

# Unused Medications Disposal Practice: The case of Patients Visiting University of Gondar Specialized Teaching Hospital, Gondar, Ethiopia

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## Abstract

**Background:** The disposal of unwanted medications has been a concern in many countries, as pharmaceutical waste enters the ecosystem, ultimately having an effect on human health and environment. The main objective of this study was to assess unused medications disposal practice of patients

**Method:** Institution based cross sectional study was used. Patients were systematically selected and interviewed using structured questionnaires. The Data was analyzed using SPSS version 20.

**Result:** Out of 384 patients 342(89.1%) were having unused medications and majority (57.3%) of respondent's reason for having left over drugs was subsiding of the condition. Even though most participants 223(58.1%) aware with the bad effect of improper disposal of unused medicines, 82(21.4%) of them kept unused medicines in the house, 63(16.4%) threw into the trash and 51(13.3%) flushing them into the toilet, 40(10.4%) threw into the environment and 298(77.6%) participants disposed both solids and liquid unused medicines similarly. 289(75.3%) participants preferred appropriate household FDA and WHO disposal methods.

**Conclusion:** Majority of the participants kept the unused medications in their home, and threw into the trash and flushing into the toilet as possible disposal methods. Most respondents did not get any advice from health professionals on how to dispose unused medications. Public education regarding unused medication disposal are needed and healthcare workers should give an advice to patients on how to dispose unwanted medications and the impact of improper disposal.

**Key words:** unused medications, take back program, household disposal method

## Introduction

Usually Patients may not use all the medications dispensed to them because of many reasons: the symptoms have been relieved, forgetfulness, dosage changes, side effect intolerance, medication reaching the expiration date, or some patients die due to life-ending morbidities while on medication [1, 2].

Pharmaceuticals are an emerging class of environmental contaminants that are receiving increasing attention by the press, public, and scientific community. The use of Pharmaceuticals, including both prescription and over-the-counter medications (OTC), are on the rise among consumers and inside the healthcare system [3].

Improper disposal system is a global problem and occurs in both developing and developed countries. In developing countries this problem is enormous and not well documented. It often leads to problems such as ineffective treatment, health risks, medicine resistance, patient noncompliance, and overall decreases the quality care of population and increases morbidity and mortality, also excessive spending on pharmaceuticals and wastage of financial resources, by both patients and health care system [4].

Although there are options for disposing of unused drugs, many consumers keep drugs in their possession because they do not want the drugs to go to waste or do not know how to dispose of them properly. Keeping medication in the home poses several risks related to diversion, accidental overdose, and consumption of spoiled substances [2].

The storage of drugs at home promotes self medication, which may result in inadequate dosage administration, thus predisposing to incidences of drug resistance, sharing drugs with other members of family or neighbors resulting in incomplete dosage. Home stocked drugs may lose potency due to poor storage, as a result of exposure to heat, light, humidity and air. It is difficult to tell a drug has expired if the expiry dates are missing in most of the drug containers. Expired drugs pose toxicity risk as in some cases allow the active substance to undergo degradation leading to formation of toxic products [5].

As associated Press report in 2008 trace amounts of active pharmaceutical ingredients (APIs) in the drinking water, alarmingly increases the risk to human health. Some of the common drugs found in surface and drinking water include antibiotics, anticonvulsants, and artificial hormones. [3].

Unsafe disposal system contaminates surface bodies and drinking water and contributes to development of antibiotics resistance, or exposure of populations to irritant or mutagenic anticancer drugs and the possible link between endocrine disrupting compounds and failing fertility [6].

Different studies conducted in different parts of the world on disposal practices for unused medicines revealed that the most popular method for household drug disposal was by trashing into garbage (24% to 89%) or rinsing down a toilet or sink (2% to 55%). Solid dosage forms were more likely to be put into rubbish and liquid dosage forms were more likely to be poured into drainage. Landfills or incineration are also used to dispose unused medications [7, 8].

