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Original Research Article

Knowledge attitude and practice of medical personnel on ecopharmacology

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ABSTRACT

Background: Increasing disease incidence and prevalence has led to tremendous increase in the use of medications. The consumers are not able to use all the dispensed medications because of various reasons. The improper disposal of these unused medicines has led to environmental contamination to an alarming extent. The present study aims to assess the knowledge, attitude and practice of medical personnel about disposal of unused medicines.
Methods: The study was conducted on post graduate medical students, MBBS and nursing students of a tertiary care hospital of North India. It was cross sectional, descriptive study based on a structured questionnaire to assess the knowledge, attitude and practice about the disposition of left-over medications. Descriptive statistical analysis of the results was done.
Results: Stockpiling was reported by 100% of the students. The most common reason for stockpiling was excess purchase of medicines (41%). The most commonly procured medicine was NSAID (55.9%). The most common method of disposal was with household waste (69%). Majority of the respondents answered that take back programmes and government interference is the solution to this problem.
Conclusions: Majority of the people are having unused medicines at home and most commonly they dispose it by throwing along with rubbish. Lack of knowledge regarding proper disposal is the main reason behind this. Initiatives should be taken to spread awareness regarding proper disposal methods of unused medicines.

Keywords: Ecopharmacology, Disposal of medicines, Unused medicines

INTRODUCTION

Medications are essential part of one's lifestyle and left over medicines are commonly found at every home. The reasons of accumulation of left over and expired medicines can be discontinuation of therapy, start of new medicine or expiry of medicines. As per the literature reports these stocked medicines are disposed by improper methods leading to environmental hazard.[1] The presence of pharmaceuticals and their products in environment are potentially hazardous. Their accumulation in water contributes to increased antibiotic resistance or exposure of population to drugs including aquatic animals.[2] In addition personal care products, pesticides used in fields also enter the surface water, ground water leading to entry in to food chain. Disposal of accumulated drugs (unused, partially used, unneeded or expired) by both hospitals and patients maximize the introduction of active pharmaceutical ingredients (APIs) to the environment by dodging natural physiological processes that might have reduced their amounts via excretion.[3] This disturbs the whole ecosystem e.g. indirect exposure to diclofenac lead to substantial decline in number of vultures in Indian subcontinent and inculcation of the same. NSAID (non steroidal anti-inflammatory drug) in treatment of livestock and consumption of their dead bodies by vultures led to their kidney failures and consequently they were declared as endangered species.[4] Various

Government and non-Governmental organizations became active to save these most efficient scavengers of nature. In effort to improve the natures balance Government of India also banned diclofenac in India for veterinary use.[5] But the solution for this problem is not only banning a single medicine but to look out for all the causes leading to entry of chemicals in ecosystem. Medicine disposal habits are influenced by environmental awareness, availability of official state guidelines, dosage form, social and cultural attitudes. Sink, toilet and rubbish bins are the most commonly used but environmentally unfriendly routes of drug disposal. A huge pileup of expired and unused medications in the medicine cabinets among public reflects ignorance regarding disposal techniques and how drugs affect the environmental health.[6] Although FDA has issued certain guidelines for proper disposal but still in India people are not that much aware.[7] Assessing and improving Knowledge, Attitude and Practice towards disposal of unused medicines is the need of the hour. This serves as an important measure for the policy makers and concerned environmental regulatory bodies for development of formalized protocol for accurate and safe drug disposal guidelines along with destruction of expired drugs and also a driving force to control the drug wastage.

METHODS

Study design and population

This was a descriptive, cross-sectional survey, conducted through pre-validated structured questionnaire. The study was conducted in LLRM medical college, Meerut over a period of four months between JULY 2021 to October 2021. The study population was of either gender, which included MBBS students from LLRM medical college Meerut.

Sampling and questionnaire

A non-probability sampling technique (convenience method) was employed to reach to the representative population in our institute. Total of 200 participants were included. The questionnaire was designed which consisted of two sections. Section one was about respondent's personal information including gender, age and education. Section two of the questionnaire included questions related to participants knowledge, attitude and practices regarding ecopharmacology. The questionnaire consisted of 20 questions out of which 3 were open ended & remaining were close ended.

Data collection and analysis

The data collectors were trained and prevailed upon to explain the purpose of the study to their respondents prior to administering the survey questionnaire. Participation in survey was voluntary. The questionnaire was provided in English only. All returned questionnaires were double-checked for accuracy and then the collected data were feed into an excel spreadsheet dataset. 190 participants completed the questionnaire satisfactorily and only those were included for evaluation by descriptive manner. Written informed consent was obtained from all the respondents before the start of the survey. Participation in this research was voluntary. Participant identity was kept confidential.

RESULTS

Out of 200 consenting participants 190 MBBS students satisfactorily completed the questionnaire and were included for evaluation. The response of participants regarding knowledge of "ecopharmacology" was as summarized (Table 1).

Table 1: Knowledge about ecopharmacology amongst participants (n=486).

