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MEDispose: A Program Improving the Attitude and Knowledge of Community Pharmacists on Proper Disposal of Expired Pharmaceuticals in Davao City

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ABSTRACT :

Improper disposal of expired pharmaceuticals presents significant risks to human health and the environment. In Davao City, Philippines, the Environmental Management Bureau estimates that 15–20% of expired medications—equating to 300–400 kilograms annually—are disposed of improperly. Community pharmacists are essential in guiding the public on safe disposal practices. This quasi-experimental study was conducted in Toril, Davao City, to assess changes in knowledge and attitude among registered community pharmacists before and after participation in the MEDispose Program. Using purposive sampling, pharmacists with at least one year of experience completed validated pre- and post-test questionnaires. Knowledge was measured on a 4-point Likert scale and attitude on a 5-point scale, with data analyzed using standard mean deviation and Paired Sample T-test. Pre-test results indicated pharmacists were generally "Informed" (mean = 2.805), though gaps existed in specific areas. Post-test results showed a significant improvement to "Fully Informed" (mean = 3.68, $p < .001$). Attitudes were initially "Very High" (mean = 4.393) and remained so after the intervention (mean = 4.707), though the change was not statistically significant ($p = 0.115$). The findings demonstrate the MEDispose Program's effectiveness in enhancing knowledge, while also affirming community pharmacists' consistently positive attitudes toward proper pharmaceutical waste disposal. Sustained educational efforts are recommended to maintain and further improve responsible disposal practices.

keywords: Pharmaceutical waste disposal, attitude and knowledge of pharmaceutical waste, assessment and symposium.

1. INTRODUCTION

Improper disposal of expired and unused medications is a global concern that poses significant risks to both human health and the environment. Reports show that more than 50% of prescriptions are not used as directed, with many being disposed of unsafely—by throwing them in household waste or flushing them—leading to environmental contamination and health hazards. Countries like France, Saudi Arabia, Ethiopia, Indonesia, and the United States report high levels of unused or expired medications, with many households discarding them improperly. In the Philippines, similar issues persist. Agencies like the Commission on Audit (COA) and the Department of Health (DOH) have reported large quantities of expired, near-expiration, or overstocked medications in government inventories. In Davao City alone, about 300–400 kilograms of expired drugs are improperly disposed of annually, according to the Environmental Management Bureau (EMB). Despite efforts by the Philippine Drug Enforcement Agency (PDEA) and local authorities to destroy expired and illicit drugs, challenges remain.

2. METHOD

2.1 Research Design

This study utilized a quasi-experimental research design to evaluate the impact of the MEDispose Program on pharmacists' knowledge and attitudes toward the proper disposal of expired medications. The MEDispose Program is a one-day symposium initiated by the researchers in collaboration with healthcare partners, aimed at educating community pharmacists on appropriate pharmaceutical waste disposal practices. By administering pre- and post-intervention assessments, the study measures changes in participants' awareness and attitudes, allowing researchers to determine the program's effectiveness and offer recommendations for improving pharmaceutical waste management.

2.2 Research Locale

The barrio of Toril in Davao City, Philippines will host the research because of its relevance as an urban center with a significant number of community

pharmacies and its application to the issue of pharmaceutical waste management in an urban context, Davao City will be the study's primary site.

2.3 Research respondent

This research study, looks into Davao City community pharmacists' attitudes and knowledge about how to properly dispose of expired medications. Because community pharmacies are directly involved in the proper disposal of expired pharmaceuticals, they function as research sites.

Participants are chosen using purposive sampling, a purposeful, non-random technique, in accordance with predetermined goals. In contrast to random sampling, this deliberate approach concentrates on individuals who possess particular attributes that are essential to the study. This methodology allows for a targeted exploration of community pharmacists' viewpoints and comprehension concerning the proper elimination of expired pharmaceuticals. In order to contribute to a thorough understanding of the variables influencing pharmacist attitudes in the local context, this strategy attempts to capture a variety of experiences and viewpoints. Purposive sampling improves the study's applicability and relevance by aligning with particular objectives.

