

RETRACTED ARTICLE: Disposal Practices of Unused Medications Among Patients in Public Health Centers of Dessie Town, Northeast Ethiopia: A Cross Sectional Survey

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Background: Disposal of pharmaceutical waste among patients is a global challenge, especially in developing countries like Ethiopia. Improper medication disposal can lead to health problems and environmental contamination. Therefore, the present study was aimed to assess disposal practices of unused medications among patients in public health centers of Dessie town, Northeast Ethiopia.

Methods: A descriptive cross-sectional survey was conducted among 263 patients in four public health centers of Dessie town, Ethiopia from March to June 2019. Face-to-face interviews using structured questionnaires were used to collect data from each study subject.

Results: The majority of the respondents, 214 (85.17%), had unused medications at their home during the study period. The most commonly reported disposal method in the present study was flushing down in a toilet, 66 (25.07%). None of the respondents practiced returning unused medications to the pharmacist. However, 85 (32.31%) of the respondents reported never disposing of their medications and believed that it is acceptable to store medications at home for future use.

Conclusion: In the present study, there was a high practice of keeping medications at home and most of the disposal practices were not recommended methods. In addition, most of the respondents did not receive advice from pharmacists and other health-care professionals on how to dispose of unused medications. Hence, there is a need for proper education and guidance of patients about disposal practices of unused medications.

Keywords: unused medicines, disposal practices, patients, Dessie

Background

Medicines play a vital role in the diagnosis, prevention, and treatment of diseases.¹ Increasing disease incidence and prevalence necessitate health-care practitioners to prescribe and dispense different medications. Patients are not able to use all the dispensed medications because of adverse effects, alteration of dosage, feeling better, medications reaching the expiration date, physicians' prescribing practices, or dispensers' practices.¹⁻³ Unused medicine is any pharmaceutical product that is not fully consumed, whether prescription or over-the-counter drugs that can arise from households or health-care activities.⁴

The methods of disposal of unwanted pharmaceuticals determine their presence in the environment and their potential to contaminate water. Households contribute to environmental concerns related to pharmaceutical waste since they dispose of the unwanted pharmaceuticals through sinks, toilets or in the trash. All these methods have detrimental impacts on the environment.^{2,5-7} Improper medication disposal is a worldwide problem

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that leads to health problems such as ineffective therapy, drug resistance, medication non-adherence, hospitalization, and an overall increase in health-care costs.^{4,8,9}

Although different studies have been conducted in developed countries to determine the extent of improper medicine disposal, the problem is not well documented in developing countries, and hence a knowledge gap exists regarding the disposal of unused medications among patients in developing countries.⁴ Studies conducted in different countries indicated there were diverse practices of disposal of unused medicine. For example, studies conducted in Kenya¹⁰ and Nigeria¹¹ indicated that the most preferred disposal method for unused medications was throwing in garbage bins followed by flushing in toilets.

Due to the shortage of funds for the safe disposal of pharmaceutical waste, cost-effective management and methods are needed. Therefore, WHO and national policies in Ethiopia recommended the following guidelines for the safe disposal of unused and expired drugs: return to donor or manufacturer, landfill (open uncontrolled non-engineered dump and engineered landfill) after immobilization by encapsulation or inertization, waste immobilization (encapsulation and inertization), and flushing liquid pharmaceuticals into sewers in small quantities over a period of time. Others as medium temperature incineration, novel high-temperature incineration, and chemical decomposition in accordance with the manufacturer's recommendations, followed by landfill.^{12,13} Similarly, the Food and Drug Administration recommends a "take-back" program as the best option for drug disposal. A take-back program is a community-based initiative that allows the public to bring leftover drugs to a central location for proper disposal, which is currently regulated only through law enforcement agencies.^{4,5} For instance, many take-back programs have been initiated in the USA.⁶

Disposal of pharmaceutical waste among patients is a global challenge, especially in developing countries like Ethiopia. No study has ever been conducted regarding disposal practices of unused and expired pharmaceuticals among patients in public health centers of Dessie town, Northeast Ethiopia. Therefore, this study was aimed to assess the disposal practice of unused medications among patients in four public health centers of Dessie town, Northeast Ethiopia.

Methods

Study Design and Study Area

A descriptive, cross-sectional survey was conducted in four public health centers of Dessie town, Northeast Ethiopia from

March to June 2019. The survey was carried out through face-to-face interviews using pre-validated structured questionnaires. Dessie town, located in Amhara regional state of Ethiopia, is 401 km from Addis Ababa. There are eight public health centers in Dessie town and four health centers (ie, Buwanbwua, Hotie, Segno Gebeya, and Kurkur Health Centers) selected randomly were included in this study.

Study Population

The study population included patients who visited selected public health centers during the data collection period and fulfilled the inclusion criteria.

Sampling Procedure

The study was conducted in four public health centers of Dessie town using proportionally allocated sampling methods. A non-probability sampling technique (convenience method) was employed to select study subjects.

