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Effectiveness of a training program about bio-medical waste management on the knowledge and practices of health-care professionals at a tertiary care teaching institute of North India

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Abstract:

BACKGROUND: Training of health-care providers about the various aspects of biomedical waste (BMW) management and handling (M and H) rules can improve the safe disposal of BMW and protect the patients and public from related hazards.

OBJECTIVES: Our study objective was to evaluate the existing knowledge regarding BMW management rules among selected health-care professionals and to evaluate the impact of training program on BMW management on the knowledge and practices of health-care professionals.

METHODOLOGY: The training program on BMW management rules was conducted in April 2018. A total of 250 participants were trained. A structured validated questionnaire was used. The data were analyzed, and the mean score of pre- and post-test was compared by the paired-*t* test.

RESULTS: Majority of the participants were female (83%) aged 20–30 years (56%). The majority of the participants were married (74%) and were from urban areas (74%). The mean pretest and posttest score were 14.00 and 19.94 respectively ($P < 0.000$).

CONCLUSION: The structured training on all aspects of BMW management led to statistically significant improvement in the knowledge among health-care professionals.

RECOMMENDATIONS: Such training programs need to be regularly conducted.

Keywords:

Biomedical waste, bio-medical waste (management and handling) rules, handling, segregation, training

Introduction

The hospital waste is different from the domestic waste. The hospital waste may also be categorized into hazardous and nonhazardous waste, and if this waste is not handled properly, then the patient, staff, and public are at risk of getting infection from hazardous waste. In developed countries, hazardous waste accounts for around 15%–20% of total waste and this figure will be much higher in India due to improper segregation at source of generation and final disposal of biomedical waste (BMW).[1] Therefore, proper segregation, storage, and disposal of the hospital waste are of prime importance. The exposure to BMW can lead to disease or injury.[2] The person exposed to BMW can easily get infectious diseases such as HIV and hepatitis B.[3] Keeping in view, the importance of Hospital Waste Management, the Ministry of Environment and Forest, Government of India notified BMW management and

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handling (M and H) rules in 1998 under the Environment Protection Act, 1986. As per these rules, the BMW is defined as "Any waste which is generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological."[4] In our hospitals, approximately 1.30–1.50 kg/patient/day waste is generated compared to around 4.50 kg/patient/day in developed countries.[5] Under these BMW (M and H) rules, the head of the waste-generating facility is responsible for safeguarding the well-being of personnel involved in handling, transportation, and disposal of BMW in addition to ensuring the safety to the community and environment.[6] The Government of India has amended the BMW (M and H) rules in 2016 and at present the BMW (M and H) rules, 2016 are applicable. These rules have defined various waste categories, their mode of collection, storage, transportation, and final treatment modalities. These BMW (M and H) rules, 2016 are applicable to all waste-generating facilities, including hospitals.

Rationale for this study

The knowledge of the BMW rules (2016) among the hospital staff is of prime importance for the overall smooth functioning of the hospitals. Therefore, it is important for each medical institution to keep its health-care professionals updated about the various new provisions of BMW (M and H) rules, 2016. Lack of awareness about this updates may make the entire organization liable to be blamed for the implications of the poor BMW disposal. Arrangements for the awareness of the providers about various provisions of BMW (M and H) rules will help in improving the BMW management.

The Department of Hospital Administration has a vital role to play in the regular update of knowledge among the staffs working in the hospitals. However, very little focus has been given on these updates. Still, more scarce is the administrative operational research studies on this subject. To our knowledge, hospital staffs have been the focus of research in hospital administration mainly for the observational study. Very few interventional studies have been conducted to date, in India, after the implementation of new BMW rules 2016. With this background, we intended to do this operational research for the overall improvement/update in knowledge among the hospital staff working in this teaching hospital.

Objectives

The aim and objective of this study are as follows:

1. To evaluate the existing knowledge regarding BMW management rules among selected healthcare professionals
2. To evaluate the impact of a training program on BMW management on the knowledge and practices of health-care professionals.

