

Impact of Educational Intervention on Pharmaceutical Waste Management in a Tertiary Care Teaching Hospital-Healthcare Staff Centered Study

Binu, K. M^{1*}, Harika, N², Jaya Swathi², B. P. Nivedita², Saniya², H. Doddayya²

¹Assistant Professor, Department of Pharmacy Practice, N.E.T. Pharmacy College, Raichur, Karnataka-584103, India

²NET Pharmacy College, Raichur- 584103, Karnataka, India

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*Corresponding author: Binu, K. M

Assistant Professor, Department of Pharmacy Practice, N.E.T. Pharmacy College, Raichur, Karnataka-584103, India

Abstract

Expired and unused medicines are potentially toxic substances that should be managed effectively to avoid accumulation of potentially toxic pharmaceuticals in the hospital and environment. This study aimed to identify and assess the disposal practices of pharmaceutical waste at tertiary care teaching hospital. A cross-sectional prospective questionnaire study was conducted for a period of six months at tertiary care teaching hospital with a sample size of 120. Healthcare professionals above the age of 18 years were included in the study. Data from the questionnaire was analyzed using appropriate statistical tools and Chi-square test. A pre and post educational intervention study was conducted among 120 participants. The study found that 90.83% (109) participants were under the age group of 18-25 years. Among them 77.5% (93) were female and 22.5% (27) were male. Before intervention only 80.8% (97) participants were aware of different types of bags used to dispose pharmaceutical waste, whereas after educational intervention 97.5% (117) are aware of bags used to dispose pharmaceutical waste ($\chi^2=0.000<0.001$). Before intervention 55.83% (67) of participants were known of drug takeback system, after intervention 99.16% (119) known of drug takeback system ($\chi^2=0.000<0.001$). Majority of the study participants agreed that safe pharmaceutical disposal practice is an important concern in both pre and post study. Hence awareness and concern regarding the problem is high. It was observed that the knowledge of healthcare staff about pharmaceutical waste management was good. We found that educational programs can improve staff awareness level on pharmaceutical waste management.

Keywords: Attitude, Educational intervention, Healthcare professionals, Knowledge, Pharmaceutical waste, Tertiary care teaching hospital, Vulnerable population.

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INTRODUCTION

Expired products, dispensed drugs that are unwanted or discontinued, and contaminated medicines is known as pharmaceuticals wastes. When the medicines are prescribed according to the illness of a patient, only the active ingredients of medicines are metabolized but the non-metabolized parent compound as well as the metabolites enters the water system and harms the aquatic system and pollute the water system. Also, the improper disposal of the unused medicines causes the environmental pollution (Paudel E *et al.*, 2019).

Improper disposal of medication has several possible consequences such as childhood poisoning, environmental pollution, a negative impact on wildlife, and antibiotic resistance. Pharmaceuticals from human

use have serious effect on the environment due to micropollutants released into the nature, with well-known examples, i.e.; estrogens and their effects on fish and the effects of diclofenac on vultures through chemical analysis. If unused post expiry date medicines may further increase the threat to the environment like expired tetracyclines can cause renal tubular damage (Shivaraju PT *et al.*, 2017).

Improper dispose of medication potentially pose a significant environment risk and storage of unwanted or unused medication, increase risk of accidental poisoning. The global increase in the use of pharmaceutical has led to an enhanced international awareness of the potential detrimental effect on the environment from the disposal of these compounds

either in landfills or the aquatic environment (Azad AK *et al.*, 2012).

Environmental exposure to pharmaceuticals could lead to hazardous effect especially on vulnerable population, including pregnant women, newborn, and children. In addition, evidence shows that the presence of antibiotics in environment may lead to antibiotics resistance. The most of the respondent's lack of awareness in proper methods of dispose of unwanted medicine (Ayele Y *et al.*, 2018).

Waste generated by health care facilities are divided in to 85% non - hazardous waste, hazardous waste is generated from contaminated source or potentially contaminated with infectious, chemical, or radioactive source that pose a potential risk to health, pharmaceutical waste includes unused, expired, or contaminated vaccines, sera and drugs (Aboelnour A *et al.*, 2019).

