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Disposal Practice for Unused Medications among the Students of the International Islamic University Malaysia

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ABSTRACT

This survey has led to an enhanced international awareness of the potential detrimental effects on the environment. The main objective of this survey is to develop of public awareness about harmful effect of medications waste. This was a descriptive cross-sectional survey involving with patients based on a structured questionnaire format with answer sets and asked why people do not use all of their medications; why they are keep unused medications, storage and how to dispose their medications. This study carried out at International Islamic University Malaysia (Health center Gombak campus, Selangor) and the medical college of the International Islamic University Malaysia (kuantan campus, Pahang). Although, 87% of the respondents; they known about medications waste but only near about 2% of the respondents who are follow drug-take-back system because of above 93% of the respondents, they did not know about drug-take-back system. Most of the participants reported disposing of these in a manner that leads to their ending up in a landfill more than 65%. Finally, 83% of the respondents added to a disposal system ultimately ending up in a landfill. In this survey suggests that there is an urgent need to develop of public awareness and there is also need to develop dispensing policies & delivered to collection bag which deduction the volume of medication waste.

Keywords: Household pharmaceutical Medications waste, Aquatic environment, dispensing policies, Antibiotic resistance.

INTRODUCTION

Medical waste is a subset of solid waste and is defined as any solid waste which is generated in the diagnosis, treatment (e.g. Provision of medical services), or immunization of human beings or animals in research pertaining there to, or in the production and testing of biological. The global increase in the use of pharmaceuticals had led to an enhanced international awareness of the potential detrimental effects on the environment from the disposal of these compounds either to landfills or to the aquatic environment (Halling-Sorensen *et al.*, 1998). For example, even trace levels of ethinyl estradiol (the active component of a common oral contraceptive) found in waterways has been shown to impair sexual development and the feminization of fish (Jobling *et al.*, 2006). There is also evidence that the presence of antibiotics in waterways has impact on the bacteria present and may lead to antibiotic resistance (Costanzo *et al.*, 2005).

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Improperly dispose of medications potentially pose a significant environmental risk (Daughto, 2003) and storage of unwanted or unused medication in the household provides an increased risk of accidental childhood poisonings (Beirens *et al.* 2006, Franklin and Rodgers, 2008). Health policies that give raise to increased medication waste as well as improper disposal of household pharmaceuticals potentially increase these problems. One estimate shows that some 5.2 million people (including 4 million children) die each year from waste-related diseases. Globally, the amount of municipal waste generated will double by the year 2000 and quadruple by year 2025” (Haque, 1994; Akter *et al.*, 1999). Concerned with this situation Agenda 21, adopted in the United Nations Conference on Environment and Development (UNCED) in Rio de Janeri in June, 1992, set the following goals and targets with regard to waste management in cities:

Anti-infective drugs and anti-neoplastics are encapsulated to delay release to the environment and avoid high concentrations. Small quantities of solid and semi-solid pharmaceuticals, typically not more than 1% of the total daily waste, can be disposed of directly in a landfill with large volumes of municipal solid waste, if no other suitable method is available. Previous research has indicated that that the adaptation of dispensing may have lead to a significant amount of medications with a Large monetary value being return to pharmacies (Braund *et al.*, 2008). International studies have suggested that the volume and the cost of medications that are returned to pharmacies represents only a small portion of unwanted medications that are dispose of annually or remain in the community unused. Studies in the UK found that only 22% of unused medications are returned to a pharmacy (Bound and Voulvoulis 2005) similar to the 23% reported in a USA study (Seehusen and Edwards, 2006). This is an improvement on the figure of only 2% returned to us pharmacies 10 years earlier (kuspis and Krenzelok, 1996). There is also evidence that targeted campaigns can influence the way that patients handle unwanted medications (person *et al.*, 2008).

