

ORIGINAL RESEARCH

A cross-sectional survey of the pattern of medication disposal practices of unused and expired drugs among medical students

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Received date: 26 February, 2024

Acceptance date: 31 March, 2024

ABSTRACT

Background: Majority of Indian communities lack knowledge about how to properly dispose of the unwanted medications. According to the Bio-Medical waste Management (BMW) rule of 2016, any medication that has expired or been discontinued is considered biomedical trash. Pharmaceutical waste disposal is a major issue for healthcare professionals globally, especially in developing countries like India. The question of how the medical students, who are the future medical professionals, dispose of unwanted and expired drugs has received very little attention so far. Thus, the objective of this study was to investigate how medical students manage unused and expired medications. **Methods:** A cross-sectional study was conducted with 143 second-year medical students at our institute. Students willing to participate in the study and who gave written informed consent were included and their answers were documented by a self-administered structured questionnaire. Data were entered into Microsoft Excel and subjected to relevant statistical tests for analysis. **Results:** The current study involved 143 second-year undergraduate medical students. Most of the students (62.2%) said they would toss the unused medicine in dust bins at home, and the municipality would come and take them. **Conclusion:** Understanding and following the proper disposal procedures for unwanted and expired medications is essential for safeguarding both human health and the environment. Despite the fact that the WHO has published guidelines for the appropriate disposal of unused and expired pharmaceuticals, appropriate regulations should be put in place to implement the procedures for the proper disposal of them in order to save our ecology.

Keywords: Unused drugs, medical students, disposal practice.

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INTRODUCTION

Medicines are essential to diagnose, prevent and treat illnesses. Health care professionals must prescribe and dispense a variety of medications due to the rising incidence and prevalence of diseases.¹ Patients with chronic conditions like diabetes mellitus and hypertension are supposed to take medicines on long term basis and may need their dosages adjusted by consultants frequently. Patients with acute infections, fever, soft tissue injuries and other conditions may not take all of the prescribed medications for a variety of reasons such as; symptoms have subsided, unpleasant side effects, amnesia or medications that are set to expire or become ruined from inappropriate storage

and patient non-adherence.² Unused medication refers to any pharmaceutical product that is not completely utilized, including over-the-counter and prescription medications that may come from homes or medical activities.³ Majority of Indian communities lack knowledge about how to properly dispose of these unneeded medications. These medications are frequently flushed down the toilet or sink, dumped in the trash, thrown in the sea and thrown on public property.⁴

To protect human health and the environment, people must be aware of and adhere to the procedures for properly disposing of unwanted or expired drugs; if not, it can result in environmental contamination,

poisoning from unintentional consumption or intentional poisoning and other health risks.⁵

According to the Bio-Medical Waste Management (BMW) rule of 2016, any medication that has expired or been discontinued is considered biomedical trash. The World Health Organisation (WHO) has recommended the following methods for safely disposing of unused or expired medications: returning them to the manufacturer, dumping them in an engineered landfill after immobilization, incinerating them at medium or high temperatures, chemically decomposing them in accordance with the manufacturer's recommendation and finally landfilling them.⁶ The Food and Drug Administration (FDA) recommends that the safest and most efficient method of getting rid of unneeded pharmaceuticals is through a "take-back" program which is a community-based initiative that urge people to return unneeded medications to a designated collecting location, so that they can be disposed safely.⁷

Pharmaceutical waste disposal is a major issue for healthcare professionals globally, especially in developing countries like India. The question of how the medical students, who are the future medical professionals, dispose of unwanted and expired drugs has received very little attention so far. Thus, the objective of this study was to investigate how medical students manage unused and expired medications.

METHODS

A cross-sectional analytical study design was used to gather data from 143 second year medical students at an institute in south India. This study was conducted in January 2023. Students who were willing and able to participate in the study were included once the necessary informed consent was obtained and their answers were documented by a self-administered pre-tested structured questionnaire. Questionnaire included questions related to demographic

details, knowledge, attitude and practice of students regarding the disposal of unused and expired medicines. Data were entered into a Microsoft Excel worksheet and results were expressed in percentages and frequency.

RESULTS

The current study involved 143 second-year undergraduate medical students. Of the 143 pupils, 66 (46.2%) were male and 77 (53.8%) were female. 86% of the participants were aware of what was a pharmaceutical waste and 93 (65%) were aware of the safe practice of discarding leftover, expired and unused medicines.

