

ORIGINAL ARTICLE

Reliability and Validity of the Malay Version of the Return and Disposal of Unused Medications (Redium) Questionnaire in Malaysia and the General Public's Knowledge, Attitude and Practice on Unused Medications

Siew Chin Ong¹, Irwinder Kaur Chhabra^{1,2}, Guat See Ooi³, Nur Aizati Athirah Daud³, Asrul Akmal Shafie¹, Mohamed Azmi Ahmad Hassali¹

¹ Discipline of Social and Administrative Pharmacy, School of Pharmaceutical Sciences, Universiti Sains Malaysia, Malaysia., 11800 Minden Pulau Pinang, Malaysia.

² Pharmacy Department, Sabah Women and Children's Hospital, Ministry of Health Malaysia, Karung Berkunci No.187, 88996 Kota Kinabalu, Sabah, Malaysia.

³ Discipline of Clinical Pharmacy, School of Pharmaceutical Sciences, Universiti Sains Malaysia, Malaysia, 11800 Minden Pulau Pinang, Malaysia.

ABSTRACT

Introduction: In understanding of the general public's knowledge, attitude and practice (KAP) on the returning and disposal of unused medications is imperative towards the designing of better educational materials and policy development. The objectives of this study was to validate the Malay version of the Return and Disposal of Unused Medications (ReDiUM) questionnaire for use among Malaysian as well as to gain an understanding on these patterns of behaviour among Malaysians. **Methods:** The English version of the ReDiUM was translated into Malay language according to international guidelines. Content and face validity of the questionnaire was examined by experts. Subsequently, the questionnaire was pilot tested in 10 native speakers. Reliability was assessed using Cronbach's alpha coefficients. The test-retest reliability was measured with Spearman's Correlation Coefficient and Cohen's κ coefficient. Public were recruited through convenient sampling for the study. **Results:** The study recruited 319 respondents. For test-retest reliability, all the correlation coefficient values were >0.5 indicating strong reliability (26 respondents). Except few items, most of the kappa coefficients were >0.61 indicating substantial to almost perfect agreement. Cronbach's alpha of the KAP domains were 0.585, 0.770 and 0.759, respectively. The median knowledge score was only 50% with some negative attitudes and practices found. **Conclusions:** The translated questionnaire was valid and reliable for use in Malaysia with acceptable to strong internal consistency and most items with substantial to almost perfect agreement. The findings from the study provide supporting evidence for policy makers to develop interventions to help with reducing wastage and optimize healthcare expenditure.

Keywords: Reliability and validity, Unused Medications, Knowledge, Attitude, Practice

Corresponding Author:

Siew Chin Ong, PhD

Email: siewchinong@usm.my; oschin99@yahoo.com

Tel: +604-6533888 (ext 4725)

subsidized by the government.(2) The study estimated the government to pay around MYR 1.5 million in 2007 for the total waste in just one hospital's medical outpatient department (2).

INTRODUCTION

Public healthcare in Malaysia is heavily subsidized by the government, but studies found that this may lead to drug wastage (1-3). Inappropriate medicine use and wastage is a great concern to the Ministry of Health in view of the scarcity of financial resources. A local study found that while patients still had enough of medication stock left for months, they choose to continue collecting as many medications as necessary, as this was free and

On the other hand, inappropriate disposal of unused medications not only has a negative impact on the environment(4), waste-related diseases causing around 5.2 million death each year in Bangladesh alone (5). A review reported that public dispose of unused or expired medications most commonly by throwing into the garbage and flushing medications down the sink, drain, or toilet(6). Improper disposal methods has resulted in the detection of these compounds in the environment and drinking water, which may pose a threat to the

humans health and the environment (7).

Understanding the Malaysian publics' knowledge, attitude and disposal practices of unused medications is essential in the effort to reduce the pollution and wastage related to unused medications. The Return and Disposal of Unused Medications (ReDiUM) tool is a validated tool in Malaysia to measure the knowledge, attitude and practice of returning and disposal of unused medications. The original English version of the tool was developed and validated by Sim et al (8).