To ascertain the potential environmental impact of improperly disposed medications in Malaysia, it is necessary to determine the amount of unused medications that are not currently returned to a pharmacy and disposed of via the landfill or water systems. Additionally if the reasons for why there are unwanted or unused medications in patients’ households can be identified, it might be possible to target strategies to minimize wastage and

encourage safe and appropriate disposal of these medications. In this study we report the results of questionnaire administered to IIUM medical college and Health center.

METHODS

Study Design

This was a descriptive cross-sectional survey involving with patients based on a structured questionnaire format. This study carried out in the health center (Gombak campus, Selangor) and medical college of the International Islamic University Malaysia (kuantan campus, Pahang).

Study Population

The study populations include educated adults that are able to read clearly of all questions. All the respondents who fulfilled the inclusion criteria were selected. This study period was from February 2011 to November 2011.

Inclusion and Exclusion criteria

Inclusion Criteria

Adults of more that eighteen years of age; currently using or had previously took medicine according to prescription within the past three months.

Exclusion Criteria

Respondents had previously took medicine without prescription within past three months.

Survey Instrument

The questionnaire was placed by the interviewer to the individual respondents and collected question-sheet with their answers. The questionnaire was divided into two sections. The first section asked for demographic data including age, gender, ethnic group and educational level. In the second section, questions about various type of medications waste were listed namely solid, liquid and semi-solid medications. A series of questions with predefined answer sets as shown in table-1 were used to ask about collection of medications, why there may be unused medications, how they are stored and how they are disposed of. The order in which the predefined answer sets were displayed was changed for each question to ensure that the respondent read all answers and to minimize selection bias of the displayed answer.

Table. 1: Questions and possible response options given to participants.

Questions	Response options
When you get a prescription from a doctor, do you collect all the medications that were prescribed the first time even if you decide that you do not need some of them?	Yes or No
Do you collect all of the prescription repeats even if you decide that you do not need /want them	Yes, no or no answer
Do you have any leftover unused or unwanted prescription medications in your house at present?	Yes or no
There are many different reasons Why people do not use all of their medications. Please tick all the reasons that apply to you.	Change to another treatment Excess quantity supplied Inconvenience/difficulty following instructions Medicine level had unclear instructions Medical condition improved or resolved Other Patient deceased Passed expiry date Side-effects of medication Unsure why medicine was prescribed

Why do you keep unused medications?	Do not want to waste them I do not keep them I dispose of them In case they are needed later Not sure how to dispose of them Other To give them away To keep a 'stockpile' in case of shortages
Where do you usually store your medications?	Bathroom Bedroom Kitchen No answer Other Burn
How do you dispose of your unused a)Liquid medications b)Tablets/capsules c)Ointments/creams	Down the toilet Down the sink Take it to the tip Give away No answer Return to pharmacy With the household rubbish
Do you know about medication waste?	Yes or No
Are you known about drug -take-back system?	Yes or No
Are you never following drug-take- back system?	Yes or No

The data was then quantified and all of the options given in the other category were identified and collated.

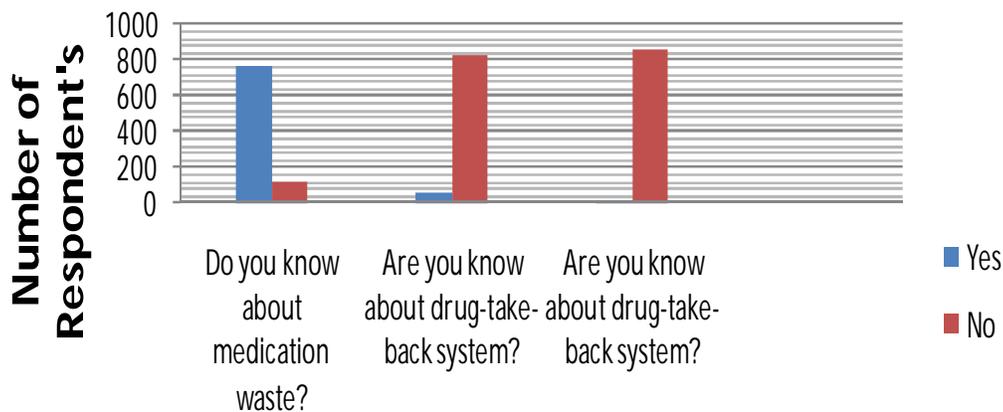


Fig. 1: Awareness type question about medication waste and system .

