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EXAMINING PERSONNEL'S UNDERSTANDING OF HANDLING UNUSED AND EXPIRED MEDICATION

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Abstract:

In recent times, there has been a notable increase in medication wastage, encompassing medications that expire or remain unused across the entire supply chain. This waste also includes instances of unnecessary or inappropriate medication consumption by patients, as well as non-adherence to treatment guidelines by healthcare professionals. Such wastage imposes financial burdens on both patients and the economy, necessitating comprehensive education efforts across all involved parties. The objective of this research is to examine the knowledge of handling unused and expired medication among the staff at UiTM Cawangan Pulau Pinang (UiTM CPP). An online questionnaire survey was conducted among the staff. The primary reason cited by respondents for keeping medications at home was for future use and the sense of security in having a stock of medication at home. The common action taken with expired medication was disposal in household garbage, with only 27 respondents indicating a preference for returning expired drugs to pharmacies. The most preferred sources of information regarding the proper handling of expired and unused medication were the Ministry of Health and pharmacists. In conclusion, this study emphasizes the importance of addressing the perceived awareness of medication handling among staff at

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UiTM Bertam. The university administration must take proactive measures to enhance awareness among its staff members.

Keywords:

Expired Medication, Handling, Personnel, Unused Medication, Wastage

Introduction

The global rise in medication consumption due to improved healthcare access and public health awareness, has brought challenges in managing unused and expired medications (Gonzalez Pena, Lopez Zavala & Cabral Ruelas. 2021). These medications, often retained at home due to treatment changes or surplus supply, are frequently disposed of improperly—either flushed down toilets, thrown in household waste, or stored long-term—posing risks to public health and the environment. Active pharmaceutical ingredients (APIs) released into the environment through these routes can pollute water sources, harm aquatic life, and contribute to antimicrobial resistance (Boxall, Wilkinson & Bouzas-Monroy, 2023).

In Malaysia, despite efforts to educate the public on safe medication disposal, improper practices persist. For example, patients in government healthcare settings often accumulate excess medications due to subsidized services, leading to significant wastage (Hassali et al., 2012). While existing research has focused on patients and the general public, there is limited evidence on how institutional personnel—particularly in academic environments—understand and manage unused and expired medications.

As personnel at higher education institutions are not only medication users themselves but can potentially influence community practices, proper knowledge on medication disposal is essential. The absence of targeted awareness and accessible disposal systems among this group may contribute to unsafe medication handling, inadvertent misuse, and environmental contamination. Therefore, this study aims to examine the understanding of personnel at Universiti Teknologi MARA Cawangan Pulau Pinang (UiTM CPP), Bertam Campus, regarding the handling of unused and expired medications. Identifying gaps in their knowledge and practices is essential to developing informed strategies for safer medication management within academic settings and beyond.

Literature Review***What Are Unused and Expired Medications?***

Unused medication primarily refers to medicine that remains unconsumed after a patient discontinues its usage. This state can occur when doctors alter the prescription or advice patients to cease taking the medication due to changes in their health condition. The surplus stock of medication retained at home falls under the category of unused medication. Expired medications, on the other hand, are pharmaceuticals that have surpassed their designated expiry date (Makki et al., 2019; Wang, Aziz & Chik, 2021).

Medication Consumption and Disposal Issues

In recent times, the consumption of medications is on the rise, paralleling the global population growth rate. Nevertheless, a significant portion of individuals lacks the knowledge on proper and safe handling or disposal methods for their unused or expired medications. Consequently, there's a tendency for unused and expired medications to accumulate at home. This situation arises due to the complexities involved in managing medication disposal. Consequently, medication wastage is on the rise. Improper disposal practices pose risks to both environmental and public health. Medical waste contains hazardous chemicals that can endanger human health and aquatic ecosystems (World Health Organisation [WHO], 2025).

Currently, there is a rising trend of pharmaceutical consumption. Active Pharmaceutical Ingredient (API) which are found in medication, can leak and harm the environment if not managed properly. This concern is heightened by the global expansion of the API (Gonzalez-Pena et al., 2021). At the same time, growing public awareness has led to improved health-seeking behaviour across populations. This could be attributed to numerous public awareness campaigns. Consequently, there has been an increase in the use of medication, including both prescription and over the counter (OTC) treatments (Hassali & Shakeel, 2020; Narang, Garg & Sharma, 2023).