The majority of students 90% opined that improper disposal of old or expired medications would have a negative impact on human, animal and environmental health. Merely 10% of the respondents stated that it just impacts the health of the environment and does not pose a threat to the wellbeing of humans or animals. Approximately 44% of students stated that a pharmacist is the best person to consult when it comes to safely disposing of leftover, unused and expired medicine. Only a small percentage of research participants thought that information on the proper disposal of medications may also be obtained from physicians (30%), nurses (14%) and the media (12%). 134 (93.7%) students believed that one of the first step to reducing the risks involved is to give the consumer appropriate guidance.

Of the 143 students, 67% strongly agreed that education about the detrimental impacts of using non-scientific techniques to dispose of leftover, expired and unused pharmaceuticals on human and environmental health should be provided to both the public and students. Additionally, most of them strongly agreed that the public should be exposed to educational initiatives like take-back programs (Table 1).

Table I: Attitude of students toward the unsafe disposal of unused and expired medications

Questions related to attitude of the students	Strongly agree (%)	Agree (%)	Neutral (%)	Strongly disagree (%)	Disagree (%)
Children are particularly at danger from the careless and unscientific disposal of leftover, unused, and expired medicine.	84%	6.2%	0	0	9.8%
Information about the scientific disposal of unwanted, expired and leftover pharmaceuticals is lacking.	76.2%	7%	0	8.4%	8.4%
Healthcare providers, including physicians, pharmacists, and nurses are required to give patients information on expired, unused and leftover drugs.	67%	8.4%	0	7%	17.6%
It is important to carry out educational initiatives like drug take-back programs for unused, expired and leftover prescription drugs.	72%	7%	0	10.5%	10.5%
It's crucial to run educational campaigns among the public about the dangers of improper medicine disposal techniques as well as safer ways to get rid of unneeded or expired drugs.	60.1%	7%	0	9.8%	23.1%

10.5% of students said that they currently do not have any leftover prescription pills at home, whereas rest of them claimed to have some (Table 2). Based on the replies of the participants in this survey, the most prevalent category of pharmaceuticals that were kept in households was topical formulations (55.9%),

which were followed by antipyretics (16.1%), antibiotics (7%), antacids (10.5%), analgesics (7%), and others (3.5%). Different classes of medications that are often kept in household storage are depicted in (Figure 1).

Table II: Number of unused/leftover drugs at home of study participants

Number of drugs	Number of students (n=143)	Percentage
0	15	10.5%
1-5	96	67.1%
6-10	21	14.7%
11-25	9	6.3%
>25	2	1.4%

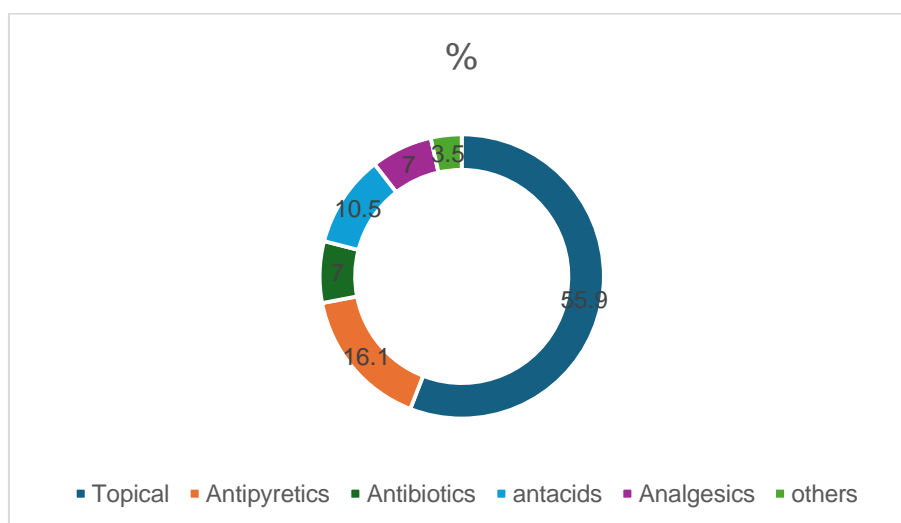


Figure 1: Classes of unused/expired drugs stored at home.

For the majority of research participants (39.2%), self-discontinuation is the most frequent cause for medication storage. Other common reasons for unused medications included: change of regimen because of

delayed recovery, adverse reaction, over the counter drugs brought for common symptoms and expiry of the medication (Figure 2).