Sample Size Determination

The sample size was determined using the following single population proportion formula:

$$n_i = \frac{(Z\alpha/2)^2 P(1 - P)/d^2}{0.5(1 - 0.5)/(0.05)^2} = \frac{(1.96)^2}{0.5(1 - 0.5)/(0.05)^2} = 384$$

Since the total number of patients in the selected public health centers of Dessie town, Ethiopia is less than 10,000, the reduction formula was applied, and accordingly, 263 samples were taken and the study subjects were selected by using a non-probability sampling technique.

Data Collection Procedure

The questionnaire consisted of two sections. Section one was about the respondent's personal information including gender, age, marital status, and level of education. Section two of the questionnaire included respondents' practices and perceptions concerning unused medication disposal. The questionnaire was translated into the local language (Amharic) and back-translated into English to avoid any misinterpretation. The questionnaire was tested for validity and it was pretested on 10 respondents. Following the pilot testing, minor changes were made based on respondents' recommendations. Finally, the questionnaire was distributed to 263 patients visiting the outpatient (ambulatory) pharmacies for prescription dispensing at four public health centers of Dessie town, Northeast Ethiopia. Data

were collected by five trained graduating pharmacy students through face-to-face interviews using structured questionnaires adapted from previous studies^{3,14} and modified to achieve objectives.

Ethical Considerations

Written informed consent was obtained from all the respondents before the start of the survey. Participation in this research was voluntary. Participant identity was kept confidential. The study was ethically approved by the College of Medicine and Health Sciences Research Ethics Review Committee at Wollo University, Dessie, Ethiopia.

Data Analysis

All returned questionnaires were double-checked for accuracy and were analyzed using SPSS version 25 software. The descriptive statistical analysis such as frequencies and percentages were computed and presented by using tables.

Results

Socio-Demographic Characteristics of the Respondents

All the approached individuals agreed to participate, giving a 100% response rate. A total of 263 patients participated in this study. The majority of respondents, 150 (57.03%), were female. About half of the respondents were married and 183 (69.58%) of them were aged 25–35 years, 95 (36.12%) of the respondents were illiterate (Table 1).

Respondents' Disposal Practices of Unused Medicines

As shown in Table 3, the majority of the respondents, 224 (85.17%), had unused medications at their home during the study period. The frequently stated reason for having unused medications was improvement of the patient's medical condition, 149 (56.65%), and treatment change, 62 (23.57%). The most common method of disposal of unused medications was flushing down into a toilet, 66 (25.09%), while some respondents, 60 (22.81%), said they would give medications to a friend. Throwing into the household garbage bin, 50 (19.01%), was also practiced to dispose of unused medicines. However, none of the respondents practiced returning unused medications to the pharmacy. Moreover, 85 (32.31%) of the respondents reported never disposing of their medications and believed that it is acceptable to store medications at home for future

Table 1 Socio-Demographic Characteristics of Respondents in Selected Public Health Centers of Dessie Town, Northeast Ethiopia (n =263)

Variables	Categories	Frequency (%)
Gender	Male	113 (42.97)
	Female	150 (57.03)
Age (in years)	14–24	62 (23.57)
	25–35	183 (69.58)
	>35	18 (6.84)
Marital status	Single	25 (9.5)
	Married	140 (53.23)
	Divorced	64 (24.33)
	Widowed	7 (10.26)
	Widower	7 (2.66)
Educational status	Illiterate	95 (36.12)
	Only read and write	60 (22.81)
	Elementary (1–8)	33 (12.54)
	Grade 9–12	40 (15.20)
	College and university	35 (13.30)

use. All of the respondents did not know about the drug take-back system.

Respondents' Perceptions on Disposal Practices of Unused Medicines

As shown in Table 3, the majority of the respondents, 212 (80.60%), believe that unused medicines present potential risks at home and 205 (77.94%) of the respondents also agreed that children are more vulnerable with unused medicines. Further, 215 (81.74%) of the study participants also agreed that a lack of adequate information on safe disposal practices is a precursor to the risks and negative consequences of unused medicines. In addition, the majority of the respondents, 236 (89.73%), agreed that there should be advice from pharmacists and other health-care professionals on safe disposal practices of unused and expired household medicines.

Discussion

Improper disposal of unwanted or surplus medicines is one of the main routes via which household medications enter the environment, which exerts an impact on people and the natural environment.¹⁵ Therefore, the aim of the current study was to assess disposal practices of unused medications among patients in four public health centers of Dessie town, Northeast Ethiopia.