A study conducted at a Malaysian government hospital revealed that despite patients possessing a sufficient medication supply lasting for several months, they opted to persist in obtaining additional medications, given the free and subsidized nature of the service provided by the government. The study's findings estimated the government's expenditure at approximately MYR 1.5 million in 2007 solely attributable to the total wastage observed within the hospital's medical outpatient department (Hassali et al., 2012).

Some patients improperly dispose of their medications, such as by flushing them down the toilet, which poses dangers as medicinal waste can adversely affect the environment when deposited into the soil (Tong, Peake & Braund, 2011; WHO, 2025). Furthermore, storing unused or expired medications at home may inadvertently lead to misuse and subsequent adverse effects. Therefore, the optimal approach for patients is to return their unused or expired medications to pharmacies or chemical waste depots (Ong, Ooi, Shafie, & Hassali, 2020).

Knowledge and Practices of Medication Disposal Among Malaysian Population

Improper disposal of unused and expired medications is a growing concern in Malaysia, with significant implications for public health and environmental safety. To address this issue, the Malaysian Ministry of Health (MoH) introduced the Medication Return Programme (MRP), also known as the "Return Your Medicines" campaign, which encourages the public to return unused or expired medications to healthcare facilities for safe disposal.

Despite the existence of this initiative, public awareness and participation remain suboptimal. A study by Yang, Tan, Goh, Liao (2018) revealed that although 73% of respondents were aware of the environmental risks associated with improper medication disposal, only 54% were familiar with the MRP. Similarly, Saharuddin, Md Hussin & Mohd Nordin (2024) found that in Terengganu, nearly 90% of respondents disposed of medications improperly, and only 33.4% were aware of the return program. These findings highlight a significant gap between awareness of environmental impact and knowledge of available disposal mechanisms.

The lack of awareness is not limited to the general public. Even among healthcare providers, proper disposal practices are inconsistent. According to a systematic review by Lam, Nsouli, Lee, Alqeisi & Armani (2024), although healthcare professionals generally support safe medication disposal in principle, actual practices vary due to unclear guidelines and insufficient training. This inconsistency indicates the need for a more robust policy framework and better integration of disposal protocols within the healthcare system.

Hassali & Shakeel 2020) emphasized that although public understanding of medication wastage is increasing, practical actions are lacking. In their study, 84.9% of respondents admitted to discarding expired medications in household trash, despite awareness of potential harm. Moreover, Ong et al. (2020) pointed out a significant knowledge deficit in proper disposal methods, which could lead to environmental contamination and unintended drug exposure.

Tools like the ReDiUM (return and disposal of unused medications) questionnaire (Sim, Lai, Tan, Lee & Sulaiman, 2018) have been used to measure public understanding of medication disposal. This questionnaire was developed by expert panel consisting of academicians and healthcare professionals to determine the knowledge, attitude and practices related to disposal of unused medications in community in Malaysia. Although 94.4% of respondents acknowledged the environmental impact of improper disposal, detailed knowledge about correct methods remained limited (11.2%). This highlights the need for more focused educational interventions.

In response to these challenges, the MoH has gradually expanded the MRP to more public healthcare facilities. However, barriers such as limited accessibility, inadequate promotion, and absence of legal enforcement reduce its effectiveness. Stakeholders suggest that broader engagement—including collaboration with pharmacies, community clinics, and educational institutions—could enhance the reach and impact of return programs. Although Malaysia has established frameworks to support the safe return of unused and expired medications, current literature reflects a substantial gap in both awareness and practice. Strengthening public education, healthcare provider training, and policy implementation are critical to improving medication return behaviours across the country. Accordingly, the research aims to determine the knowledge of individuals when managing their unused and expired medications. The research focus on the staff of the UiTM Cawangan Pulau Pinang (UiTM CPP) Bertam Campus. Table 1 summarises previous findings on knowledge, awareness and practices in of medication disposal in Malaysia.

Table 1: Summary of Studies on Awareness and Practices of Medication Disposal in Malaysia

Reference	Population	Key findings
Sim et al. (2018)	Respondents of ReDiUM questionnaire	94.4% understood environmental impact; limited knowledge of specific disposal methods (11%).
Yang et al. (2018)	General public	73% acknowledged environmental risks of improper disposal; only 54% were aware of the Medication Return Programme (MRP).
Ariffin & Zakili (2019)	General public	Aware of adverse effects of pharmaceutical waste on environment

		and public health. Improper disposal of medication
Hassali & Shakeel (2020)	Public in Selangor	Over 80% aware of medication wastage; 84.9% discarded expired medications in the trash despite awareness.
Ong et al. (2020)	General public in Malaysia	Noted a significant lack of awareness on proper disposal methods for unused and expired medications.
Lam et al. (2024)	Healthcare staff (systematic review)	Positive attitudes towards safe disposal; practices inconsistent due to inadequate training and unclear guidelines.
Ling, Ng, Shamsuddin, Zulkifli & Lee (2024)	General Public in Malaysia	Prevalent practice of improper disposal, low participation in MRP & 73% aware of effect on environment.
Saharuddin et al. (2024)	Public in Terengganu	Nearly 90% disposed of medications improperly; only 33.4% were aware of the "Return Your Medicines" program.