Although different studies have been conducted in different parts of the world to show the degree of improper drug disposal, to the best of the authors' knowledge concerned, there is no even a single study conducted in the study area in particular and in Ethiopia in general. Hence, the aim of this study was to assess patient's practice and awareness of unused medication disposal. This study could be important for policy makers and responsible offices at different levels to take appropriate measures. It would also serve as a base line data for researchers who are interested to conduct similar studies.

## Method

### *Study design*

An Institutional based cross sectional study was conducted

### *Study area and period*

The study was conducted in Gondar University teaching and specialized hospital which is found in Amhara region, North Gondar Zone and located 748 km North West from Addis Ababa, capital city of Ethiopia. The hospital provides service for about 5 million patients. The study was done at pharmacy units from May 13 to May 21, 2014.

### *Source and study population*

The source population was all patients who come to the hospital and the target population was those patients who visit the pharmacy units during the study period.

### *Methods of data collection*

Data was collected by interviewing patients using standardized and pretested questionnaire

### *Sample size and sampling technique*

The sample size was calculated using single population formula, since our study population size was greater than 10,000.

$n = \frac{Z^2 p (1-p)}{W^2}$ ; Where  $n$ =sample size = 184,  $Z$ = confidence interval level (95% =1.96),  $P$ = estimated population proportion 50%,  $w$ = margin of error (5%)

The study subjects were selected using systematic sampling method. On average, about 663 patients came to pharmacy units per day. Total estimated number of patients visiting hospital pharmacy per week would be 4641 and, the interval was = 4641/384=12. Hence, after selecting the first patient randomly, then every twelfth patient was included in the study. Whenever, non volunteer patients encountered, the immediate next patient was considered.

### *Data processing and analysis*

The collected data was checked for its completeness, consistency and the accuracy before analyzed. It was analyzed with SPSS (version 20) and presented using tables and different figures.

### *Ethical considerations*

Ethical clearance was obtained from both administrations of the school of pharmacy and university of Gondar specialized teaching hospital. Verbal consent was also obtained from respondents by explaining the objective and anticipated benefits of the study.

## Results and Discussion

### *Socio-demographic characteristic of the respondents*

A total of 384 patients participated in this study. The majority of them 199 (51.8%) were male. About half of the respondents were married and 218(56.8%) of them were in the age of 18-29 years. Concerning the educational status 129 (33.6%) of the respondents finished higher education (table 1).

Table 1: socio-demographic characteristic of the respondents, N=384

Variables	Categories	Frequency (%)
Gender	Male	199(51.8)
	female	185(48.2)
Age(in years)	10-17	16(4.2)
	18-29	218(56.8)
	30-65	138(35.9)
	>65	12(3.1)
Marital status	Single	170(44.3)
	Married	193(50.3)
	Divorced	14(3.6)
	Widowed	6(1.6)
	Widower	1(0.3)
Educational status	Illiterate	73(19)
	Only read and write	41(10.7)
	Grades (1-8)	53(13.8)
	Grades (9-12)	88(22.9)
	College and University	129(33.6)
Residency	Rural	124(32.3)
	Urban	260(67.7)

### ***Past medication profile***

This study showed that almost all, 381(99.2%), respondents took medication before. Out of 384 patients, 342(89.1%) were having unused medications. Majority, 220 (57.3%), of respondents' reason for having left over drugs was subsiding of the condition. Some respondents, 66(17.2%), gave more than one reasons like 21(5.5%) of them stopped taking medicines due to subsiding of the condition and forgetfulness (table 2). Similar finding was reported in India, which showed 165(70%) participants had up to five expired medications at home and major reason for possession of unused, expired medicines was purchase of over the counter (OTC) drugs for self-medication and excess supply of medications [6].

