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Research Article

KNOWLEDGE, ATTITUDE, AND PRACTICE ABOUT STORAGE AND SAFE DISPOSAL OF UNUSED MEDICINES AMONG MEDICAL AND DENTAL PERSONNEL: ECOPHARMACOVIGILANCE PERSPECTIVE

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ABSTRACT

Objective: This study aimed to evaluate the knowledge, attitudes, and practices related to the storage and safe disposal of unused medicines among students at MGM Medical and Government Dental College, Indore, marking the first such assessment among this population.

Method: A cross-sectional survey, approved by the Institutional Ethics Committee, utilized a questionnaire-based approach. Medical and dental students provided 509 responses, yielding a response rate of 96%. The pre-validated questionnaire, administered through Google Forms, encompassed sociodemographic details and sections on knowledge, attitudes, and practices. Statistical tools were employed for the analysis of response frequencies.

Results: A response rate of 96% was achieved, with 509 participants providing insights. While participants exhibited awareness regarding medication expiry, storage conditions, and environmental contamination, a significant knowledge gap existed concerning standardized medication disposal methods. Despite a high acknowledgment (above 80%) of the reduction in efficacy post-expiry, safe drug disposal practices were found to be lacking.

Conclusion: The prevailing practice of storing medicines at home until expiry, followed by disposal in the trash, persists despite awareness of the hazards associated with pharmaceuticals in the environment. This underscores a deficiency in knowledge and the absence of secure disposal methods. Respondents expressed a preference for evidence-based and environmentally friendly approaches to dispose of unwanted medications.

Keywords: Pharmaceutical pollutants, Unwanted medicine, Safe disposal, Take back system.

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INTRODUCTION

In the backdrop of remarkable advancements in modern medicine, the pharmaceutical industry has experienced an unprecedented surge, emerging as a crucial player in the global economy. According to the Government of India's Ministry of Chemicals and Fertilizers Department of Pharmaceuticals (2022–2023 report), the Indian pharmaceutical industry ranks third globally in production volume, with an annual turnover of Rs. 3,44,125 crore (USD 42.34 billion) for the fiscal year 2021–22 [1]. This progress has led to a proportional increase in biomedical waste generation, reaching 28,747.91 tons in India between June 2020 and December 2021, with COVID-19-related medical waste contributing significantly [2,3].

Despite the positive impact of pharmaceutical advancements on healthcare, concerns have arisen about the environmental presence of pharmaceutical pollutants. This concern has given rise to "Ecopharmacovigilance," a field that combines pharmacovigilance and environmental science [4]. The issue dates back to 1976 when drugs were detected in sewage water effluents, and it has since grown more complex. Pharmaceuticals enter the environment through various pathways, including direct disposal by patients, hospitals, pharmaceutical production facilities, and veterinary use.

The environmental consequences of pharmaceutical pollutants are diverse and impactful. Antibiotic residues encourage antibiotic resistance, veterinary diclofenac poses a threat to Asian Gyps vulture species, and estrogen compounds lead to feminization of aquatic ecosystems. Moreover, pharmaceutical contaminants affect human health, as seen in the increased risk of obesity among schoolchildren exposed to veterinary antibiotic residues [6-11].

The improper storage and disposal of surplus medications in households compound the environmental impact. This practice, driven by various reasons, results in expired medications being disposed of inappropriately and poses risks of accidental poisoning in children and intentional poisoning in adolescents. In addition, it contributes to self-medication practices, leading to various drug-related side effects, toxicities, and interactions.

Pharmaceuticals enter the environment through diverse pathways, including pharmaceutical production industries, improper disposal by individuals, hospital waste, pharmacy practices, veterinary use, and other sources. With over-the-counter medications widely used, public awareness of responsible disposal practices becomes crucial [17-20]. Glassmeyer et al. underscore the importance of responsible disposal as a starting point to control pharmaceutical contamination [24].

To address the ingress of pharmaceuticals into the environment, particularly through the disposal of unwanted medications, understanding current public behaviors is essential. This research focuses on evaluating the knowledge, attitudes, and practices related to the storage and disposal of medications from an Ecopharmacovigilance perspective among medical and dental students. The goal is to gain insights into the behaviors of future prescribers and enhance their understanding of medicine storage and disposal practices.