The inclusion and exclusion criteria have been carefully crafted to ensure scientific validity, participant safety, and fair selection practices. These criteria have been designed with meticulous consideration of the study's scientific objectives, ensuring that participants possess the requisite expertise and experience relevant to the research topic. Additionally, safety concerns have been addressed by excluding individuals who may not have the necessary qualifications or experience to handle pharmaceuticals safely.

2.4 Eligibility Criteria

Inclusion criteria

1. Registered pharmacist working full-time in community pharmacy located in Toril, Davao City.
2. Must have a 1 year and above experience of being a community pharmacist

Exclusion Criteria

1. Pharmacy assistant and other employees in the community pharmacy aside from the registered pharmacist.
2. Have a less than 1 year and above experience of being a community pharmacist

***2.5 Research Instruments*:**

The primary tool employed in the research to gather data was the pretest and post-test questionnaires, designed to assess the attitudes and knowledge level of community pharmacists in Davao City regarding how to properly dispose of expired medications. Data was gathered using this quantitative quasi-experimental methodology. The System Usability Scale (SUS) questionnaire will be modified for use by the researchers, and they will also employ a self-created questionnaire whose reliability has been endorsed by three experts in unrelated fields. A module booklet formulated by the researchers in partnership with the Philippine Pharmacists Association Inc. will also be used to assist the participants in thoroughly learning about the pharmaceutical waste management. The pre-test and post-test, together with the module booklet is created with the help of related sectors. The City Health Office provides the researchers a guideline on what they are basing on, which is the WHO Guideline. The questionnaire made is consequently based on the said guideline and the questionnaire along with the booklet are subjected to be validated by experts in chemical safe & management.

Three survey questionnaires will be administered by the researchers to gauge participants' attitudes and levels of knowledge about the appropriate disposal of expired pharmaceuticals. The Likert scale will be used in assessing their knowledge and attitude. In Section 1 of the survey, participants were asked to rate their pharmacists' knowledge regarding the appropriate disposal of expired medications. Responses ranged from 1 (low) to 4 (very much informed). In contrast, pharmacists' attitudes about appropriate disposal of expired pharmaceuticals are assessed in Section 2 of the survey, where respondents can select a response option that ranges from 1 (Strongly Disagree) up to 5 (Strongly Agree).

2.6 Data Collection Procedure

The recruiting process is critical in reaching and activating the intended participants, who will offer their knowledge, ideas, and experiences to our collaborative efforts. The researcher hope to engage with licensed community pharmacists from various areas and sectors through strategic outreach and personalized communication, encouraging them to join us in this critical conversation about pharmaceutical waste and safe disposal.

Phase 1: Conducting Post-Test: After conducting the MEDispose Program, the researchers will administer a post-test questionnaire which is similar to the pre-test in order to evaluate if the intervention is effective

Phase 2: Data Collection and Evaluate the Effectiveness of the MEDispose Program: After the post-test, data collection takes place, during which time data is gathered and examined.It will be the primary source of data used to evaluate whether the MEDispose Program improved community pharmacists' attitudes and knowledge about how to properly dispose of expired medications.

Phase 3: Processing Procedure: After being gathered, data is entered, maintained, checked for errors and coded responses are made ready for analysis. Accuracy, dependability, and preparation for statistical analysis are guaranteed by data processing.

Phase 4: Analysis Techniques: To compare pre- and post-test results and assess the efficacy of the program, statistical analysis techniques are used. Descriptive statistics like means and standard deviations are included in this. Consistency and dependability are ensured through the coding of collected data using predefined schemes and variables for statistical analysis. During disposal, data anonymization or de-identification procedures are used to protect participant confidentiality.

Phase 5: Data storage: Printed questionnaires will be securely stored in locked filing cabinets or secure storage areas when not in use, with access restricted to authorized personnel directly involved in the research project. Physical security measures will be implemented to prevent loss, theft, or unauthorized access to the questionnaires.

Phase 6: Disposal of Data: Once the study is complete, the printed questionnaires will be securely disposed of using shredding to ensure that they cannot be reconstructed or accessed by unauthorized individuals. Records of the disposal process will be meticulously maintained in accordance with institutional or regulatory requirements. The timing of questionnaire disposal will be determined based on the specific requirements of the study protocol, ethical guidelines, and relevant regulations, ensuring prompt and secure disposal in alignment with established procedures.