Table 2: Reasons given by the respondents for having unused medication, N=384

Category	Frequency (%)
Subsiding of the condition	220(57.3%)
Combined reasons	66 (17.2%)
No left over drugs	38(9.9%)
Forgetfulness	8(2.1%)
Excess supply	11(2.9%)
Intolerable side effects	11(2.9%)
Passed expiry date	9(2.3%)
Changed treatment	6(1.6%)
Unclear instruction	3(0.8%)
Unpleasant taste	3(0.8%)
Others	9(2.3%)

### ***Unused medicines disposing practice***

Majority of the respondents, 82(21.4%), kept the unused medications in the house, followed by threw into the trash 63(16.4%) and flushing them into the toilet 51(13.3%). Threw into the environment 40(10.4%), burning 6(1.6%), return to nearby pharmacy 5(1.3%), buried in ground 3(0.8%), give to other ill person 3(0.8%) were also practiced to dispose unused medicines. Some respondents, 91 (23.7%), used more than one method to dispose drugs like 21(5.5%) keep them in the house and threw into the trash, 13(3.4%) used to keep in the house and threw to the environment, 10(2.6%) used to keep in the house and flushing into the toilet (fig. 1). Similar finding was obtained in Khon Kaen, Thailand which showed that 89.4% of people kept some kind of drugs in their houses [7]. However, somewhat different disposal practice was reported by Redhwan and Adel in Malaysia

that showed that the majority (57.1%) of respondents threw unused medication into the trash, followed by burning the unused medication (14.2%) and storing it in a refrigerator (14.2%) [1]. A different result was also reported in India in 2012, with majority (57%) of them threw unused medications into the trash, 14% burning unused medication, and 5.3% returned to hospital [9].

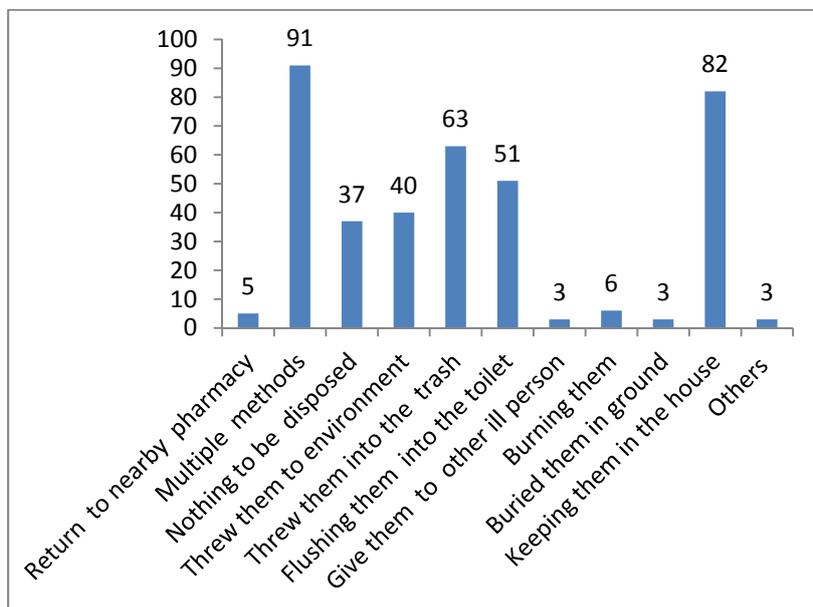


Fig. 1 Respondents Unused medicines disposing practice, N=384

Overall, 151(39.3%) of the respondents kept unused medications in the house. They mentioned different reasons for keeping them in the house. For instance, 119(31.0%) of them for other day use, and 29(7.6%) didn't know how to dispose them (fig. 2).

