World Journal of Pharmaceutical Sciences
ISSN (Print): 2321-3310; ISSN (Online): 2321-3086
Published by Atom and Cell Publishers
Available online at: http://www.wjpsonline.org/
Original Article

Education on disposal of medicines - A concept on safe disposal of drugs in curriculum of Indian Education system

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Received: 09-06-2015 / Revised: 19-07-2015 / Accepted: 26-07-2015

ABSTRACT

The aim of the study was to analyze the availability of safe drug disposal guidelines in the curriculum of health care professional courses like medical, dental and nursing in Indian education system. This was a cross sectional observational study, it was conducted from February 2015 to April 2015 and it was carried to identify and correlate the availability of drug disposal guidelines in the curriculum. The data collected was analyzed and results expressed in counts and percentages. None of the Indian Universities of medical, dental and nursing education had mentioned about drug disposal practice in their educational curriculum, none of the text books in the medical, dental and nursing courses has discussed about pharmaceutical waste management (excluding biomedical waste management) in any chapter and there was no questions asked in examination of last 5 years duration of these courses in these Universities. The results of this study suggested that there is a lack of knowledge regarding management of unwanted medicines and there is a very important need for new educational curriculum for medical/ dental and other health care professionals to minimise this lacuna.

Keywords: Drug disposal, medical, dental, nursing education, curriculum

INTRODUCTION

The improper disposal of pharmaceuticals by environment unfriendly routes poses a hazardous threat to environment and health of human beings. The most common practice for the disposal of unwanted medicines includes flushing down the toilet, simply disposing in garbage and poured down the sink [1]. There are several reasons why drugs are unused. For instance, change of treatment course, death of the patients, side effects and medicines reaching expiry date [2]. Two routes by which pharmaceuticals enters environment have been identified, These include as a metabolic waste when taken and after the body absorb some of the drug content while the others are excreted in an unchangeable form into sewage lines which may sip into environment and/ or by improper disposal practice of the unwanted drugs which may eventually finds the way to the water supplies [3,4]. In both the cases the waste water is treated by our local sewage facilities before it sent for household supplies but unfortunately most of the treatment plants are not equipped to remove the drug residues as a result, the contaminated water are piped to our faucets [5,6]. Usually the concentrations of these medications are negligible. However, long term exposure to low levels of multiple medications could be hazardous [7,8]. The occurrence of various pharmaceuticals in the environment primarily in surface water, costal water, underground water and drinking water as well as in the soils had been documented in many countries [9,10,11,12]. The potential environment and human health impacts of these improperly disposed pharmaceuticals are currently being debated. The effect of these pharmaceuticals in the environment had been well documented by several studies [5,13]. Due to the high solubility of molecules of pharmaceuticals, aquatic organisms are especially vulnerable to their harmful effects. Slow development in frogs by antidepressants, feminization effect in certain fish and aquatic organisms due to accumulation of contraceptives,

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oestrogen and other hormones in water had been reported [14]. There is concern about the potential they have for harm because they may act unpredictably when mixed with other chemicals from the environment or concentrate in the food chain [14]. The impact of pharmaceutical wastes especially to vulnerable groups like children, pregnant women, elders and people with renal and liver diseases is of major concern [4]. Pharmaceuticals like atenolol, bezafibrate, carbamazepine, cyclophosphamide, ciprofloxacin, furosemide, hydrochlorothiazide, ibuprofen, lincomycin, ofloxacin, ranitidine, salbutamol and sulfamethoxazole had been reported to inhibit the growth of human embryonic cells HEK293, with the highest effect observed as 30% decrease in cell proliferation compared to controls [15]. The study also noted that the drug mixture effectively stimulated the expression of cell-cycle progression-mediating genes, with a slight accumulation of cells in the G2/M phase of the cell-cycle [15]. One of the important effects expelling from improper disposal practice of antimicrobials is development of antibiotic resistance. Continuous exposure of microorganisms present in the aquatic environment to the drug residues may lead to mutations and development of new strains [4]. Recent identification of antibiotic resistance bacteria [16,17] in the environment has added a new dimension to the risk posed by the presence of drug residues in the environment. The recent studies had proved that the presence of pharmaceuticals in aquatic system not only affects its biota but continual exposure had also given rise to the presence of multidrug resistance microorganisms which were not known earlier [16]. Organisms respond to pharmaceutical exposure at trace environmental concentrations [18], which indicates that pharmaceutical residuals are of significant environmental concern [19]. Many studies had already proved that, poor knowledge and awareness existed regarding safe methods of drug disposal [1,2]. The reason for this may be partly because of low availability/ access to related materials, absence of subject area/ topic from curriculum, poor assessment focus in exams of at least health care professionals; who should be role models to the society on health issues and have the responsibility to teach the public and patients. An earlier questionnaire survey conducted among health care workers (medical doctors, dental doctors and nurses) showed poor knowledge related to proper drug disposal procedures [20]. Even most of the respondents were not bother about the environmental impact and human health risks regarding the improper drug disposal. Thus as an extension of the previous work, an analysis to determine if any learning related to safe drug disposal was being taught in the curriculum of the Indian medical, dental and nursing institutions. In this regard, the present study was undertaken to assess the availability of adequate syllabus in the study curriculum and examination questions to determine level of training regarding hazardous impacts of improper drug disposal as well as best practices in safe disposal of drugs in the syllabus of medical, dental and nursing educating Universities and Institutions (both government and deemed).

MATERIALS AND METHODS

The research was cross sectional observational study. It was carried out from February 2015 to April 2015. A total of 14 government and 30 deemed Universities of INDIA in concerned with medical, dental and nursing education were included. The analysis was to check whether the drug disposal details are available in syllabus and also to verify last 5 year question papers of various subjects concerned to create awareness or training procedure to standardize the drug disposal. The recommended/ approved the text books of these professional courses were taken for observation to identify the topics/ chapters (excluding biomedical waste) discussed about safe drug disposal. The data was analyzed and results were expressed in counts and percentages.