Studies in Bangladesh, Nepal, and other parts of the country reveal a low level of knowledge about the storage and proper disposal of medicines among medical, dental, nursing, and pharmacy students and professionals [25-27]. The research emphasizes the need for a secure medicine takeback system, citing successful models in developed countries such as Australia, the UK, and the US [28-30].

METHODS

This study is cross-sectional, descriptive self-completion questionnaire-based, conducted in September 2023 after obtaining approval from the Institutional Ethics Committee (EC/mgm/July-23/16).

Study site
The study was done at Mahatma Gandhi Memorial Medical College and Government College of Dentistry, Indore Madhya Pradesh, India.

Study duration
Responses were collected during September 13–172023.

Study population
All undergraduate and postgraduate medical (MBBS) and dental (BDS) students were invited to participate in this study. Before participating, informed consent was taken from all the students willing to participate in the study.

Sample size
A total of 509 students participated in the study. The study questionnaire was administered through Google form. Students were informed before the scheduled class in their respective to participate in the study and the link was shared. Google Form Link was also circulated through personal emails and social networking platforms. Students were counseled about the importance of the objective of this study and convinced to submit the survey only once and to the best of their own knowledge and thus an integrity pledge was signed by the participants.

Sampling method
All those students who voluntarily agreed to participate in the study were included in the study.

Tools utilized for data collection:

Questionnaire
As per the research question taking into consideration of the various aspects of knowledge attitude and practice of medical and dental personnel on various aspects of unused medicine storage and unsafe disposal of unused and expired medicines ultimately impacting the ecosystem, a self-administered, structured questionnaire was prepared. A broad literature review of published studies on medicine storage and disposal practices as well as information about Ecopharmacovigilance and discussion with the subject expert was done to finalize the content [31-34]. The questionnaire was prepared in English language.

Questionnaire contents
The content was framed into four sections. The first section collected basic sociodemographic details of the students, such as age, gender, education, and other relevant variables. Second section covered the knowledge of students about various aspects of medicine storage and unsafe disposal of unused and expired medicines and their understanding of Ecopharmacovigilance, for which a total of eight questions were framed. The next section contains five questions requesting responses regarding the perceptions and attitudes concerning the storage and unsafe disposal of unused and expired medications. The responses of these questions were based on a 5-point Likert-scale format: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). This section aimed to understand the student's beliefs, perceptions, and opinions about responsible medication management and its ecological implications. Moreover, the last part of questionnaire composed of five questions exploring the participant's actual behavior and practices concerning the storage, disposal, and management of pharmaceuticals.

Validity and reliability of questionnaire
The content of the questionnaire was validated by the two appointed experts of the concerned subject. These were academicians from the medical and dental college. The remarks of the experts were noted. After suggested modifications, the questionnaire was presented to 30 volunteer faculties of the institute through personal emails for their responses and suggestions. This helped to refine the questionnaire for improved understanding of the question.

Data analysis
After data were collected, the frequency of responses to each question was downloaded as a Microsoft Excel file and sent to SPSS Statistics for Windows Version 26 software for analysis. Descriptive statistics were applied to identify common trends and patterns in the student's knowledge, attitudes, and practices. The categorical variables were analyzed by Chi-square test. Differences with a $p \leq 0.05$ were considered to be statistically significant.

RESULTS AND DISCUSSION

Demography of study population
We distributed the Google Form link to a total of 530 students. A total of 509 students participated in the study, resulting in a response rate of 96%. Among these participants, 284 (55.8%) were male, and 223 (43.8%) were female. The majority of the respondents, approximately 86%, were from the medical stream, with 438 individuals, while 71 students (14%) represented the dental field. The mean age (±SD) of the respondents was 21.4±2.69 years. Distribution of the student participants in age groups is shown in Table 1. Among the respondents, 260 students (51.1%) were residing with their families, and a substantial 473 students (92.9%) confirmed the presence of children under the age of 2 in their households. Notably, 389 students (76.4%) had a first-degree relative involved in the medical field, underscoring the strong influence of medical backgrounds in their families. A significant majority, specifically 374 students (73.5%), reported the use of allopathic medication within the past 6 months.

Knowledge toward storage and disposal of unused medicines among medical and dental personnel
It was found that 95.5% of students have knowledge that after expiry, the efficacy of medicines may decrease or it may cause adverse effects.

Inquiring about the motives behind keeping medications at home, respondents were given the freedom to provide multiple reasons as presented in Fig. 1. The primary rationale for storing medicines in households was the potential need for them in the future. In addition to this, other factors for having leftover medication due to surplus, alterations in prescriptions by physicians, discontinuation of medications due to side effects, improvements in health conditions, and noncompliance among patients.

