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## Knowledge, Attitude and Practice on Medication Disposal of Registered Pharmacists in an Academic Institution

### INTRODUCTION

**A**ccording to the World Health Organization (WHO) (2014), more than half of all medication is inaptly prescribed, dispensed and sold, thus causing unnecessary storage, as well as creating an ecological threat. Unused and expired medicines are neglected in a variety of ways. Storing lapsed medicines at home or offering them to loved ones, specifically to friends and family, may increase the danger of incidental or unseemly ingestion of the medications (Seehusen & Edwards, 2006). Furthermore, the most common ways of disposing expired medication disposal – washing the drug down a sink, flushing them down the toilet, and throwing them in the garbage cans – are not environmentally responsible methods of disposal (Patel, Shah, & Upadhyay, 2011).

Various medicines have been found in groundwater, surface waterways, as well as in drinking water. The increasing presence of pharmaceuticals and their metabolites in water through the years has been perceived as possibly hazardous (Boehringer, 2004). In the Philippines, countless analgesics like diclofenac, antibiotics, anti-platelet agents, hormones, psychiatric drugs, anti-histamines were detected in nature at levels hazardous for the ecosystem (Francepresse, 2018).

Unfortunately, ebb and flow water treatment frameworks fail to expel a number of pharmaceuticals from drinking water and the latest and highly sensitive investigative strategies make it possible to identify natural pharmaceutical compounds in groundwater and consumable water even after treatment and decontamination (Abahussain, Ball, & Matowe, 2006).

Safe and responsible disposal of medications is an important public health initiative because it directly concerns both the pharmaceutical industry. Improper disposal of expired medications has potentially negative consequences in the environment

and the human body. The Clean Air Act (1999), prohibited the use of burning as a technique in treating health care waste. The DOH-DENR Manual on Health Care Waste Management (2013) sought to reduce the amount of pharmaceutical waste in the environment by recording elective advancements for the correct transfer of healthcare wastes. Despite the perceived hazards of improper medication disposal, there has been no research regarding this issue in the Philippines, and no data about the practitioners' knowledge and practice of medication disposal. The dearth of literature is indicative that studies on medication disposal are insufficient.

The study aims to assess the knowledge and awareness that registered pharmacists currently possess when it comes to medication disposal. It also aims to identify the prevalent attitude patterns of registered pharmacists towards different aspects of medication disposal, to identify the current practices based from their knowledge and attitude, and to assess if there is a significant improvement on their knowledge regarding proper medication disposal after the intervention.

## **METHODS**

### *Research Design*

The study is a mixed method, using a pre-intervention survey that assesses the respondents' knowledge, followed by an open-ended questionnaire that would assess the attitude and practices on disposal of expired personal medicines. This research design typically involves two phases: (1) an initial quantitative instrument phase, followed by (2) a qualitative data collection phase, in which the qualitative phase supports the results from the quantitative phase (Wisdom & Creswell, 2013). The researchers showed a 5-minute video and provided handouts to the respondents that served as an educational intervention to enhance the respondent's knowledge about proper medication disposal and leaflets were also given for additional information. A post-intervention survey was also given.

### *Sampling Method*

A purposive sampling method was used to carry out a descriptive survey. The method is used to obtain comprehensions of a phenomenon, individuals, or incidents.

### *Study Site*

The study site is a pharmacy school in Manila. The respondents are licensed pharmacists taking up second degree Clinical Pharmacy, Doctor of Pharmacy, graduate school students and pharmacists in the academe. All of them are currently affiliated with the school.

### *Ethical Consideration*

This study follows the Ethics Review Board and ethical clearance was submitted to the ERB of the pharmacy school (FOPREC1-181929). Informed consent was prepared to properly inform the respondents.

### *Data Gathering Instrument*

A three-part questionnaire was administered by the researchers to assess the knowledge, attitude, and practices of the respondents. An 8-item multiple choice questionnaire was given to assess their knowledge, 5-point Likert-type survey questions with 12 questions were used to gauge the attitude and an 11-item open-ended questionnaire to identify the medication disposal practices of the pharmacists.

The responses from close-ended questions from the Knowledge and Attitude part of the survey are further elaborated in open-ended questions in the Practices part using concurrent mixed method data collection strategy. This collection strategy is employed to validate one form of data with the other form, to transform the data for comparison, or to address different types of questions (Creswell and Clark 2007).