Questions	Yes (%)
Have you heard of the term "ecopharmacology"?	73.25
Do you feel drugs that you consume can cause environmental (water and soil) pollution?	91.15
Have you read any media reports regarding effects of drugs pollution on environment?	84.97
Do you think environmental pollution by drugs can be a reason for antibiotic resistance and cumulative toxicity?	86
Do you know if companies in India have rules and regulations for minimizing the risk due to drug entry into the environment?	76.13
Can the expired /unused medicines which are not properly disposed poses hazard to public safety	96.09

When asked about routes by which drug can pollute environment >75% answered soil, water and air. As shown in the (Table 1), knowledge and awareness about ecopharmacology in or study was good. Most of the participants knew about this issue through media report and were aware of the hazardous effect of drugs in environment. Responses to the items intended to measure participants' attitudes towards ecopharmacology. attitude of participants was empathetic is depicted in (Table 2). They were aware of issue as well as bothered by excess medicines at home. Very few felt that their methods of drug disposal were safe and most agreed that there was a need for safe drug disposal guidelines for public. The need for drug collection locations and take back schemes for safe drug disposal was accepted by almost all of them. Majority of participants felt it is their responsibility to protect the environment and expressed willingness to participate in campaigns for raising the awareness about this issue.

Table 2: Attitude of participants towards ecopharmacology (n=486).

Question	Yes (%)
Has it ever bothered you, what to do with excess medicines?	83.12
In your opinion are the present methods* safe for disposing medicines?	17
Do you think there should be guidelines for public for ecologically safe disposal of drugs?	94.03
Do you think there should be safe medicine disposal locations (e.g. collection boxes for unused drug in hospitals, pharmacies in city)?	92.18
Do you think manufactures and pharmacies should have drug take back schemes?	97.94
Will you participate in activities like campaign for this issue?	94.23
Do you feel it's your responsibility to protect environment from the pharmaceutical waste?	97.73

As shown in (Table 3), half of the participants practice purchasing the medicines in bulk. Most common medicines left unused at home were paracetamol and antibiotics. 64.19% of respondents said that unused medicines were in tablet form, 25.10% in syrup form and 10.69% in ointment form. Many drugs are released into the environment, which makes them pollutants, through industrial waste and subproducts, animal and human excretions, household garbage, etc.

Table 3: The practices of participants about ecopharmacology (n=486).

Question	Yes (%)
Do you buy drugs in bulk for family members?	51.02
Do you remove he drug from its container before throwing in the garbage?	18
Do you pour leftover syrup/lotion from the bottle in the wash basin?	18

DISCUSSION

Poor knowledge and unsafe disposal practices are alarming in medical students of a tertiary care hospital and teaching institute and we can easily relate the grave situation prevailing with the common man. Some previous studied among health professionals, undergraduates' students [8] and consumers/patients in Indian scenario have also mentioned a poor requisite knowledge and practice of safe methods of disposal are currently inadequate.[9]

Stressing on education at root levels seems to be like at the point of prescription (doctors), point of dispensers (pharmacist), point of consumption (consumers) and at point of waste disposal management (various agencies). An attention and appropriate action to the drug environment interaction and the hazards which can be seen presently and in near future is the need of the hour. Medications are not immortal. Drug expiration dates are meant to indicate the date at which the drug potency begins to diminish. It is legal requirement, that all pharmaceutical products must carry the date of manufacture and date of expiry on their label which is called life period or shelf life of drug. The expiry date of a pharmaceutical specifies the date that manufacturer guarantees the full potency and safety of a drug. Checking of expiry date is a practice to be implemented. In India the schedule P (rule 96) drugs and cosmetics act (1940) specifies the life period (mostly 1-5 yrs.) of drug and conditions of storage. Medications are not immortal. Drug expiration dates are meant to indicate the date at which the drug potency begins to diminish. It is legal requirement, that all pharmaceutical products must carry the date of manufacture and date of expiry on their label which is called life period or shelf life of drug. The expiry date of a pharmaceutical specifies the date that manufacturer guarantees the full potency and safety of a drug. Checking of expiry date is a practice to be implemented. In India the schedule P (rule 96) drugs and cosmetics act (1940) specifies the life period (mostly 1-5 yrs.) of drug and conditions of storage.

Authors observed that the knowledge of ecopharmacology in the study group was satisfactory and majority of them had read the media reports regarding it. Most of our participants (91.15%) felt that the drugs they consume could cause environmental pollution and were aware of the hazardous environmental and health impact of improper disposal of unused and expired medicines. Studies of drug disposal practices in university students from Kabul and general population from Serbia have also reported of awareness on this issue but lesser than our study.[10,11] In present study 86% of the participants agreed that environmental pollution by drugs can be reason for antibiotic resistance and cumulative drug toxicity. A wide range of antibacterials have been observed in waters and soils and many of these persist for some time. Subtle effects of pharmaceutical compounds on aquatic and terrestrial organisms have been reported. One such study indicated that increased amount of pig manure resulted in increased levels of tetracycline resistance in the soil, which could pose a threat to human and animal health.[12] According to the media report, antibiotics we throw away may be breeding superbugs. Researchers found that at entry of Yamuna River near Wazirabad in north Delhi, concentrations of fluconazole (antifungal), ofloxacin (antibiotic) and ibuprofen (painkiller) were less than 0.05 micrograms per liter. At the Yamuna's exit near Okhla barrage, the concentrations of fluconazole, ofloxacin and ibuprofen increased by 80, 96 and 50 times, respectively.[13] Present study participants were concerned about the disposal of the excess medicines at home but were unaware of safe disposal methods. There are WHO