Solid waste materials from hospitals, which also include pharmaceutical waste, require different handling and disposal technologies. It is the responsibility of healthcare establishments to treat and dispose of waste materials generated by them in such a manner as to ensure that there would be no adverse health or environmental effects. Therefore, waste materials should be properly segregated at the point of generation before treatment and disposal to protect both humans and the environment, segregation of waste material would result in a clean solid waste stream which would be easily, safely, and cost – effectively managed through recycling, composting, and land filling (Sasu S *et al.*, 2011).

Nurses, pharmacists, and doctors typically undertake the disposal of medicines within health -care facilities. Disposing medicines into municipal sewage systems result in trace amounts of these medicines in waste waters and decontaminated water for drinking, which hinders the effectiveness of water purification chemicals. Most HCPs reported receiving on-the-job training regarding the proper disposal of medicines after graduation and to identify SOPs as well as legislative documents that healthcare facilities have for the disposal of medicines. They also need to advice patients regarding the safe disposal of medicines and to identify SOPs as well as legislative documents that healthcare facilities have for the disposal of medicines, Lack of knowledge by health care professionals' results in patient not being counselled on the safe disposal of medicinal waste or not being advised, negatively impacting the environment and patient (Mahlaba KJ *et al.*, 2021).

A disposal plan should be made for the collection, handling, predisposal treatment, and terminal disposal of pharmaceutical waste, sharp waste should be puncture proof container, used syringe needles should not be bent, recapped or broken before discarded them

into a container, Treatment methods of regulated pharmaceutical waste includes (stream sterilization, incineration, burial or microwave treatment) (Aboelnour A *et al.*, 2019).

Awareness towards improper disposal of medicines (Pharmaceuticals) and its hazardous impact on environment is one of the major issues. Increasing disease incidence and prevalence necessitate healthcare practitioners to prescribe and dispense different medications. According to World Health Organization (WHO), more than half of all medication is inappropriately prescribed and sold, which causes unnecessary storage and creates environmental threat. The presence of antibiotics in water may lead to antibiotic resistance and in long term may cause genetic effect in human and marine life (Narwat A *et al.*, 2019).

It was observed that the knowledge of healthcare staffs about pharmaceutical waste management was good. But most of them were unaware about various disposal practices of Pharmaceutical waste. Hence the study entitled Impact of educational intervention on Pharmaceutical waste management in a tertiary care teaching hospital was conducted to assess knowledge, attitude, and practice of healthcare staff towards pharmaceutical waste management and also to assess the impact of educational programme on knowledge, attitude, and practice towards Pharmaceutical waste management.

MATERIALS AND METHODS

2.1 Study design and sample size

A cross-sectional prospective questionnaire study was carried out among Health care professionals of a tertiary care teaching hospital. Sample size was calculated based on a previous study which recorded the prevalence of 92% i.e., 0.92, taking 5% confidence interval, the required sample size for the study was minimum of 120. Health care professionals like Nurse, Dentist, Pharmacist who were given written consent, Interns, and trainers were included in the study. Physicians, students and health care professional who has not given written consent were excluded from the study. Base line data was collected from study participants during pre-interventional phase. Educational intervention was carried out to the participants who were already participated in pre-intervention phase of the study. The data were further analyzed by comparing pre-interventional result with post- interventional result using Chi-square test. The study was approved by the Institutional Ethics committee by issuing ethical clearance certificate.

2.3 Development of Questionnaire

A questionnaire for incorporating participant details was taken from previous studies (Advani M *et al.*, 2019). The questionnaires used in the study consist of two sections. Section A includes socio – demographics characteristics of respond like age, sex, level of

education and Profession. Section B deal with assessment of knowledge and practice on pharmaceutical waste among health care professional. Questionnaire was validated using Cronbach's alpha (.781).