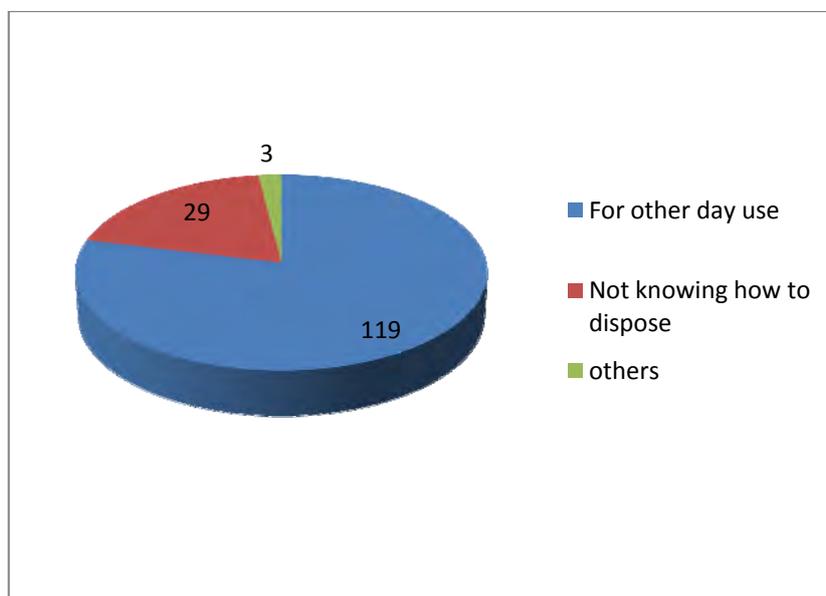


Fig. 2 Reasons given by the respondents why they keep unused medications, N=384

#### ***Patients' opinion on the appropriateness of the disposal methods***

Most respondents 97(25.3%) thought that burning, followed by flushing into the toilet 57(14.8%) returning to nearby pharmacy 51(13.3%), threw into the trash 45(11.7%), and buried in the ground 43(11.2%) was more appropriate. More than one methods were also mentioned as appropriate by 54(14.1%) respondents: burning and burying 13(3.3%), threw into the trash and flushing into the toilet 8(2.0%), flushing into the toilet and burning 6(1.6%), threw into the trash and burying 6(1.6%), return to nearby pharmacy and burning 5(1.3%), flushing into the toilet and burying 3(0.8%) (table3).

Table 3: Patients' opinion on appropriateness of the disposal methods of UMs, N=384

Category	Frequency (%)
Burning them	97(25.3%)
Flushing into the toilet	57(14.8%)
More than one disposing methods	54(14.1%)
Returning to nearby pharmacy	51(13.3%)
Threw them into the trash	45(11.7%)
Buried in ground	43(11.2%)
Threw them to environment	12(3.1%)
Give them to other patients	8(2.1%)
Keeping them in house	7(1.8%)
Others	6(1.6%)
Take back program	4(1.0%)

#### ***Patient's different disposal practice based on medicines dosage form***

298(77.6%) participants disposed both solids and liquid unused medicines similarly. However, 86(22.4%) of them disposed differently: mostly, liquid dosage forms were disposed by flushing down to the toilet 58(67.4%), and flushing them into the sink 15(17.4%). Regarding solid dosage forms, 45(52.3%) and 25(29%) of the respondents disposed them by burning and throwing into the trash respectively (table 4). A study conducted in Bangladesh also showed same disposal methods for solids and liquid dosage forms: 58% of the participants reported disposing of liquid medication waste in a landfill and 73% of participants solid dosage form also ends up in a landfill [10]. Similar disposal for solid and liquid dosage forms was also reported in a survey conducted in Khon Kaen, Thailand where the most common method of discard was trashing in to rubbish bin for 81.4% and 64.6% of solid dosage form and liquid dosage form respectively [7].

