

## Original Research

# To Ascertain The Level Of Awareness And Adherence To Proper Disposal Methods For Leftover And Expired Medication Among Nursing And Dental Students

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## ABSTRACT

**Aim:** To ascertain the level of awareness and adherence to proper disposal methods for leftover and expired medication among nursing and dental students.

**Material and methods:** The study included senior level students of nursing and dental (2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> year dental and nursing students). Convenience sampling is a non-probability technique in which study subjects are selected based on certain criteria, such as availability at a given time, willingness to participate, accessibility, and geographical proximity to the researchers. The questionnaire consisted of 10 items divided into two parts and included both multiple choice and binary answers. Part A contained demographic questions, including age, marital status, and methods for obtaining medication. Part B addressed students' knowledge and habits regarding unused and expired medicine.

**Results:** Of the participants, 65% of dental students and 60% of nursing students reported that they check the expiry date of medicine before procuring it from the pharmacy, while 25% of dental students and 17.5% of nursing students said they do not check it. A small percentage of both groups (10% and 22.2%, respectively) said they did not know. Nearly half of dental students (51.2%) and over half of nursing students (67.5%) threw away leftover medicines in household garbage, while 3.7% and 2.5%, respectively, flushed unused medicine down the sink or toilet. A large majority of both dental (77.5%) and nursing (91.2%) students said they discard expired medication in household garbage, while 11.2% and 5%, respectively, flushed expired medicine down the toilet or sink. Interestingly, only a small percentage of both groups said they return leftover or expired medicine to the medical store or pharmacy. More than half (72.5%) of dental students and a majority (70%) of nursing students agreed that the responsibility for creating awareness of proper disposal methods for leftover and expired medicine lies with the Ministry of Health.

**Conclusions:** The results of this study demonstrate the need for improvement in practices by Indian health care students regarding the disposal of leftover and expired medicine. Improper disposal of medication can cause contamination of water supplies, introduce toxins into the environment, and risk unintentional overdose or drug abuse.

**Keywords:** Disposal, Leftover, Expired, medication, Nursing, Dental

## Introduction

The prevalence of many illnesses among the general population is heightened as a result of an unhealthy lifestyle. It is often seen that once a patient experiences the presence of any health disorders, it necessitates the administration of various pharmaceutical interventions for their therapeutic management. Pharmaceutical interventions serve a multifaceted role in the realm of healthcare, including not only the treatment of diseases, but also encompassing diagnostic and preventive measures. However, it is worth noting that drug adherence has emerged as a widespread issue on a worldwide scale. Noncompliance with treatment may result in patients not using all prescribed medications, leading to the accumulation of unused or expired pharmaceuticals inside their households [1]. Other factors contributing to pharmaceutical waste include discontinuation of pharmacological treatment owing to improved symptoms, transitioning to other therapies or regimens, and excessive prescribing by physicians in response to patient or medical representative requests [2]. It is important to provide information to the general public on appropriate protocols for the disposal of unused or expired pharmaceuticals within household settings. The dissemination of knowledge to the general population on the several ways of dumping