Malaysia is a multiracial country with each ethnic group speaking its own language. English is considered as a second language in Malaysia where official statistics showed barely 50 percent of Malaysians are literate in English, while up to 90 percent can speak, read and write Malay(9). Malay language is used by most of its citizens as the national language. Besides Malaysia, Malay language is also widely used in Southeast Asia especially Brunei, Indonesia, Singapore and parts of Thailand. The availability of the instrument in the Malay language would ensure that the instrument can target the population that has been excluded by English version and be used in a larger population. Therefore, the main objective of this study was to validate a Malay version of the ReDiUM for use among Malaysians and those well verse in the language as well as to gain an understanding on the general public's knowledge, attitude and practice on the returning and disposal of unused medications.

MATERIALS AND METHODS

Study design and patient recruitment

This was a cross-sectional study using convenient sampling method. The general public was approached randomly in public areas across Malaysia, for example, shopping centers, hawker or eateries centers and so on between April and July 2019. Participants may choose to use a web-based or a paper-based survey based on their preferences. Survey link was also promoted through social media, for example, Whatsapp, email, Facebook and Instagram. In order to assess the test-retest reliability of the questionnaire, the questionnaire was administered again to the participants one week later after the first set of the questionnaire. The inclusion criteria for participants included Malaysian adults aged 18 years and older who were able to comprehend Malay language. The exclusion criteria were foreigners, aged below 18 years old or from any of the vulnerable groups. The study was approved by the Human Ethics Committee, University Sains Malaysia (HECU2019/003). Prior to data collection, informed consent was obtained from the participants. Sample size calculation.

The sample size was estimated based on the rule of thumb subject to item ratio of 10:1(10, 11). The total number of participants required was 300 as the ReDiUM questionnaire comprised of 30 items (8, 10, 11). In order

to account for possible missing data, an additional 5% of the participants were recruited in the study.

Survey instrument

The survey instrument was divided into five sections. Section A, which was the knowledge section, contains ten questions. One score was given for every correct answer, and zero was given for a wrong or 'do not know' answer. The sum of score was then converted into 0 to 100%. A higher score was interpreted as a higher level of knowledge (8). The difficulty factor was computed for each domain items by dividing the total correct responses with the total number of responses. Higher values indicate the ease of the question, making it harder to discriminate between levels of knowledge. The optimal difficulty level would be 0.5 (12). Section B and C measured the attitude and practice domains on a 5-point Likert scale, have ten questions on each section. One score was given for each "strongly disagree" and five for "strongly agree" response. The scale scores would be described in terms of percentage and median responses on the Likert scale. There were six additional questions appended to the ReDiUM to ascertain participants' actual method of disposing unused medication in Section D. Section E consisted of socio-demographic data of participants.

Translation of the Instrument

The original English version of the ReDiUM and the additional sections were translated and adapted into Malay language according to international guidelines. (13) The questionnaire was translated independently by two bilinguals who were fluent in both languages. The translations were reconciled and another two translators independently translated the reconciled Malay version back into English. The back-translated version was compared with the original questionnaire to ensure its similarity. Content and face validity is to determine whether the questionnaire items could assess the concept satisfactorily and appropriately.(14) An expert panel consisted of an academic pharmacist and expert in the field of health services research and three bilinguals with medical background who were fluent in both English and Malay languages assessed the content and face validity of the questionnaire. They were to ensure that the Malay versions were equivalent to the original English version in terms of its content, wording, and cognitive level and that the questionnaire had been adapted linguistically appropriate to Malaysians. Their suggestions were extensively discussed until obtaining the final version. Ten local Malaysians who knew the Malay language well as native speakers of Malay language were selected for pilot testing the questionnaire. They were asked whether having any perplexity or trouble in understanding questionnaire items as well as possible suggestion to rephrasing of the questions. Their comments and recommendations were recorded by the researchers.

Statistical analyses

Data were analysed using IBM SPSS version 20.0 (IBM Corporation, Armonk, NY) (15). Statistical significance for all tests was set at less than 0.05. Categorical variables were presented as frequencies and percentage. Continuous variables such as age and the percentage of knowledge scores were tested for distributional normality using the Shapiro-Wilk test. As the data were found to be non-normal (p -value < 0.05), the median and interquartile range (IQR) were presented.

