63	0.88
Respiratory medicines	17,004.1	0.42
Total	4,048,594	100

Table 3 Estimated Values of Wastage of Medicines by Dosage Forms in the Study Facilities (EFY 2010–2012), Dire-Dawa City Administration, Ethiopia, June 2021 (n=16)

Type of Dosage Form	Value in ETB	%
Tablet	2,615,391.755	64.6
Capsule	518,220.0382	12.8
Injection	461,539.7215	11.4
Suspension	125,506.4155	3.1
Cream	100,000.273	2.47
Syrup	89,069.06907	2.2
Suppository	64,777.50478	1.6
Solution	34,413.04941	0.85
Ointment	24,696.4237	0.61
Drop	12,550.64155	0.31
Jell	2024.297024	0.05
Aerosols	404.8594049	0.01
Total	4,048,594.049	100

Perceived Contributing Factors to Medicine Wastage

The study revealed that the major medicine wastage contributing factors were near expiration medicines being delivered to health facilities, no participation of clinicians in medicine selection and quantification, abrupt change treatment practices resulting in medicine wastage, the presence of overstocked medicines due to improper forecasting and lack of accountability for stockout and wastage medicine (Table 5).

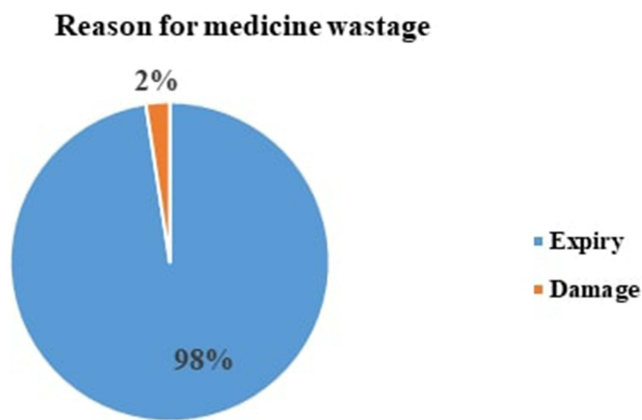


Figure 2 Percentage of wastage of medicines by reasons in the study facilities (EFY2010-2012), Dire-Dawa city administration, June 2021 (n=16).

Qualitative Findings

The key informants (KIs) were interviewed to find information about the current situation of medicine wastage in their facilities, factors that contribute to medicine wastage, the effect of medicine wastage on service provision and ideas for improving medicine wastage. They included drug store personnel, pharmacy heads, and health facility.

Table 4 Demographic Features of Self-Administered Questionnaire Respondents in Public Health Facilities, Dire-Dawa, June 2021 (n=161)

Demography	Characteristics	Frequency (n =161)	%
Gender	Male	92	57.1
	Female	69	42.9
Age	20–30 years	59	37
	30–40 years	102	63
Profession	Pharmacist	41	25.5
	Diploma pharmacy	42	26.1
	BSC nurse	28	17.4
	General practitioner	7	4.3
	Diploma nurse	12	7.5
	BSC laboratory	9	5.6
	Health officer	11	6.8
	Other	11	6.8
Work experience	<5 years	51	32
	5–10 years	104	64
	>10 years	6	4

Table 5 The Perceived Factors Contributing to Medicine Wastage by Health Professionals in Public Health Facilities of Dire-Dawa Administration, Ethiopia, June 2021 (n=161)

Contributing Factors	Response						Mean	Standard Deviation
	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Total		
Near expiry medicines are being delivered to health facilities	0	0	4	42	115	161	4.7	0.51
No participatory of clinicians in medicine selection and quantification	5	6	12	68	70	161	4.19	0.95
Abrupt change treatment practices results medicines wastage	5	10	17	53	76	161	4.15	1.0
Presence of over stocked medicines due to improper forecasting of need in the facility	17	21	15	69	39	161	3.57	1.27
Lack of accountability for stockout and wastage medicine in the facility	21	20	27	43	50	161	3.50	1.38
Absence of functional DTC in the health facility	25	58	59	13	6	161	2.48	0.97
Poor stock management like using neither FIFO nor FEFO in stock management	37	56	40	16	12	161	2.44	1.16
No accurate data available in health facility to facilitate quantification	36	59	54	5	7	161	2.3	0.99
Lack of knowledge and skill of pharmacy professionals in medicine supply management	46	49	52	5	9	161	2.27	1.0
Medicine purchased without procurement plan	36	69	49	3	4	161	2.19	0.89
Selection of medicines are not based on medicine lists of facility	41	62	50	5	3	161	2.17	0.91
Weak or no mechanism for medicine wastage monitoring and evaluation	40	68	47	2	4	161	2.14	0.9
Lack of system to move nearly expired medicines facility to facility	49	66	35	3	8	161	2.10	1.0
Lack of electronic stock management tools that automatically capture	44	75	33	6	3	161	2.06	0.89
Medicines are store on the floor not arranged systematical on shelf	42	85	28	1	5	161	2.02	0.86
Medicines that need cold temperature are not stored in a functional refrigerator in the health facility	51	68	32	8	2	161	2.02	0.91
Shortage of pharmacy human resources in the facility	56	68	30	3	4	161	1.95	0.9