expired or unwanted pharmaceuticals has significant importance. There exists a dearth of understanding pertaining to the suitable methodologies for the disposal of unwanted, leftover, or expired prescriptions. Consequently, some patients choose to dispose off their pharmaceuticals in household waste receptacles and via flushing them down toilets or sinks. This practice subsequently leads to the contamination of drinking water and the environment [3]. Improper disposal of drugs yields numerous ramifications, with the primary ones encompassing the contamination of community drinking water sources, resulting in health hazards. Additionally, the presence of antineoplastic drugs in water can pose a threat to aquatic life. Insecure landfills can expose expired drugs to manual scavengers and children, potentially leading to adverse consequences. Furthermore, pilferage from waste drugs may contribute to the diversion of expired and unused drugs back into the market, facilitating their misuse and resale. The presence of expired pharmaceuticals might potentially lead to diverse or unanticipated adverse drug reactions, while the cremation of unused medications in open containers can result in the emission of hazardous pollutants into the atmosphere [4]. It has been substantiated via reports that there exists a deficiency in the understanding of health care personnel about the notable hazards associated with unused or expired medication, including diversion, misuse, and accidental overdose. According to research conducted by Raja et al, health care personnel had only a limited understanding of appropriate methods for drug disposal and showed a deficiency in implementing safe disposal practices [5]. The existing body of research has also shown that students in the field of healthcare get knowledge on drug use and disposal from several sources, such as healthcare professionals, educational curricula, media outlets, instructors, and medication package inserts. The acquisition of knowledge about appropriate drug handling and disposal practises before to graduation may have an impact on the subsequent disposal practices of medications throughout one's work [5]. Numerous studies have provided empirical evidence to support the assertion that the cooperation between healthcare professionals, including chemists and nurses, yields significant therapeutic advantages [6]. The inclusion of nurse practitioner and chemist visits within the context of family practice has been shown to provide significant enhancements in medication adherence [7]. Numerous studies have been conducted on the subject of safe drug disposal knowledge and practice. However, it is worth noting that a significant portion of the initial research primarily focuses on the general people, including Indians as well as other nationals [2]. There exists a paucity of studies pertaining to the understanding and implementation of drug disposal practices among healthcare students, namely those enrolled in dentistry and nursing programs, who play a pivotal role in the frontline delivery of healthcare services.

### Material and methods

This study was conducted for a period of 6 months, from February to July 2023. The study included senior-level students of nursing and dentistry (2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> year dental and nursing students). Data collection was carried out with a paper-based, printed questionnaire through a self-administration procedure using convenience sampling. Convenience sampling is a non-probability technique in which study subjects are selected based on certain criteria, such as availability at a given time, willingness to participate, accessibility, and geographical proximity to the researchers [8]. The study tool was prepared after conducting an extensive review of questionnaires used in previous studies that evaluated the disposal of expired and unused medication [4,5]. Slight modifications to the survey language were made, and the questionnaire was amended to be suitable for dental and nursing students. The questionnaire consisted of 10 items divided into two parts and included both multiple choice and binary answers. Part A contained demographic questions, including age, marital status, and methods for obtaining medication. Part B addressed students' knowledge and habits regarding unused and expired medicine.

### Methodology

The study population included nursing and dental students who were regular students at the colleges and willing to participate in the survey. A student who was appointed to collect the data visited the students in their classrooms during lecture periods. A brief talk was given to explain the purpose of study and to ensure the students of confidentiality in their responses. Written informed consent was obtained from the students. Participants were given enough time to complete the questionnaire. Data collection was conducted using convenience sampling and performed in such a way that all of the dental and nursing students would be included. Students with incomplete answers to more than a half of the study questionnaires were considered as incomplete responses and therefore excluded from the study, and students who missed 2 or 3 questions in the survey were considered as a treatable response and therefore included in the study. Students who did not return questionnaires were considered non-respondents.

**Statistical Analyses:** The data were entered and coded, and descriptive statistics were calculated for all survey items. All statistical analyses were conducted using SPSS Version 25.0 (SPSS Inc., Chicago, IL, USA). The results are expressed as numbers and percentages presented in the forms of tables and graphs. In addition, the associations between variables were determined by performing chi-square tests. A  $p$ -value  $< 0.05$  was considered a statistically significant difference in all analyses.

## Results

A total of 210 questionnaires were distributed during the study period, and the response rate was (n = 160, 76.19%) noted. Of all participating subjects, 80 (50%) were dental students, and 80 (50%) were nursing students. The marital status of majority of students was single. Most of the respondents were between 19 and 24 years of age. Nearly 82.5% of dental students and 56.2 % nursing students reported that they were storing unused medicine in their home. Almost a quarter percent (71.2%) of dental students, and 76.1% of nursing students purchased medicine over the counter. Details are presented in Table 1