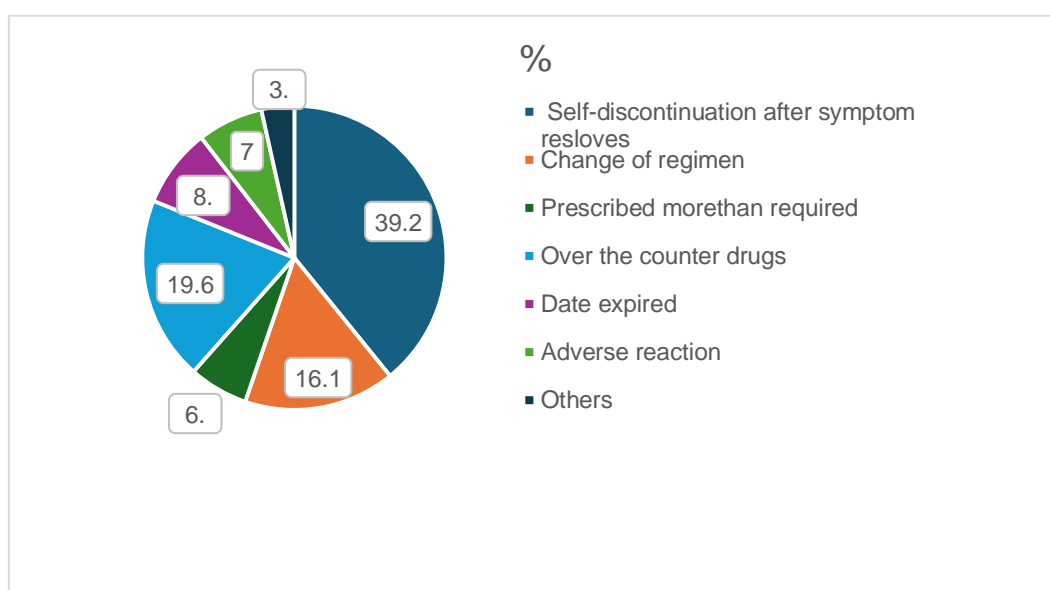


Figure 2: Reasons for possession of unused/expired medications.

When questioned about their technique for getting rid of unused drugs, most of the students 62.2% said they would toss them in dust bins at home and the municipality would come to collect them. Just 11.2%

of participants said they would go back to the pharmacy and 7% of them rinse it down into the sink for safe disposal (Figure 3).

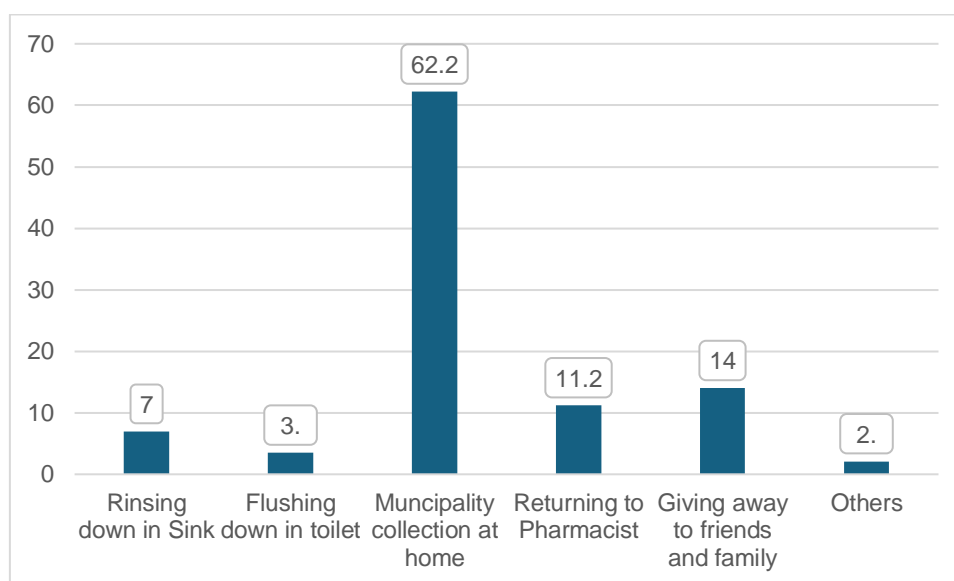


Figure 3: Disposal techniques for outdated or unneeded pharmaceuticals.

DISCUSSION

Medical waste improper disposal may poison the environment, degrade the quality of the water and air, destroy agricultural products, upset the balance of the food chain, and even hurt animals and cattle. For these reasons, it is a serious issue that is presently getting a lot of attention.⁸ People are still unaware of how to properly dispose of medications, despite the growing awareness of safe pharmaceutical usage.⁹ Hence, this study was conducted to assess the knowledge, attitude and practices of medical students regarding disposal of unused and expired medications.