Socio-Demographic Characteristics of Key Informants

Forty-eight health professionals working in 16 public health facilities participated in this study as key informant interviewees. Of these, 48 (67%) were males. The mean age of the respondents was 30.7 years (SD= ± 3.94), ranging from 26 to 42 years. In terms of profession, 19 (39.9%) respondents were pharmacy technicians, 13 (27%) were pharmacists, and 9 (18.7%) were BSC nurses. The work experiences of the respondents ranged from 3 to 15 (6.8 ± 3.25) years (Table 6).

The Situation of Medicine Wastage in Public Health Facilities

With regard to wastage, most of the key informants stressed that it was a major problem in their health facilities due to acceptance of donation of near-to-expiration medicines and overestimation of medicine during disease outbreaks. Some informants felt that medicine wastage was decreasing from time to time due to proper utilization of the FEFO system.

Age range of 35- to 40-year old male pharmacy head mentioned the following:

Medicine wastage in our health facility is recently increasing due to donors pushing near expiry and excess products during the occurrence of different disease outbreaks in the region. For example, chikungunia, AWD and COVID-19, which are the main causes of the expiry of products, also push too many products, which results in an overstock of items. However, budget product wastage significantly decreases from time to time as a result of good forecasting practice.

Conversely, some respondents believe that their health facilities medicine wastage is decreasing mainly due to a strong inventory control system. A 41-year-old female hospital CEO explained that

Table 6 Demographic Features of Key Informants in Public Health Facilities, Dire-Dawa, 2021 (n=48)

Socio-Demographic Profile		Number	%
Sex	Male	32	67
	Female	16	33
Age	20–30 years	28	58
	31–40 years	18	38
	>40 years	2	4
Profession	Pharmacist	13	27
	Pharmacy technician	19	40
	BSC nurse	9	19
	MSC nurse	2	4
	MSC health officer	2	4
	Health officer	2	4
	General practitioner	1	2
Working experience in years	<5	13	27
	5–10	28	58
	>10	7	15

Our health facility medicine wastage is on decreasing as a result of strong medicine data recording by using both computerized and manual recording system which enhanced accessibility of information to pharmaceutical managers and administrative that helped us in taking appropriate action before it get wasted.

Perceived Factors Contributing to Medicine Wastage

KIs were asked about the causes of the medicine wastage, and most of the respondents reported that no participation of clinicians in medicine selection and quantification, push near to expiry product from EPSA for program medicines, abrupt change treatment practices, presence of overstocked medicines due to improper forecasting during disease outbreak, lack of accountability for stockouts and wastage of medicines in the facility were the main causes of the medicine wastage.

Female store manager in her late 20s said that

I think the main reason for medicine wastage in our health facility is the nonparticipation of prescribers in medicine selection during procurement. Sometimes clinicians prefer to prescribe certain medicines; hence, the other will expire due to a lack of consensus between the pharmacy department and prescribers. The other reason is pushing program products that are near-expiry and sometimes unnecessary at the health facilities; thus, it will expire before it is consumed.

Another key informant, a male health center director between the ages of 35 and 40 said,

The main reason for medicine wastage is a sudden change in treatment practice. In our health facility program medicine, ART and TB medicine were especially wasted due to frequent changes in the treatment protocol. Another reason is pharmacy department is not accessed the lists of available medicine for prescribers as a result medicines are expired due to lack information.

Some key informants mentioned that forecasting error during disease outbreak, excess procurement of medicine due to fear of shortage medicine from market, poor DTC functionality, slow move medicine (psychotropic medicines, expensive drugs and medicine with potential ADR), prescribers-dependent medicine order, prescribers not adhere to STG, lack of accountability for wasted medicines and shortage of reagent were responsible for medicines wastage.