**Table 1. Demographics, storage, and procurement of medicine.**

Participant Classifications	Dental (n =80)		Nursing (n =80)		p-Value
	N	%	N	%	
<b>Age (years)</b>					
19–23	71	88.7	68	85	0.001
24–26	08	10	04	5	
27–30	01	1.2	08	10	
<b>Marital status:</b>					
Single	54	67.5	72	90	0.005
Married	26	32.5	8	10	
<b>Does any quantity of purchased medicine remain unused in your home *?</b>					
Yes	66	82.5	45	56.2	
No	14	17.5	35	43.7	
<b>Ways of purchasing medicine:</b>					
Purchased using a prescription	57	71.2	61	76.2	0.001
Purchased without a prescription (OTC)	11	13.7	14	17.5	
Received from a friend /colleague	12	15	5	6.2	

Of the participants, 65% of dental students and 60% of nursing students reported that they check the expiry date of medicine before procuring it from the pharmacy, while 25% of dental students and 17.5% of nursing students said they do not check it. A small percentage of both groups (10% and 22.5%, respectively) said they did not know. Nearly half of dental students (51.2%) and over half of nursing students (67.5%) threw away leftover medicines in household garbage, while 3.7% and 2.5%, respectively, flushed unused medicine down the sink or toilet. A large majority of both dental (77.5%) and nursing (91.2%) students said they discard expired medication in household garbage, while 11.2% and 5 %, respectively, flushed expired medicine down the toilet or sink. Interestingly, only a small percentage of both groups said they return leftover or expired medicine to the medical store or pharmacy. More than half (72.5%) of dental students and a majority (70%) of nursing students agreed that the responsibility for creating awareness of proper disposal methods for leftover and expired medicine lies with the Ministry of Health. Additionally, 7.5% and 15% of dental and nursing students, respectively, believed that pharmacists bear the responsibility for this awareness. Large majorities of both groups (91.2% and 96.2%) accepted that inappropriate disposal of unused and expired medicine can affect the environment and health. Detailed information is presented in Table 2.

**Table 2. Knowledge and practice regarding unused and expired medicine among dental and nursing students**

Characteristics	Dental	Percentage (%)	Nursing	Percentage (%)
<b>Do you check the expiry date of medicine before procuring?</b>				
Yes	52	65	48	60
No	20	25	14	17.5
Do not know	08	10	18	22.5
<b>What do you do with unused medicine?</b>				
Throw away in household garbage	41	51.2	54	67.5
Donate to hospital	09	11.2	02	2.5
Give to friends or relatives	21	26.2	19	23.7
Return to medical store	04	5	02	2.5
Keep at home until expired	02	2.5	01	1.2
Flush in toilet or sink	03	3.7	02	2.5
<b>What do you do with expired medicine?</b>				
Throw away in household garbage	62	77.5	73	91.2
Flush in toilet or sink	09	11.2	04	5
Give to friends or relatives	03	3.7	01	1.2
Return to medical store	06	7.5	02	2.5
Don not know	04	05	27	33.7
<b>Who is responsible for creating awareness of the proper disposal of unused and expired medicine?</b>				
Ministry of Health	58	72.5	56	70
Pharmaceutical industry	11	13.7	07	8.7
Pharmacist	06	7.5	12	15
General public	05	6.2	05	6.2
<b>Do you think improper disposal of unused and expired medicine can affect the environment and health?</b>				
Yes	73	91.2	77	96.2
No	07	8.7	03	3.7

The most common classes of drugs purchased by respondents were painkillers, followed by antibiotics. There was a statistically significant difference between dental and nursing students regarding checking the expiry date of medicine before procuring, unused medicine being stored at home, and awareness that improper disposal can affect the environment. There was no statistically significant difference in the belief that the pharmaceutical industry and the general public are responsible for creating awareness of proper disposal of unused and expired medicines ( $> 0.05$ ). Details are presented in Table 3.