A multiple choice pre and post-intervention consisting of 15 questions were given to evaluate the knowledge of the pharmacist before and after an intervention.

### *Data Analysis*

Variables to be used for the quantitative portion of the study are age, gender, Pharmacy cluster and scores in the knowledge, attitude portion of the survey questionnaire, as well as their pre and post-test results.

### *Scoring*

Knowledge section: The participant gets 1 point for the correct answer to each question. If they choose "Uncertain" this indicates that they do not know the correct answer, thus earning them a score of 0 (Khan, Sarriff, Khan, & Mallhi, 2014).

Attitude section: The participant provides their agreement with each agreement on a 5-point Likert scale. The ordinal scale goes as follows: 1 for “Strongly Disagree”, 2 for “Disagree”, 3 for “Neither Agree nor Disagree”, 4 for “Agree”, and 5 for “Strongly Agree”. Likewise, reverse coding was used for negative statements.

Practice section: The participants answered open-ended questions which will then be processed by MAXQDA to generate the frequently-occurring themes from the responses.

MAXQDA 2018 software program was used for the coding of qualitative data and SPSS was used to analyze the answers of the respondents in the quantitative part of the survey.

## RESULTS

A total of sixty-seven (67) registered pharmacists of a pharmacy school participated in the study. Table 1 summarizes the demographic characteristics of the respondents. The majority of the respondents are age 21 to 30 years old, female, and from the Pharmacy Doctor program.

<i>Characteristics</i>	<i>Number (%)</i>
<b>Age</b>	
21 to 30 years old	49 (73.17%)
31 to 40 years old	16 (23.88%)
41 to 50 years old	2 (2.99%)
<b>Gender</b>	
Female	46 (68.66%)
Male	21 (31.34%)
<b>Pharmacy Cluster</b>	
Second Degree Clinical Pharmacy	17 (25.37%)
Pharmacy Doctor	25 (37.31%)
Graduate School	11 (16.42%)
Academe	14 (20.90%)

*Table 1.* Characteristics of licensed pharmacists surveyed about their knowledge, attitude, and practice on medication

### *Knowledge*

The majority (95.58%) of the respondents answered correctly on the description of proper medication disposal. Respondents from Second Degree Clinical Pharmacy (n=17), Academe (n=14), and Graduate School (n=11) all had correct answers. One (1) out of the

twenty-five (25) respondents from the Doctor of Pharmacy field got the wrong answer. A majority felt that the best way of disposing medicine is by returning it to the Pharmacy (61.19%) followed by flushing in the toilet (42.28%) and through collection program (41.79%). More than half (68.66%) of the respondents think that the best way to dispose of packaging and labeling materials is by tearing and mixing it with dry waste, while 53.73% would scratch out the information. Among the respondents, only six (6) correctly identified all the proper ways of disposing of packaging and labeling materials. The respondents believed that improper medication disposal can lead to accidental exposure of children, pets, and wildlife to the medicine (95.52%), increased level of pharmaceutical in rivers and drinking water supplies (79.10%) and identity theft (37.31%). Majority (83.58%) of the respondents believe that the best source of information about proper medication disposal is from the advice of a pharmacist, 70.14% from Pharmaceutical companies, while 40.30% say that the information should come from the government, and 26.87% of the respondents believe that the best source is social media. Only 14 participants correctly identified all best sources of information. As for the reasons of the respondents for their disposal of medications, the data shows that the most common reason has to do with the medicine's expiration and the least common is the unaesthetic appeal of the medicine. On the factors which the respondents think has to do with the degradation of drugs, 97.01% consider temperature as a major factor, 94.03% for moisture, 94.03% for light, 86.57% for removal from packaging and 83.58% for oxidation. Fifty-three (53) of the respondents (79.10%) correctly identified all of the possible reasons for disposing of medications. The majority (91.04%) of the respondent correctly identified that the best way to store medicines is in a locked cabinet which is cool, dry and away from direct sunlight. 8.96% of the respondents answered either a bathroom cabinet where moisture is vastly present or "I don't know". Another answer that nobody chose is in a kitchen cabinet which is near a stove or a sink.

