Comparison of the knowledge, attitude, and practices of doctors, nurses, and pharmacists regarding the use of expired and disposal of unused medicines in Delhi

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Abstract:

Objectives: The use of out-of-date medicines and improper disposal of pharmaceutical products harm consumers and environment. To limit pharmaceutical load on the environment, it is important that healthcare professionals (HCPs) are aware of and have good practices toward their disposal.

Materials and Methods: A pretested instructor administered questionnaire containing 21 questions was used to assess knowledge, attitude, and practices (KAP) of 300 HCPs toward use and disposal of unwanted/expired medicines.

Results: Nurses (76%) had significantly ($P < 0.01$) better knowledge over doctors regarding the methods of drug disposal, whereas both doctors (63%) and nurses (64%) knew significantly ($P < 0.05$) more than pharmacists about type of formulations not to be incinerated. The majority (88%) of overall respondents were unaware of validity of dispensing medicines before 15 days of mentioned expiry date. A large proportion of HCPs had a positive attitude toward checking the expiry date of medicines (96%), and a significant proportion of doctors and nurses believed that drug disposal is everyone’s responsibility. Only 8% of the HCPs received unused/expired drugs back from the consumers. Nurses (59%) had better ($P < 0.01$) practice than pharmacists regarding the disposal of expired medicines. Nearly half (44%) of all HCPs agreed that there existed a system for removing expiry and unused medicines from the inventory.

Conclusions: The KAP of HCPs toward use and disposal of out-of-date and unused medicines need upgrading. The existing guidelines should be implemented to ensure patients’ safety and to preserve the ecosystem.

Key words: Disposal of unwanted medicines, expiry medicines use, healthcare professionals, unused medicine disposal

Recently, several reports have documented the presence of pharmaceuticals and their metabolites in the environment including surface and drinking water, in the concentration ranging from nanograms to micrograms per liter. The detectable levels of pharmaceuticals in the environment cause chronic exposure to humans or animals which may pose a threat to their health and may also have detrimental environmental consequences. The primary reason for the presence of pharmaceuticals in the environment is their excretion by humans either unchanged and/or metabolites into sewage. In addition, inappropriate disposal of unwanted medicines including out-of-date medicines may further contaminate the environment. The excretion of synthetic gestagens, levonorgestrel and drospirenone, from the body into water bodies has adversely caused masculinization of female fishes and inhibition of their reproduction.

Accumulation of unused and expired medicines at households usually results from excessive prescribing by doctors and/or poor patients’ adherence to prescribed medicines. If unused post-expiry date medicines are disposed inappropriately, they may further increase the threat to the environment as such medicines may have different safety profile. For example, expired tetracyclines can cause renal tubular damage. The impact of improper disposal of expired medicines is also not limited to aquatic environments, but solid waste, thus leading to total contamination of the environment.

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expired medicines has not been studied in the literature. To minimize the adverse impact of pharmaceutical compounds on the environment, the challenges related to the improper disposal of unused and expired medicines needs to be addressed.13,14

In addition to the availability of required infrastructure (e.g., landfill, incinerator) to dispose of unwanted and expired medicines, it is imperative that the public, including healthcare professionals (HCPs), are aware of proper disposal methods and harms associated with their improper disposal. A survey conducted in the UK revealed unhealthy practices of 400 households where they disposed unused and expired pharmaceuticals either as household waste or via the sink or toilet.13 An Indian study on the knowledge, attitude, and beliefs about the disposal methods for expired and leftover medicines recommended the need to improve their awareness about safe and prudent disposal methods.14 While treating patients, HCPs including doctors, nurses, and pharmacists can apprise them and their attendants regarding the safety issues related to the use of out-of-date medicines and their disposal. HCPs should have updated knowledge and awareness in this regard. Hence, this study was conducted to generate baseline data on the knowledge, attitude, and practices (KAP) of doctors, nurses, and pharmacists on the use of out-of-date medicines and disposal of unwanted and expired medicines.