Methods

This cross-sectional study was conducted from March to May 2023 and involved staff members from Universiti Teknologi MARA (UiTM), Cawangan Pulau Pinang (UiTM CPP), Bertam Campus. The primary aim was to assess respondents' understanding, attitudes, and practices regarding the handling of unused and expired medications.

Data were collected through an online survey developed using Google Forms, adapted from a validated questionnaire by Hassali & Shakeel (2020). The survey link was distributed via official online platforms, including emails and WhatsApp group, to ensure broad participation across the campus community. The structured questionnaire comprised four sections:

Section 1: Demographic background that gathered information on participants' gender, age group, educational level, and employment position to characterise the study population.

Section 2: Medication Procurement Practices. Participants were asked about how they typically obtained medications (e.g., clinic, pharmacy, hospital) and whether they routinely checked the expiry dates before purchase.

Section 3: Awareness and Attitudes Toward Medication Wastage. This section contained 12 items adapted from the Perceived Awareness Scale (PAS), measured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The PAS assessed participants' self-reported awareness of medication wastage and their attitudes toward its prevention. Each statement (PAS1–PAS12) aimed to quantify awareness levels in a structured and consistent manner. The total PAS score for each respondent ranged from 12 to 60, with higher scores indicating greater perceived awareness.

Section 4: Disposal Practices for Unused and Expired Medications. This section included six questions that explored participants' usual methods of managing expired or unused medications. It examined whether participants retained, discarded, or returned these medications, and their reasons for doing so.

Upon completion of the data collection phase, all responses were exported and analysed using IBM SPSS Statistics Version 22. Descriptive statistics were generated to summarise the demographic data and response patterns. For inferential analysis, Independent t-tests were conducted to compare the mean PAS scores across gender groups. One-way ANOVA was applied to determine whether there were statistically significant differences in PAS scores across different career categories within the institution. The results were presented using tables, charts, and graphs to facilitate interpretation and comparison (Figure 1).