### *Attitude*

Twenty-five (25) respondents strongly agreed that they are aware of the proper medication disposal, twenty-seven (27) agreed, twelve (12) are uncertain, and three (3) disagreed. Majority of the respondents (32 out of 67, 47.76%) believed that they practice

proper medication disposal, seventeen (17) strongly agreed, twelve (12) are uncertain, and seven (7) disagreed. In sharing of their knowledge regarding medication disposal, a majority (32 out of 67), which comprises 47.76% of the total respondents agreed, seventeen (17) strongly agreed, eight (8) are uncertain, and eight (8) disagreed and one (1) strongly disagree.

Knowledge	Graduate School (n=11)	Second Degree Clinical Pharmacy (n=17)	Doctor of Pharmacy (n=25)	Academe (n=14)
<b>Definition of Proper Medication Disposal</b>	11	17	24	14
<b>Proper Ways of Medication Disposal</b>				
Rinse in the sink	1	2	2	0
Flush in the toilet	5	4	15	3
Crush and mix*	6	3	2	8
Throw in Trash w/ packaging	0	4	12	3
Throw in Trash w/o packaging*	3	0	9	0
Return to Pharmacy*	7	15	9	12
Burn	0	1	3	2
Keep inside your cabinet	0	0	2	0
Give away to friends/ family	0	0	2	0
Collection Program*	2	11	8	8
<b>Proper Way of Disposing Packaging and Labeling Materials</b>				
Throw in trash	1	1	10	0
Tear and Mix w/ Dry Waste	10	9	16	6
Tear and Mix w/ Wet Waste*	2	4	0	6
Scratch out Information*	5	11	11	11
Flush in the Toilet	0	2	5	1
<b>Effects of Improper Medication Disposal</b>				
Increase level of pharmaceuticals in rivers and drinking systems*	11	15	16	13
Identity Theft*	2	11	6	7
Accidental exposure of children, pets, and wildlife*	10	17	25	14
<b>Best Source of Information about Proper Medication Disposal</b>				
Advice from Pharmacists*	9	17	21	10
Pharmaceutical Companies*	8	16	15	10
Government*	4	12	3	9
Social Media	2	6	6	2
<b>Possible Reasons for Disposing Medicines</b>				
Expired/Near Expiry*	11	17	25	14
Treatment course has ended	10	13	14	11
Side Effects*	3	6	6	9
Unaesthetic appeal*	1	3	2	5
<b>Best Storage for Medications</b>	10	17	23	13
<b>Factors that Accelerate Degradation of Drugs</b>				
Temperature*	11	17	25	14
Moisture*	11	17	23	14
Light*	10	17	24	14
Removal from Packaging*	11	17	20	12
Oxygen*	10	15	19	14

\*Correct answers based from US-FDA Guidelines on Safe Disposal of Medicines

Table 2. Summary of Scores in Knowledge

Attitude		Mean	Verbal interpretation	
Proper medication disposal is important		4.12	Agree	
I am confident that my way of disposing medication is the right way		3.89	Agree	
I share my knowledge in proper medication disposal		3.88	Agree	
I am aware of the dangers from improper medication disposal		4.55	Strongly Agree	
Improper medicine disposal is an environmental problem		4.69	Strongly Agree	
Proper medication disposal concerns me		4.66	Strongly Agree	
Information about proper medicine disposal should be provided to patients in the community setting		4.88	Strongly Agree	
Proper medication disposal should be included in BS Pharmacy programs		4.88	Strongly Agree	
Pharmacists should be the main source of medication disposal information		4.78	Strongly Agree	
I know how to dispose expired medication		4.09	Agree	
I follow the proper protocol in disposing medications		3.95	Agree	
I am satisfied with my knowledge in line with proper medication disposal		3.98	Agree	
1	1.8	Strongly Agree	1.8 2.6	Agree
2.6	3.4	Uncertain	3.4 4.2	Disagree
4.2	5	Strongly Disagree		

Table 3. Mean scores and verbal interpretation on Attitude

Practices. Theme No. 1. Ways of disposal of solid and liquid dosage forms

Different medicines warrant different methods of disposal. Expired, unwanted and unused medication must be disposed according to its dosage form. See Table 4.