Table 2 Respondents' Disposal Practices of Unused Medicines in Selected Public Health Centers of Dessie Town, Northeast Ethiopia (n=263)

Variables		n (%)
Did any quantity of purchased medicine remain unused at your home?	Yes	224 (85.17%)
	No	39 (14.82%)
Respondents reason for purchased medicine remaining unused at home	Became better and stopped	149 (56.65)
	Changed the treatment	62 (23.57)
	Finished the dose and remained	35 (13.30)
	Passed expiry date	17 (6.46)
Disposal practices of unused medicines	Stored at home/never disposed	85 (32.31)
	Flushed in the toilet	199 (75.66)
	Gave to friends	60 (22.81)
	Threw in garbage bin	50 (19.01)
	Flushed in the sink	2 (0.76)
	Returned to pharmacy or hospital	0 (0.00)

Table 3 Perceptions of Disposal Practices of Unused Medicines Among Patients in Selected Public Health Centers of Dessie Town, Northeast Ethiopia (n=263)

Statement	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)
Unused medicines present potential risks at home?	–	–	51 (19%)	212 (80.60%)	–
Children are more vulnerable to the risks associated with unused medicines	–	5 (1.90%)	53 (20.15%)	205 (77.94%)	–
There is a lack of adequate information on safe disposal of unused household medicines	–	–	48 (18.25%)	215 (81.74%)	–
Pharmacists and other health-care professionals should provide advice on safe disposal of unused and expired medicines	–	65 (24.71%)	67 (25.47%)	131 (49.80%)	–

In the current study, more than 85.17% of the respondents had leftover medications at home. This result is similar to findings from Kuwait¹⁵ and higher than a study conducted in western India¹⁶ and Saudi Arabia.¹⁷ Major reasons suggested by participants in the present study for this practice include improvement of the patient's medical condition and treatment change. In our study, nearly one-third of the respondents reported never disposing of their medications, which is comparable to a study done in Kenya where a significant number of respondents did keep medicines at home while only 15.24% disposed of their unused medicines.¹⁰ This result, however, is significantly higher than a study conducted in Jeddah.¹⁸ This difference might be due to different systems and educational programs available in different countries. This finding clearly shows that most of the respondents lack awareness in the proper disposal of unused medicines. Pharmacists and other health-care professionals should counsel the patients regarding the disposal of unused medicines. Many consumers keep drugs in their homes

because they want to use those medicines for self-medication practice in the future.

The most commonly reported disposal method in the current study was flushing medication down into a toilet. This can lead to a direct impact on public safety and environmental hazard. Current FDA guidelines on the proper disposal of prescription drugs recommend that unused/leftover/expired medicines should not be flushed down the toilet or drain.¹⁹ However, different findings were reported in other studies. In Saudi Arabia,¹⁷ Jeddah,¹⁸ and India,¹⁶ disposal in household trash was found to be the most common method of disposal, as reported by 79.15%, 73%, and 30.5% of the respondents, respectively. Among all means of disposing of drug waste, the most environmentally friendly way is incineration at high temperature, although this is possible only if medicines are brought back to pharmacy stores. However, in the present study, none of the respondents practiced returning unused medications to the pharmacy, which is comparable to a study conducted in Kenya.¹⁰ Some respondents returned

unused and expired pharmaceuticals to the pharmacy in Kuwait,¹⁵ USA,²⁰ Malaysia,²¹ and Jeddah.¹⁸ This could be explained by the lack of comprehensive drug disposal policies and pharmacies with take-back programs in Ethiopia. Sharing of medications to friends was also stated by some respondents. This finding is similar to the finding from Kuwait¹⁵ and Kenya.¹⁰ However, it is different from a study conducted in Jeddah, where 50% believed that giving leftover medications away to family, friends, is the best method of disposal.¹⁸ Raising awareness through various educational interventions should be considered to improve the disposal practice. By counseling on proper medication use, pharmacists and other health-care professionals can educate patients on the importance of taking their medications as directed, leading to an increase in adherence while minimizing the need for disposal at the same time. In general, safe disposal of leftover pharmaceuticals plays a significant role in reducing the introduction of pharmaceuticals to the environment since it can cause environmental, human health, and safety hazards.

The current study also found that more than 80% of respondents believed that unused medicines present potential risks at home. This finding is higher than a study conducted in Saudi Arabia, where 55.3% of respondents were unaware of the consequences of keeping unused medication in the home.¹⁷ In this study, the majority of the respondents never received advice on medication disposal from a health-care provider. This result is consistent with studies done in Kenya.¹⁰ This reflects gaps in communication services provided by pharmacists and other health-care professionals. Hence, pharmacists and other health-care professionals should offer periodic education for their customers regarding safe medication disposal practices. Pharmacists in every setting have an integral role in encouraging safe medication disposal practices. While counseling patients on medications, pharmacists have the opportunity to instruct patients on how to dispose of unused medications.²²

Conclusion

In the present study, there was a high practice of keeping medications at home and most disposal approaches indicated by the participants were not recommended methods. In addition, most of the respondents did not receive advice from pharmacists and other health-care professionals on how to dispose of unused medications. Hence, there is a need for proper education and guidance of patients

about disposal practices of unused and expired medications.

Data Sharing Statement

All data are presented within the article.

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Disclosure

The authors declare no conflict of interest in this work.

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