

Original Research Article

EVALUATION OF THE KNOWLEDGE, ATTITUDES AND PRACTICES OF SUBJECTS REGARDING SAFE DRUG DISPOSAL IN A TERTIARY CARE HOSPITAL IN SOUTH INDIA

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A B S T R A C T

Background: Contamination of ecosystem with Pharmaceuticals and their metabolites is an emerging global issue. Drugs enter into the environment during manufacturing, consumption and disposal. Pharmaceutical products have shown to endanger the fish, birds and other wildlife. Creating awareness and educating public about pharmaceutical waste management is necessary to protect the environment. This study was conducted to study knowledge, attitudes and practices (KAP) of general population as understanding the levels of KAP will enable a more efficient process of creating awareness and seeking solutions.

Materials and Methods: A descriptive cross-sectional study was conducted using a pre-validated semi-structured questionnaire related to knowledge, attitude and practices regarding safe drug disposal. The questionnaire consisted of 14 questions with close ended answer of "yes" or "No" and an objective question. The sample size was of 1000 subjects. The data was analysed and presented as percentages.

Results: In our study, majority of subjects (96%) felt that it was their responsibility to protect environment from pharmaceutical waste. A significant majority (85%) were aware of the potential threat to public by expired or unused medicines if not disposed of properly. Only 21% of subjects were aware of rules that could minimize drug entry into the environment. Most of the individuals (95%) in our study thought that collection boxes in hospitals and pharmacies to collect unwanted/ expired medicines from public would be good. Further, 88% of the participants approved the policy of manufacturers and pharmacies to have drug take back schemes

Conclusion: We hope this study creates awareness among public regarding proper drug disposal and helps policy makers to form drug disposal regulations.

Keywords: Safe Drug Disposal, Environment, KAP.

INTRODUCTION

The presence of medicinal products in the environment is a globally emerging issue. Ecopharmacology or environmental pharmacology a component of pharmacovigilance is an emerging science which deals with the presence of pharmaceuticals in environment (PIE) and the adverse impact of the pharmaceutical active ingredients on the environment.^[1] Medications and their metabolites can enter the environment during their manufacturing, consumption, and disposal.^[2,3] The inappropriate discarding of medicines in trash, toilets or sinks, as well as industrial waste and veterinary uses, are common sources of pharmaceuticals entry into the environment.^[4,5] Medicinal products even at low concentrations, may cause adverse effects in living organisms.^[6]

Pharmaceuticals have been proved to be a threat to fish and other wildlife, potentially impacting their reproductive abilities, altering their behavior that is deleterious for their survival, or inducing direct adverse effects.^[7-10] In addition, they may increase the significant challenge of antimicrobial resistance.^[7-10] Creating awareness and educating public about pharmaceutical waste management is important to protect the environment and prevent drug related disasters. In India, no such national programs aim to control the safe disposal of unused medicines and make the public aware of the problem. To achieve this objective, a prior assessment of general public's knowledge, attitudes, and practices (KAP) concerning drug disposal is imperative. Hence this study was conducted to study KAP. Understanding the levels of KAP will enable a more efficient process of creating awareness and seeking solutions.

MATERIALS AND METHODS

This is a descriptive cross-sectional study. The study population comprised of patients from the outpatient department of our tertiary care hospital. Sample size was calculated to 382 using Yamane equation but due to good inflow of patients we included 1000 participants in the study. The study duration was from November 2024 to January 2025.

It was a questionnaire-based survey. Study was conducted using a pre-validated semi-structured Questionnaire.^[11,12] The questionnaire was designed which consisted of two sections. Section one is about respondents' personal information including gender, age and education. Section two of the questionnaire comprised of questions related to participant's knowledge, attitude and practices regarding safe drug disposal. The questionnaire consisted of 14 questions with close ended answer of "yes" or "No" and an objective question. Before filling out the questionnaire, the study participants were explained the study's importance and purpose. Voluntary written informed consent was taken prior to getting the questionnaire filled.