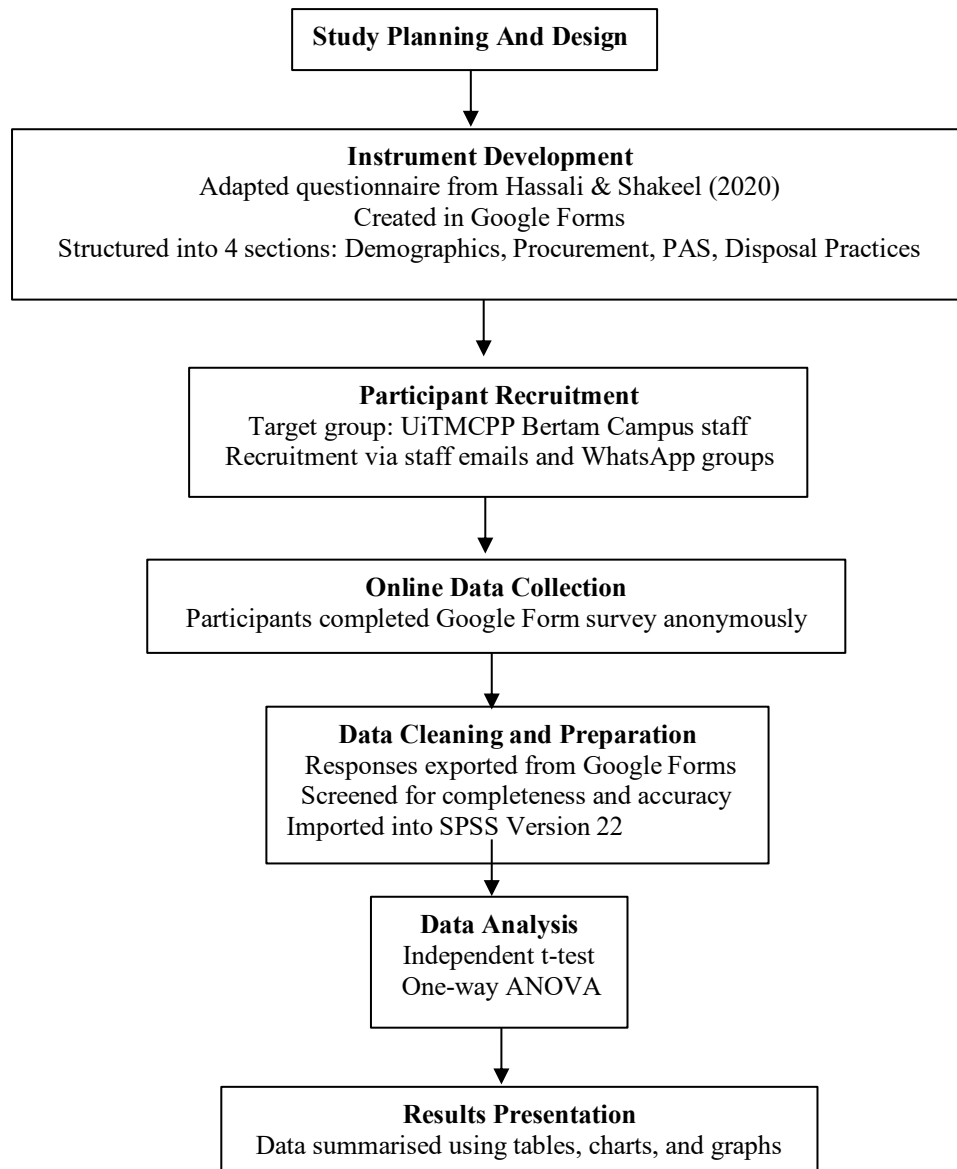


Figure 1: Overview of the Study Procedure and Data Collection Process

Results And Discussion

Demographic information

A total of 101 out of 120 staff members from Universiti Teknologi MARA (UiTM), Cawangan Pulau Pinang (UiTM CPP), Bertam Campus successfully completed the questionnaire, yielding a response rate of 84.2%. The demographic characteristics of the respondents, including gender, age group, career designation, and area of residence, are presented in Table 2.

Table 2: Demographics Profile of Staffs from Universiti Teknologi MARA Cawangan Pulau Pinang Bertam Campus (N=101)

Variables	N	No.(%)
Age		
18-24 Years old	11	10.89%
25-31 Years old	39	38.61%
32 Years old and above	51	50.50%
Gender		
Male	26	25.7%
Female	75	74.3%
Ehtnic group		
Malay	97	96.04%
Chinese	4	3.96%
Indian	0	0%
Career		
Lecturer of Faculty of Pharmacy	15	14.85%
Lecturer of Faculty of Health Science	28	27.72%
Management staffs	18	17.82%
Lab assistants	8	7.92%
Cafe management staffs	5	4.95%
College management staffs	2	1.98%
Janitors	3	2.97%
Others	22	21.78%
Area of residence		
Rural	32	33%
Urban	65	67%

Practice of Procuring Medications

This segment of the survey aims to explore participants' methods of acquiring medication. The data indicates that a significant portion (83.2%) opt for over-the-counter purchases, while more than half (55.4%) obtain prescriptions. Additionally, a small fraction (5.9%) acquire medication from acquaintances. Regarding the types of medication purchased, the majority favour painkillers (76.2%), followed by supplements (58.4%), over-the-counter antihistamines (40.6%), antibiotics (25.7%), antidiabetic (5%), and antihypertensive drugs (5%). Notably, the questionnaire also reveals that a considerable number of respondents (77.2%) conscientiously verify the expiry dates of their purchased medications.

Respondents' Awareness and Attitude towards Medication Wastage

Respondents were asked a total of 12 questions, and they were given choices of answers which strongly agreed, agreed, not sure, disagreed and strongly disagreed. Descriptive statistics, including means, standard deviations, and frequencies, were computed for the Perceived Awareness Scale. The interpretation of means was categorised as follows: "Strongly disagree" between 1.00 and 1.80, "Disagree" between 1.81 and 2.60, "Neutral" between 2.61 and 3.40, "Agree" between 3.41 and 4.20, and "Strongly agree" between 4.21 and 5.00. Analysis of the Perceived Awareness Scale (PAS) survey revealed that PAS1 obtained the highest mean score, while PAS6 received the lowest mean score. Table 3 and 4 present the detailed results from the collected data.