Hypothesis

1. No significant difference will be observed between post and pre-test knowledge score.
2. A significant difference will be observed between post and pre-test knowledge score.

Methodology

Study setting

The training program on BMW (M and H) rules 2016 was conducted at a tertiary care teaching and research hospital of Haryana in collaboration with the Center for Disaster Management, Haryana Institute of Public Administration, Gurugram in April, 2018. It was a pre-post single-group intervention study.

Sample and sampling

For administrative purpose, we included all interested staffs as a sample and convenient sampling technique was used. Total 250 participants were imparted training in a batch of 50 participants per day for 5 days. The participants include nursing personnel and laboratory technicians. They are directly involved in patient care activities and the generation of BMW in the hospital setting.

Study tool

A structured questionnaire was prepared and was validated through a pilot study. The questionnaire had questions regarding the sociodemographic information of participants and 25 different questions regarding the various aspects of BMW management rules. These 25 questions were for assessing the knowledge regarding BMW (M and H) rules.

Tool administration

The consent from each participant was obtained individually for filling the pre-test questionnaire before imparting a structured training program. The filled questionnaire were collected before the commencement of training program. Thereafter, the structure training program on BMW (M and H) rules was imparted with the help of audiovisual learning techniques by different experts. The training program was held from 9.00 a.m. to 5.00 p.m. The participants were given the post-test questionnaire after the training session, and the filled questionnaire was collected before the closing of training program. The same pre and post-post questionnaire were used on all the 5 days, and response from 250 participants was received

Statistical analysis

All questions were scored. Each correct response was

given a score of one. Overall, mean score difference of pre and post-post was calculated. Various inferential and descriptive statistical tests were applied, and category-wise subgroup analysis was done.

Ethical clearance

The permission from the institution authorities was obtained. The study was conducted after taking informed consent from the participants, and anonymity and confidentiality of the participants are maintained.

Results

There was a total of 250 participants in the training program. The age, sex, education qualification, designation, and place of residence-wise distribution of the participants are given in Table 1.

It was observed that 56% of participants were in the age group of 20–30 years, 84% were females, 48% were General Nursing and Midwifery (GNM), 82% were staff nurses, and 74% were from the urban area. The mean knowledge score of the respondents in pretest was 14.00 (standard deviation [SD] 3.040, standard error 0.192) which was 56% of the total achievable score. The mean knowledge score of the respondents in posttest was 19.94 (SD 1.990, standard error 0.126) which was 80% of the total achievable score [Table 2].

The paired *t*-test was applied to the pre and post-test scores, and the difference in knowledge regarding BMW (M and H) rules among pre- and post-test group was found statistically significant ($P < 0.000$) [Table 3].

The difference in knowledge score of each participant in pre- and posttest was calculated, and it varies from −2 to 15. Four different knowledge score groups were prepared on the basis of knowledge differential (i.e., from <2 [poor], 2–6 [average], 6–9 [good], and >9 [v. good]), and the subgroup analysis, namely age group, educational qualification, and sex was done using the Chi-square test, as shown in Table 4.

On age group-wise analysis, it was found that the participants in the age group of 20–30 years had maximum knowledge followed by the participants in the age group of 31–40 years, but the knowledge differential was not statistically significant ($P = 0.538$). It was found that females had better knowledge about BMW (M and H) rules than males, but the knowledge differential was not statistically significant ($P = 0.057$). On educational qualification-wise analysis, it was found that the participants with GNM degree had maximum knowledge followed by Bachelor of Science (B.Sc.) degree holders, and the difference was statistically significant ($P < 0.008$). It was observed that the married participants had higher knowledge scores than the unmarried, and the knowledge differential was not statistically significant ($P = 0.288$). On designation wise analysis, it was found that the staff nurses had maximum knowledge score followed by a laboratory technician, and the difference was statistically significant ($P < 0.008$).