Codes	Narratives
Flush in the toilet	"Let it dissolve in water, may also be crushed prior to dissolution, then flush on toilet or pour to sink" "Remove packaging. Place in a plastic/Ziploc type then crush it put some coffee powder, talc powder then mix and without the plastic flush in the toilet." "flush in the toilet/crushing-dispose in the bin"
Trashcan	"empty blister packs or foils of tablets in a trashcan" "We usually remove them from the/its original container and then cover it w/ a new container and throw it in the trashcan." "remove from package and put in a single container and label it as hazardous and throw in trash."
Crush then dispose *	"Let it dissolve in water, may also be crushed prior to dissolution, then flush on toilet or pour to sink" "Crush & mix to coffee grounds & dispose/ wait for collection day" "Grind solid substance and mix with dirt for disposal"

\*Correct answer based from US-FDA

Table 4. Different ways of disposal of solid dosage forms

Pharmacists commonly throw their expired solid medication by flushing it down the toilet, and that some crush the dosage form prior to flushing. Aside from flushing, throwing it in a trashcan is also a common practice. Most of those who answered throwing in the trashcan as their method of disposal said that they crush the dosage form before throwing it. Flushing of expired medication in the toilet is the most common practice of the respondents.

Some crush or dilute the medication prior flushing it in the toilet, and to a lesser extent, flush it in the sink, this method of disposal lessens the risk of exposure to people but could take a toll on the environment since it raises the levels of pharmaceutical products

in bodies of water.

Different practices before throwing in trashcans also emerged such as crushing the dosage form, putting it in a plastic bag, removing from packaging material and labeling as hazardous before throwing it away. These are good practices that could minimize the risk of retrieving the disposed medication.

A good number of respondents said that they mix the medicine with coffee grounds, kitty litter, unpalatable substances, or dirt to make the render the product unattractive to pets and children. This method, according to FDA is the correct way of disposing expired, unwanted and unused medicine.

Table 5 summarizes the different ways of disposal of liquid dosage forms by the respondents. Flushing of liquid dosage forms is the most common practice among registered pharmacists, followed by flushing in the sink. Some throw the medicine in a trashcan while still in its bottles. Among the answers of the respondents, flushing of liquid dosage forms in the toilet wherein they dilute it first water or is the most common practice of registered pharmacists, followed by flushing in the sink. Although convenient, flushing medication in the toilet will end up in water supplies affecting drinking supplies and aquatic life. Some pour the medicine on soil, gives to the garbage collector, throws in a labeled container, endorse to maintenance personnel and returns to the pharmacy. Some answered national collection programs, which is an ideal practice but it is not yet a practice here in the Philippines.

Other than solid and liquid dosage forms, respondents were asked about their way of disposal of semisolid preparations, and the majority answered flushing down the toilet and throwing it in the trashcan, followed by returning the medication to the pharmacy.

Codes	Narratives
Flush in the toilet	"Flush the liquid in the toilet."
	"removed them from their container and flush/them in the toilet"
	"Pour in the sink or flush in the toilet"
Flush in the sink	"flush in the toilet/sink"
	"Dispose/pour in the sink with running water."
	"Throw the contents in the sink. The best way to dispose it is to ask the manufacturer on how to properly dispose it."
Trash can	"Straight in the trash can"
	"throw w/ container"
	"Trash Can"

Table 5. Different ways of disposal of liquid dosage forms

Aside from the actual dosage form, the primary and secondary packaging materials should be disposed properly. Some medications, especially loose tablets or capsules are contained in carton boxes or paper envelopes which contain their personal information. It is important to know how to properly dispose of certain packaging materials to prevent identity theft. According to the respondents, the best way to dispose packaging materials is by throwing it straight to the trash can. Tearing the material is also a common practice prior to disposal as well as scratching out the information written on labels. In this way, the risk of identity theft will be greatly diminished. Destroying packaging materials by burning or wetting are also being practiced but it is not an advisable as it may have an undesirable impact on the environment. There were few who flush their packaging materials in the toilet which should be avoided since it can clog pipelines.