Table 3: Frequency of Responses to the Perceived Awareness Scale (PAS) on Medication Wastage Among Staff of Universiti Teknologi MARA Cawangan Pulau Pinang Bertam Campus (N=101)

Questionnaires	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Q1 I am aware of the medication wastage issue in Malaysia	1	6	7	45	42
Q2 I am aware of the impact of the medication wastage on patients	3	11	16	48	23
Q3 I am aware of the impact of the medication wastage on economy	7	2	10	56	26
Q4 I am aware that inappropriate practices of medication wastage may have harmful consequences on both the health and environment	7	8	6	49	31
Q5 I often purchase medications regularly whether or not they have run out	13	39	11	28	10
Q6 I often obtain free medications regularly whether or not they have run out	13	47	14	15	12
Q7 I often pass medications that I have bought for myself to relatives, neighbours or friends	18	38	5	28	12
Q8 I feel that free healthcare resources are contributing to the medication wastage	10	20	22	39	10
Q9 I feel that healthcare professionals are responsible for the issue of medication wastage	8	20	19	40	14

Q10 I feel confident in my ability to reduce medication wastage	6	8	21	49	17
Q11 I think that healthcare professionals could do more to reduce medication wastage	9	6	8	64	14
Q12 I think that Ministry of Health could do more to reduce medication wastage	19	19	1	42	19

The findings indicate a high total mean score of 41.05 out of a maximum of 50 across 12 items, suggesting that most staff possess awareness regarding the proper handling of unused and expired medication. While there was no difference in awareness scores between male and female staff, variations were observed across different career categories.

Table 4: Mean Scores (\pm Standard deviation) of Perceived Awareness Scale on Medication Wastage Among Staff at Universiti Teknologi MARA Cawangan Pulau Pinang Bertam Campus (N=101)

QUESTION PAS (PAS1 – PAS12)	LIKERT SCALE	INTERPRETED
I am aware of the medication wastage issue in Malaysia	4.20 \pm 0.8	AGREE
I am aware of the impact of the medication wastage on patients	3.76 \pm 1.0	AGREE
I am aware of the impact of the medication wastage on economy	3.91 \pm 1.0	AGREE
I am aware that inappropriate practices of medication wastage may have harmful consequences on both the health and environment	3.88 \pm 1.1	AGREE
I often purchase medications regularly whether or not they have run out	2.83 \pm 1.2 5	NEUTRAL
I often obtain free medications regularly whether or not they have run out	2.66 \pm 1.2 2	NEUTRAL
I often pass medications that I have bought for myself to relatives, neighbours or friends	2.78 \pm 1.3	NEUTRAL
I feel that free healthcare resources is contributing to the medication wastage	3.19 \pm 1.1	NEUTRAL
I feel that healthcare professionals are responsible for the issue of medication wastage	3.32 \pm 1.1	NEUTRAL
I feel confident in my ability to reduce medication wastage	3.62 \pm 1.0	AGREE
I think that healthcare professionals could do more to reduce medication wastage	3.67 \pm 1.0	AGREE
I think that Ministry of Health could do more to reduce medication wastage	3.23 \pm 1.4	NEUTRAL

Given the normal distribution of the data, an independent T-test was used to compare PAS scores across genders, while a One-Way ANOVA was employed to assess differences in PAS scores across various career categories. A significance level of $p < 0.05$ was set for statistical significance. The results of the independent T-test indicated that the discrepancy in scores between males was not statistically significant ($p = 0.66$). Similarly, the One-Way ANOVA revealed that the variation in scores among different career groups, including lecturers of different faculties and administrative staffs were not statistically significant, ($p = 0.903$).

Respondents' Practices of Discarding Unused and Expired Medications

In this section, the questionnaire examined into the respondents' approach to disposing of medications. Participants were queried about the presence of unused medications in their households. Results reveal that 67% of respondents do have unused medication at home.

In terms of intended actions for unused medications, 48.5% of respondents indicated that they would retain the medications until expiry. A notable 31.7% stated they would dispose of them in household garbage, while 24.8% planned to return them to pharmacies. Additionally, 23.8% intended to give their unused medications to friends, and 17.8% were unsure of the appropriate disposal method. A smaller percentage reported intending to donate unused medications to hospitals (8.9%) or dispose of them by flushing them down the toilet (5.0%).