Materials and Methods

The mixed methods questionnaire which included qualitative and quantitative responses was used to conduct this study after the approval of the Institutional Human Ethics Committee. Doctors, nurses, and pharmacists who gave their written informed consent were enrolled in the study. A pretested questionnaire comprising 14 items to assess knowledge, 4 for attitude, and 3 for practices was employed. Most of the questions had multiple choices with one or more correct options, and two were of subjective type. The questionnaire was instructor administered to 100 each of medical doctors, nurses, and pharmacists working at Lady Hardinge Medical College and associated tertiary care public hospitals, New Delhi, taken as a sample of convenience. Since there were very few pharmacists in this institution, the qualified pharmacists working at private pharmacies in the nearby vicinity of tertiary care hospital were included. A significant proportion of doctors (95%) and nurses (94%) believed that it is everyone’s responsibility to dispose unused/expired medicines [Table 1]. Only 8% of the HCPs received unused/expired drugs back from the consumers.

Half of the pharmacists (53%) agreed that there existed a system for removing expiry medicines from the inventory. However, only 16 pharmacists knew of the correct temperature required in the incinerator to dispose of unwanted medicines. Nurses had higher scores (59%; P < 0.01) for practices than pharmacists (46%) regarding disposal of unused medicines in terms of their disposal in black containers [Table 1].

None of the pharmacists working in this institution agreed to participate in the study. As a result, KAP of 100 pharmacists working in private pharmacies in the nearby vicinity of tertiary care hospital were included. A large proportion of HCPs (96%) had positive attitude toward checking the expiry date of medicines. The majority (93%) of the study respondents believed that it is unsafe to use expired medicines with 77% agreed that there were issues related to both safety and potency.

Regarding the preferred and recommended method (disguise and put such medicines in thrash) of disposal of unused and expired medicines, nurses (76%) had significantly (P < 0.01) better knowledge over doctors (59%). In this regard, more doctors (16%) preferred to dispose unused and expiry date medicines through flushing than nurses (8%) and pharmacists (8%) [Table 1 and Figure 1], which is not a recommended method. Nurses (82%) also had higher scores of knowledge than doctors and pharmacists with regard to the last day of mentioned month or expiry date of the medicines [Table 1]. Doctors (63%) and nurses (64%) had significantly better knowledge than pharmacists (46%) about the type of formulations (i.e., inhaler) not to be incinerated [Table 1]. Majority (88%) of the respondents were unaware of the validity of dispensing medicines, i.e., 15 days before mentioned expiry date.

A significant proportion of doctors (95%) and nurses (94%) had higher scores (59%; P < 0.01) for practices than pharmacists regarding disposal of unused medicines in disguise and put in the trash or flush them.
Table 1: Responses of the doctors, nurses, and pharmacists to the study questionnaire used to assess their knowledge, attitude, and practices toward use and disposal of unused/expired medicines

| Parameters studied                                      | Correct responses (n) |
|--------------------------------------------------------|-----------------------|
| What should be done to dispose of unused/expiry date medicines | Doctors | Nurses | Pharmacists |
|                                                         | 59       | 76**   | 70         |
| Does waste water treatment remove all drugs before they reach waters? | 38       | 26     | 27         |
| If only month and year have been mentioned as expiry date, the day of expiry will be | 71       | 82*    | 69         |
| If it is mentioned that use before month and year mentioned as expiry date, the day of expiry will be | 40*      | 24     | 30*        |
| Expiry date of two different formulations in fixed drug combination is | 38       | 38     | 48         |
| What is an average shelf life (expiry date) of medicines? | 36       | 57**   | 53*        |
| Validity until the expiry date before which medicine should be dispensed? | 15       | 12     | 8          |
| For which types of formulations, method of incineration for disposal is restricted? | 63*      | 64*    | 46         |
| For incineration, which level of temperature is good? | 80***.5** | 49***  | 16         |
| Disposal of unused/expiration medicines is whose responsibility? | 95**     | 94***  | 66         |
| Expiry/expiry medicines should be put in which color container? | 47       | 59**   | 37         |
| Is there exist a system in place for removing expiry medicines from the inventory | 44       | 48     | 53         |

Comparison of: doctors versus nurses: *P<0.05, **P<0.01, ***P<0.001; nurses versus pharmacists: *P<0.05, **P<0.01, ***P<0.001; pharmacists versus doctors: *P<0.05, **P<0.01, ***P<0.001