Subjects who were conscious, oriented, aged between 18-60 years, of either gender and were willing to provide voluntary written informed consent were included in this study. Completed questionnaires were collected from all participants to evaluate their responses. The data was analyzed using statistical software SPSSv23 and Microsoft excel.

Ethical Considerations: The present study protocol was approved by our Institutional Ethics Committee before the commencement of the study. Additionally, prior to the collection of any information from the patients, their written

voluntary informed consent was obtained. Only the data on the study variables were analysed, and all the personal information of the patients was kept confidential.

RESULTS

Majority of the patients belonged to the 41–50 years age group (40%), followed by the 31-40 years group (36%). Their mean age was 44.96±8.90 years. Out of 1000 consenting participants 683 (68.3%) were male and 317 (31.7%) females. Further, 4% of the patients were illiterate, while only 62% of them had completed their graduation or post-graduation. With reference to occupation, 21% patients were housewives or unemployed, 9% were engaged in farming, 26% were engaged in business, 18% were labourers, and rest of the patients were employed or in service (26%). Further, 11% of the patients had a poor socioeconomic status, 23% belonged to the lower middle class, majority of them (58%) belonged to the middle class, and only8% of them were in the upper class (Graph 1).

In the present study, a majority of 85% understood that unused/expired medicines which are not disposed properly can be a threat to public safety. Likewise, a large number of them were aware that medications can cause environmental pollution and antimicrobial resistance with 71% and 70% respectively. Only 21% of subjects were aware of rules that could minimize drug entry into the environment (Table 1).

Majority (95%) of the participants were bothered by the thought of discarding drugs. A huge number of study subjects believed there should be guidelines for the public for environmentally safe drug disposal and they were ready to participate in activities and initiatives related to safe disposal of medicines, comprising of 95% and 96% members respectively. Most of the individuals (95%) in our study thought that collection boxes in hospitals and pharmacies to collect unwanted/ expired medicines from public would be good. Further, 88% of the participants approved the policy of manufacturers and pharmacies to have drug take back schemes (Table 2).

When it came to buying medicines in bulk for family members, 62% of our subjects agreed to it. A lage part of our participants discard medicines only if it has expired. Only 31% remove the drug from its cover/container before discarding it in the garbage and 13% had the habit of pouring unused leftover lotion/ syrup from the bottle into the wash basin (Table 3).

Most common method used for drug disposal by our subjects (71%) was throwing drugs in the garbage bin. (Graph 2).

Table 1: Knowledge of participants regarding safe drug disposal	
Questions	Yes (in%)
1) Can unused/expired medicines which are not disposed of properly, pose a threat to public safety?	85%
2) Are you aware that the medicines we consume can cause environmental (water and soil) population?	71%
3) Could improper medicine disposal potentially be one of the reasons for antibiotic resistance?	70%
4) Do you know if we have any rules and regulations for minimising the risk of drug entry into the	21%
environment?	

Table 2: Attitudes of participants regarding safe drug disposal	
Questions	Yes (n%)
1) Does the thought of disposing of unused or extra medicines bother you?	95%
2) Do you believe there should be guidelines for the public for environmentally safe drug disposal?	94%
3) Dou you think there should be collection boxes in hospitals and pharmacies to collect unwanted/expired	95%
medicines from the public?	
4) Should manufacturers and pharmacies have drug take-back schemes?	88%
5) Do you feel it is your responsibility to protect the environment from pharmaceutical hazards?	96%
6) Are you willing to actively participate in activities and initiatives related to the safe disposal of	96%
medicines?	