Reliability was measured over time (test-retest reliability) and across items (internal consistency) (16). Stability and correlation of the responses between the test and the retest were measured using the Spearman's Correlation Coefficient (r_s), with values >0.7 indicating stable responses.(17) Categories of correlation was defined as strong ($r_s > 0.5$), moderate ($r_s = 0.3 - 0.5$) and weak ($r_s < 0.3$).(18) The intra-rater test-retest reliability was measured using Cohen's κ coefficient as the variables were nominal or ordinal. Cohen's κ coefficient score, which ranges between -1 to 1, is a measure of agreement between two categorical variables. A value of 0 indicates the agreement occurred by chance, 0.01 to 0.20 slight agreement, 0.21 to 0.40 fair agreement, 0.41 to 0.60 moderate agreement, 0.61 to 0.80 substantial agreement and 0.81 to 1 indicating almost perfect agreement(19) between the test and retest responses. The Spearman's correlation coefficient focuses on the association of changes in the test and retest for reliability whereas the Cohen's Kappa measures agreement or the reproducibility during the test and retest for reliability (20).

The internal consistency, which measures how closely related the items are for each domain, was measured using Cronbach's alpha coefficients. Values of 0.7 to 0.9 indicate strong internal consistency while values of 0.5 to 0.69 are considered acceptable (16, 21). Corrected item-total correlations with values of >0.20 indicates that each questionnaire item is correlated to the total score (22). Values of <0.2 indicates low correlation and the item may be considered for removal. By referring to the Cronbach-alpha if item is deleted values, it can be determined if exclusion of the item would enhance the overall reliability of the instrument (22).

RESULTS

Sample Characteristics for Validation Study

A total of 329 potential participants were approached in the study and 319 of them responded (response rate of 97%). Majority of the participants were of Malay ethnicity (78.4%), female gender (72.7%) with a median age of 27.5 years old. More than half of the participants were tertiary educated (53.6%). Table I summarizes the other characteristics of the study participants.

Table I: Participants Demographics (N=319)

Characteristics	Frequency	Percentage
Age	Median (interquartile range): 27.5 (22.0 - 37.0) years old	
Gender	Male	87 27.3
	Female	232 72.7
Ethnicity	Malay	250 78.4
	Chinese	20 6.3
	Indian	19 6
	Others	30 9.4
Level of Education	Undergraduate	171 53.6
	Pre-university	105 32.9
	Postgraduate	5 1.6
	Secondary School	34 10.7
	Primary School	4 1.3
Monthly Income	Less than RM1000	134 42
	RM1000-RM3999	125 39.2
	RM4000-RM6999	54 16.9
	RM7000-RM9999	5 1.6
	More than RM10000	0 0
Marital Status	Single	162 50.8
	Married	154 48.3
	Divorce/Separated	1 0.3
	Widowed	2 0.6
*Region of state	Northern	110 34.5
	Southern	86 27.0
	Central	75 23.5
	East coast	23 7.2
	East Malaysia	25 7.8
Status as Healthcare Professional	Yes	19 6
	No	300 94

*Northern Region: Perlis, Kedah, Penang, Perak; East Coast Region: Kelantan, Terengganu, Pahang; Central Region: Selangor, federal territories of Kuala Lumpur and Putrajaya; Southern Region: Negeri Sembilan, Malacca, Johor; East Malaysia: Sabah, Sarawak, Labuan

Validity

Face and content validity of the questionnaire were deemed satisfactory to the expert panel. All the participants in the pilot test completed the questionnaire unassisted without any problem. Hence, the final questionnaire was used in the subsequent validation study without any further revisions.