*Theme No. 2. Effects of improper medicine disposal*

Improper medication disposal always leads to harm and it is crucial that every person be properly educated about the consequences of it. See Table 6. Most of the pharmacists indicated accidental exposure, possible reuse of the drug, and the possibility of the medication to be a pollutant as effects of improper medication disposal. Associated with accidental exposure are the environment, children, and animals, which may lead to unfavorable consequences. Possible reuse of the drug is an alarming concern especially for those who collect garbage which may try taking the drug to reduce expenditures and children trying the medicine out of curiosity. Other answers that were also listed were identity theft, misuse of the medication, reselling of the drug products, bacterial resistance in terms of antimicrobial drugs, and harm.

Codes	Narratives
Accidental exposure	"Yes, it might cause an accident or unwanted exposure that might lead to allergic reaction." "Yes. They get into the water systems and contaminate it which can be harmful." "It can be a cause of water pollution, and also an effect with the health of an individual who might accidentally take the disposed medicines."
* Reuse	"Yes. Unwanted/harmful environmental effects such as land/water contamination. People that scavenge for living may recycle and reuse disposed medicines that are already expired." "Yes, if you won't properly dispose meds. Some might take advantage & use it or children might think it's a candy." "Yes. People who look for stuff in dumpsters might self-medicate with expired medicines."
* Pollutant	"Somehow, it can be a pollutant." "Yes, it may pollute the water system." "It can be a cause of water pollution, and also an effect with the health of an individual who might accidentally take the disposed medicines."

\*Correct answer based from US-FDA

Table 6. Effects of improper medicine disposal

*Other themes Proper Storage of Medications*

Storage of medication is important in maintaining the integrity of the product. Inappropriate conditions may hasten the degradation and render the drug product ineffective. Majority of the respondents kept their medication in a medicine cabinet, wherein the following codes: dry place, bathroom, unlocked, cool temperature and living room were themes associated with the response. There are few respondents who do not have any storage for their medicine which is a practice that should be discouraged since this lead to accidental exposure.

*Reasons for having unused, unwanted and expired medications*

Most people keep a stock of medicine in their homes for present illness or for convenience. Some of these medications, having been kept for a long amount of time, were already forgotten. Furthermore, some may have intolerable side effects which lead to disposal. Most of the respondents answered that they do not have any unused, unwanted, or expired medication. For those who have unused medicines, the major reasons were that they failed to adhere to the medication regimen and that they no longer need the medications anymore. Other notable reasons include excess medication, having no time to sort them out, and waiting for the next collection.

*Drug categories that are commonly disposed*

The most common types of medication that people buy are over-the-counter (OTC) drugs, which are readily available and easily purchased on drugstores and even supermarkets. OTC drugs such as analgesics, cough medications, and vitamins are the most commonly disposed drugs in pharmacists' home. Other OTC drugs that were stated were anti-motility drugs, proton pump inhibitors (PPIs), antacids, and antihistamines.

For prescription drugs, the most commonly disposed drug categories were antibiotics and antihypertensives, other medications such as anticoagulants, antihyperlipidemic, insulin, and ophthalmic drugs were also included.

Antibiotics are medications used for the treatment of infection caused by microorganisms; it is alarming that some of the respondents answered having unused antibiotics especially that Multi-Drug Resistance (MDR) has been on a disturbing level. Also, the prescription drugs stated by the pharmacists are usually used for maintenance

therapy; pharmacists know the importance of adherence to medication regimen, especially for these drugs in order to prevent rebound effects and possible exacerbation of the condition. Some respondents answered having drug samples, however, the actual drug category for the samples were not specified by the respondents.

*Dosage forms that are commonly disposed*

Most of the respondents answered that the liquid dosage form, syrup, is the most commonly disposed, other liquid dosage forms such as nebulas and suspension were also listed. Liquid dosage forms are usually packaged in large volumes and mostly stored in the refrigerator after a few doses, most people tend to forget having these medications leading to possible expiration and disposal.

For the solid dosage forms, capsules and tablets were ranked as the most common; pills were also stated by some of the respondents. Tablets and capsules are considered as the most convenient dosage forms, its ease of administration and small size make it convenient to take thus most people prefer buying medications in this form.

For semi-solid dosage forms, ointment and cream were specified together. A number of respondents answered that they do not have any commonly disposed dosage form.