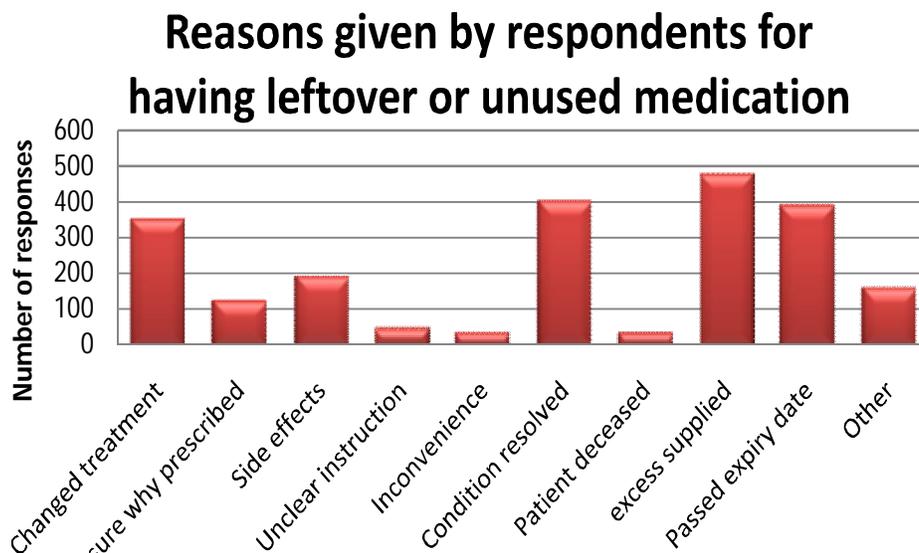


Fig. 2: Reasons given by respondents for having leftover or unused medications



Fig. 3: Reasons given by respondents for why they keep unused medications.

Respondent's method of disposal depending on medication formulation type

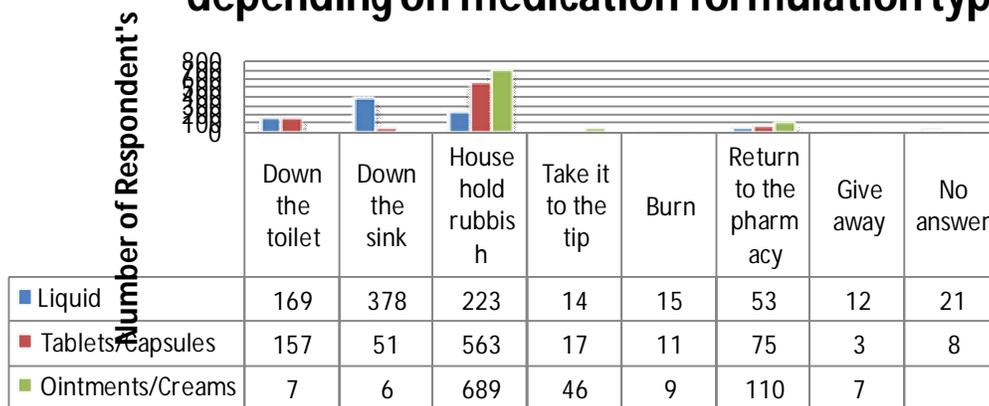


Fig. 4: Respondent's method of disposal depending on medication formulation type

RESULTS

Over the 10 month collection period we are received 1067 respondents from 1200 unique respondents and it was completed by 885 individuals. In table 2 the respondents given possible answer about awareness and disposal system that's who are practically followed his/her life. Here most of the respondents; they known about medication waste (N=768) and they did not know (N=117). On the other hand, a large portion of the respondents did not know about drug-take-back system (N=828), and only a small portion of the respondents knew about drug-take-back system (N=57). In spite of, a little parts of the participants were follow drug-take-back system (n=16). Where as a big portion of the respondents did not follow this system.