A 33-year-old male pharmacy head mentioned:

Some reagent dependent products were frequently wasted when their reagents were not available. Added that other main cause of medicine wastage was oversupply medicine by donor and regional health bureau during episode chikungunia virus, AWD and covid-19 outbreak.

The consequence of medicine wastage on health facilities service delivery. Key informants were asked for their view on the effect of medicine wastage on their service. The key informants disclosed that decreasing internal revenue and disposal costs, occupying space that could be used for usable medicines, environmental pollution and reducing client satisfaction were the main consequences mentioned by key informants.

Another male health center head in his early 40s said that

Health care need is increasing from time to time; however, annual medicine budget is constant or not significantly increases as result patients cannot get all medicine they need due to shortage of budget so this will be worsened when scarce resource is wasted. In addition, wasted medicine is occupies storage space that can be used for usable medicine.

Ideas for Improving Medicine Wastage

The respondents were asked to offer ideas on how to minimize medicine wastages in public health facilities. Participating clinicians in medicine selection and quantification, conducting regular discussion on medicine supply management with EPSA, using medicine transfer guidelines effectively, improving communication between prescribers and pharmacy departments, training for DTC and pharmacy professionals on medicine supply chain management were among the suggestions made to improve medicine wastage.

Discussion

The study mainly focused on assessing the medicine wastage rate, the class of medicines commonly wasted and its contributing factors in public health facilities in Dire-Dawa, Ethiopia.

In this study, the average medicine wastage rate was found to be 3.07%, which is lower than the study done in southwest Shoa, zone (7.5%)²⁶ and Federal and Addis Ababa city government hospitals during the collection of the Auditable Pharmaceutical Transaction and Service (APTS) baseline data (4.8%).¹³ This could be due to the implementation of different stock management initiatives, such as the integrated pharmaceutical logistic system (IPLS), auditable pharmaceutical transaction system (APTS), medicine transfer guideline, and electronic stock management tool. However, higher than the national target in the health Sector Transformation Program (HSTP, II) for medicines, the wastage rate is below 2%.^{19,20} This might be due to receiving bulk and near expiration program medicines that will expire before being consumed by clients.

The current study indicated a class of commonly wasted medicine. Anti-infective medications were found to be the most wasted medicines (58.3%), followed by medicines used in the endocrine system (16%) and gastrointestinal system (9.1%). Similar findings were reported by a study conducted at a tertiary hospital in Dar Es Salaam, Tanzania, in which anti-infective medicine wastage was 18.9%, cardiovascular medicine was 8.9%, and the other category was 23.7% of the total medicines dispensed.¹⁶ Study done in United Kingdom cardiovascular system medicines were the most common therapeutic class of medication wasted (22.6%) followed by central nervous system drugs (22.11%).²⁷ Another study conducted in Egypt, Cairo, also found that antibiotics were the most wasted medications (20.15%), gastrointestinal system drugs (16.27%) followed by cardiovascular system drugs (10.72%).²⁸

In addition, other studies conducted in Ethiopia also revealed that anti-infective medicines were the most wasted medicine. A study conducted in southwestern Shoa reported zone anti-infective (39.1%), followed by medicine used for corrective water, electrolyte, and acid base balance (12.9%) and medicines acting on the gastrointestinal tract (10.6%).²⁶ Similar findings were also reported from the Awi zone Amhara regional state, in which anti-infective medicines were the most wasted medicines (36.4%), followed by anti-pain medications (21.4%) and cardiovascular medications (11%).²¹

The high level of anti-infective medicine wastage in developing countries might be due to communicable diseases being the most prevalent diseases and anti-infective being the primary medicine to treat this disease. As a result, their prevalence in wastage may also show that they are the most commonly utilized and abused medicines at health facilities. In addition, high wastage anti-infections in the current study area might be due to abrupt treatment changes in communicable diseases, such as HIV/AIDS, malaria, and TB, in which large amounts of medicines were left unused and expired.

The Perceived Contributing Factors for Medicine Wastage

The major contributing factors were near-expiration medicines being delivered to health facilities, no participation of clinicians in medicine selection and quantification, abrupt change treatment practices resulting in medicine wastage, the presence of overstocked medicines due to improper forecasting and lack of accountability for stockout and wastage medicine. Similar findings were also reported from Uganda, Tanzania and Ethiopia, in which short shelf life, improper forecasting of need that leads to overstock, poor storage practices, poor inventory control, stop/change of medicines and lack of accountability for stockout and wastage medicines were the major factors for high wastage rates of medicines.^{16,24,26} This might be mainly due to weak communication between medicine managing stakeholders and low participation of clinicians in medicine selection and quantification.