Reliability

Table II summarizes the psychometric properties of the Malay ReDiUM questionnaire. We reached out to as many participants as we could, but only 26 samples responded for the test-retest (response rate of 8%) within the interval of 7 days. The r_s value was 0.734 based on the total knowledge scores and >0.5 for all the

Table II: The Psychometric Properties of the Malay version of the Return and Disposal of Unused Medications (ReDiUM) Questionnaire

Domain	Question	Test (N=319)					Retest (N=26)	
		Difficulty Factor	Cronbach's Alpha	Cronbach's alpha if item is deleted	Corrected Item-Total Correlation	Number of Correct Responses, n (%)	Spearman's Coefficient Correlation	Cohen's Kappa
Knowledge	1. Improper drug disposal has harmful effects on the environment and ecosystem	0.84	0.585	0.587	0.159	267 (83.7)	0.734	1.000
	2. Wastewater treatment removes most of the medicines from the environment and ecosystem.	0.24		0.585	0.202	75 (23.5)		0.642
	3. It is acceptable to dispose solid medicines (such as tablets, capsules and patches) in the garbage.	0.56		0.541	0.333	178 (55.8)		0.735
	4. It is acceptable to dispose liquid medicines by throwing down the sink.	0.59		0.548	0.309	187 (58.6)		0.851
	5. It is acceptable to dispose medicines by flushing down the toilet.	0.65		0.549	0.309	208 (65.2)		0.583
	6. Incineration is the environmentally sound way of disposing unwanted medicines.	0.08		0.559	0.27	24 (7.5)		0.840
	7. It is acceptable to dispose needles and syringes in the garbage.	0.77		0.577	0.18	247 (77.4)		-0.040
	8. It is acceptable to return or dispose unused medicines to a local pharmacy or healthcare facility.	0.83		0.565	0.242	264 (82.8)		0.634
	9. It is acceptable to dispose pressurized aerosol metered-dose inhalers (like the Ventolin inhaler) in the garbage.	0.10		0.536	0.365	33 (10.3)		0.285
	10. It is acceptable to dispose creams and ointments in the garbage	0.49		0.544	0.318	156 (48.9)		0.451
Domain	Question	Cronbach's Alpha	Cronbach's alpha if item is deleted	Corrected Item-Total Correlation	Number of Correct Responses, n (%)	Cohen's Kappa		
Attitude	1. It is my responsibility to protect the environment even if others are unconcerned or irresponsible.	0.770	0.735	0.587	4.0 (Agree)	0.766		
	2. It is my responsibility to ensure the safety of other living species on earth.		0.744	0.509	4.0 (Agree)	0.661		
	3. It is my responsibility to protect my household members from unintended harmful exposure to unused medicines.		0.743	0.525	5.0 (Strongly Agree)	0.530		
	4. If medicines are free or heavily subsidised by the government, I will collect all the prescribed medicines even if I have sufficient medicines at home.		0.78	0.2019	2.0 (Do not agree)	0.111		
	5. Media reports and campaigns can influence my willingness to return unused medicines.		0.741	0.508	4.0 (Agree)	0.601		
	6. I believe discarding unused medicines that are still in good condition is a waste of resources.		0.747	0.463	4.0 (Agree)	0.617		
	7. I am willing to donate my unused medicines before expiry to reduce wastage.		0.75	0.444	4.0 (Agree)	0.662		
	8. If there is monetary incentive for me to return unused medicines, I am more likely to do so.		0.756	0.399	3.0 (Neutral)	0.660		
	9. If I have paid for my prescribed medicines, I expect a refund when I return my unused medicines.		0.756	0.397	3.0 (Neutral)	0.523		
	10. If I have excess medicines, I will share my medicines with others		0.753	0.427	3.0 (Neutral)	0.616		
Practice	1. I have unused medicines because I stop taking the medicines when I feel better.	0.759	0.733	0.466	4.0 (Agree)	0.459		
	2. I dispose my medicines when the medicines have expired.		0.749	0.344	4.0 (Agree)	0.680		
	3. I have unused medicines because I experience unwanted side effects.		0.744	0.384	3.0 (Neutral)	0.594		
	4. I dispose my medicines when I experience unwanted side effects.		0.731	0.48	3.0 (Neutral)	0.700		
	5. I have unused medicines because my doctor has changed my treatment.		0.73	0.49	3.0 (Neutral)	0.551		
	6. I dispose my medicines when they smell bad, taste bad, or look bad		0.738	0.434	4.0 (Agree)	0.720		
	7. I have unused medicines because I do not feel better as I have expected.		0.726	0.515	3.0 (Neutral)	0.650		
	8. I dispose my medicines when I have not stored them correctly and my medicines turned bad.		0.741	0.406	4.0 (Agree)	0.667		
	9. I have unused medicines because I have not taken the medicines as instructed/prescribed.		0.736	0.447	3.0 (Neutral)	0.451		
	10. I keep medicines that I no longer require just in case I need them in the future.		0.763	0.28	3.0 (Neutral)	0.490		