Table. 2: Awareness type question about medication waste and system.

Question	Answer	
	Yes	No
Do you know about medication waste?	768	117
Do you know about drug -take-back system?	57	828
Do you never follow drug-take- back system?	16	869

The respondents were given a number of possible answers including 'other' to select as to why they did not use the medications. More than one answer could be selected. The most common reasons given by respondents for having leftover or unwanted medications was 'changed to other treatment' (n=354), 'passed expiry date' (n=389), 'medical condition improved or resolved' (n=398), 'excess quantity supplied' (n=478), 'side-effect of medication' (n=187), 'medicine labels had unclear instructions' (n=44), 'unsure why medication was prescribed' (n=123), 'inconvenience or difficulty following instructions' (n=34), and 'patient deceased' (n=35) and 'other' category respondents (n=158).

In table 3 shows the reasons that respondents still have unwanted medications at home. More than half of these respondents indicated that they had kept unused medications at home because they are not sure how to dispose of them. Almost half of the respondents (49%) store their medications in the bedroom and the other category included response such as hall cupboard or garbage. As shown in table 3, near about 62% (n=547)

of the respondents dispose of unwanted liquid medications into the domestic water system, via the toilet or sink. A further almost 27% (n=237) add liquid medications to a waste disposal system which ultimately end up in a landfill. Only 6% (n=53) return these medication to the pharmacy for disposal. With respect to solid dosage form (tablets and capsules), more participants reported disposing of these in a manner that leads to their ending up in a landfill more than 65% (n=580), while 8% (n=75) return the unused medications to a pharmacy. Lastly, response to the question concerning ointments and creams indicated that more than 1% of the respondents (n=13) disposed of this type of medication via the water system, but 83% (n=735) of the respondents added to a disposal system ultimately ending up in a landfill, with only 12% (n=110) returning unwanted medication to the pharmacy.

Table. 3: Respondent's method of disposal depending on medication formulation type

Response	Medication formulation type		
	Liquid	Tablets/Capsules	Ointments/creams
Down the toilet	169	157	7
Down the sink	378	51	6
With household rubbish	223	563	689
Take it to the tip	14	17	46
Burn	15	11	9
Return to pharmacy	53	75	110
Give away	12	3	7
No answer	21	8	11

Precaution of data collection and ethical issues

Ethical considerations are essential to any form of data collection in a humanitarian operation. Collecting information for any purpose, including monitoring, assessments or surveys, can put people at risk not only because of the sensitive nature of the information collected, but also because simply participating in the process may cause people to be targeted. The risks can range from physical violence to social marginalization and are often unknown to the individual soliciting the information. Therefore, participants were treated fairly and with dignity. Because the research involved an intrusion into the private lives of the participants, the researcher and FIs were always respectful, polite and reliable to the respondents. This helped to built rapport between interviewer and respondents. Proper training of field personnel represents a critical aspect of quality control. Before conducting the study, ten Field Investigators (FI) were recruited from different universities based upon their previous experience regarding the field level data collection. It was noted that almost all of the FIs had already received training on the use of standardized protocols to ensure safe and ethical collection of data, and to ensure compatibility among different

DISCUSSION

This has been achieved through a process of reducing patient co-payment and increasing the volume of dispensed medication as previously not all monthly refills were collected. It could be speculated that this combination of low co-payment part charge and large volumes of dispensed medications may lead to unwanted or unused medications being available in people's