Discussion

Although the study was conducted in New Delhi, India, the implications of this study apply to the whole world. The rapid growth of the pharmaceutical industry and the increased consumption of pharmaceutical products have led to their increasing presence in the environment with diverse biological effects. This is a challenge and is receiving increasing attention.[18]

It should be the responsibility of all the HCPs to check the expiry date mentioned on the pharmaceutical products before they are dispensed and/or consumed and to ensure their proper disposal. The World Health Organization, US-Food and Drug Administration, and Indian Guidelines for Safe Disposal of Unwanted Pharmaceuticals medicines recommended high-temperature incineration with temperatures greatly in excess of 1200°C for solids, semisolids, and powders forms of pharmaceuticals including antineoplastic and controlled substances.[14–18]

Majority of all the respondents (93%) in this study opined that medicines were not safe postexpiry. Similarly, a study of the general public in Karachi opined that their use was harmful.[19] The knowledge of HCPs and consumers in this regard may be based on the propagation of information by the drug regulators[20] and pharmaceutical industry, generally not supported by scientific evidence, though the use of expired date tetracycline has found to be associated with permanent harm.[13]

In the process of drug development, a new chemical entity is not studied for any deterioration in its efficacy, potency, and safety after proposed expiry date; however, its expiry date is based on stability and sterility studies.[20] It is documented that at expiry, drugs should be at least 90% potent.[22]

In our study, nurses (76%) had significantly better knowledge over doctors (59%) regarding the method of disposal of unused/expiry medicines [Table 1]; whereas in the USA, 25% of physicians were aware of the correct method for disposal of unused medication.[23] In this study, pharmacists (37%) had better disposal practices than that reported (15.9%) from Kuwait.[24] Better knowledge and practices of the respondents in our study could be due to their formal training during undergraduate and postgraduate teaching about the use and disposal of unwanted medicines; whereas in the USA, the majority (75%) of the physicians had no formal training and many were unaware of such guidelines.[23]

Pharmacists (84%) in this study expressed their concern toward protecting the environment from disposed medicines. Similarly, Kuwaiti pharmacists (97%) also expressed their concern to protect the environment.[24] It is important to understand that the improper disposal of medicines may contribute to their presence in the ecosystem despite treatment of the sewage.[1–3] Of these, antibiotics are of growing concern as fractions of many antibiotics used for preventing or treating infections in humans or animals and for promoting faster growth of livestock and intensive fish farming are excreted unchanged, either to sewage treatment plants or directly in water bodies causing antibiotic resistance.[25]

It is imperative for every country to have guidelines for disposal of unwanted and expired medicines which may influence the practices of its people to dispose them properly.[24] In this study, 53% of the doctors and 63% of the pharmacists were unaware of the color code of the containers, a method for removing unused medicines from the inventory, and only 16% of the pharmacists knew the optimum temperature required for the incineration of unwanted drugs. This was probably due to their inadequate awareness and practices. It has been reported that most of the pharmacists used trash, sink, or toilet to dispose of unwanted medicines, which is not the ideal method.[24]

Ingenious collection and disposal system for the unused and expired medicines is pivotal in ensuring the safety of the natural environment and mankind. The adoption and implementation of global policy on disposing unused medicines through landfills[27] and drug take-back system[16] are crucial. In a few countries, drug take-back program is practiced,[28] in which the pharmacy is considered as the nodal point for the collection of unwanted medicines and the pharmacist plays a role as a campaigner for the proper disposal of medicines.[24]

It is concluded that the current KAP of HCPs including doctors, pharmacists, and nurses toward the use and disposal
of expired and unused medicines are inadequate. There is a need to design an innovative policy, namely the drug take-back program, and to motivate the health regulators to strengthen and implement the existing drug disposal policies more effectively. Teaching undergraduate and postgraduate medical, nursing, and pharmacy students and conducting continuous medical education training for HCPs on the use, collection, and disposal of expired and unwanted drugs are recommended. Such endeavors may safeguard the ecosystem and the mankind.

Conclusion

There were certain limitations in the study conducted. In this study, KAP of qualified pharmacists working in private sector were studied and compared with that of doctors and nurses working in public tertiary healthcare setup. There is also need to understand the practice and awareness of the public to make any such program a success.

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Conflicts of Interest

There are no conflicts of interest.

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