About half of the study population (56%, n=285) had heard about the standard drug disposal methods of medicines.

When the correct method of disposal of unused expired medicines was asked 47 % (n=239) were aware that it should be returned to the drug take-back site or drug take-back program immediately; however, significant proportion of students 36.3 % (n=185) said that it should be discarded in the trash bin or household garbage, return to the

Table 1: Demographic information of participants

Characteristics	Frequency (%) (N=509)
Age groups (years)	Mean±SD 21.4±2.69
18–20	223 (43.8%)
21–23	194 (38.1%)
24–26	30 (5.9%)
26and above	62 (12.2%)
Gender	
Male	284 (55.8%)
Female	223 (43.8%)

pharmacy 28.7% (n=146), should be donated to the health-care center 10.2% (n=52), flush down the drain 8.1% (n=41), and donated to the society or to the friends 4.1% (n=21).

Similarly, if we observe knowledge about disposal of leftover non-expired medicines maximum respondents 51.9% (n=260), said that return to the pharmacy is the right way of disposal followed by returned to the drug take-back site or drug take back program immediately 39.5 % (n=198), should be donated to the health-care center 38.7 % (n=194), should be donated to the society or to the friends 27.1 % (n=136) and flush down the drain 3.4 % (n=17). Fig 2 shows the comparison in the knowledge among medical and dental personnel about disposal methods of unused expired and non-expired medicines.

Inadequate disposal of medications presents a significant risk of environmental hazards, with potential consequences across various domains. An impressive 86.2% of the surveyed respondents (n=439) emphasized concerns about the potential contamination of water resources and soil resulting from improper disposal. Furthermore, a significant portion, 68.6% (n=349), expressed apprehension regarding the capacity of improperly discarded medicines to infiltrate and harm wildlife. Moreover, 60.1% (n=306) acknowledged the possibility of these substances entering the human system. The additional ways in which improper medicine disposal can harm the ecosystem, as indicated by the respondents, are detailed in Table 2.

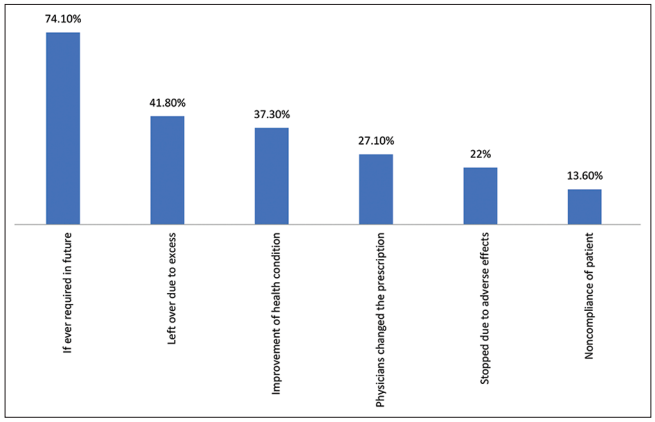

Fig. 1: Graph showing reasons for stocking of medicines at households by the medical and dental personnel (N=509)

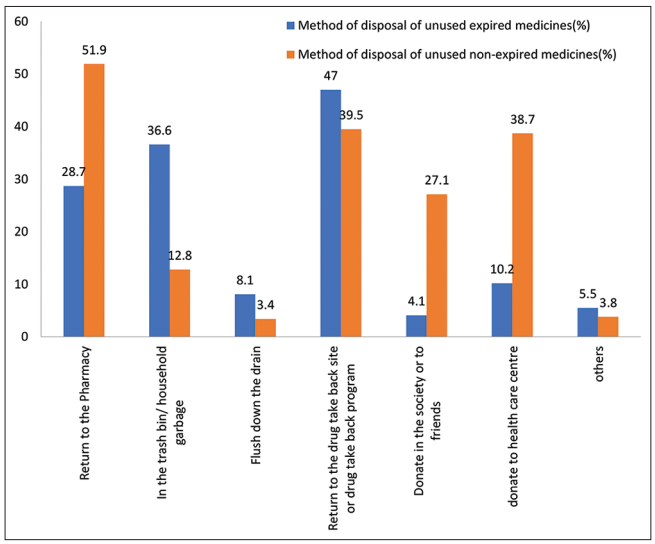

Fig. 2: Graph showing comparison in the knowledge among medical and dental personnel about disposal methods of unused expired and nonexpired medicines (N=509)