homes. The present study found that 62% of homes had leftover, unused or unwanted medications during the period of survey data collection (20, 02.2011). Further evidence of this excess is provided by the number of responses to the reasons for having medications including 'changed treatment', 'condition resolved', 'excess supplied' and 'passed expiry date'. This excess of medications in homes leads to the issue of appropriate disposal in homes and has potential implications for accidental childhood ingestions (Beirens *et al.*,2006, Franklin and Rodgers,2008) It is important to understand why this medication accumulates in order to reduce the potential impact to the environment, potential for diversion and to reduce healthcare spending (Ruhoy and Daughton,2008) Unused pharmaceuticals that are not returned to the dispensing source are more likely to be disposed of as solid waste in a landfill or flushed down a toilet to become a component of liquid sewage. As mentioned in the introduction, research in the USA found that 54% of people added unwanted medications to household waste and 35% disposed of them down the toilet or sink (kuspis and Krenzelok,1996). By comparison, in 2005, 63% of the respondents in a UK survey discard unused medications in the household waste, 11% emptied them into the sink or toilet and 22% returned them to a pharmacy (Bound and voolvoulis, 2005). The present study undertaken in New Zealand, indicated between 13 and 24% of medications are returned to a pharmacy, and that this percentage depends on the formulation type. For example, only 17% of respondents return liquid medications to pharmacies with over 55% disposing via the toilet or sink. It is important to remember that these liquid formulations include analgesics, antibiotics and agents that act on the central nervous system. Conventional sewage treatment facilities were never designed to remove trace constituents such as pharmaceutical compounds but rather just to improve bulk properties such as odour, colour, the total level of suspended solids, the biological oxygen demand (BOD) and to ensure the pH of the effluent was acceptable for discharge into any receiving water. Given the variable physical and chemical properties of pharmaceuticals, their removal efficiency using conventional primary and/or secondary treatment can vary significantly (jones *et al.*,2001) This situation has led to many of the pharmaceutical compounds having long half-lives that can lead to accumulation in treated sewage effluents to reach biologically-active levels (Fent *et al.*,2006) Studies in the USA have shown that landfill leach ate can be a significant source of organic waste water contaminants with decreasing concentrations being detected further away downstream from a landfill (Barnes *et al.*,2004) Many states in the USA recommend disposing of pharmaceuticals in plastic before entry into the landfill to reduce the likelihood of their leaching out into any water draining from the site Glassmeyer *et al.* 2009). Further approaches being investigated include 'take-back' and 'mail-back' schemes in attempts to reduce the introduction of pharmaceuticals into the environment (Glassmeyer *et al.*,2009) Although the present study would suggest that there is a significant proportion of unwanted prescribed pharmaceutical material flushed into sewage systems or disposed of in landfills in Malaysia, few measurements appear to have been reported on the resulting levels

of these compounds in the Malaysia environment either in parent form or in a degraded form arising from chemical reaction in the body, or after some form of waste treatment (Gielen *et al.*, 2009, Sarmah *et al.*, 2006 & 2008) There also appears to be only one published report of the potential environmental impacts in Malaysia of any of these pharmaceutical materials (Schallenberg and Armstrong, 2004) However current overseas research clearly indicates even trace levels of many of these compounds can have a detrimental effect on the environment by affecting aspects of biological activity (Jones *et al.*, 2003; Kostich and Iazorchak, 2008) Therefore it is essential that all aspects of pharmaceutical use and disposal should be further investigated within Malaysia.

CONCLUSION

Practice of proper medical waste disposal and management is also inadequate. In this survey suggests that there is an urgent need to develop of public awareness and education on medical waste issues through the campaign and a disposal of unwanted medication properly (DUMP) in community pharmacy. From this study, it can be said that there is also need to develop dispensing policies which deduction the volume of medication waste and also delivered to collection bag to each patient for the collection and disposal of unwanted medications. For further study, it is needed to collect more information on impacts, disposal and management to draw a clear conclusion.

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REFERENCE

Akter, N., R. E. Acott, S. A. Chowdhury, (1998). Medical Waste Disposal at BRAC Health Centres An Environmental Study. BRAC Research, Research and Evaluation Division, 75 Mohakhali C/A, Dhaka 1212.

Barnes K, Christenson S, Kolpin D, Focazio M, Furlong E, Zaugg S, *et al.* Pharmaceuticals and other organic waste water contaminants within a leachate plume downgradient of a municipal landfill. *Ground Water Monit Remediat* 2004;24:119–26.