Data Analysis: The standard mean deviation and Paired Sample T-test are two essential statistical tools in evaluating pharmacist attitudes regarding the appropriate disposal of expired pharmaceuticals. The standard mean deviation measures how closely participants' attitudes match the average score by illuminating the variability in responses around the mean. Furthermore, the Paired Sample T-test determines and measures statistically significant variations in mean scores between the pre- and post-tests, evaluating whether knowledge exposure results in appreciable changes in pharmacist attitudes. This methodology provides insights for bettering information distribution and waste disposal procedures in community pharmacies by shedding light on the existing attitudes as well as enabling a nuanced analysis of changes over time.

3. RESULT

This section presents the findings of the study and provides a detailed analysis and interpretation of the collected data. The objective is to assess the changes in knowledge and attitudes of community pharmacists in Davao City regarding the proper disposal of expired medications. Both descriptive and inferential statistical methods were used to analyze the pre- and post-intervention data, offering insights into patterns, significant differences, and the overall impact in relation to the research questions and hypotheses.

Interpretation of data:

Level of mean:	**Interpretation:**	**Description:**
3.40 - 4	Very High	Fully informed
2.60 - 3.39	High	Informed
1. 80 - 2.59	Moderate	Partially informed
1.00 - 1.79	Low	Not Informed

3.1 Level of knowledge toward pharmaceutical waste

Table 1A - Level of Knowledge on Proper Disposal of Expired Pharmaceuticals Before the Use of Medispose

ITEMS	**MEAN**	**STANDARD DEVIATION**	**DESCRIPTION**
1. Antibiotics should not be disposed immediately on a sewer system because there is a possibility of antibiotic resistance of bacteria in the system	3.25	0.85	Informed

2. Liquid antibiotics may be diluted with water, left to stand for several weeks and discharged to the sewer. This used a waste encapsulation procedure	2.8	0.77	Informed
3. Drugs containing opioids can be flushed in a designated treated water system. This include drug containing buprenorphine, fentanyl, hydrocodone, hydromorphone, methadone, and other opioids	2.25	0.85	Partially Informed
4. Drugs contain the term “sodium oxybate” can be flushed	2.4	1.00	Partially Informed
5. Diazepam rectal gel can be flushed	2.55	1.10	Partially Informed
6. Disinfectants must be diluted and flushed in fast-flowing water course of small quantities of diluted disinfectant (max. 50 litres per day under supervision)	2.7	0.73	Informed
7. Aerosol canisters can be disposed in waste encapsulation or landfills, but do not burn it due to a possible explosion	2.65	0.93	Informed
8. Packaging, paper, and cardboard can be burned in open containers.	2.45	0.89	Partially Informed
9. Solids, semi-solids, powders, and controlled substance must can be incinerated in chamber	2.65	0.75	Informed
10. IV’s (D5W & NaCl) can be flushed	2.65	0.93	Informed

11.	In disposing of pills, tablets and capsules. It should not be crushed and place it in a container and disposed in a incinerator	3.15	0.67	Informed
12.	Toxic heavy metals should be incinerated in high temperature chamber	2.75	0.91	Informed
13.	Chemo agents (residue, bulk) must be incinerated in high temperature	2.5	0.95	Partially Informed
14.	Metered dose inhaler and nasal spray can be thrown in a normal waste in the garbage	2.9	0.79	Informed
15.	Pills and capsules are easily damaged by heat and moisture	3.35	0.75	Informed
16.	Aspirin pills break down into vinegar and salicylic acids when damaged by heat and moisture which can irritates the stomach	2.85	0.75	Informed
17.	Do not give medicine that has changed colour, texture, and smell. Even if it has not passed the expiry date	3.4	0.75	Fully Informed
18.	Once the antibiotic is reconstituted, most need to be discarded after 1 to 2 weeks	3.25	0.79	Informed
19.	The burning of expired medicines can release toxic substances which can be inhaled by the people	3.15	0.75	Informed
20.	The DEA suggest mixing medicinal tablets and capsules with undesirable substances, like coffee grounds or kitty litter and tossing the mixture into the trash inside a sealed bag	2.45	0.76	Informed

