

Knowledge, Attitude and Practice (KAP) Towards Disposal of Unused and Expired Medications: an Assessment Among Patients

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Medicines play a very significant role in treating many diseases, but it is essential to dispose of them properly at the treatment's end. Therefore, knowledge and awareness of proper drug disposal are necessary for a safe environment; this deficiency can lead to many problems, including environmental pollution and health hazards directly or indirectly. Hence, the study aimed to assess the knowledge, practice, and awareness of disposing of unused/expired drugs among the patient population. This cross-sectional questionnaire-based study was conducted in a tertiary care teaching hospital. The study includes a total of 399 participants. The questionnaire consisted of demographical data and multiple-choice questions associated with knowledge and awareness of drug disposal. The collected data is expressed in percentages. Out of 390 respondents, 49% were males and 51% were females. It was found that the most expected disposal pattern of expired/ unused drugs was through household trash (63%). A total of 300 (77%) were cautious of the consequence of inappropriate disposal. We observed that 20(5%) participants had partial knowledge about proper drug disposal, and 63% (n=245) did not practice safe disposal of the medicines. However, 66%(n=256) of participants sought to implement the National Drug Take Back program. Our study aimed to create an awareness to connect the gaps between knowledge and practice of proper and environmentally safe disposal methods of expired/ unused drugs among the overall population.

Keywords: Drug Disposal; Expired Medicines; Environment Hazard; Unused Medications.

There has been an increase in pharmaceutical product use in recent years due to many advances in medical research. The elderly take medications for extended periods of their lives to tackle chronic diseases. The accumulated unused and expired medications are due to medication changes, poor patient compliance, and excess procurement of over-the-counter medicines.

Improper disposal of unused pharmaceutical drugs poses a significant threat to the environment. ^{1,2}Most of the time, the health care professionals give instructions regarding the proper use and store of medications but seldom do they provide proper instructions on safe and appropriate ways of disposal of drugs. Unused medications, if stored at home in an unsafe condition, can lead to an increased risk of accidental exposure by children.

^{3,4}

The expiration date of a pharmaceutical drug is not the termination of medication use. If not stored correctly, the expiry date is on which the effectiveness of the medication begins to reduce. The manufacturer does not guarantee the usefulness of the medicine.⁵

In most countries, unwanted medications are disposed of in the garbage or burn them. The burning of pharmaceuticals may lead to residues due to improper combustion. These might get access to the environment through water sources and can create health hazards for people living in and around the area. The fumes from the combustion of the drugs may impact far away places. Long-term exposure cause hazardous effects, primarily on vulnerable populations like the elderly, pregnant women, newborns, and children. The chronic exposure to these sub-therapeutic levels of bioactive pharmaceutical compounds in water bodies is primarily unknown to humans; however, it directs aquatic wildlife toxicity.^{6,7,8}

All over the world, the safe disposal of unused or expired medications, particularly by the population, is of deep concern. Many developed countries have started enacting programs to dispose of new medicines. Countries like Australia and Canada have been implementing the National Return and Disposal of Unwanted Medicines Project, aided by the government and pharmaceutical industry. Drug take-back programs have been implemented in the United Kingdom and Sweden.⁹

In India, no such national programs aim to control the safe disposal of unused medicines and make the public aware of the problem. It is imperative to boost the appropriate and safe disposal of medications and pharmaceuticals by the public and bring the matter to the government's attention. We need to thoroughly understand a community's level of knowledge and attitude toward disposing of unused and expired medications. Moreover, information on the disposal methods of new pharmaceuticals would help in the awareness of appropriate ways of disposing of new medicines.

Thus, our study aimed to evaluate the knowledge, attitude, and practices toward disposing unused and expired medicines among the patient population in a tertiary care teaching hospital in South India.

MATERIALS AND METHODS

This cross-sectional, questionnaire-based study included patients who attended the OPD of SRM Medical College Hospital & Research Centre Chennai, Tamil Nadu. The Institutional Ethics committee approved the study. A total of 399 participants were recruited for the study and distributed with a study questionnaire. Before filling out the questionnaire, the study participants explained the study's importance and purpose. After the Informed consent was obtained from the target population, the semi-structured questionnaires were distributed, and sufficient time was given to the participant to complete the questionnaire.