individual items in the attitude and practice domains indicating instrument reliability. When all 3 domains were examined on its individual items using Cohen's Kappa, except items 7 and 9 on the knowledge domain and item 4 on the attitude domain had low coefficient values and a few items with moderate agreement, most of the kappa coefficients were >0.61 indicating substantial to almost perfect agreement.

The overall reliability of the questionnaire changed with the addition of each domain. Apart from the knowledge domain with Cronbach's alpha of 0.585, both the attitude and practice domains had strong internal consistency of 0.770 and 0.759, respectively. When the knowledge, attitude and practice domains were analysed together, the index increased to 0.803. On the knowledge domain, item 1 and 7 had corrected item-total correlations less than 0.2. However, removing these items did not significantly improve the Cronbach alpha index, therefore, they were maintained in the analysis. These items were imperative in assessing the knowledge of respondents towards the impact of improper drug disposal.

Knowledge Scores

Table III summarizes the knowledge scores and the responses of the Malay ReDiUM questionnaire. The median total knowledge score was 50% (IQR: 40% - 70%). The minimum score was zero while the maximum score was 80. Item 1, which tested if respondents were aware that disposing drug inappropriately have damaging impact on the environment and ecosystem, had the highest number of correct responses, with a total

Table III: Summary of responses of the Malay version of the Return and Disposal of Unused Medications (ReDiUM) Questionnaire

	Question	True, n (%)	False, n (%)	Not Sure, n (%)
Knowledge Domain	1. Improper drug disposal has harmful effects on the environment and ecosystem	267 (83.7)	10 (3.1)	42 (13.2)
	2. Wastewater treatment removes most of the medicines from the environment and ecosystem.	92 (28.8)	75 (23.5)	152 (47.6)
	3. It is acceptable to dispose solid medicines (such as tablets, capsules and patches) in the garbage.	76 (23.8)	178 (55.8)	65 (20.4)
	4. It is acceptable to dispose liquid medicines by throwing down the sink.	64 (20.1)	187 (58.6)	68 (21.3)
	5. It is acceptable to dispose medicines by flushing down the toilet.	47 (14.7)	208 (65.2)	64 (20.1)
	6. Incineration is the environmentally sound way of disposing unwanted medicines.	24 (7.5)	220 (69.0)	75 (23.5)
	7. It is acceptable to dispose needles and syringes in the garbage.	29 (9.1)	247 (77.4)	43 (13.5)
	8. It is acceptable to return or dispose unused medicines to a local pharmacy or healthcare facility.	264 (82.8)	30 (9.4)	25 (7.8)
	9. It is acceptable to dispose pressurized aerosol metered-dose inhalers (like the Ventolin inhaler) in the garbage.	33 (10.3)	205 (64.3)	81 (25.4)
	10. It is acceptable to dispose creams and ointments in the garbage.	89 (27.9)	156 (48.9)	74 (23.2)
Mean ± SD Score: 51.38 ± 19.38				
Median Score (interquartile range):		50 (40 - 70%)		

Table III (continued)