or container (don't crush)			
AVERAGE	**2.805**	**0.43**	**Informed**

3.1.1 Pre-Test Assessment of Community Pharmacists' knowledge Toward Proper Disposal of Expired Medications

The pre-test results indicate that some pharmacists are not fully informed about pharmaceutical waste, as evidenced by their low scores. This lack of comprehensive knowledge suggests a significant gap in their understanding, which could potentially impact their ability to manage pharmaceutical waste safely and effectively. The low scores highlight the urgent need for targeted educational interventions to address these deficiencies. By improving their knowledge through such programs, pharmacists can enhance their practices, contributing to better environmental management and public health safety. These findings underscore the importance of ongoing education and training to ensure that all pharmacists are equipped with the necessary knowledge to handle pharmaceutical waste responsibly.

Table 1B: Level of Knowledge on Proper Disposal of Expired Pharmaceuticals After the Use of Medispose

ITEMS	**MEAN**	**STANDARD DEVIATION**	**DESCRIPTION**
1. Antibiotics should not be disposed immediately on a sewer system because there is a possibility of antibiotic resistance of bacteria in the system	3.9	0.31	Fully Informed
2. Liquid antibiotics may be diluted with water, left to stand for several weeks and discharged to the sewer. This used a waste encapsulation procedure	3.85	0.37	Fully Informed
3. Drugs containing opioids can be flushed in a designated treated water system. This include drug containing buprenorphine, fentanyl, hydrocodone, hydromorphone, methadone, and other opioids	3.25	0.91	Informed
4. Drugs contain the term "sodium oxybate" can be flushed	3.55	0.61	Fully Informed
5. Diazepam rectal gel can be flushed	3.65	0.49	Fully Informed
6. Disinfectants must be diluted and flushed in fast-flowing water course of small quantities of diluted disinfectant (max. 50 litres per day under supervision)	3.65	0.59	Fully Informed
7. Aerosol canisters can be disposed in waste encapsulation or landfills, but do not burn it due to a possible explosion	3.8	0.41	Fully Informed

8. Packaging, paper, and cardboard can be burned in open containers.	3.85	0.37	Fully Informed
9. Solids, semi-solids, powders, and controlled substance must can be incinerated in chamber	3.65	0.49	Fully Informed
10. IV's (D5W & NaCl) can be flushed	3.55	0.69	Fully Informed
11. In disposing of pills, tablets and capsules. It should not be crushed and place it in a container and disposed in a incinerator	3.7	0.47	Fully Informed
12. Toxic heavy metals should be incinerated in high temperature chamber	3.65	0.49	Fully Informed
13. Chemo agents (residue, bulk) must be incinerated in high temperature	3.55	0.51	Fully Informed
14. Metered dose inhaler and nasal spray can be thrown in a normal waste in the garbage	3.75	0.44	Fully Informed
15. Pills and capsules are easily damaged by heat and moisture	3.75	0.44	Fully Informed
16. Aspirin pills break down into vinegar and salicylic acids when damaged by heat and moisture which can irritates the stomach	3.65	0.49	Fully Informed
17. Do not give medicine that has changed colour, texture, and smell. Even if it has not passed the expiry date	3.8	0.41	Fully Informed
18. Once the antibiotic is reconstituted, most need to be discarded after 1 to 2 weeks	3.85	0.37	Fully Informed
19. The burning of expired medicines can release toxic substances which can be inhaled by the people	3.7	0.47	Fully Informed
20. The DEA suggest mixing medicinal tablets and capsules with undesirable substances, like coffee grounds or kitty litter and tossing the mixture into the trash inside a sealed bag or container (don't crush)	3.5	0.61	Fully Informed
AVERAGE:	**3.68**	**0.31**	**Fully Informed**

3.1.2 Post-Test Assessment of Community Pharmacists' Knowledge on Proper Disposal of Expired Medications

The data analysis conclusively shows that the MEDispose symposium had a positive impact on the knowledge levels of community pharmacists regarding pharmaceutical waste management. This not only demonstrates the value of educational initiatives but also underscores the need for continuous professional development to address ongoing and emerging issues in pharmaceutical waste management.