Of the 143 students in our study, the majority (86%) knew about pharmaceutical waste and 90% of respondents believed that throwing away unneeded and expired medications improperly is bad for the environment and bad for people's health. Regarding the lack of information on how to properly dispose of used and expired pharmaceuticals, more than three-fourths of research participants strongly agreed (76.2%). This can be correlated with the study done by Muppa L. et al.¹⁰ and Mishore, K. M et al.¹¹

Our survey's findings make it evident that most medical students are adopting risky disposal methods for unwanted and expired medications, which presents a significant issue for the medical field. The data presented in Figure 2 indicates that the primary causes of medication leftovers among the participants were early disease recovery and improvement, switching to a different treatment mode when recovery was not achieved quickly, drug side effects, and when more medication was supplied or purchased than what was prescribed. This is comparable to the research carried out by Muppa L. et al.¹⁰ This conduct demonstrates

that customers do not understand the need of completing their therapy.

Figure 3 demonstrates that 62.2% of respondents said they often threw away pills and capsules that were unused or expired by throwing them in the garbage which later collected by the municipality, which is much less compared to Kumari et al.⁶ (75%) and Srikanth et al.¹² (73%), but well above the study conducted by Patel et al.¹³ (35.6%). In comparison to studies conducted in Bangladesh (96.8%)¹⁴ and Malaysia (93.6%)¹⁵, this number is lower; nonetheless, it is greater than that of a research conducted in Eastern Ethiopia (65%)¹¹.

Around 10% participants used either flush in the toilet method or rinsing in the sink which is comparable to Srikanth et al.¹² (13%), on the other hand Patel et al.¹³ has reported 31% of participants used flush in the toilet method.

This difference could result from participant's beliefs that, in order to prevent inadvertently harming children and the environment, outdated or unused medications should be disposed of by flushing them down the toilet or into a river. Flushing unnecessary medications, however, has been found to pollute water and could damage aquatic life. For the reason that chemicals can endanger aquatic life in bodies of water like lakes and rivers, they can find their way into our waterways through drains or toilet flushes.¹⁶ Previous research has also demonstrated that pharmaceutical ingredients, such as diuretics, mood stabilizers, antihypertensives, and different antibiotics, that are either in groundwater or the wastewater system may have negative effects on human health, including hormone imbalance and antibiotic resistance,

particularly in teenagers.^{17,18} Consequently, when medications are disposed of improperly—by either disposing them as solid trash in landfills or dumping them into sewage systems—they endanger the environment. The use of medications is spreading around the world¹⁹, and as a result, toxins that have just recently come to light may one day endanger the ecosystem.²⁰

In our study, 14% participants retained the medication for reuse or they give it to family or friends. Which is comparable with Shivarajet.al²¹ (8.59%) but less than Maharanaet.al²² (57.6%). Encouraging this positive aspect and raising awareness of the implications of reuse, storage and disposal practices while keeping eco-pharmacovigilance in mind are important.

Unused prescription medications frequently build up in homes where they might be abused for recreational purposes (psychotropic substances, for example), misused for self-medication of future illnesses or inadvertently consumed and can cause acute poisoning.^{23,24}

The national and state governments in India ought to implement strong measures to manage this matter, since it has the potential to impact the scientific approach to disposing of medicines.²⁵ The universe can be spared of negative consequences in the future by receiving the appropriate knowledge about drug disposal that is favourable to the environment through conferences, street play, the media, and awareness camps in schools and universities. Patient drug information leaflets are one possible source of information about how to dispose of pharmaceuticals safely.

There are certain limitations to this study, such as the small sample size and the possibility of recall bias in memory; however, the study could be expanded upon within the institution and at other institutions to raise awareness of drug disposal techniques.

CONCLUSION

Understanding and following the proper disposal procedures for unwanted or expired medications is essential for safeguarding both human health and the environment. This study clearly shows that medical undergraduates have a decent understanding of safe and appropriate medication disposal practices. However, this awareness may be raised even further by prioritizing the implementation of educational programs by relevant authorities. Despite the fact that the WHO has published guidelines for the appropriate disposal of unused or expired pharmaceuticals, appropriate regulations should be put in place to implement the procedures for the proper disposal of unused and expired pharmaceuticals in order to save our ecology.

Conflict of interest: none declared

Acknowledgement: We would like to thank Dr. Vishanth.K Orthopedician for his help and support.

Authors contribution: All the authors have contributed in concept and design of the study or acquisition, analysis and interpretation of data, drafting and revising the manuscript for important intellectual content and final approval for the version which is going to be published.

Abbreviations:

1. BMW - Bio-Medical waste Management
2. WHO - World Health Organisation
3. FDA - Food and Drug Administration

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