Table 1: Distribution of sample size as per age group, sex, educational qualification, designation, and residence

Parameters	Demographic variable	Frequency (%)
Age (years)	20-30	140 (56)
	31-40	61 (24.4)
	41-50	24 (9.6)
	Above 50	22 (8.8)
	Information NA	3 (1.2)
Sex	Male	41 (16.4)
	Female	209 (83.6)
Education qualification	12th	6 (2.4)
	GNM	119 (47.6)
	B.Sc.	101 (40.4)
	M.Sc.	18 (7.2)
	Ph.D.	1 (0.4)
	MBBS	2 (0.8)
	Information NA	3 (1.2)
Designation	Staff nurse	206 (82.4)
	Nursing sister	10 (0.4)
	Laboratory technician	31 (12.4)
	Media maker	1 (0.4)
	CMO	2 (0.8)
Residence	Rural	56 (22.4)
	Urban	186 (74.4)
	Information NA	8 (3.2)

NA=Not available, B.Sc=Bachelor of Science, M.Sc=Master of Science, Ph.D=Doctor of Philosophy, MBBS=Bachelor of Medicine and Bachelor of Surgery, CMO=Chief Medical Officer

Table 2: Distribution of mean score among pre- and posttest group

Group	Sample size	Mean score	SD	SEM
Pretest	250	14.00	3.040	0.192
Posttest	250	19.94	1.990	0.126

SD=Standard deviation, SEM=Standard error of the mean

Discussion

All medical, paramedical, and health-care professionals must fully understand BMW (M and H) rules, 2016 and the amendment made by the government from time to time. In our study, the difference in mean knowledge score regarding BMW (M and H) rules among pre- and posttest was found statistically significant ($P < 0.000$) on the *t*-test analysis. Hence, substantial improvement in knowledge score can be attributed to the training program administered to the participants between pre- and posttest regarding BMW (M and H) rules. The training program improved the knowledge of

Table 3: Comparison of knowledge among pre- and posttest groups (*t*-test analysis)

Variance	Levene's test for equality of variances		*t*-test for equality of means						
	F	Significant (*P*)	*t*	df	*P*	Mean difference	SEM	95% CI of the difference	
								Lower	Upper
Equal variances assumed	36.686	0.000	−25.832	498	0.000	−5.936	0.230	−6.387	−5.485
Equal variances no assumed			−25.832	429.305	0.000	−5.936	0.230	−6.388	−5.484

SEM=Standard error of the mean, CI=Confidence interval

Table 4: Chi-square test analysis for the association of knowledge group with age group, sex, educational qualification, designation, and residence