This structured interpretation of the data highlights the importance of educational interventions in enhancing professional knowledge and practices, ultimately contributing to better environmental and public health outcomes. While the education program on pharmaceutical waste has positively impacted community pharmacists by enhancing their understanding and awareness, it has also revealed a concerning trend in the post-test results. Despite the overall improvement, certain areas of the post-test showed a decrease in the pharmacists' level of knowledge. This suggests that while the program was effective in many respects, there are specific aspects that may require further clarification or reinforcement to ensure comprehensive and lasting understanding among the participants.

3.2 Level of attitude toward pharmaceutical waste

The table 3 & 4 presents the mean of the attitude level of community pharmacists toward handling pharmaceutical waste in davao city, the table below present the before and after result of the educational intervention. The Items are based upon the international pharmaceutical waste guideline (WHO), which is being validated by a pharmacist expert.

Mean Scale	Interpretation	Description
4.20 - 5.00	Always	Strongly agree
3.40 - 4.19	Usually	Agree
2.60 - 3.39	About half of the time	Moderate
1.80 - 2.59	Seldom	disagree
1.00 - 1.79	Never	Strongly Disagree

TABLE 2A - Level of Attitude on Proper Disposal of Expired Pharmaceuticals Before the Use of Medispose

ITEMS	Mean	Sd	Description
1. I highly give conscious care for the safety of the public and the environment when it comes to proper pharmaceutical waste disposal of expired drugs.	4.5	0.889	Strongly Agree
2. I have patience in following the guidelines of proper waste disposal of expired pharmaceutical products.	4.45	0.759	Strongly Agree
3. I enthusiastically encourage other personnel regarding the importance of proper disposal of expired pharmaceutical drugs.	4.5	0.761	Strongly Agree
4. I portray a positive attitude towards proper waste disposal of expired pharmaceutical products.	4.4	0.821	Strongly Agree

5. I comply with the city government in terms of business practice and waste disposal guidelines	4.5	0.761	Strongly Agree
6. I am open to new practices and new information on proper waste disposal of expired pharmaceuticals.	4.5	0.946	Strongly Agree
7. I am fast in adapting new regulations or methods in proper waste disposal of expired pharmaceutical products.	4.25	1.07	Agree
8. I cooperate with my colleagues and ensure the safety of staff and pharmacy when it comes to proper waste disposal..	4.4	0.821	Strongly Agree
9. I consistently prioritize and effectively manage waste disposal of expired drugs, even during busy periods, demonstrating a high level of responsibility and commitment	4.25	0.91	Agree
10. I guide and train pharmacy staff on the importance of proper pharmaceutical waste disposal.	4.25	0.851	Agree
11. I am willing to lend a hand if my colleague needed help in disposal of expired pharmaceutical products.	4.4	0.821	Strongly Agree
12. In the face of mistakes or damages made by a coworker in garbage disposal, I maintain a calm and courteous manner.	4.35	0.813	Strongly Agree
13. I diligently manage pharmaceutical inventory to minimize the accumulation of expired or unused pharmaceutical products.	4.35	0.813	Strongly Agree
14. I return expired or unused drugs to the manufacturer a month before the expiry date.	4.4	1.142	Strongly Agree
15. I regularly do inventory checkups or audits in order to determine which drugs need to be disposed of or returned.	4.35	0.988	Strongly Agree
16. I am willing to provide counseling to the patient if they raise concern with regards to the disposal of expired pharmaceutical products.	4.55	0.759	Strongly Agree

17. I find a way to dispose expired drugs properly if they missed to return to the company	4.25	1.07	Strongly Agree
18. I segregate the waste in proper order following the proper disposal guidelines of expired pharmaceutical products.	4.45	0.945	Strongly Agree
19. I follow the proper guideline in disposing expired liquid dosage form.	4.35	0.745	Strongly Agree
20. I strictly follow proper storage requirement in order to prevent early onset of product instability due to incorrect temperature.	4.4	0.94	Strongly Agree
Average	**4.393**	**0.767**	**Very High**