Respondents were also asked about their reasons for keeping unused medications. The majority (76%) cited future use as the main reason. Almost half (46%) reported retaining medications to feel secure by having them readily available. Other reasons included forgetting to take the medication (18%), experiencing side effects (6%), and changes in treatment regimens prescribed by doctors (3%).

Subsequently, participants were surveyed about their past practices concerning the disposal of expired medications. The majority (68.3%) disclosed that they discarded them in household garbage, while (26.7%) prefer returning them to pharmacies. A smaller percentage (11.9%) expressed uncertainty regarding the appropriate method, with only (10.9%) admitted to flushing them down the toilet or sink.

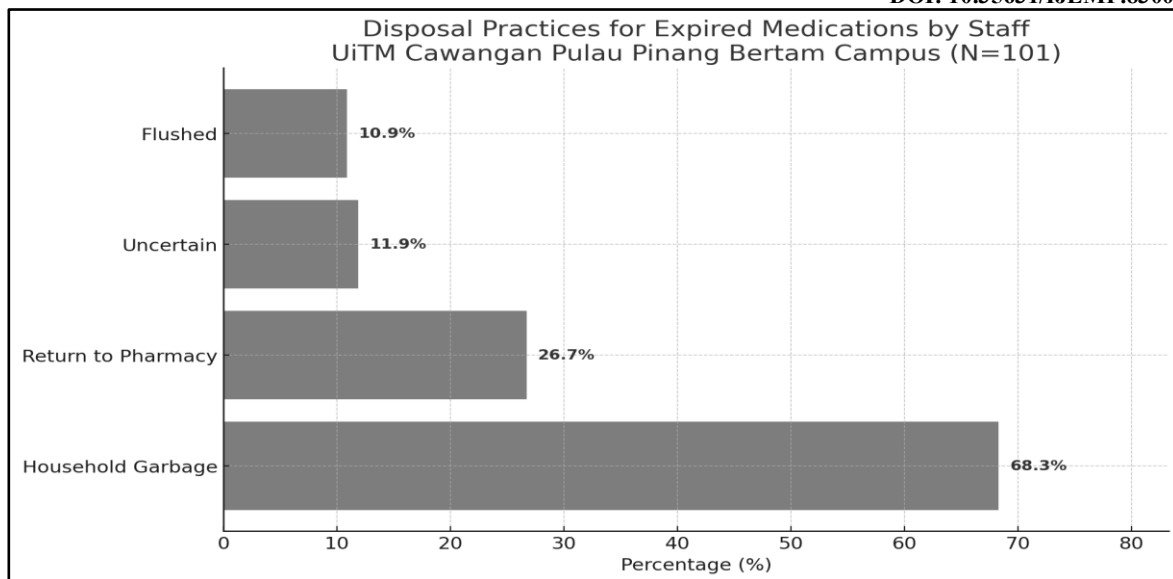


Figure 2: Disposal Practices for Expired and Unused Medications by Staff at Universiti Teknologi MARA Cawangan Pulau Pinang Bertam Campus (N=101)

Finally, respondents were questioned regarding their perception of reliable sources of information. The results indicate that the majority (76%) consider the Ministry of Health to be a trustworthy source, followed by pharmacists (56%), pharmaceutical organizations (43%), electronic media (42%), physicians (36%), and print media (26%).

The increased usage of medications is a consequence of the global population growth rate. According to a cross-sectional study conducted by Ong et al. (2020) and Ling et al. (2024), Malaysia also faces significant problems with medication wastage. This wastage occurs when medicines expire or are not used effectively along the supply chain, leading to financial losses and the need for better public education. Contributing factors to this issue include poor patient compliance, excessive prescribing practices, and inadequate inventory control in pharmacies. Patients often maintain surplus medication at home, fearing unavailability when needed.

This study investigated the understanding and practices related to the handling of unused and expired medications among staff at UiTM CPP, Bertam Campus. The results showed that while most respondents demonstrated a good level of awareness, there were still significant gaps in knowledge and behaviour—especially concerning the proper disposal of these medications.

A significant proportion of respondents (67%) acknowledged having unused medications at home. This aligns with past Malaysian studies such as Ong et al. (2020), which also found high household accumulation of unused medications. Notably, nearly half of the respondents (48.5%) indicated an intention to retain these medications until expiry. Such practices increase the likelihood of stockpiling and, subsequently, inappropriate disposal. Similar retention behaviours have been documented in previous studies by Azad et al. (2012), Hassali & Shakeel (2020) and Makki et al. (2019), emphasizing a widespread misconception regarding the safety and utility of retaining medications for future use. In terms of disposal practices, household garbage disposal emerged as the most common method for both unused (31.7%) and expired medications (68.3%).