The questionnaire comprises three parts; in which part I includes demographic details of the study participants such as participant, gender, age, and education. Part II contains questions regarding the knowledge of unused and expired drugs. The inquiries related to the awareness and practices of unused and expired drug disposal were included in part III. The data were represented as percentages and analyzed through the Microsoft office package.

RESULTS

A total of 390 patients completed the questionnaire and returned it. Among the participants, the percentage of males and females was n=191 (49%) and n= 199 (51%), respectively (Figure 1). The education levels of the participants

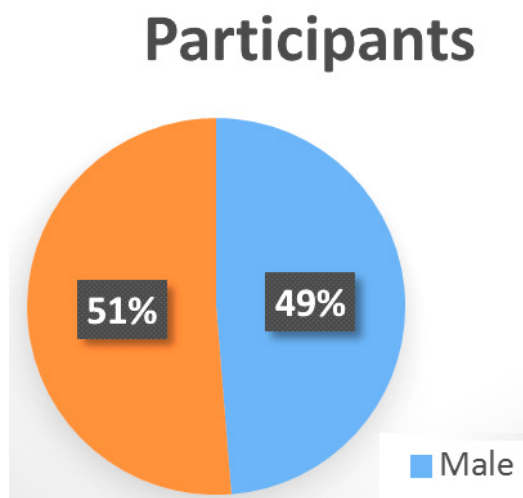


Fig. 1. Sex distribution of the participants

were 10th class (12%), 12th class (33%) and graduates (55%).

Knowledge of patients regarding unused and expired medications

About 94.6 % of the participants knew that it is not safe to use expired medications. About 156 participants (40%) thought that the drugs lost their effect beyond the expiry date, but 137 (35.2%) thought that drugs become toxic and 97(24.8%) thought the product remained the same after the expiry date. The majority of the patients[302(77.4%)] knew that inappropriate medicine disposal could harm the environment and health, whereas 48(12.3%) said there wouldn't be any effect on the environment and health. About 10.3% didn't know the answer it. Most patients didn't realize that irrational use or change of antibiotics and an incomplete course can cause drug resistance (Table 1).

Perception of unused and expired medicines among patients

Most patients (68.7%) said they keep the drugs at home until it expires. The purpose of keeping the expired medications was like a need at a later stage, unsure of the disposal methods, unwillingness for destruction, etc. About 42.3% of the population said that electronic media would be the best source of awareness, and the rest mentioned newspapers (27.4%), the internet (18.2%), and physicians as sources of information (7.2%), and pharmacists (4.9%). Most patients said

there should be a national drug take-back program in India (Table 2).

Disposal practice of unused and expired drugs among the study population

Most patients keep unused medicines at home and flush the medications in the toilet or sink (Table 3). Most of them separate the new drug before disposal too.

DISCUSSION

The knowledge, attitude, and practices of disposing the unused and expired medications among the patients attending a tertiary care teaching hospital were assessed in this study. The majority of the patients had good knowledge about the safety as well as the toxic effect of the expired medicines. They had good knowledge about the impact of improper disposal of expired medications on health and the environment. Many patients agreed that there is a lack of suitable material about the proper disposal methods and that the government should take the initiative to disseminate the appropriate expired drug disposal information.

In our study, many participants understood that improper disposal of unused and expired medicines is hazardous to the health and environment. Our study finding shows higher knowledge than the study conducted by Ahmed et al and Paul et al.^{10,11} A study conducted by Bashar et al showed that the entire participants