*Conditions that lead to drug disposal*

When stored in inappropriate storage conditions, drug stability may be affected, leading to physical changes on the drug product itself. Many of the pharmacists answered defects such as a change in appearance, no longer need the medication, and damaged packaging as conditions for disposal of drug products regardless of expiration date. Changes in the appearance of the drug products such as having defects like a change in color, tablet crumbling, and having unknown particles cause consumers to think that the product is unsafe thus forcing the consumers to dispose the product.

No longer needing the medication, was stated as one of the most occurring answers for this theme and also for reasons having unused, unwanted, and expired medication, related to this are no indication and discontinued drugs as other reasons stated by the respondents. Damaged packaging plays a huge role in consumer satisfaction, most consumers believe that dented or punctured packaging materials mean that the drug is also defective. Other conditions that were specified were drugs nearing expiry, drug

instability, carelessness, and having no space to keep their medicines.

#### *Reasons of medicine disposal*

Disposal of medications vary from each person, this may be because of a lack of knowledge about proper disposal, tradition, and belief of what is correct. Most of the respondents reasoned that they dispose of their medication to avoid harm. They also said that the manner through which they dispose is based on their knowledge and based on convenience. Other explanations stated were: trust on garbage collectors; laziness, which can also be associated with convenience; to prevent the drug from being used by other; the respondent being tired; and other confidential reasons. It is also noted that some respondents were not aware of the proper medication disposal, because they have no explanation for their methods of disposal.

#### *Awareness of proper medication disposal*

This theme aims to find out if pharmacists, the drug experts, are aware of the proper medication disposal. Most of the respondents answered yes on having awareness, some answered being uncertain and some answered having awareness but not fully educated. It is also notable that there are respondents who answered having no awareness of proper medication disposal.

#### *Respondents' source of information about proper medication disposal*

Reliable and trusted sources about proper medication disposal are important for spreading awareness on the proper procedure of medication disposal and explaining its environmental consequences to everyone. Pharmacists frequently answered school, work, and seminars as places from which they learned about proper medication disposal. Several respondents also learned it from government agencies, written information, internship, newsletters, internet queries, pharmacists, and experience.

#### *Best source of information for proper medication disposal*

The most prevalent answer of registered pharmacists, when asked about the best source of information, is healthcare professionals, specifically pharmacists. Followed by government agencies in which according to the respondents, the Food and Drug Administration should be the primary source of proper medication disposal information.

Other government agencies were also mentioned such as Philippine Drug Enforcement Agency, Department of Health and Department of Environmental Resources. Most registered pharmacists answered manufacturing companies as a good source of information and heavily associated it with providing information about proper disposal in package inserts.

According to the respondents, healthcare providers are the best source of information. Pharmacists, especially those in the community setting are the front-liners in providing information about the medication that patients use. Pharmaceutical manufacturers must also include information about the disposal in package inserts or the packaging material itself. This is especially important for medications being sold without the aid of pharmacists, such as supermarkets. The FDA is responsible for safeguarding public health through the enforcement of its standards. Having mandated regulations about proper medication disposal would raise awareness and establish correct practices. Seminars and school were also frequently answered and are common co-occurring themes. A few also said that online and social media are reliable sources of information, given its easy accessibility. Printed materials such as journals can also be good sources of information regarding medication disposal.

#### *Intervention*

As seen in Table 2 there is an increase of 1.76 ( $p < 0.05$ , 95%CI) on the mean scores of pharmacists after the brief intervention given by the researchers. All of the questions have an increase in the weighted mean from pretest to post-test. It also shows the result of the paired samples t-test, having a significance value of less than 0.05; thereby rejecting the null hypothesis. This implies that the difference between the pretest and posttest is statistically significant. The question which had the highest increase (238.46%) was about the best definition of proper medication disposal while the question which had the lowest increase (4.64%) is about the FDA has a list of drugs and the specific ways on how to properly dispose them.

Paired Samples Test							
Paired Differences							
Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
			Lower	Upper			
-1.76119	1.90764	.23305	-2.22650	-1.29588	-7.557	66	.000

Table 4. Paired sample t-test results

**DISCUSSION**

Medication disposal has not been discussed as much as other pharmaceutical topics when, in fact, knowledge on proper medication disposal plays an important role in preventing certain problems like environmental contamination (Sirisha et. al., 2016).