guidelines for 'safe disposal of unwanted pharmaceuticals'.[14] In addition to that; National Formulary of India also has an appendix 7 regarding the methods of disposal of unused/expired pharmaceutical products. Good manufacturing practices (GMP) laid down in Schedule M of the 'drugs and cosmetics rules, 1945' also give the requirements for disposal of waste including the rejected drugs.[15] These guidelines are useful for wholesale chemists, clinics, hospitals and pharmaceutical manufacturers but not for general consumers. This is a finding reflected in our study where 96% of our participants agreed regarding the need for guidelines for ecologically safe disposal of drugs by people. Responses from 87% showed that they throw away the excess medicines in the household trash. This is similar to findings of the study an Asian study in which most of the respondents (234/301; 77.7%) were throwing the expired medicine in household trash while 21.3% of the respondents returned unused and expired pharmaceuticals to medical stores. Returning expired and unused medicines to medical stores is community practice in the USA (23%) and UK (22%).[10,16,17] Whereas in present study, none of the participants have done this. Another method of disposal observed in our study was that 44% of the participants shared their excess medications with other when indicated. Few other studies have also reported the practice of sharing of medications albeit in 1-2% of the study population, probably because they were from non-medical background.[10,18,19] Total 18% of studied participants practiced pouring of liquid medication in the wash basin. Similar practices were reported in studies from Kuwait, UK and USA.[17,20] According to standard guidelines also small quantity liquid medications should be diluted with water and drained. Drugs or their metabolites also find their path to enter the food chain through this route.[21] Therefore, studies have been conducted throughout the world about this issue to find the policy solutions. Indian government also needs to be proactive to launch feasible expired pharmaceutical collection programs, such as Francisco's safe medicine disposal program, dispose a med program, chemical control program, sharps waste disposal program expired medications drop-off operation in California USA. [22] Medications return program or take-back programs in Canada, Meds disposal in Europe. [23-5] The Nebraska medication education for disposal strategies (MEDS) has suggested the "golden standard" for safe, legal, environmentally sound disposal, to put tamper resistant boxes in pharmacies that will allow consumers to bring medicines back to knowledgeable pharmacists.[10] In Sweden and Korea, more people return unused medicines to a pharmacy for correct disposal, as they have realized the environmental concerns posed by expired medicines.[26,27] The proper and best option for the safe disposal of pharmaceutical waste is incineration which requires third party intervention for the collection of unwanted medicines.[28] For example, in Australia, the return of unused medication service runs a medication collection and destruction service through community pharmacies which employ a high-temperature incineration method approved by the US Environmental Protection Agency.[29] In Taiwan, an educational pharmacist intervention booklet has been designed to teach their customers in how to use and store the medications properly.[30] Many of the big pharmaceuticals are supporting the take-back schemes worldwide, India needs to be the part of it. Participants, in present study have also suggested the same. The following combinations of management strategies will most likely be effective in mitigating the risks presented by pharmaceuticals in the environment, rational drug use, pharmaceutical-return programs, raising awareness among stakeholders, i.e., patients, doctors, nurses, and pharmacists, Advanced effluent treatment with sophisticated sewage treatment plants and waste water treatment plants Advani et al. Incentives for the development of "green" pharmaceuticals, and improved regulations and guidance on pharmaceutical waste management. There is evidence that targeted campaigns can influence the way patients handle unwanted medications.[16] It was observed that in USA only 2% people returned unused medicines to USA pharmacies; 10 years later the percentage of people returning unused medicines to pharmacy raised to 23%.[17,30,31] Careful and proper disposal of medications can help to decrease environmental load of drugs. All multidisciplinary stake holders will need to work together hand in hand to reduce burden of unused and expired medicine on ecosystem. Proper waste management strategy is needed to ensure health and environmental safety.[2] From the questionnaire it was observed that the knowledge of medical personnel and student about ecopharmacology and problems associated with it was good. Attitude of medical personnel and students was also very empathetic, but this is not transforming into practices. Gaps exist in knowledge and practices, therefore robust, safe and cost-effective pharmaceutical waste management program supported with media campaign is needed. Healthcare practitioners and community pharmacists should be trained and then offer training to educate customers on standard medicine disposal practices.

Limitations

The limitation of our study is that it included a small sample size from a specific region; so, a generalization cannot be made. Self-reported data is subject to recall bias and is thus a confounding factor. Moreover, mutual influence between the students could not be ruled out. Nevertheless, this study gives an insight into a problem that has not been given the importance it deserves.

CONCLUSION

Low level of knowledge about EPV poses direct hazard to environment. Government/institutional intervention for take back programmes is need of the hour. Initiatives should be taken to spread awareness through various mass media means.

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