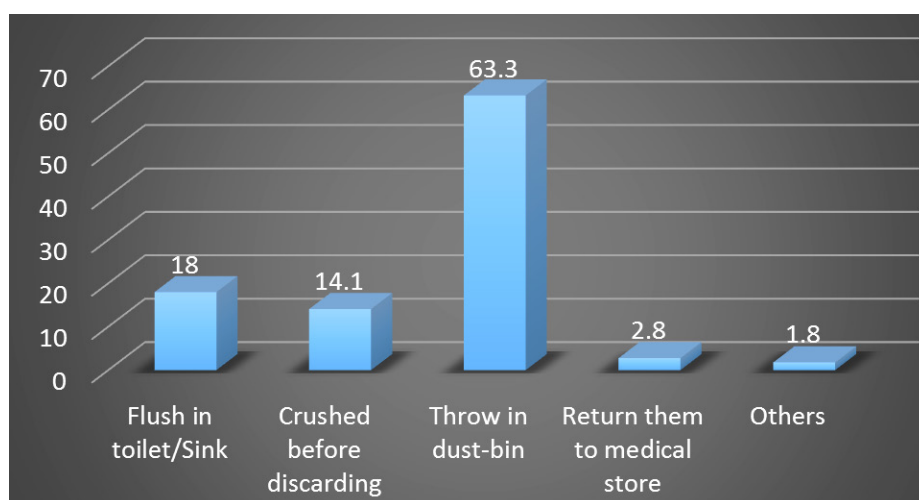


Fig. 2. Respondents most preferable way of discarding expired medicines (n=390) expressed in percentage

felt that improper disposal of unused and expired medications can affect the health and environment.¹² Unwanted and expired medications are habitually stored in homes or likely to be disposed of in the sink, flushed down the toilet or to be found in the garbage. People keep many medicines in their homes for a long time, posing risks to health and the environment. In our study, many participants said that drugs lose their effect beyond expiry. There

is a general insight that the expiry date is the end of the drug's usefulness. In reality, the expiry date is the date when the potency of the drug begins to lessen.¹³ Rapid degradation of certain medications, like antibiotics, leads to poisoning or toxicity. The excipients used in the drug formulations (solvents, dyes, emulsifiers, and preservatives) impact the environment.

Table 1. Knowledge of patients regarding proper disposal of unused medications

Questions/Statement	n (%)
Is it safe to take expired medicine?	
Yes	11 (2.8)
No	369 (94.6)
Maybe	10 (2.6)
What will be the effect of drugs beyond its expiry date?	
Toxic	137 (35.2)
Remains same	97 (24.8)
Loses its effect	156 (40)
Do you know that drug resistance can develop due to irrational use/change of antibiotics as well as incomplete course of antibiotics?	
Yes	134 (34.3)
No	256 (65.7)
Do you aware that improper disposal of drugs can have effect on the environment and health?	
Yes	302 (77.4)
No	4 (1.2)
Do not know	40 (10.3)
How to minimise the hazardous effect of unused and expired medicines?	
Decreasing the no. of prescribed medicines by doctors	191 (49)
The unused medicines can be donated	87 (22.3)
Proper guidance can be provided to the consumer	73 (18.7)
By prescribing sufficient quantities of medications which can ensure cure	39 (10)
Whose responsibility is to create awareness among society for proper disposal of unused medications?	
Government	33 (8.5)
Health Care personal	33 (8.5)
Both	324 (83)
Are there different disposal methods for different formulation?	
Yes	97 (24.9)
No	293 (75.1)
Incineration (burning of) as a disposal method is used for which formulation?	
Tablets & Capsules	23 (5.9)
Liquid formulation	49 (12.6)
Do not know	318 (81.5)
Do you know about National take-back programme in other countries for return of unused medicine?	
Yes	29 (7.4)
No	163 (41.8)
Do not know	198 (50.8)

The US Food and Drug Administration (USFDA) suggests that consumers follow the medication label instructions or the subject information for proper disposal of medications.⁹ In our study, most participants were informed that they keep the medication s until it expires. Few

participants return the expiry drugs to the pharmacy store or donate them to the welfare or hospital. Unused medications stored at home are recovery from a medical condition, treatment changes, side effects, patient non-compliance, and buying OTCs in more than the required quantity.¹⁴ In our