Beirens TM, van Beeck EF, Dekker R, Brug J, Raat H. Unsafe storage of poisons in homes with toddlers. *Accid Anal Prev.* 2006; 38:772–6.

Braund R, Chuah F, Gilbert R, Gn G, Soh A, Tan L, *et al.*

Identification of the reasons for medication returns. *N Z Fam Physician* 2008;35:248–52.

Bound JP, Voulvoulis N. Household disposal of pharmaceuticals as a pathway for aquatic contamination in the United Kingdom. *Environ Health Perspect* 2005;113:1705–11.

Costanzo SD, Murby J, Bates J. Ecosystem response to antibiotics entering the aquatic environment. *Mar Pollut Bull* 2005;51:218–23.

Daughton CG. Cradle-to-cradle stewardship of drugs for minimizing their environmental disposition while promoting human health. II. Drug disposal, waste reduction, and future directions. *Environ Health perspective* 2003;111:775–85.

Franklin RL, Rodgers GB. Unintentional child poisonings treated in United States hospital emergency departments: national estimates of incident cases, population based Poisoning rates, and product involvement. *Pediatrics* 2008;122:1244–51.

Fent K, Weston AA, Caminada D. Ecotoxicology of human pharmaceuticals. *Aquat Toxicol (Amsterdam, Netherlands)* 2006;76:122–59.

Glassmeyer ST, Hinchey EK, Boehme SE, Daughton CG, Ruhoy IS, Conerly O, *et al.* Disposal practices for unwanted residential medications in the United States. *Environ Int* 2009;35:566–72.

Gielen GJ, van den Heuvel MR, Clinton PW, Greenfield LG. Factors impacting on pharmaceutical leaching following sewage application to land. *Chemosphere* 2009;74:537–42.

Halling-Sorensen B, Nors Nielsen S, Lanzky PF, Ingerslev F, Holten Lutzhoft HC, Jorgensen SE. Occurrence, fate and effects of pharmaceutical substances in the environment — a review. *Chemosphere* 1998;36:357–93.

Jobling S, Williams R, Johnson A, Taylor A, Gross-Sorokin M, Nolan M, *et al.* Predicted exposures to steroid estrogens in U.K. rivers correlate with widespread sexual disruption in wild fish populations. *Environ Health Perspect* 2006;114(Suppl 1):32–9.

Jones OA, Voulvoulis N, Lester JN. Human pharmaceuticals in the aquatic environment a review. *Environ Technol* 2001;22:1383–94.

Jones OA, Voulvoulis N, Lester JN. Potential impact of pharmaceuticals on environmental health. *Bull W H O* 2003;81:768–9.

Kuspis DA, Krenzelok EP. What happens to expired medications? A survey of community medication disposal. *Vet Hum Toxicol* 1996;38:48–9.

Persson M, Sabelstrom E, Gunnarsson B. Handling of unused prescription drugs —knowledge, behaviour and attitude among Swedish people. *Environ Int* 2008. doi:10.1016/j.envint.2008.10.002.

Seehusen DA, Edwards J. Patient practices and beliefs concerning disposal of medications. *J Am Board Fam Med* 2006;19:542–7.

Schallenberg M, Armstrong A. Assessment of antibiotic activity in surface water of the lower Taieri Plain and impacts on aquatic bacteria in Lake Waipori, South Otago, New Zealand. *N Z J Mar Freshw Res* 2004;38:19–28.

Sarmah AK, Northcott GL, Leusch FD, Tremblay LA. A survey of endocrine disrupting chemicals (EDCs) in municipal sewage and animal waste effluents in the Waikato region of New Zealand. *Sci Tot Environ* 2006;355:135–44.

Sarmah AK, Northcott GL, Scherr FF. Retention of estrogenic steroid hormones by selected New Zealand soils. *Environ Int* 2008;34:749–55.

Ruhoy IS, Daughton CG. Beyond the medicine cabinet: an analysis of where and why medications accumulate. *Environ Int* 2008; 34:1157–69.