Despite the availability of the MRP programme only about a quarter of respondents returned their medications to pharmacies. These figures are consistent with Saharuddin et al. (2024) and Yang et al. (2018), who identified similarly low engagement with formal return systems. Such patterns suggest either limited accessibility to MRP facilities or insufficient awareness regarding their use, even among university staff—individuals generally expected to be better informed.

Interestingly, while the overall mean score on the Perceived Awareness Scale was high (41.05 out of 60), deeper analysis shows that awareness of systemic causes of wastage—such as overprescribing or ineffective public campaigns—was only moderate. For example, statements regarding the Ministry of Health's role or the responsibilities of healthcare professionals yielded neutral responses (mean scores around 3.2–3.3). This reflects a lack of critical awareness concerning the broader structural drivers of medication wastage. It also underlines the need for more in-depth educational interventions that not only focus on individual behaviour but also address system-level contributors.

In this study, respondents demonstrated responsible behaviours in the procurement of medication, with over 77% reporting that they consistently checked expiry dates prior to purchase. This reflects a positive self-regulation and aligns with findings by Hassali & Shakeel (2020), which highlighted the growing role of consumers in ensuring medication safety. Furthermore, according to the Ministry of Health, Pharmaceutical Services Division (2012) perceptions of labelling adequacy among consumers are influenced by demographic factors. In particular, individuals from certain ethnic backgrounds and those with lower educational levels reported greater difficulty in interpreting medication labels.

Despite high self-reported confidence in reducing medication wastage (mean score of 3.62), actual practice patterns indicate a division between perceived and actual behaviours. This highlights the limitations of self-assessed awareness tools and suggests the need for more observational or intervention-based studies to validate behavioural outcomes.

Overall, the findings support previous studies showing that medication wastage is not only caused by a lack of public awareness, but also by habits, convenience-based disposal methods, and low participation in official return programs. Since university staff can influence health behaviours in their communities, improving knowledge and practices at the university level may create positive effects and encourage better medication disposal among the general public.

Conclusion

This study has successfully achieved its objective of assessing personnel's understanding of handling unused and expired medications. The findings indicate a generally commendable level of awareness among participants, particularly in responsible procurement behaviours such as consistently checking medication expiry dates prior to purchase. Most respondents also demonstrated mindfulness in avoiding medication overstocking, reflecting an intention to reduce wastage and a degree of confidence in their ability to manage medications responsibly.

However, a critical knowledge gap remains regarding the proper disposal of expired medications. This behaviour raises concerns about potential misuse and environmental harm, highlighting the urgent need for structured public education. The study contributes meaningfully to the growing body of knowledge in public health and pharmaceutical practices by identifying specific behavioural patterns and gaps in awareness among educated personnel.

Academically, it supports the integration of medication disposal education into healthcare training and outreach programmes. From an industry perspective, the findings provide valuable insights for developing return-to-pharmacy initiatives and enhancing product labelling to encourage safe disposal practices. At the national level, the results inform policymakers—particularly within the Ministry of Health—of the need to strengthen policies and implement nationwide awareness campaigns. Such efforts are essential to safeguard environmental health and reduce the accumulation of pharmaceutical waste.

In conclusion, while positive attitudes and practices are evident, targeted interventions led by trusted authorities are crucial to addressing the existing knowledge gaps and promoting a more informed, responsible approach to medication disposal in Malaysia.