Table 4: Patient's different disposal practice based on medicines' dosage form, N=384

Disposal method	Dosage form	
	Liquid	solid
Down the sink	15(17.4%)	0
Down the toilet	58(67.4%)	2(2.3%)
Into the trash	1(1.2%)	25(29%)
Burn	0	45(52.3%)
Buried	12(14%)	3(3.5%)
Threw in to the environment	0	10(11.7%)
Keep them in house	0	1(1.2%)
All types disposed similarly	298(77.6%)	

#### ***Patients' awareness and preference on FDA's and WHO's acceptable disposal methods***

Most of the participants did not aware of appropriate disposal methods, only 51(13.3%) of them were aware with returning to nearby pharmacy and 4(1%) knew drug take-back program. Though some of the participants used flushed into the toilet, threw into the trash, buried in the ground, they didn't follow the FDA guidelines to make it more safe. FDA recommended three acceptable ways of drug disposal: take-back program, return to nearby pharmacy and appropriate house hold disposal methods. The appropriate house hold drug disposal method is described by FDA as: threw into the trash by take them out of their original containers and mix them with an undesirable substance, such as used coffee grounds or kitty litter, the medication will be less appealing to children and pets, and unrecognizable to people who may intentionally go through your trash. Put them in a sealable bag, empty can, or other container to prevent the medication from leaking or breaking out of a garbage bag as acceptable disposal methods [11]. However, different result was obtained in Malaysia where above 93% respondents knew about drug-take back program [12] and in India where 52% agreed that drug wastage can be managed by returning to pharmacy [6].

The respondents were interviewed about their preference among WHO and FDA acceptable disposal methods as their future practice. Majority of the respondents, 289(75.3%), preferred appropriate household disposal methods followed by return to nearby pharmacy 65(16.9%) and take back program 30(7.8%). Most of the participants 350 (91.1%) were not advised about these acceptable disposal methods by health professionals. Only 34(8.9%) of them got the appropriate advice.

#### ***Patients' awareness about bad effect of improper disposal of medicines***

Most of the participants, 223(58.1%), mentioned that unused medicines affect the health of humans and animals, followed by 85(22.1%) affect the health of humans, animals and the environment, 41(10.7%) were not sure whether it pose a problem or not, 21(5.5%) affect the environment only and 14(3.6%) didn't pose any unwanted effects. A comparable finding was obtained in study conducted in Kuwait where 82% were aware that improper disposal causes damage to the environment and pose undesired health impact [13].

#### ***Best way to educate the community about appropriate disposal of unused drugs***

Most of the participants, 120(31.3%), preferred religious places to educate the public about proper drug disposal method, followed by community meeting 100(26%) (fig.3). However, different public preferences were shown in Malaysia where 60.7% of the respondents mentioned that the best way to educate the public about disposal unused medication was through school, university and public campaign [9].

While public education about appropriate drug disposal is conducted, these public preference areas have to be considered. In addition innovative solutions, such as placing disposal information on medication labels or pill bottles, might prove effectiveness.

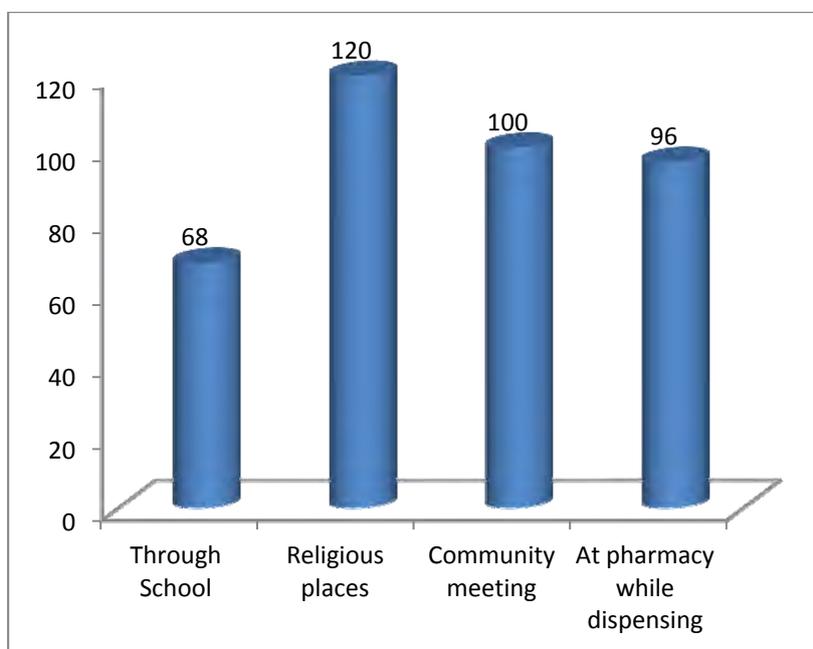


Fig. 3 Best way to educate the community about appropriate disposal of unused drugs, N=384