Addressing the potential hazards arising from unused and expired medicines requires a comprehensive approach. Notably, 59.7% of respondents (n=328) stressed the importance of patients receiving

Table 2: Ways in which improper medicine disposal can harm the ecosystem indicated by medical and dental personnel

S. No.	Ways in which improper medicine disposal can harm the ecosystem
1	In long run it will be detrimental for society as medicine resistance will cause lack of efficacy of the medicines.
2	Any bad cause to environment
3	In case of antimicrobials if enters the ecosystem can cause emergence of range of resistant bacteria.
4	Depends on type of medicine
5	Chemicals can cause biomagnification and eutrophication in animals and lakes respectively.
6	It can harm environment if it is burn out and cause air pollution.
7	It can harm plants
8	Biomagnification of harmful chemical metabolites can occur.

Table 3: Attitudes toward storage and disposal of unused medicines among medical and dental personnel (N=509)

S. No.	Statements	Respondents, n (%) (N=509)
1.	Expiry dates are clear visible and readable in the medicine dosage forms.	
	Strongly agree	171 (33.6%)
	Agree	232 (45.6%)
	Neutral	73 (14.3%)
	Disagree	27 (5.3%)
	Strongly disagree	6 (1.2%)
2.	Stocking medicines in non-ideal storage conditions may reduce or destroy its effectiveness.	
	Strongly agree	182 (35.8%)
	Agree	270 (53%)
	Neutral	45 (8.8%)
	Disagree	8 (1.6%)
	Strongly disagree	4 (0.8%)
3.	Doctors and health care professionals should advise patients on proper storage and disposal of unused and expiry medicines.	
	Strongly agree	244 (47.9%)
	Agree	224 (44%)
	Neutral	24 (4.7%)
	Disagree	13 (2.6%)
	Strongly disagree	4 (0.8%)
4.	Is it necessary to minimize the entry of pharmaceutical products and medicines into the environment.	
	Strongly agree	249 (48.9%)
	Agree	202 (39.7%)
	Neutral	40 (7.9%)
	Disagree	13 (2.6%)
	Strongly disagree	5 (1%)
5.	I want to obtain the information and know about potential environmental pharmaceutical residues, rational disposal, take back system and management of unwanted medicines.	
	Strongly agree	221 (43.4%)
	Agree	228 (44.8%)
	Neutral	50 (9.8%)
	Disagree	3 (0.6%)
	Strongly disagree	7 (1.4%)

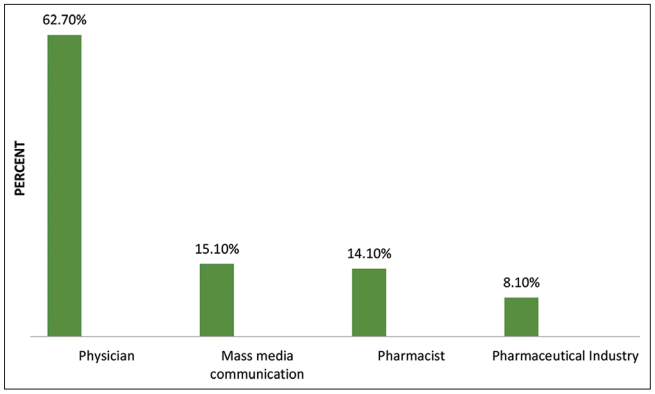

Fig. 3: Graph showing the best source of spreading awareness about pharmaceuticals in the eco-system for our society

counseling from physicians and pharmacists to ensure adherence to treatment regimens and complete medication intake. Equally endorsed was the establishment of a drug take-back system for secure disposal (59.7%, n=328). Among the respondents, 54% (n=275) suggested that physicians should prescribe limited quantities tailored to a patient's specific condition. An additional 32% (n=166) proposed donating unused medicines as an alternative to disposal. A smaller subset (27.1%, n=138) recommended the implementation of minimal prescription categories by physicians. While a modest 0.6% (n=3) recognized the value of mass awareness campaigns about the risks of unused and expired drugs, a mere 0.2% (n=1) called for strict controls on the quantity of drugs sold by chemists or drug stores. By collectively embracing these strategies, effective management and mitigation of the adverse consequences associated with retained medications can be achieved.