This study identified abrupt change treatment practices, resulting in medicine wastage in health facilities as one of the contributing factors for medicine wastage. This finding was witnessed in Uganda, in which huge stocks of chloroquine, sulfadoxine/pyrimethamine and isoniazid were expired due to changes in treatment practice.²⁴ This might be due to poor management of a change in treatment policy. However, this can be minimized by decreasing the entry of phased-out medicines into the market before implementation of the change.

The other identified factor for medicine was the delivery of nearly expired medicines (<6 months) to the health facilities by the suppliers. The provision of near-to-expiration medicines by EPSA was another contributing factor

identified in the present study. This finding is in line with studies conducted in South Africa²⁹ and in the southwest Shoa Zone, Oromia Regional State, Ethiopia.²⁶ This might be due to weak information exchange about the stock status of medicine between EPSA and health facilities as well as the provision of EPSA to reduce its medicine wastage rate below 2%.

This study also identified the presence of overstocked medicines due to improper forecasting of need in the health facilities as the major cause of medicine wastage. Both in the survey and in-depth interview mentioned that the provision of medicines without needs by suppliers resulted in the stocking of medicines. Similarly, a study performed in Uganda and Tanzania showed that overstocking of medicines was one of the major contributing factors for expiry of medicines^{16,24} Poor quantification and forecasting of medicines will lead to overstocking of the medicines. Overstocking of medicines normally leads to a high number of expired medicines, high cost of storing excess stock and high incidences of pilferage of highly potent medicines.¹¹ This might lead to poor utilization of consumption data and nonparticipation of clinicians during forecasting and selection medicines. Thus, public health facilities need a great effort to reduce the rate of expiration by improving medicine quantification and selection.

Lack of accountability for stockout and wastage medicine in the health facilities was also among the major causes of medicine wastage cited by key informants. Ineffective monitoring and accounting mechanisms, corruption and poor record-keeping are among various factors that cause the wastage of limited resources due to theft, bribery and fraud.⁸ A study conducted in Ethiopia stated that poor documentation of wastage and pilferage and the absence of accountability on the part of health facilities to properly document and report wastage in the pharmaceutical sector are believed to significantly contribute to most of the challenges in medicine management, which have resulted in multiple forms of irrational practices and waste.⁹

The present study also identified nonparticipation of clinicians in medicine selection and quantification as one of the contributing factors for medicine wastage. A similar study conducted in Uganda revealed that nonparticipation of clinicians in medicine quantification in hospitals, profit- and incentive-based quantification, and third-party procurement by vertical programmes and overstocking were the main causes of medicine wastage.²⁴ The selection of medicines without proven evidence and techniques results in wastage due to expiry.¹¹ Thus, the final medicine selection criteria should be based on discussion and acceptance by a multidisciplinary committee of experts.

Limitations of the Study

The wasted medicines without price list were not included in the study. Difficult to inference on medicine wastage perceived factors due to lack of inferential statistical test.

Conclusion

The study revealed that Dire-Dawa public health facilities medicines wastage rate was above the acceptable limit 2%. The medicines wastage rate was 3.07%. The most common therapeutic classes of wasted medicines in terms of value were anti-infective, medicines used in endocrine disorders and contraceptives and gastrointestinal medicines. Near expiry medicines are being delivered to health facilities, no participatory of clinicians in medicine selection and quantification, abrupt change treatment practices results medicines wastage, presence of over stocked medicines due to improper forecasting and lack of accountability for stockout and wastage medicine were major perceived contributing factors.

Abbreviations

ADR, adverse drug resistance; ART, anti-retroviral therapy; AWD, acute watery diarrhea; DTC, Drug and Therapeutic Committee; EFMHACA, Ethiopia Food, Medicine and Health Care Administration and Control Authority; EFY, Ethiopian fiscal year; EPSA, Ethiopian Pharmaceutical Supply Agency; ETB, Ethiopian birr; LMIC, low- and middle-income countries; STG, standard treatment guideline; TB, tuberculosis.

Ethics Approval and Consent to Participate

This study was ethically approved by the Institutional Ethics Review Committee of Dire Dawa University. The ethical letter was written to the Dire-Dawa City Administration Health Bureau, and an official letter of permission was written to

each respective health facility official before data collection. Voluntary written and informed consent was obtained for the participation in the study and publication of the manuscript from each study participant by removing identifying information that should be anonymised.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; agreed on the journal to which the article has been submitted; and agreed to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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