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References

- Ariffin, M., & Zakili, T. S. T. (2019). Household pharmaceutical waste disposal in Selangor, Malaysia—Policy, public perception, and current practices. *Environmental Management*, 64(4), 509–519. <https://doi.org/10.1007/s00267-019-01199-y>
- Azad, M. A. K., Ansar, R. H., Akhter, A., Al-Mamun, S. M., Uddin, M., & Rahman, M. M. (2012). Disposal practice for unused medications among the students of the International Islamic University Malaysia. *Journal of Applied Pharmaceutical Science*, 2(7), 101–106.
- Boxall, A. B. A., Wilkinson, J. L., & Bouzas-Monroy, A. (2022). Medicating nature: Are human-use pharmaceuticals poisoning the environment? *One Earth*, 5(10), 1080–1084.
- González Peña, O. I., López Zavala, M. Á., & Cabral Ruelas, H. (2021). Pharmaceuticals Market, Consumption Trends and Disease Incidence Are Not Driving the Pharmaceutical Research on Water and Wastewater. *International Journal of Environmental Research and Public Health*, 18(5), 2532. <https://doi.org/10.3390/ijerph18052532>
- Hassali, M. A., Supian, S., Ibrahim, M. I., Al-Qazaz, H. K., Al-Haddad, M., Saleem, F., & Palaian, S. (2012). The Characteristics of Drug Wastage at the Hospital, Tuanku Jaafar Seremban, Malaysia: A Descriptive Study. *Journal of Clinical Diagnostic Research*, 6(5), 787–790.
- Hassali, M. A., & Shakeel, S. (2020). Unused and Expired Medications Disposal Practices among the General Public in Selangor, Malaysia. *Pharmacy*, 8(4), 196. <https://doi.org/10.3390/pharmacy8040196>
- Lam, J., Nsouli, D. E., Lee, E. L., Alqeisi, T., & Armani, K. (2024). Knowledge, attitudes and practices of the healthcare staff and students about disposal of unwanted medications: a systematic review. *International Journal of Pharmacy Practice*. <https://doi.org/10.1093/ijpp/riae058.022>
- Ling, J. Y., Ng, P. Y., Shamsuddin, A. S., Zulkifli, A., & Lee, K. E. (2024). Medication Disposal Patterns and Practices with Awareness of Environmental Contamination Caused by Pharmaceuticals among the General Public in Malaysia. *Asian Pacific Journal of Cancer Prevention*, 25, 2723–2734. <https://doi.org/10.31557/apjcp.2024.25.8.2723>

- Makki, M., Hassali, M. A., Awaisu, A., & Hashmi, F. (2019). The Prevalence of Unused Medications in Homes. *Pharmacy (Basel)*, 7(2), 61. <https://doi.org/10.3390/pharmacy7020061>
- Ministry of Health Malaysia, Pharmaceutical Services Division. (2012). National Survey on the Use of Medicines III (NSUM III). Penang, Malaysia.
- Narang, P., Garg, V., & Sharma, A. (2023). Regulatory, safety and economic considerations of over-the-counter medicines in the Indian population. *Discover Health Systems*, 2(1), 17. <https://doi.org/10.1007/s44250-023-00032-y>
- Ong, S. C., Ooi, G. S., Shafie, A. A., & Hassali, M. A. (2020). Knowledge, attitude and disposing practice of unused and expired medicines among the general public in Malaysia. *Journal of Pharmaceutical Health Services Research*, 11(2), 141–148. <https://doi.org/10.1111/JPHS.12333>
- Saharuddin, N. A., Md Hussin, N. S., & Mohd Noordin, Z. (2024). Assessing Public Awareness and Practices in Medicine Disposal: A Cross-Sectional Study on the Utilisation of the “Return Your Medicines” Program in Terengganu, Malaysia. *International Journal of Pharmaceuticals, Nutraceuticals and Cosmetic Science*, suppl(1), 34–47. <https://doi.org/10.24191/ijpnacs.suppl1.03>
- Sim, S. M., Lai, P. S. M., Tan, K. M., Lee, H. G., & Sulaiman, C. Z. (2018). Development and Validation of the Return and Disposal of Unused Medications Questionnaire (ReDiUM) in Malaysia. *Asia-Pacific Journal of Public Health*, 30(8), 737–749. <https://doi.org/10.1177/1010539518811161>
- Tong, A. Y., Peake, B. M., & Braund, R. (2011). Disposal Practices For Unused Medications Around The World. *Environment International*, 37(1), 292–298. <https://doi.org/10.1016/j.envint.2010.10.002>
- Wang, L. S., Aziz, Z., & Chik, Z. (2021). Disposal Practice And Factors Associated With Unused Medicines In Malaysia: A Cross-Sectional Study. *BMC Public Health*, 21, 1695. <https://doi.org/10.1186/s12889-021-11676-x>
- World Health Organization. (2025). Safe Management Of Pharmaceutical Waste From Health Care Facilities: Global Best Practices. Geneva: World Health Organization. License: CC BY-NC-SA 3.0 IGO.
- Yang, S., Tan, S., Goh, Q., & Liao, S. (2018). Utilization of Ministry of Health Medication Return Programme, Knowledge and Disposal Practice of Unused Medication in Malaysia. *Journal of Pharmacy Practice and Community Medicine*, 4, 07–11. <https://doi.org/10.5530/jppcm.2018.1.3>