Respondents believe that the best source of spreading awareness about pharmaceuticals in the eco-system for our society would be through physicians, pharmacists, mass media communication, and pharmaceutical industries.

Attitude toward the awareness of medicine storage and disposal among medical and dental personnel

In the assessment, it was found that 45.6% of students are in agreement regarding the clear visibility and readability of expiry dates on medicine dosage forms. In addition, 53% of the surveyed students concur that storing medicines under non-ideal conditions could potentially diminish or compromise their efficacy. Moreover, a substantial proportion of students, specifically 47.9%, express a strong inclination toward the view that health-care professionals and doctors should play an active role in guiding patients on the appropriate storage and disposal methods for unused and expired medicines.

Furthermore, a significant consensus emerges, with 48.9% of students strongly agreeing on the necessity to impose restrictions on the introduction of pharmaceutical products and medications into the environment. In addition, a notable 44.8% of participants agree with their willingness to acquire knowledge encompassing areas such as understanding potential environmental pharmaceutical residues, adopting rational disposal practices, engaging in take-back systems, and effectively managing unwanted medicines.

Practice toward storage and disposal of unused medicine among medical and dental personnel

When asked about the practice of checking the expiry date of medicines, mostly 82.3% (n=419), indicated a consistent practice of always verifying expiry dates. A notable 14.1% reported doing so often or sometimes, while a smaller proportion, 2.6%, stated checking rarely. A minimal 1% acknowledged never engaging in this practice. Almost three-fourth (72.5%, n=369) of the Participants affirmed that they and their family members had practice of retaining medicines at home even if it is no longer needed, while 27.5% denied.

The most common reason for storing medicines medicine at home includes emergency preparedness, other potential reasons are illustrated in Fig. 4.

It is a habit to keep the unused excess medicines at household till it expires, (62.5%, n=318) and then disposing it off in household trash bins. Various other inappropriate disposal practices of medicines came into notice which are mentioned in Fig. 5.

Regarding educating friends or family members about safe medicine disposal, 48.5% of students had such discussions at households, while 51.5% said that they had never educated their family and friends about storage and safe disposal of medicines. When asked if they would opt for a demonstrably environmentally friendly method of disposing of unwanted medications. Almost all (95.3%, n=485) of the students expressed willingness to follow the proven environmentally friendly routes of drug disposal in the future.

Ecopharmacovigilance aims to ensure that significant environmental problems associated with pharmaceuticals in the environment are promptly identified and treated appropriately. Ecopharmacovigilance is of major concern nowadays, as the unwanted presence of even trace amounts of active pharmaceutical ingredients in the environment may lead to a greater risk.

There are various ways by which pharmacological pollutants may end up in the environment; one of the most important factors is the consumption of medicines by human beings and animals. These medicines are excreted from the body and find their way into sewers or sewage treatment plants. Mackridge *et al.*, in their study, state that when unused medicines are allowed to accumulate at home, they will pose a risk to public health through poisoning and suicide and to the environment through poor disposal practices [35].

Thus, through this study, we aimed to assess the knowledge, attitude, and practice regarding the storage and proper disposal of unused medicines from the Ecopharmacovigilance perspective, among undergraduate and postgraduate students from the medical and dental institutes of central India for the first time, including a sample size of 509 participants.

Negligence in storage location in households is another aspect of concern in the case of families having children. Accessible locations can lead to ingestion that could cause life-threatening consequences. According to the National Capital Poison Center (NCPC), in 2018, children under 12 years of age had the highest rate of unintentional poison exposure [36]. The highest percentage of fatalities of both intentional and unintentional medication exposures was most common in teenagers, nearly 20% of all exposures had this outcome. It is suspected that the medications are stored in locations that can be easily accessed by children [12].

In our study, 51% of respondents were residing at home with family and 92% of total confirmed the presence of children <2 years of age in the households. Raising this issue with the medical personnel might lead to awareness and reduction in incidences of such accidental poisonings.

Our findings reveal a high level of awareness (95.5%) among the respondents regarding the diminished effectiveness and potential adverse effects of expired medications. This aligns with previous research conducted by Jha *et al*. and Raja *et al*., which reported that students were cognizant of the reduced efficacy and adverse consequences associated with expired medicines.[37,38] In our study, we observed that only 18% of the students surveyed did not routinely inspect the expiration dates of medicines, both when purchasing them and in their household supplies.