2.4 Questionnaire distribution, collection and analysis of the data

Project team approached eligible study participant and discussed about purpose of the study. Participant consent form was taken from healthcare professionals. An interviewer administrated questionnaire was used as study tool. Base line data was collected from study participants during pre-interventional phase. A total of 120 data was collected from March 2023 to August 2023. Data from the questionnaire were analyzed using descriptive statistics namely total numbers, percentage and mean. Microsoft word and Excel have been used to generate graphs, tables etc. Educational intervention was carried out to the participants who were already participated in pre-intervention phase of the study. The method employed was Microsoft Power point presentation on pharmaceutical waste management in English language. The duration of power point presentation was 15 minutes. Questionnaire was re-administered to 120

participants who were participated in pre- intervention phase and reassessed the knowledge, attitude, and practice of pharmaceutical waste disposal among healthcare professionals. The data were further analyzed by comparing pre-interventional result with post-interventional result using Chi-square test. Statistical calculations were done by using Statistical Package for Social Science (SPSS) version 20.0.

RESULTS AND DISCUSSION

Among the total data collected, age was taken into consideration by dividing 3 age groups most them were in age group of 18-28 years ie.90.83% of the total participants followed by 8.33% of the participants in the age group of 28-38, participants of 38-48 were 0.83%. By collecting the data on the gender status of the participants, it was understood that about 22.5% were male and 77.5% were female, most of the participant were educated i.e., 14.16 %were diploma, 59.16% were undergraduate, 26.66% were postgraduate. When taken into consideration of the professional status of the participants, it was understood that 15% were pharmacist, 68.33% were nurse, 16.66% were other professionals i.e.; X-ray or lab technicians (Table 1).

Table 1: Socio Demographic Characteristics of Healthcare Professionals (n=120)

Sl. No	Characteristics	Number (%)
1	Age group (years)	
	18-28	109 (90.83)
	28-38	10 (8.33)
	38-48	1(0.83)
2	Gender	
	Male	27 (22.5)
	Female	93 (77.5)
3	Educational Status	
	Diploma	17 (14.16)
	Under-graduation	71 (59.16)
	Post-graduation	32 (26.66)
4	Profession	
	Pharmacy	18 (15)
	Nurse	82 (68.33)
	Others	20 (16.66)

In pre-interventional study only 80.8% (97) participants were aware of different types of bags used to dispose pharmaceutical waste, whereas after educational intervention 97.5% (117) are aware of bags used to dispose pharmaceutical waste ($\chi^2=0.000<0.001$). On intervention 15% of increment was seen on the opinion of improper disposal of medicine causes public hazard. Around 12% increment was seen on the opinion of maintaining the hospital waste records. Before

intervention 55.83% (67) of participants were known of drug takeback system, after intervention 99.16% (119) known of drug takeback system ($\chi^2=0.000<0.001$). In pre-interventional study only 73.33% (88) of participants used to read the directions for disposing the medications, but after educational intervention 95.83% (115) of them agreed to read the directions for disposing the medications ($\chi^2=0.000<0.001$) (Table 2).

Table 2: Comparison of Assessment of Knowledge and Practice on Pharmaceutical Waste among Healthcare Professionals before and after intervention

	Pre intervention			Post intervention			Chi-square	P Value
	Yes no. (%)	No no. (%)	Don't know no. (%)	Yes no. (%)	No no. (%)	Don't know no. (%)		
Are you aware of different types of Bags used to dispose pharmaceutical waste?	97 (80.8)	23 (19.16)	–	117 (97.5)	3 (2.5)	–	17.254	0.000<0.001
Do the expired medicine which are not properly disposed pose hazards to public safety?	102 (85)	18 (15)	–	120 (100)	0	–	19.459	0.000<0.001
Is there any drug waste policy in hospital?	98 (81.66)	9 (7.5)	13 (10.83)	115 (95.83)	2 (1.66)	3 (2.5)	29.447	0.000<0.001
Do you think provision of training on pharmaceutical waste management would create awareness on safe disposal of damage and expired medicine?	92 (76.6)	6 (5)	22 (18.33)	117 (97.5)	0	3 (2.5)	23.430	0.000<0.001
Is it mandatory to maintain pharmaceutical waste records in hospital?	106 (88.33)	3 (2.5)	11 (9.16)	120 (100)	0	0	14.867	0.001
Do you think inappropriate disposal of pharmaceutical waste results in environmental degradation?	109 (90.83)	11 (9.16)	–	120 (100)	0	–	11.528	0.001
Do you know about drug take back system?	67 (55.83)	53 (44.16)	–	119 (99.16)	1 (0.83)	–	64.612	0.000<0.001
Is it important to wear personal protection equipment is while handling pharmaceutical waste?	108 (90)	12 (10)	–	120 (100)	0	–	12.632	0.000<0.001
Have you ever read the direction for disposing of medications?	88 (73.33)	32 (26.66)	–	115 (95.83)	5 (4.16)	–	23.294	0.000<0.001
Do you agree that every single person has a responsibility to contribute to a sustainable development in hospital?	110 (91.66)	10 (8.33)	–	117 (97.5)	3 (2.5)	–	3.985	0.046<0.05
Is it the responsibility of government to create awareness on the safe disposal of damaged and expired medicine?	113 (94.16)	7 (5.83)	–	120 (100)	0	–	1.670	0.196>0.05
Is it important to have storage room for pharmaceutical waste in each hospital?	108 (90)	12 (10)	–	118 (98.33)	2 (1.66)	–	7.585	0.006<0.05
Do you think safe pharmaceutical waste management is an important concern?	109 (90.83)	11 (9.16)	–	120 (100)	0	–	11.528	0.001