Table 3: Practices of participants regarding safe drug disposal	
Questions	Yes (n%)
1) Do you buy medicines in bulk for family members?	62%
2) Do you discard medicines only if they have expired?	90%
3) Do you remove the drug from its cover/container before discarding it in the garbage?	31%
4) Do you pour unused left over lotion/syrup from the bottle into the wash basin?	13%



Graph 1: Pie chart showing the gender ratio of participants



Graph 2: Methods used for drug disposal by the participants

DISCUSSION

Some studies done around the world have stated that most patients stored their medications unwilling to waste them, were unaware of the proper and safe way to dispose of medicines, all these can lead to unintentional risks to both health and environment.^[13]

Knowledge

In our study, majority participants (85%) agreed that unused or expired medicines, if disposed inappropriately, posed a threat to public safety. This finding was in consensus with studies done by Woldeyohanins et al, in Ethiopia, Naser et al. in Jordon and Bhadoriya SS et al. in India with 88.4%, 72.5% and 96% respectively.^[11,14,15] However, similar Indian study by Kumar, et al showed that 76.6% were unaware of the consequences of improper drug disposal.^[13] The awareness regarding drugs causing water & soil pollution was on higher side in our study with 71% but was much lower when compared to the survey conducted by Bhadoriya SS et al. on Indian population which conveyed a positive response of 91.15%.^[11] When it came to risk of antibiotic resistance in our study, 70% of subjects felt that improper drug disposal could pose unwarranted risk of the same which was in concurrence with 86% respondents of Bhadoriya et. al. and 80.4% of Khanavkar et. al. in similar studies done in India.^[11,12] Most participants (79%) were ignorant about rules and regulations for minimizing the risk of drug entry into the environment, which was in contrast to the findings obtained in studies by Bhadoriya et. al. and Khanavkar et. al. where large part of subjects had the knowledge about the rules and regulations meant for safe drug disposal with 76.13% & 52% respectively.[11,12]

Attitude

The thought of disposing of unused or extra medicines troubled a very high number of participants (95%) in the current study. On the brighter side, a large majority of participants (88-95%) demonstrated positive attitude for a variety of initiatives for proper drug disposal, including the provision of collection boxes at hospitals for unused drugs and medicine take-back programs facilitated by manufacturers and pharmacies. These values mirrored the findings of Bhadoriya et al. (94-98%) and Khanavkar et. al. (84-95%).^[11,12] The present study subjects (96%) were compassionate towards the environment and felt it was their responsibility to protect the environment from pharmaceutical hazards and agreed to actively participate in activities and initiatives related to safe disposal of drugs.

Practices

In the current study 62% of individuals said that they bought medicines in bulk which was in agreement with the study conducted by Bhadoriya et. al. with 51% of participants.^[11] Here, only 31% of our respondents removed the drug from its cover/container before discarding it in garbage and just 13% of them discarded leftover syrup and lotions into the drain. However, this was inconsistent with observation seen by Khanavkar et. al. where 58% and 76.5% admitted to discarding drugs without containers and pouring leftover syrup/lotion into the wash basin, respectively.^[12]

Most preferred method of drug disposal.

In the present study, the preferred method for disposing of leftover or expired medicines among the majority of participants (71%) was discarding in the garbage. This was close to the findings of studies carried out in India by Raja et al. and Narwat A et al. where in large number of individuals 63.3% & 62% respectively, disposed medicines in trash.^[16,17]

CONCLUSION

KAP studies are necessary for designing efficacious awareness and disaster prevention programs. Environment protection is the need of the hour. According to our study, most of the individuals have the right attitude and knowledge about the environmental hazards and other consequences of inappropriate drug disposal, but they lag behind in practicing safe method of disposal. We could bridge this gap by having proper rules and regulations by policy makers and creating awareness among the public. Although our study provides important baseline data, it is associated with limitations such as the limited sample size, the inclusion of outpatients alone, and the incorporation of a single study Centre.