One contributing factor to this behavior may be the visibility of expiration dates on drug packaging. In line with other studies, respondents in our study agreed with this observation, highlighting the importance of clear and easily accessible expiration date information on medication packaging [37].

In spite, 88% of respondents agreed that storing medicines at home in non-ideal conditions can reduce their effectiveness [12]. We found 72.5 % of students responding that they and their family members have medicines at their home which are no longer needed. This is similar with the study by Yimenu *et al.*, in which out of total of 507 households surveyed, 70 (13.8%) were found to have unused medicines [13].

Another study conducted at the University of Gondar Specialized Teaching Hospital found that the majority of the study participants (89.1%) had unused medicines [14].

Wang *et al*. study showed that out of the total respondents, 995 (84%) reported having unused medicines at households [10].

Most common reasons for left over medicines at home are if ever required in the future, left over due to excess purchase, improvement in health conditions like acute illnesses, physicians changed the prescription on subsequent visits, stopped due to adverse effects, and non-compliance of patients in case of chronic illness, it was (69%, $p<0.05$).in wangs study.[10] These reasons were found to be common with the study of Makki *et al*. [10,15].

While the practice of willfully stockpiling excess medications at home had some common reasons. Most important, 71.1 % respondents said that they maintain a surplus of medicines as a means of managing unforeseen emergencies such as sudden illnesses, injuries, or unexpected health. About 21% of participants said that having medicines available at home provides a sense of preparedness and security in the face of such situations, ensuring that prompt treatment can be administered when needed.

The anticipation of future needs within the family is another motivation for storing excess medications (69.5%). Recurring health conditions of family members or illnesses for which the same medication might be required. Keeping extra supplies of medications minimizes the hassle for repeated visits to physicians or pharmacists, and offers self-sufficiency in managing common health issues. Similar reasons were quoted by Yang *et al*. [39] in the study, stating the possibility of needing medicines again in the future may cause patients to keep medicines in households.

Individuals may accumulate surplus medications to avoid the inconvenience of seeking medical attention, especially for conditions they had suffered previously. By having a reserve of medications available at home, 17% said they can circumvent the need for doctor's appointments and prescriptions, saving time and effort.

Purchase of medicines during travel as a precautionary measure without actual indication was marked by 14% of participants as a reason for the accumulation of excess medicines. This is often done due to the unpredictability of health challenges that may arise during trips, as well as the potential unavailability of specific medications at the travel destination.

In addition to the above factors Yimenu *et al*. [13] study states that people who paid for medicines by themselves, those who lacked knowledge about medicines, and those who did not receive enough counseling about medicines that they took were found to be 2.6, 4.8, and 3 times more likely to have unused medicines, respectively.

The main reason for having unused medicines among those with chronic illness was non-adherence (69%, $p < 0.05$). Only 27% of these respondents returned unused medicines under the "Medicine Return Programme (MRP)". The other group who used medicines for acute illnesses had unused medicines because their health conditions improved [39].

When asked about the knowledge of the correct method of disposal of unused expired medicines, 47% of students correctly stated that it should be returned to the drug take-back system or drug take back programs immediately if available but in Wangs *et al*. study only 27% of these respondents returned unused medicines under the "Medicine Return Program., while 36.3% of respondents said that disposal in the trash bins or household garbage is the correct way of disposal. Return to the pharmacy was also considered as correct by 28.7% of students. Some believe (10 %) that it should be returned to the health-care facility. Various studies like Alazmi *et al*. [40], Kuspis *et al*. [41], Boivin *et al*. [42], Arkaravichien *et al*. [43], Osei-Djarbeng *et al*. [44], and Banwat *et al*. [45] also highlight that people in possession of excess medicines may manage them in above mentioned ways.

While knowledge about the disposal of unused non-expired medicines is that it should be returned to the drug take-back system or drug take-back programs, wangs study for non-expired medicines a large number of respondents think that it should be returned to the health care system followed by donating to society or friends. Very few believe that non-expiry drugs should be disposed of in household garbage trash bins or should be flushed down.

Out of all the respondents in this study 62.5% practice to store the medicines at home till it gets expire. While 23% return it to the pharmacy, 21.8% throw it into the household trash bins, 15% said they have returned to the take-back system, 6% practice donating medicines to health care systems and society, and 4% burn with garbage or flush down in the toilet.