3.2.1. Pre-Test Assessment of Community Pharmacists' Attitude Toward Proper Disposal of Expired Medications

The pre-test results reveal that participants exhibit a high level of positive attitude not only toward pharmaceutical waste management but also toward collaborating with their colleagues in team-building efforts related to this issue. This indicates that community pharmacists are not only aware of the importance of proper pharmaceutical waste handling but are also committed to working together to improve practices in this area. Their strong, positive attitude toward teamwork and collective responsibility lays a solid foundation for further educational interventions. With enhanced knowledge and skills, these pharmacists are well-positioned to lead and support effective and sustainable pharmaceutical waste management initiatives within their professional communities.

TABLE 2B - Level of Attitude on Proper Disposal of Expired Pharmaceuticals After the Use of Medispose

ITEMS	**Mean**	**Sd**	**Description**
1. I highly give conscious care for the safety of the public and the environment when it comes to proper pharmaceutical waste disposal of expired drugs.	4.85	0.489	Strongly Agree
2. I have patience in following the guidelines of proper waste disposal of expired pharmaceutical products.	4.8	0.523	Strongly Agree
3. I enthusiastically encourage other personnel regarding the importance of proper disposal of expired pharmaceutical drugs.	4.7	0.571	Strongly Agree

4. I portray a positive attitude towards proper waste disposal of expired pharmaceutical products.	4.75	0.55	Strongly Agree
5. I comply with the city government in terms of business practice and waste disposal guidelines	4.85	0.489	Strongly Agree
6. I am open to new practices and new information on proper waste disposal of expired pharmaceuticals.	4.65	0.587	Strongly Agree
7. I am fast in adapting new regulations or methods in proper waste disposal of expired pharmaceutical products.	4.55	0.686	Strongly Agree
8. I cooperate with my colleagues and ensure the safety of staff and pharmacy when it comes to proper waste disposal..	4.7	0.571	Strongly Agree
9. I consistently prioritize and effectively manage waste disposal of expired drugs, even during busy periods, demonstrating a high level of responsibility and commitment	4.65	0.671	Strongly Agree
10. I guide and train pharmacy staff on the importance of proper pharmaceutical waste disposal.	4.8	0.523	Strongly Agree
11. I am willing to lend a hand if my colleague needed help in disposal of expired pharmaceutical products.	4.65	0.587	Strongly Agree
12. In the face of mistakes or damages made by a coworker in garbage disposal, I maintain a calm and courteous manner.	4.75	0.55	Strongly Agree
13. I diligently manage pharmaceutical inventory to minimize the accumulation of expired or unused pharmaceutical products.	4.7	0.571	Strongly Agree

14. I return expired or unused drugs to the manufacturer a month before the expiry date.	4.65	0.587	Strongly Agree
15. I regularly do inventory checkups or audits in order to determine which drugs need to be disposed of or returned.	4.75	0.55	Strongly Agree
16. I am willing to provide counseling to the patient if they raise concern with regards to the disposal of expired pharmaceutical products.	4.7	0.571	Strongly Agree
17. I find a way to dispose expired drugs properly if they missed to return to the company	4.6	0.681	Strongly Agree
18. I segregate the waste in proper order following the proper disposal guidelines of expired pharmaceutical products.	4.65	0.671	Strongly Agree
19. I follow the proper guideline in disposing expired liquid dosage form.	4.7	0.571	Strongly Agree
20. I strictly follow proper storage requirement in order to prevent early onset of product instability due to incorrect temperature.	4.7	0.571	Strongly Agree
Average	**4.707**	**0.471**	**Very High**

3.2.2. Post-Test Assessment of Community Pharmacists' Attitude Toward Proper Disposal of Expired Medications

The post-test results following the educational intervention indicate no significant difference in the attitude levels toward pharmaceutical waste compared to the pre-test, as both tests consistently show high values. This suggests that participants already possessed a strong positive attitude toward pharmaceutical waste management prior to the intervention. The sustained high scores reflect their ongoing commitment and awareness regarding the importance of proper pharmaceutical waste handling. This consistency implies that the community pharmacists have a deeply ingrained recognition of the significance of managing pharmaceutical waste responsibly. Their pre-existing positive attitude likely stems from an intrinsic understanding of the environmental and public health implications associated with improper disposal of pharmaceutical products. Therefore, while the educational program effectively reinforced their attitudes, it did not produce a significant change, as the foundation of their attitudes was already solid.