	Question	Strongly Disagree, n (%)	Disagree, n (%)	Neutral, n (%)	Agree, n (%)	Strongly Agree, n (%)
Attitude Domain	1. It is my responsibility to protect the environment even if others are unconcerned or irresponsible.	11 (3.4)	3 (0.9)	13 (4.1)	145 (45.5)	147 (46.1)
	2. It is my responsibility to ensure the safety of other living species on earth.	9 (2.8)	4 (1.3)	24 (7.5)	142 (44.5)	140 (43.9)
	3. It is my responsibility to protect my household members from unintended harmful exposure to unused medicines.	9 (2.8)	3 (0.9)	8 (2.5)	117 (36.7)	182 (57.1)
	4. If medicines are free or heavily subsidised by the government, I will collect all the prescribed medicines even if I have sufficient medicines at home.	70 (21.9)	116 (36.4)	70 (21.9)	44 (13.8)	19 (6.0)
	5. Media reports and campaigns can influence my willingness to return unused medicines.	16 (5.0)	17 (5.3)	58 (18.2)	142 (44.5)	86 (27.0)
	6. I believe discarding unused medicines that are still in good condition is a waste of resources.	25 (7.8)	22 (6.9)	64 (20.1)	126 (39.5)	82 (25.7)
	7. I am willing to donate my unused medicines before expiry to reduce wastage.	28 (8.8)	46 (14.4)	69 (21.6)	112 (35.1)	64 (20.1)
	8. If there is monetary incentive for me to return unused medicines, I am more likely to do so.	35 (11.0)	62 (19.4)	82 (25.7)	100 (31.3)	40 (12.5)
	9. If I have paid for my prescribed medicines, I expect a refund when I return my unused medicines.	39 (12.2)	66 (20.7)	102 (32.0)	79 (24.8)	33 (10.3)
	10. If I have excess medicines, I will share my medicines with others.	53 (16.6)	78 (24.5)	59 (18.5)	98 (30.7)	31 (9.7)
Practice Domain	1. I have unused medicines because I stop taking the medicines when I feel better.	19 (6.0)	36 (11.3)	47 (14.7)	164 (51.4)	53 (16.6)
	2. I dispose my medicines when the medicines have expired.	9 (2.8)	17 (5.3)	42 (13.2)	157 (49.2)	94 (29.5)
	3. I have unused medicines because I experience unwanted side effects.	27 (8.5)	83 (26.0)	89 (27.9)	99 (31.0)	21 (6.6)
	4. I dispose my medicines when I experience unwanted side effects.	21 (6.6)	67 (21.0)	79 (24.8)	115 (36.1)	37 (11.6)
	5. I have unused medicines because my doctor has changed my treatment.	26 (8.2)	65 (20.4)	114 (35.7)	85 (26.6)	29 (9.1)
	6. I dispose my medicines when they smell bad, taste bad, or look bad.	15 (4.7)	12 (3.8)	52 (16.3)	149 (46.7)	91 (28.5)
	7. I have unused medicines because I do not feel better as I have expected.	33 (10.3)	53 (16.6)	96 (30.1)	114 (35.7)	23 (7.2)
	8. I dispose my medicines when I have not stored them correctly and my medicines turned bad.	15 (4.7)	18 (5.6)	63 (19.7)	156 (48.9)	67 (21.0)
	9. I have unused medicines because I have not taken the medicines as instructed/prescribed.	44 (13.8)	64 (20.1)	94 (29.5)	92 (28.8)	25 (7.8)
	10. I keep medicines that I no longer require just in case I need them in the future.	46 (14.4)	62 (19.4)	61 (19.1)	105 (32.9)	45 (14.1)

of 83.7%. This was consistent with the difficulty factor of the question, which had a value of 0.84, indicating the ease of the question. On the other hand, item 6, which questioned if incineration was an environmentally sound method of disposing unwanted medications, had the lowest percentage of correct responses (7.5%), with a difficulty factor of 0.08. Only around 10% of the participants thought that it is unacceptable to dispose

of pressurized aerosol metered-dose inhalers in the garbage. More than half of the participants (76.5%) did not know or not sure whether wastewater treatment would remove traces of medicine from the environment or ecosystem.

Attitude Scores

More than 85% of the participants agreed that they had a responsibility towards protecting their household members and the environment from exposure to potentially harmful effects of unused medication (Table III). Only around 58% of the participants disagreed with collecting all the prescribed medications even if they have sufficient medications. Most of the participants (71.5%) agreed that media campaigns could influence their decision on returning unused medications and 65.2% agreed that disposing of unused medications which are not expired is wasteful.

In order to decrease wastage, 55.2% of the participants were keen to giveaway their unwanted medications and 43.8% agreed that monetary incentive would motivate them further to return unused medications. However, only 35.1% of the participants expected a refund of money if they were to return unused medications which were self-purchased. With regards to the sharing of unused medication, 40.4% agreed to the practice.