Almost all 86% know that improper disposal of medicines can cause environmental hazards through contamination of water resources and soil, it can enter wildlife and also into the human system. Moreover, 87% believe that it is necessary to minimize entry of pharmaceutical products and medicines into the environment. About 91% believe that health-care professionals should advise patients on proper storage and disposal of unused and expired medicines. In the study by Tong *et al*. [46] and Azmi Hassali [47], also the respondents opined that the provision of appropriate directions by healthcare professionals (73.2%) and prescribing medications in quantities for the duration that ensures patient adherence (26.7%) could control or minimize medication wastage. It is well-recognized that appropriate prescribing and dispensing activities are the major stages for reducing medication waste and may contribute significantly to combating the issue of pharmaceuticals in the environment. However, our study revealed some room for improvement in public education and awareness about safe medicine disposal practices. Noteworthy that 48.5% of students reported having discussions with their friends and family members regarding the storage and safe disposal of medicines. This suggests that a significant portion of students are actively engaged in raising awareness about proper medicine storage and disposal. Educating the immediate social circle can have a cascading effect in reducing the storage of excess medicines and promoting safe medicine disposal practices, reducing environmental contamination.

On the other hand, the fact that 51.5% of students indicated they had never educated their family and friends about the storage and safe disposal of medicines highlights a potential gap in knowledge dissemination. It is essential to address this gap to ensure a more widespread understanding of the importance of safe medicine disposal, as well as the potential risks associated with improper disposal.

About 85% of the respondents indicated their interest in gathering more information about potential environmental pharmaceutical residues, rational disposal methods, take-back systems, and the management of unwanted medicines. This demonstrates a proactive approach to environmental responsibility. The most encouraging finding from

the research is that a vast majority of students (95.3%) expressed a willingness to adopt environmentally friendly methods for disposing of unwanted medications in the future. This high level of willingness indicates a strong potential for behavior change and a collective effort to contribute to environmental sustainability. These results underscore the importance of providing education and resources to encourage responsible medicine disposal methods.

To further promote safe medicine disposal practices, educational campaigns, and initiatives could be developed to reach out to students and the broader community. These campaigns should not only focus on raising awareness about safe medicine disposal but also emphasize the environmental impact of improper disposal. Providing easy access to environmentally friendly disposal methods, such as take-back programs or drop-off locations, can also play a crucial role in translating this willingness into concrete actions.

CONCLUSION

Ecopharmacovigilance is of paramount importance as the presence of pharmaceutical residues in the environment, even in trace amounts, can pose significant risks. This study, conducted among undergraduate and postgraduate students from medical and dental institutes in central India, sheds light on the knowledge, attitudes, and practices surrounding the storage and disposal of unused medicines from an Ecopharmacovigilance perspective. The research indicates that there is a high level of awareness among the participants regarding the diminished effectiveness and potential adverse effects of expired medications. However, it is concerning that a significant portion of respondents do not routinely check expiration dates, highlighting the importance of clear labeling on medication packaging. The reasons for accumulating unused medicines at home are diverse, with concerns ranging from future needs to managing emergencies. Nevertheless, the study emphasizes the need for proper disposal practices, as most unused medications often remain unreturned or improperly discarded. This study reveals a strong willingness among students to adopt environmentally friendly disposal methods, presenting an opportunity for positive behaviour change. It is crucial to develop educational campaigns that not only raise awareness about safe disposal but also emphasize the environmental consequences of improper practices. Providing accessible and eco-friendly disposal options can further facilitate responsible medication disposal. Ultimately, Ecopharmacovigilance is not just a responsibility for health-care professionals but also for individuals in society. Proper knowledge and practices can significantly contribute to reducing pharmaceutical contamination in the environment and, in turn, safeguarding public health and ecological sustainability

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AUTHORS CONTRIBUTION

Conceptualization: Dr Sapna Arun More; methodology: Dr Sapna Arun More, Dr Kamayani Gupta Dr Avina Kharat, and Dr Pooja Mishra; formal analysis, Dr Sapna Arun More and, Dr Avina Kharat; data collection: Dr Sapna Arun More, Dr Avina Kharat, and Dr Kamayani Gupta; writing—original draft preparation Dr Sapna Arun More; and final review — Dr Sapna Arun More, Dr Pooja Mishra, Dr Avina Kharat, and Dr Kamayani Gupta.

CONFLICTS OF INTEREST

The author declares no conflicts of interest.

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