Parameter	Knowledge group (based on the difference in pre- and posttest knowledge score) (%)				Total	*P*<0.05 (significant)
	<2 poor	2-5 average	6-9 good	>9 very good		
Age group						
20-30	12 (4.8)	44 (17.6)	67 (26.8)	17 (6.8)	140 (56.0)	0.538
31-40	7 (2.8)	21 (8.4)	28 (11.2)	5 (2.0)	61 (24.4)	
41-50	2 (0.8)	8 (3.2)	10 (4.0)	4 (1.6)	24 (9.6)	
Above 50	1 (0.4)	12 (4.8)	5 (2.0)	4 (1.6)	22 (8.8)	
Information NA	1 (0.4)	1 (0.4)	1 (0.4)	0 (0.4)	3 (1.2)	
Total	23 (9.2)	86 (34.4)	111 (44.4)	30 (12.0)	250 (100)	
Sex group						
Male	2 (0.8)	20 (8.0)	12 (4.8)	7 (2.8)	41 (16.4)	0.057***
Female	21 (8.4)	6 (26.4)	99 (39.6)	23 (9.2)	209 (83.6)	
Total	23 (9.2)	86 (34.4)	111 (44.4)	30 (12.0)	250 (100)	
Educational qualification						
12th	0 (0.0)	1 (0.4)	5 (2.0)	0 (0.0)	6 (2.4)	0.008***
GNM	6 (2.4)	46 (18.4)	52 (20.8)	15 (6.0)	119 (47.6)	
B.Sc.	12 (4.8)	32 (12.8)	44 (17.6)	13 (5.2)	101 (40.4)	
M.Sc.	2 (.8)	4 (1.6)	10 (4.0)	2 (0.8)	18 (7.21)	
Ph.D	0 (0.0)	1 (0.4)	0 (0.0)	0 (0.0)	1 (0.4)	
MBBS	2 (0.8)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.8)	
Information NA	1 (0.4)	2 (0.8)	0 (0.0)	0 (0.0)	3 (1.2)	
Total	23 (9.2)	86 (34.4)	111 (44.4)	30 (12.0)	250 (100)	
Marital status						
Married	13 (5.2)	62 (24.8)	89 (35.6)	22 (8.8)	186 (74.4)	0.288
Unmarried	9 (3.6)	23 (9.2)	19 (7.6)	7 (2.8)	58 (23.2)	
Information NA	1 (0.4)	1 (0.4)	3 (1.2)	1 (0.4)	6 (2.4)	
Total	23 (9.2)	86 (34.4)	111 (44.4)	30 (12.0)	250 (100)	
Designation						
Staff nurse	20 (8.0)	65 (26.0)	99 (39.6)	22 (8.8)	206	0.008***
Nursing sister	1 (0.4)	4 (1.6)	4 (1.6)	1 (1)	10	
Laboratory technician	0 (0.0)	17 (6.8)	8 (3.2)	6 (2.4)	31	
Media maker	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.4)	1	
CMO	2 (0.8)	0 (0.0)	0 (0.0)	0 (0.0)	2	
Total	23 (9.2)	86 (34.4)	111 (44.4)	30 (12.0)	250 (100)	
Residence						
Rural	8 (3.2)	19 (7.6)	22 (8.8)	7 (2.8)	56 (22.4)	0.595
Urban	15 (6.0)	63 (25.2)	85 (34.0)	23 (9.2)	186 (74.4)	
Information NA	0 (0.0)	4 (1.6)	4 (1.6)	0 (0.0)	8 (3.2)	
Total	23 (9.2)	86 (34.4)	111 (44.4)	30 (12.0)	250 (100)	

The *P* valve was highly significant w.r.t. education qualification (*P*<0.008), designation (*P*<0.008). For rest of the parameters, the difference was not statistically significant. NA=Not available

health-care professionals. The findings were comparable with the Dehradun study[7] where the mean difference between post- and pre-test knowledge score regarding BMW management was also found statistically significant. Similar results, i.e., significant change in the knowledge about different aspects of BMW handling

and management after training was reported in few other studies.[8-10]

This study has generated some important differentials in the knowledge scores. Younger participants in the age group of 20–30 years, females, GNM qualification, staff nurse, and married scored better in post-test than the middle-aged professionals, male, BSc and other higher qualifications, senior-level professionals, and married participants. The findings of our study are similar to a study conducted in Punjab.[10] Better knowledge score in some categories compared to others could be because of greater exposure to the BMW management in the former compared to the later. This exposure could be because of better teaching, training, and practical exposure. Of total 250 participants, the majority were females (84%), and therefore, it can be argued that due to large sample size, females have more knowledge score than males. The better knowledge score in staff nurses as compared to nursing sister can be attributed to the fact that staff nurses are directly involved in patient care activities and hence have better knowledge about the BMW (M and H) rules.

Limitations of this study

The small sample size was a major limitation for us. This result cannot be generalized, for that we need to do multicentric study with a larger sample size.

Conclusion

The structured training program was very effective in increasing the knowledge of participants regarding BMW (M and H) rules.

Practical suggestions

1. Such training program needs to be regularly conducted
2. It is also recommended that the future training program shall be evaluated time to time, and all amendments or guidelines made by the government for BMW (M and H) rules shall be incorporated in the training program.

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Conflicts of interest

There are no conflicts of interest.

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