Practice Scores

Most participants agreed that they have unused medications because they stopped their therapy when they felt better (68%), experienced unwanted side effects (37.6%), therapy did not meet their expectations in terms of treatment outcomes (42.9%) or because they were saving it for future use (47%) (Table III). Most participants agreed that they would dispose of unused medications once it has expired (78.7%), if they experienced unwanted side effects (47.7%), if the medications appeared to look, taste or smell bad (75.2%) or if they had not stored it properly (69.9%).

The majority of the participants would dispose of their medications in the rubbish bin, whether it was a liquid, tablet/capsule or ointment/cream formulation (Table IV). For liquid formulations, the most common disposal method was pouring down the sink, followed by rubbish bin disposal.

More than half of the participants (58.6%) claimed to have been in possession of unused medications that they intend to dispose of (Table V). However, less than half (42%) were aware of proper means of disposing unused medications and 64.3% of them have never been educated to send their unwanted medications to the pharmacy. Most participant (90.6%) were not sure of the cost of their unused medication at home and the majority of the participants obtained their medications from government hospitals or clinics (69.6%).

Table IV: Disposal method for each dosage form (N=319)

DISPOSAL METHODS	Liquid medicines, n (%)	Tablets/capsules, n (%)	Ointments/creams, n (%)
Flushing it down the toilet	87 (27.3)	16 (4.1)	3 (0.9)
Pouring it down the sink	148 (46.4)	8 (2.0)	11 (3.4)
Return to pharmacy	67 (21.0)	112 (28.6)	53 (16.6)
Give away or donate to friends/relatives/stranger	44 (13.8)	101 (25.8)	63 (19.7)
Dispose in rubbish bin	143 (44.8)	211 (54.0)	179 (56.1)
By burning	10 (3.13)	47 (12.0)	25 (7.8)
Dispose in biomedical waste bin	55 (17.2)	66 (16.9)	49 (15.4)

Table V: Frequency (percentage) of responses to questions (N=319)

	Frequency, n (%)
Aware of the proper methods of medicines disposal	134(42)
Have been advised by healthcare providers to return unused medicines back to pharmacy	114 (35.7)
Have unwanted medicines at home intended to dispose	187 (58.6)
Cost of unused medication at home	
Estimated mean: RM70.37	30 (9.4%)
Unsure of cost	289 (90.6%)
Total number of medicines at home	
None	28 (8.8)
1 to 5	209 (65.5)
6 to 10	53 (16.6)
11 to 25	19 (6)
Sources of medicine	
Pharmacy	197 (61.8)
Private hospital/clinic	156 (48.9)
Government hospital/clinic	222 (69.6)

DISCUSSION

The content and face validity of the Malay version of the ReDiUM were deemed satisfactory to the expert panel. The questionnaire was well accepted in the pilot test where the participants generally found the questionnaire clear and easy to understand. The Malay version of the ReDiUM tool was also found to be reliable over time and across items. Total knowledge scores and all the individual items in the attitude and practice domains with rs >0.5 indicated that the questions can produce consistent and stable responses. Apart from few items with low to moderate coefficient values, most of the items had substantial to almost perfect agreement between the 2 sampling points and hence a stable instrument. On the other hand, the internal consistency of the overall tool was adequate with a Cronbach’s alpha of 0.803, which was slightly higher than the 0.727 produced from the previous study (8).

The findings of the current study were in line with the previous studies, that most participants were not aware the following facts: 1) incineration is an environmental friendly method to get rid of unused medications; 2) unacceptable disposing of pressurized aerosol metered-dose inhalers in the rubbish bine, and 3) wastewater treatment cannot eliminate most of the medications from the environment or ecosystem (8). Therefore, future education programme should emphasize and enhance