Table 2. The Perceptions of patients on unused and expired drugs

Questions/ Statement	n (%)
How do you deal with the unused medications?	
Donate to welfare or hospital	23 (5.9)
Return to medical store	99 (25.4)
Keep at home until expired	268 (68.7)
What’s the purpose of keeping the unused/expired medications?	
In case needed later	100 (25.6)
Not sure how to dispose	103 (26.4)
Do not want to waste them	116 (29.8)
To keep a stockpile	14 (3.6)
I don’t keep them	57 (14.6)
How do you think to enhance the awareness among society?	
Newspaper	107 (27.4)
Electronic Media	165 (42.3)
Internet	71 (18.2)
Pharmacist	19 (4.9)
Physician	28 (7.2)
Is it important to implement National level drug take back programme in India?	
Yes	256 (65.6)
No	134 (34.4)

Table 3. Disposal practice of unused and expired medications among patients

Questions/ Statements	n (%)
Do you take medicine without prescriptions (OTC)?	
Yes	364 (93.3)
No	26 (6.7)
Do you check expiry date of medicines before procuring?	
Yes	267 (68.5)
No	114 (29.2)
Do not know	9 (2.3)
Do you have any unused medicine at your home?	
Yes	289 (74.1)
No	101 (25.9)
What do you do with the expired medicines?	
Flush in toilet or sink	70 (18)
Crushed before discarding	55 (14.1)
Throw in dust-bin	247 (63.3)
Return them to medical store	11 (2.8)
Others	7 (1.8)
Do you keep the unused medicines separate before disposal?	
Yes	354 (90.8)
No	36 (9.2)

study, participants kept the unused medications as they needed to be used late, were unsure of the disposal methods, or didn't want to waste the drugs. However, our participants were well educated, and awareness regarding proper drug disposal methods was lacking. A study conducted by Ayele and Mamu showed that about 67% of the participants suggested the need for adequate guidance on disposing of unused and expired medicines.¹⁵ Another study finding indicated that the health care professionals are poorly involved in creating awareness and consumers guidance on the practice of proper disposal.¹⁰ There is a lack of information on the safe disposal of unused medicines from physicians and healthcare professionals.¹⁶

Most of our participants agreed on the lack of proper information on the practice of safe disposal of medications. They suggested that government and health care professionals should be made in authority to create awareness for proper disposal of medicines. The awareness among the consumers can be improved by appropriate education through various ways like newspapers, the internet, and electronic media.¹⁵

In our study, most participants chose the mass media like newspapers and electronic media as the best source of awareness among the society compared to health care professionals like physicians and pharmacists. This shows that there is a lack of belief in health care professionals.

The effect of improper drug disposal on environmental health is a new concept for health care professionals. In the USA, pharmacists have the authority to advise patients to dispose of unused medications in their toilet, sink, or garbage if they did not or could not return their expired/new medicines to the pharmacy.¹⁷

In the present study, the most preferred method of unused medications disposal was throwing them in the dust bin, followed by flushing in the toilet. This result is consistent with other studies.^{15,18} Many other studies have shown that the most commonly used method of disposal of pharmaceuticals by individuals or households is a garbage disposal. Still, some studies have reported that participants were concerned and aware of the environmental risk involved in improper drug disposal.¹⁹ A study showed that 72% returned to the pharmacy, and 82% of the participants stated that they returned unused medications to a

chemical waste facility, as they were worried about the environment.²⁰ Another study in the United States showed that participants were aware of the pharmaceuticals detected in the background and were more likely to dispose of the medications in a manner that lessened the possible environmental pollution.²¹ In our population, the lack of awareness may not be due to educational status but due to improper guidance by health care professionals.

There should be policies for reducing unused medications by targeting health care professionals including physicians and pharmacists. Physicians need to minimize the number of prescribed drugs and define them rationally. Pharmacists can educate the patients to take all the medications as prescribed. There is a national-level drug take-back program in India that has guidelines about properly disposing of unused and expired medications. Still, the public should be aware or educated about the existing program.

The limitations of the present study are the lack of information regarding the type and characterization of medications that are kept in the house and disposed of later on due to expiry, which can be investigated further.

CONCLUSION

In the present study, it is observed that there was a lack of proper information on the practice of safe disposal of medications among the general patient population. Right drug temperament is a significant challenge for community pharmacies worldwide. The awareness of the rational use of medicines in the community can be achieved through appropriate education and motivation. The drug take-back program cannot dispose of all the new medications. And in India, we do not have an established drug take-back program. So, the best way to prevent environmental pollution is to educate the public and encourage health care professionals to understand their roles and responsibilities.