Knowledge on importance of pharmaceutical waste disposal before and after intervention was compared, it gives chi square value of 8.617 and p value

0.035 < 0.05, which shows significant result. As shown in (Table 3).

Table 3: Comparison of Importance of Pharmaceutical Waste Disposal before and After Intervention

Importance of pharmaceutical waste disposal	Pre intervention no. (%)	Post intervention no. (%)	Chi-square	P Value
To prevent environmental pollution	27 (22.5)	12 (10)	8.617	0.035<0.05
To prevent illegal use	4 (3.33)	3 (2.5)		
To prevent adverse conservancy	3 (2.5)	1 (0.83)		
All the above	86 (71.66)	104 (86.66)		

We compared the opinion on consumer enquire on drug disposal before and after intervention, the data

gives chi square value of 3.762 and p value 0.152 > 0.05, which shows significant results, As shown in (Table 4).

Table 4: Comparison of Consumer Enquire on Drug Disposal before and After Intervention

Consumer enquire about advice on drug disposal	Pre intervention no. (%)	Post intervention no. (%)	Chi-square	P Value
Never	33 (27.5)	22 (18.33)	3.762	0.152>0.05
Sometimes	69 (57.5)	83 (69.16)		
Always	18 (15)	15 (12.5)		

With contrast to opinion of healthcare professionals on best way to minimize pharmaceutical waste before and after intervention gives chi square

value of 14.751 and p value 0.000 < 0.001, which is highly significant, as shown in (Table 5).

Table 5: Comparison of Best Way to Minimize Pharmaceutical Waste Before and After Intervention

Best way to minimize pharmaceutical waste	Pre intervention no. (%)	Post intervention no. (%)	Chi-square	P Value
By drug takeback system	28 (23.33)	7 (5.83)	14.751	0.000<0.001
By educating	92 (76.66)	113(94.16)		

Regarding the factors that can be the reason for improper disposal of pharmaceutical waste according to healthcare professionals before and after intervention the

data gives chi square value of 55.264 and p value 0.000 < 0.001 shows highly significant result, as shown in (Table 6).

Table 6: Comparison of Factors that can be the Reason for Improper Disposal of Pharmaceutical Waste Before and After Intervention

Factors for improper disposal of pharmaceutical waste	Pre intervention no. (%)	Post Intervention no. (%)	Chi-square	P Value
Lack of time	9 (7.5)	0	55.264	0.000<0.001
Irresponsibility	39 (32.5)	6 (5)		
Lack of knowledge	52 (43.33)	105 (87.5)		
Lack of rules and guidelines by hospital	20 (16.66)	9 (7.5)		

CONCLUSION

It was observed that the knowledge of health care staffs on pharmaceutical waste management was good. But most of them were unaware about various disposal practices of pharmaceutical waste. Since interventional program had a positive impact on knowledge and attitude of healthcare professionals, we found that educational intervention can improve knowledge, attitude, and practice of healthcare staff towards pharmaceutical waste management.

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