Furthermore, this outcome highlights that educational efforts in this area might need to focus more on enhancing practical skills and knowledge rather than solely on attitude adjustment. Since the pharmacists already exhibit a high level of commitment, future interventions could benefit from targeting specific competencies and operational practices to ensure that their positive attitudes translate into effective and consistent waste management behaviors.

The results underscore the importance of ongoing professional development and training to maintain and build upon the strong ethical framework already present among these healthcare professionals.

3.3. Comparative Analysis of Knowledge and Attitude Levels on Proper Disposal of Expired Pharmaceuticals Before and After the Intervention

TABLE 5 - Test of Difference in the Level of Knowledge and Attitude on Proper Disposal of Expired Pharmaceuticals Before and After the Use of Medispose

	Before	After	t-value	p-value	Remarks
Knowledge	2.805	3.68	-6.939	<.001	Significant
Attitude	4.393	4.707	-1.653	0.115	Not Significant

Table 5 presents the results of the test of difference in the respondents' level of knowledge and attitude on the Proper Disposal of Expired Pharmaceuticals before and after the use of Medispose. The findings indicate a significant increase in the knowledge of the respondents, from a mean score of 2.805 to 3.680. This increase is statistically significant, as evidenced by a t-value of -6.939 and a p-value of <.001, which is below the set alpha level (0.05). This suggests that Medispose was effective in enhancing the community pharmacists' knowledge on the subject. In terms of attitude, the respondents' mean score improved from 4.393 to 4.707 after using Medispose. However, this increase was not statistically significant, with a t-value of -1.653 and a p-value of 0.115, which is above the alpha level. Despite the lack of statistical significance, the positive change in the mean score still points to a potential effectiveness of Medispose in influencing the respondents' attitudes toward the proper disposal of expired pharmaceuticals in Davao City.

4. DISCUSSION

This section critically evaluates, discusses, and analyzes the importance of the findings considering the existing understanding of the study problem. It also explores any new insights that emerged from the thematic analysis of the data collected through symposium conducted and questionnaires administered by the researchers.

4.1 Knowledge of Community Pharmacist on Proper Disposal of Expired Pharmaceuticals

Our study conducted in Toril, Davao City revealed an immediate improvement in the knowledge of community pharmacists following a symposium and the distribution of MEDispose modules. However, we observed minimal changes in their attitudes. Data indicates that community pharmacists initially exhibited an partially informed (mean score of 2.45) regarding the disposal of Diazepam rectal gel (Question #5), with some uncertainty about whether it could be flushed. However, following the symposium and distribution of educational modules, there was a slight improvement in knowledge, with the mean score increasing to a high level (3). Moreover, the a similar trend in understanding among community pharmacists regarding the disposal of drugs containing opioids (Question #3) and drugs containing "sodium oxybate" can be flushed (Question #4). Initially, pharmacists demonstrated a partially informed score (mean score of 2.25 and 2.4 respectively) on whether these medications could be flushed into a designated treated water system. However, following the symposium and distribution of educational modules, there was a notable improvement, with the mean score increasing to a informed (mean score of 3.25) and fully informed (mean score 3.55) respectively during the post-test.

Moreover, the initial pre-test data for Questions #8 and #13, focusing on the disposal of packaging materials and chemotherapy agents respectively, revealed a partially informed knowledge among community pharmacists, with mean scores of 2.45 and 2.5. This suggests that pharmacists may have lacked comprehensive training or specific knowledge regarding the proper disposal methods for these materials. Factors such as misinformation, assumptions, and limited awareness of regulations may have contributed to these initially low scores. The complexity of disposal guidelines, particularly for materials like chemotherapy agents, could have further compounded the challenge of accurately interpreting and applying proper disposal practices. However, following the educational intervention, there was a notable increase in knowledge levels, with mean scores rising to 3.85 for Question #8 and 3.55 for Question #13 during the post-test. This suggests that the intervention effectively addressed knowledge gaps and equipped pharmacists with the necessary information to understand and adhere to proper disposal practices for packaging materials and chemotherapy agents.