REFERENCES

- Rahman SZ, Khan RA, Gupta V, Uddin M. Pharmacoenvironmentology - A component of Pharmacovigilance. Environ Health 2007; 6:20.
- 2. Kümmerer K. The presence of pharmaceuticals in the environment due to human use--present knowledge and future challenges. J Environ Manage 2009; 90:2354-66
- Lapworth DJ, Baran N, Stuart ME, Ward RS. Emerging organic contaminants in groundwater: A review of sources, fate and occurrence. Environ Pollut 2012; 163:287-303.
- Quadra GR, Oliveira de Souza H, Costa RdS, Fernandez MAdS. 2017. Do pharmaceuticals reach and affect the aquatic ecosystems in Brazil? A critical review of current studies in a developing country. Environ Sci Pollut Res 24:1200–1218.
- Stephanie Klatte, Hans-Christian Schaefer, Maximilian Hempel, Pharmaceuticals in the environment – A short review on options to minimize the exposure of humans, animals and ecosystems, Sustainable Chemistry and Pharmacy, Volume 5, 2017; 61-66.
- Chaturvedi, P., Shukla, P., Giri, B. S., Chowdhary, P., Chandra, R., Gupta, P., et al. (2021b). Prevalence and hazardous impact of pharmaceutical and personal care products and antibiotics in environment: a review on emerging contaminants. Environ. Res. 194:110664. doi: 10.1016/j.envres.2020.110664
- Le Page Y, Vosges M, Servili A, Brion F, Kah O. Neuroendocrine effects of endocrine disruptors in teleost fish. J Toxicol Environ Health B Crit Rev 2011; 14:370-86.
- Fabbri E. Pharmaceuticals in the environment: Expected and unexpected effects on aquatic fauna. Ann N Y Acad Sci 2015; 1340:20-8.
- Oaks JL, Gilbert M, Virani MZ, Watson RT, Meteyer CU, Rideout BA, et al. Diclofenac residues as the cause of vulture population decline in Pakistan. Nature 2004; 427:630-3
- Shanmugam G, Sampath S, Selvaraj KK, Larsson DG, Ramaswamy BR. Non-steroidal anti-inflammatory drugs in Indian rivers. Environ Sci Pollut Res Int 2014; 21:921-31.
- 11. Bhadoriya SS, Wadagbalkar P. A questionnaire based study on the knowledge, attitude, and the practice of ecopharmacology among the healthcare professionals in Amaltas Medical College and Hospital, Dewas, Madhya Pradesh. Int J Basic Clin Pharmacol2024; 13:101-6.
- Khanavkar RP, Hannan A, Dhodi D, Chawre SM, Bhure AS, Raj D. An assessment of knowledge, attitude, and practices toward ecopharmacology among healthcare professionals at a tertiary care center – A cross-sectional study. Natl J Physiol Pharm Pharmacol 2024;14(06):1198-1203.
- Kumar LS, Logeshwaran, Rani NV, Thennarasu P, Keerthana M, Lavanya M. Assessment of Knowledge and Awareness on the Disposal of Expired and Unused Medicines among Medication Consumers. J Young Pharm. 2019;11(4):410-69.
- Woldeyohanins AE, Adugna M, Mihret T, Kifle ZD. Knowledge, Attitude, and Practices of Unused Medications Disposal among Patients Visiting Public Health Centers in Gondar Town, Ethiopia: A Cross-Sectional Study. J Environ Public Health. 2021 Dec 30; 2021:5074380. doi: 10.1155/2021/5074380. PMID: 35003272; PMCID: PMC8739181.
- Naser, A.Y.; Amara, N.; Dagash, A.; Naddaf, A. Medications disposal and medications storage in Jordan: A cross-sectional study. Int. J. Clin. Pract. 2021, 75, e13822
- Raja S, Mohapatra S, Ramu T, Rani J. Knowledge, Attitude and Practice (KAP) Towards Disposal of Unused and Expired Medications: an Assessment Among Patients. Biomed Pharmacol J 2022;15(3).
- Narwat A, Sindhu A. Practice towards disposal of medicines (unused/expired drugs) among the patients visiting tertiary care teaching hospital in Haryana, India. Int J Res Med Sci 2019; 7:3050-3.