**Table 3. Association between study participants' responses in selected variables.**

Parameter	Dental	Percentage (%)	Nursing	Percentage (%)	p-Value
<b>Do you check the expiry date of the medicine before procuring?</b>					
Yes	52	65	48	60	<i>0.001</i>
No	20	25	14	17.5	
Do not know	08	10	18	22.5	
<b>Does any quantity of purchased medicine remain unused in your home?</b>					
Yes	52	65	47	58.75	<i>0.002</i>
No	18	35	33	41.2	
<b>Improper disposal of unused and expired medicine can affect the environment and health.</b>					
Yes	73	91.2	77	96.2	<i>0.006</i>
No	07	8.7	03	3.7	

Who is responsible for creating awareness of the proper disposal of unused and expired medicine?					
Ministry of Health					
Yes	58	72.5	56	70	0.001
No	22	27.5	24	30	
Pharmaceutical industry					0.24
Yes	11	13.7	07	8.7	
No	69	86.3	73	91.3	
Pharmacist					0.14
Yes	06	7.5	12	15	
No	74	92.5	68	85	
General public					0.36
Yes	05	6.2	05	6.2	
No	75	93.8	75	93.8	

### Discussion

Globally, the improper disposal of leftover medicine poses a danger to public health and environmental safety [9,10]. Therefore, it is important to investigate the prevalence of this practice and to create awareness of and solutions for safe medicine disposal methods, particularly among health care providers. This is the first study of its kind to survey university health care students on their knowledge and practice regarding unused and expired medication. The present study results show that majority of the participants prefer to purchase medicines using a prescription, which is similar to the previous study conducted among health care students and staff, in which nearly 55% of surveyed participants purchased medicine through prescription [5]. It is believed that health care professionals such as dentists and nurses work through inter-professional collaboration to dispense medications to the patients. Additionally, a number of studies revealed that nurses and pharmacists provide counseling and education regarding the use and administration of drugs, and to emphasize the importance of expiry dates to patients [5,8]. The results show that a majority of dental and nursing students (65% and 60%, respectively) check the expiry date of medicine before purchasing it. These results are lower than the findings of a study by Raja et al., in which 98% of nursing students checked the expiry date of medication [5]. Studies have shown that nurses and dental students too provide counseling and education to patients about the use of medicine and the importance of paying attention to expiration dates [5,9]. In the present study, both dental (77.5%) and nursing (91.2%) students threw away expired medicine in household garbage. These results are in line with those of Raja et al., in which 72% of respondents threw expired medicine in the garbage [5]. A similar study among dental students by Aditya found that 94% of students threw away unused medicine in the household trash [11]. This practice has been observed internationally, irrespective of whether the subjects are the general public or health care professionals [4,5]. In the current study, 1.2% of nursing students and 2.5% of dental students stored leftover medicine. According to Raja et al., the majority of nursing students discarded leftover medicine [5], while studies done among the general public showed that leftover medicine was stored until it expired [11,12]. This could be due to the perception that it might be needed in the future [11]. However, some studies reported that keeping leftover or unused medicine for a longer time might result in polypharmacy or unintentional consumption of medicine, which can lead to toxic effects in the individuals [11]. The results also show significant differences between dental and nursing students regarding ways of purchasing medicine ( $p=0.001$ ). Additionally, results revealed that nursing students were more knowledgeable ( $p=0.001$ ) in regard to purchasing medicine, checking the expiry date of medicine, and safe disposal practice, compared to dental students. This might be due to the training and clinical rotation, which starts in nursing from the start of the course, while in dentistry, clinical rotation begins in the last or senior levels. The majority of the participants in this study said they were aware of the dangers to the environment from improper drug disposal. This finding is similar to those of other studies among both health care students and the general public [5,11-14]. Nevertheless, a general belief persists that flushing unused and expired medication down the toilet or sink is the best practice, particularly for liquid medications [14-16], even in countries such as the United States and the United Kingdom [15,16]. The present study has several limitations. Firstly, the sample referred to in this study was small and the research was limited to one university. Therefore, the outcomes of the current findings can only represent the situation in the current study's settings. In addition, to address sampling bias due to respondents who did not respond to the survey, it is recommended that future studies investigate the factors or reasons that prevented them from participating.

### Conclusions

The results of this study demonstrate the need for improvement in practices by Indian health care students regarding the disposal of leftover and expired medicine. Improper disposal of medication can cause contamination of water supplies, introduce toxins into the environment, and risk unintentional overdose or drug abuse. The

government should issue guidelines and launch education programs on correct disposal methods for professionals in health care settings and for the general public, as well as establish a convenient medicine take back program. Future studies can be conducted once these efforts are put in place to monitor their success.

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