These findings are in line with previous research that underscores the effectiveness of educational interventions in enhancing healthcare professionals' knowledge related to pharmaceutical waste management. For instance, a study conducted by Binu K.M et al. (2024) demonstrated that educational interventions can positively impact the knowledge, attitude, and practices of healthcare staff toward pharmaceutical waste management, echoing the outcomes of our study. Additionally, our results are consistent with the findings of research by Siew Mei Lai et al. (2021), which indicated that educational interventions focusing on the safe disposal of unused medications significantly improved participants' overall knowledge levels. This study emphasized

the importance of educational initiatives in fostering environmentally responsible behaviors among healthcare practitioners, including the appropriate management of pharmaceutical waste. pharmaceutical waste.

4.1 Attitude of Community Pharmacist on Proper Disposal of Expired Pharmaceuticals

The attitude of community pharmacists towards the proper disposal of expired pharmaceuticals is a significant factor in ensuring the safety and sustainability of our environment. During the pretest of the intervention, almost all of the community pharmacists already showed a very high level of attitude, with a mean score of 4.9, towards the disposal of expired pharmaceuticals. This gives substance to the result from a study conducted in Indonesia that found that almost all pharmacists were aware of the risks associated with improper disposal of expired and unused household medications, and they have acknowledged their responsibilities to protect the environment (Alfian, S., et al, 2023). Overall, both the pre-test and post-test showed high results regarding the attitude of the pharmacists. However, based on the pre-test result, there is a very low level (mean score of of attitude of community pharmacists towards returning expired or unused drugs to the manufacturer a month before the expiry date of pharmaceuticals. This result is similar to a study conducted in Malaysia where the study revealed that medicine returns to service in community pharmacies are not common due to some reasons like lack of facilities in the management of unwanted, expired, and returned medicines (Chong, K., et al, 2020). The result is also inconsistent with those studies from different countries like Saudi Arabia, where they found that the primary disposal method for all dosage forms was to return them to the manufacturers (Alghadeer & Al-Arifi, 2021b).

A lower mean of community pharmacists also enthusiastically encourage other personnel and portray a positive attitude towards proper disposal of expired pharmaceutical products. Lower mean of community pharmacists was also found where they do not diligently and regularly manage and do inventories. According to a research by Kahsay, H. (2020), a significant number of community pharmacists had a positive attitude toward the disposal of unused and expired pharmaceuticals. This suggests that improved advice and guidance from medical experts might lead to improved practices for effective disposal. Positive attitudes among community pharmacists are crucial for promoting safe disposal practices, educating the public, protecting public health, and mitigating environmental impacts. Fortunately, the level of attitudes of the community pharmacists are already high from the beginning, and increased more after the MEDispose Intervention. With these data, the study reveals that community pharmacists in the Philippines have consistent attitudes towards the disposal of expired pharmaceutical products, despite no significant difference between pre-test and post-test results. This consistency can be attributed to factors such as professional training, understanding of proper disposal methods, and regulatory environment. The data also indicates that these pharmacists possess the necessary attitudes for proper disposal, highlighting their role as responsible stewards of public health and safety. Overall, the study contributes to the growing body of literature on the role of pharmacists in environmental sustainability and public health, highlighting the commendable attitudes of these pharmacists

5. CONCLUSION

The MEDispose program successfully improved the knowledge of community pharmacists in Toril, Davao City, regarding the safe disposal of expired pharmaceuticals. Although there wasn't a statistically significant change in attitudes, there was a discernible positive shift, indicating progress in fostering a culture of responsible disposal practices. By addressing knowledge gaps and providing clear guidance, the program has laid a solid foundation for promoting environmental stewardship within the community pharmacy setting. However, ongoing efforts are crucial to consolidate these gains and ensure sustained adherence to proper disposal protocols. In essence, the MEDispose program has initiated a meaningful transformation towards safer and more responsible pharmaceutical disposal practices among local pharmacists, setting a precedent for continued improvement in public health and environmental conservation efforts.

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