RESULTS

The present study sheds light on the inclusion of safe disposal methods as a part of education/ training curriculum in regards to the medical, dental and nursing professionals who deal directly with medicines. Among the Universities included, the results showed that none of these Universities had safe disposal practice or topics in related to improper disposal of medicines in their teaching curriculum as well as in website protocol (Table 1).

Table 1: Analysis of safe disposal of drugs as a part of the educational curriculum

Type of University	No. of Universities included	Observation of inclusion in the curriculum (found/ not found)
Government Universities	14	Not found
Private Deemed Universities	30	Not found

The text books of all these health care professions (medical, dental and nursing) were examined. The text books like Pharmacology, Microbiology, Community medicine, Nursing practice of Indian

and International authors, that are highly concerned regarding drugs, community health and waste management were observed. But none of these books discussed about safe disposal practice of medicines in any chapters (excluding biomedical waste) or even have a single word. The scrutiny of last 5 years question papers from 2010 to 2014 in various subjects of these 3 courses revealed that there was no single question or learning task that was given related to the disposal of pharmaceuticals in examinations (Table 2).

Table 2: Number of questions asked about issues related to disposal of medicines in medical, dental and nursing examinations

Course	No. of years verified	Observation
Medical (MBBS)	05 (2010-2014)	No questions asked
Dental (BDS)	05 (2010-2014)	No questions asked
Nursing (B.Sc)	05 (2010-2014)	No questions asked

Improper storage and disposal of unused medications is becoming a community problem and gaining huge attention. The impacts of these unused pharmaceutical substances in the environment are an emerging concern where it directly and indirectly affects the human health. The results of this study suggest that there is a need for drug disposal education in the curriculum of various medical professional courses.

DISCUSSION

Disposal practices vary across the world [21]. The major sources of improperly disposed pharmaceutical substances into the environment are from households, hospitals and pharmaceutical companies. Some studies reflect that managing pharmaceuticals in a proper way is still substantial in India [1]. Though efforts were starting to mitigate the issue and its impacts but there is a lack of proactive approach. The most accepted disposal procedures for disposing unwanted medicines like drug take back programmes that allow public to bring leftover drugs to a central location and disposed safely are well established in some western countries and is a good solution to reduce the hazards of improperly disposed pharmaceuticals to waterways and landfills [22].

The health care professionals like medical doctors, dental doctors, nurses and pharmacists have great interaction with consumers in respect of prescription and over the counter medicines and therefore, in an excellent position to influence the use as well as disposal of medication [23]. But in our previous studies it was showed that there was low knowledge and awareness regarding safe disposal practice among these health care professionals [20]. The root cause for existence of this problem was, not having a concept of disposal practices of unwanted medicines in teaching curriculum. Without learning the chance of practice would be low, hence it is important to learn about safe disposal methods as a part of study curriculum in all educational courses. From last two decades with the identification of pharmaceuticals in water supplies of various countries and its impact on environment and human health made a point to look after the problems to avoid future dangers [5,13]. Some Universities in United States of America (USA) kept safe medication disposal in their curriculum as a priority one (Table 3).

Table 3: Universities following drug disposal practice in the curriculum

University	Location of the University
The University of MAINE	Orono, United States of America (USA)
University of San Diego	San Diego, USA
Michigan state University	East Lansing, USA
University of Colorado, school of pharmacy	Aurora, USA
Solnoma state University	California, USA
The University of New Mexico, College of pharmacy	Albuquerque, USA
City of University park	Texas, USA
Oregon state University	Oregon, USA
Kennesaw state University	Kenniesaw, USA
Arizona state University	Arizona, USA

Many authors have found that intervention by education is a right step in this direction [24] without doubt by making a footsteps starting from learning about the problem by keeping in

educational curriculum is a prudent approach to minimize the environmental contamination. The limitations of this study were restricting the observation of previous question papers in different courses to 5 years. Further for all undergraduate course in Indian Universities having a subject – Environmental Sciences as mandatory. On that, syllabus is a right place and way to teach students.

Table 4: Learning resources of safe disposal practice of pharmaceuticals

Agency	Web address
International	
World Health Organization	www.who.int
Food and Drug Administration	www.fda.gov
Environmental Protection Agency	www.epa.gov
Dispose my MEDS	www.disposemymeds.org
AWARE	www.awarerx.org
Rx Drug Drop Box.org	www.rxdrugdropbox.org
SF Environment	www.sfenvironment.org
Medicine Net.com	www.medicinenet.com
Take back YOURMEDS	www.takebackyourmeds.org
Everyday HEALTH	www.everydayhealth.com
National	
Drug control.org	www.drugcontrol.org

CONCLUSION

The occurrence of pharmaceuticals in ground water, lakes, rivers and drinking water is a big problem that will continue to grow as the population expands, more of pharmaceuticals will be dispensed and more of medications are disposed. The significance of this on environment and human health risks that this represents is hotly debated and efforts should have made to improve the current scenario. It is prudent to minimize the future risk and educating the health care professionals, patients about safe method of medication disposal by making it as part of course curriculum. By making safe disposal of drugs as a part of teaching curriculum in all health care professional courses as a separate chapter there could be a great chance to increase the knowledge and awareness towards the problem and this is the first step that has to be made to change the attitude and behaviour of current drug disposal methods. By this study, the authors planned to send a request to the Government, educational authorities and institutions for enriching the existed syllabus with safe drug disposal. Authors also planned to send this published data to all officials and Universities for taking necessary and immediate action on this arena.

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