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Conflict of interest

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REFERENCES

1. Daughton C, Ruhoy I. Lower-dose prescribing: minimizing “side effects” of pharmaceuticals on society and the environment. *Sci Total Environ* 2013; **443**:324–337.
2. Daughton CG, Ternes TA. Pharmaceuticals and personal care products in the environment: agents of subtle change? *Environ Health Perspect* 1999; **107**:907–938.
3. Kusturica MP, Sabo A, Tomic Z, Horvat O, Solak Z. Storage and disposal of unused medications: knowledge, behavior, and attitudes among Serbian people. *Int J Clin Pharm.* 2012; **34**:604–610.
4. Jassim AM. In-home drug storage and self-medication with antimicrobial drugs in Basrah, Iraq. *Oman Med J.* 2010; **25**(2):79–87.
5. Therapeutic Research Center. Proper disposal of expired or unwanted drugs. *Pharm Lett.* 2007; **23**(230401):1–9.
6. Prescott JD, Estler K. Waste not want not: drug disposal and the role of the pharmacist. *Pharm Times.* 2010; **76**:107–113.
7. Guirguis K. Medications collected for disposal by outreach pharmacists in Australia. *Pharm World Sci.* 2010; **32**:52–8.
8. Persson M, Sabelström E, Gunnarsson B. Handling of unused prescription drugs, knowledge, behavior and attitude among Swedish people. *Environ Int* 2009; **35**:771–774.
9. Tong AY, Peake BM, Braund R. Disposal practices for unused medications around the world. *Environ Int.* 2011; **37**(1):292–298.
10. Ahsaan Ahmed, Nousheen Mushtaq, Muhammad Tariq, Maliha Durrani SA, Muhammad Arif, Yasmeen G. Disposal practices of unused and expired pharmaceuticals in Karachi and their impact on health and environment. *JUMDC* 2013; **4**(2).
11. Paut Kusturica M, Tomas A, Tomic Z, Bukumiric D, Corac A, Horvat O, et al. Analysis of expired medications in Serbian households. *Slov J Public Health.* 2016; **55**(3):195–201.
12. Bashaar M, Thawani V, Hassali MA, Saleem F. Disposal practices of unused and expired pharmaceuticals among general public in Kabul. *BMC Public Health.* 2017; **17**(1):45.
13. Norma Oficial Mexicana NOM-073-SSA1-2005, Estabilidad de fármacos y medicamentos. 2005.
14. Braund R, Peake BM, Shieffelbien L. Disposal practices for unused medications in New Zealand. *Environ Int.* 2009; **35**:952–955.
15. Ayele, Y., Mamu, M. Assessment of knowledge, attitude and practice towards disposal of unused and expired pharmaceuticals among community in Harar city, Eastern Ethiopia. *J of Pharm Policy and Pract.* 2018; **11**:27.
16. AlAzmi A, AlHamdan H, Abualezz R, Bahadig F, Abonofal N, Osman M. Patients’ knowledge and attitude toward the disposal of medications. *J Pharm* 2017; 8516741.
17. Kuspis DA, Krenzelok EP. What happens to expired medications? A survey of community medication disposal. *Vet Hum Toxicol* 1996; **38**:48–49.
18. Auta A, Omale S, Shalkur D, Abiodun AH. Unused medicines in Nigerian households: types and disposal practices. *J Pharmacol Pharmacother.* 2011; **2**(3):195–196.
19. Abahussain EA, Ball DE. Disposal of unwanted medicines from households in Kuwait. *Pharm World Sci* 2007; **29**:368–373.
20. Blom ATG, De Bruijn JCMJ, Van De Vaart FJ. How consumers deal with the remainders of unused prescription drugs. *Pharm Weekbl* 1996; **131**:102–107.
21. Kotchen M, Kallaos J, Wheeler K, Wong C, Zahller M. Pharmaceuticals in wastewater: behavior, preferences, and willingness to pay for a disposal program. *J Environ Manage* 2009; **90**:1476–1482.