The study shows that pharmacists know the meaning of proper medication disposal. They, however, seem to lack knowledge of the ways of proper medication disposal. The results showed that majority of the respondents are not aware that crushing tablets or capsules and mixing it with dirt, coffee grounds, or kitty litter and throwing medications in the trash without its packaging are the proper ways of medication disposal.

A lot of the respondents seem to be aware that returning medication to the pharmacy and disposing through collection programs are the safest way of disposing medication. However, while these practices on the individual level are correct, they are not proper medication disposal methods are not currently practiced on the institutional level here in the Philippines. In the present, there are no official protocols existing for the proper disposal of medication.

As for the disposal of packaging and labeling materials, results show that majority of the respondents believe that tearing and mixing it with dry waste is the correct way when, in fact, it is not the most optimal method. Only a few are aware of the proper disposal practice, which is to scratch out information and to tear and mix it with wet waste.

On the effects of improper medication disposal, the respondents appear to have inadequate knowledge. Almost all the respondents are aware that it could lead to the increase on pharmaceutical levels on rivers and drinking water supplies and may also cause accidental exposure to children, but only a few are aware that it could also lead to identity theft.

The majority correctly identified the best source of information about medication disposal. There is also a lack of knowledge when it comes to the possible reasons for disposing medicines. Majority correctly identified that expiration and end of treatment lead to disposal of medications, however, many are not aware that the unaesthetic appeal of medicine can also be a reason for disposal, and only half of the respondents chose side effects as a reason for disposal. The storage for medicines has been correctly identified by the respondents as well as the factors that may accelerate the expiration of drugs.

The low scores on the knowledge in medication disposal can be attributed to the lack of education and information dissemination regarding the topic. In the pharmacy curriculum, medication disposal has not been given enough importance and has only been briefly taught. With the increasing demand for drugs and the increasing threat accompanied by improper disposal of medications, it's about time that this issue must be addressed.

In this study, the respondents felt that they were aware of the importance of proper medication disposal and on its danger in the environment and the health of the public; however, there was diversity on the response on whether they share their knowledge on proper medication disposal. Pharmacists, as drug experts, must be knowledgeable on drug information and it is their responsibility to impart their knowledge to their patients, especially in the community setting. There was a relatively low response on their confidence on their knowledge regarding medication disposal which greatly compliments the high scores on their belief that there is a lack of information on proper medication disposal here in the Philippines. In connection, the respondents also strongly believed that in order to improve awareness on medication disposal there is a need to incorporate this topic on the pharmacy program and fully inform the public of its dangers. With regards to the practice of medication disposal, the respondents have varied responses. Some believed that they practice proper medication but some are uncertain. There was also a diverse response to medication disposal practice. Some of the respondents had been uncertain on whether they dispose their medications properly.

In the study, most of the respondents possessed around 10-15 unused, unwanted, or expired drugs. Analgesics were the common leftover drugs and most of them are in tablet and syrup dosage form. According to the respondents, manufacturing companies and

healthcare professionals, particularly the pharmacists, are the best source of information for proper medication disposal. Majority of them believe that they are aware of the proper medication disposal but the result in practice says otherwise. Flushing their medication in sinks or toilets and throwing it in the trash are the most common ways of disposal for solid and liquid dosage forms. As for the packaging materials, throwing medication in the trash can is common.

After the intervention, there is a significant improvement in the knowledge of the registered pharmacist regarding proper medication disposal, indicating that the brief intervention was helpful.

### **CONCLUSION**

The study reveals that some medical practices among registered pharmacists need correction, as they exhibit poor knowledge and awareness of proper medication disposal. Hence, there is an increasing need to educate pharmacists as well as establish guidelines by the government agencies here in the Philippines regarding medication disposal to help lessen environmental contamination of pharmaceuticals. As seen in the significant increase in the mean score after the intervention, it can be gathered that it is effective in improving the pharmacists' knowledge, attitude, and, consequentially, practice, towards proper medication disposal.

To further enhance the study on safe medication disposal, future studies might also include other health care professionals as respondents and medical devices in the criteria. The researchers recommend imparting medication disposal to the pharmacy curriculum, to create policies and advocacies in order to impart knowledge and awareness to the public regarding medication disposal.

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