the public's knowledge and awareness of these 3 areas. The attitude of collecting all the prescribed medications even with sufficient quantity on stock was shown to be comparable with previous studies (3, 8). The findings provide additional evidence to the existing observation that heavily subsidized or free medications were linked to higher medication wastage (1, 2). This is a concerning trend as the wastage could cause an escalation in the government's spending on healthcare expenditure and subsequently lead to financial constraints on other crucial areas for development. In view of this, it is critical for the government to review the current policies and provide a sound solution to overcome this wastage problem. Even though the government hospitals and clinics are not-for-profit and meant to provide affordable healthcare for the people, it is wise to selectively sponsor the medications based on patients' income groups. It is recommended that the government only provide free or heavily subsidised medications to those from the low-income groups who really cannot afford the actual cost of the medications at the government hospitals and clinics. For those from the middle-income groups, partial subsidy, or the co-payment system where patients need to have some out-of-pocket sharing for their medications are recommended. Even with co-payment system, the structure of payment could impact on the level of wastage too(23). On the other hand, the attitude towards sharing unused medications indicates that there is a lack of awareness regarding its negative consequences and safe use of medications. In a study conducted in the United States, medication sharing had resulted in unanticipated adverse events, complications from incorrect use, delay in seeking treatment or misuse of medications (24).

Disposal of medications into the rubbish bin was the most common method used for a combination of all dosage forms, consistent with several other local studies(25-28) and international studies(29-31). Disposal of unused medications into the rubbish bin is far from ideal where landfilling is the main method used to manage solid waste in Malaysia(32). Subsequently, the disposed medications may cause pollution and risking abusing of drug, toxicities and death(33). The medications that end up in landfills could later resurface in water sources too, potentially contaminating aquatic life and water sources (4).

The present study supported the fact that majority of the participants will pour their liquid medications to the sink. The practice will potentially causing the active pharmaceutical ingredients (APIs) pollution if the APIs failed to be eliminated by the sewage treatment process (34).

Ideally, unused medications should be returned to the pharmacy for proper disposal by waste management companies. In 2010, the Malaysian Ministry of Health introduced the Medication Return Program, with the

objective of providing a safe place to dispose of unused medications (35). Despite its existence, Yang et al. showed that it was underutilized, citing that awareness regarding the existence of the program was low and there should be an agenda to promote this service to the public(28). This was reinforced by the findings of this study, where more than 50% of the participants were neither aware of the proper disposal method nor have they been advised to send unwanted medications to the pharmacy. One possible method of increasing the awareness of the public is by providing informational texts regarding proper disposal methods on the packages of prescription medications. This method was used in Sweden(36), which was one of the countries that has successfully created the awareness that the proper disposal method to return unused medications to a pharmacy for proper handling.

This study has several limitations. First, the number of participants available for the test-retest reliability was limited in the current study. Therefore, the test-retest reliability results in the current study should be taken with caution. This was mainly due to the current study was conducted across all regions in Malaysia which restricted the possibility to revisit the participants for the second set of responses. The survey was done voluntarily without any financial remunerations or benefits, hence we depended on the respondents' goodwill to respond to us when they were approached again. Second, the evaluation of the instrument's responsiveness was not possible with the cross-sectional study design of the current study. Third, empirical validity such as criterion and construct validity were not possibly assessed at the time of the study as there was no other similar validated instrument for comparison purpose. Fourth, the respondents surveyed were generally young and slightly over-represented by females. Consequently, the generalizability of the findings to Malaysians as a whole should be taken with caution. Despite these limitations, the strength of the study was that the study managed to recruit participants from all regions in Malaysia and validated the Malay version of the ReDiUM in terms of the face and content validity as well as the reliability tests.

Future studies should look into testing the test-retest reliability of the translated questionnaire with a larger sample size. In addition to that, this study has also revealed the lack of knowledge and poor practices of the Malaysian public towards unused medications despite the existence of the Medication Return Program. Future studies could also include how the Medication Return Program can be further advanced with the findings of this study.

CONCLUSION

Our study provides evidence to support the translated Malay version of the ReDiUM as a valid and reliable tool

to evaluate public's knowledge, attitude and practice on the return and disposal of unwanted medications in Malaysia. The questionnaire has acceptable to strong internal consistency. With the exception of a few items, most items had substantial to almost perfect agreement. In addition, the knowledge, attitude and practice scores from this study provides supporting evidence for policy makers to address the potential problems regarding the perception and the disposal practices of the Malaysian public. Interventions to address these shortcomings could result in reduced wastage and savings in health care expenditure.

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