#### **Conclusion**

This study showed that the majority of the participants kept the unused medications in their home threw into the trash and flushing into the toilet as possible disposal methods which were not accomplished as FDA and WHO guidelines recommend and may pose a problem to the environment, animals and facilitate drug-resistance bacteria. Even though most of the participants were aware of the bad effects of inappropriate disposal of unused medications, they did not know FDA and WHO acceptable disposal methods. They also did not get an advice from health professionals how to dispose unused medications. Public education regarding unused medication disposal are needed and healthcare workers should give an advice to patients on how to dispose unwanted medications and the impact of improper disposal. Government and other concerned stakeholders should establish take back programs to reduce the quantity of unused medicines entering the environment. National guidelines on the appropriate disposal of unused medications need to be prepared and disseminated to the public.

### Reference

- [1] Ahmed R., Alareefi A. Patient opinion and practice toward unused medication disposal: Thai Journal of Pharmaceutical Science. 2013, 34: 117-120.
- [2] Siler S., Duda S., Brown R., Gbemudu J., Weier S. and Glaudemans J. Safe Disposal of Unused Controlled Substances: King Pharmaceuticals. 2009.
- [3] Talerico D. An examination of medication disposal systems in Washington, Maine, New York the San Francisco Bay area, and Rhode Island. Pharmaceutical pollution prevention: 2012.(Thesis), 2-4.
- [4] Jaffer B. Household Survey on Medicine Use. Oman: Oman Ministry of Health; 2009
- [5] Temu M., Kaale E. and Marawiti M. Storage of antimalarials at household level an associated factors in Kiromo ward, Bagamoyo Tanzania: African Health Sciences. 2006, 6(1): 43-48.
- [6] WSD. Study of the Methods for Disposing of Unused Pharmaceuticals: Texas, USA: Water Supply Division; 2010. [www.tceq.state.tx.us/goto/publications](http://www.tceq.state.tx.us/goto/publications). Accessed on May 21, 2014.
- [7] Dharmender G., Ashutosh G., Ansari N. and Ahmed Q. Patient's opinion and practice toward unused medication disposal: Pharmaceuticals and scientific innovation. 2013, 2(5): 47-50.
- [8] Arkaravichien W., Ruchipiyarak T., Thawinwan W. and Benjawilaikul S. A Threat to the Environment from Practice of Drug Disposal in Thailand: EnvironmentAsia. 2014, 7(1): 13-18
- [9] Aditya S. Safe medication disposal: International Journal of pharmacy and Life sciences. 2013, 4(3): 2475-2480.
- [10] Khalid Z., Md. Al-mamun A., Md. Rashid H. and Sikder K. Knowledge, Awareness and Disposal Practice for Unused Medications among the Students of the Private University of Bangladesh: Biomedical and Pharmaceutical Research. 2013, 2 (2): 26-33.
- [11] United States Food and Drug administration: How to dispose unused medications. FDA. 2011.
- [12] Kalam A., Haque R., Akhter A., Al-mamun M., Uddin M. and Rahman M. Disposal Practice for Unused Medications among the Students of the International Islamic University: Journal of applied pharmaceutical science. 2012, 02 (07): 101-106.
- [13] Abahussain E., Waheedi M. and Koshy S. Practice, awareness and opinion of pharmacists toward disposal of unwanted medications in Kuwait: Saudi Pharmaceutical Journal. 2012, 20: 195–201.