Effectiveness of Virtual Teaching Tools on Knowledge and Practice of Biomedical Waste Management among Housekeeping Staff of a Tertiary Care Centre, Rishikesh

Dev Narayan*, Meena Saini, Manpreet Kaur, Nidhi Paliyan, Manorma Horo, Neha Kumari, Monika Saini, S. Manisha, Nevia Vaid, Neha Rawat, Rajarajeswari Kuppuswamy

ABSTRACT

Background: The present bio-medical waste (BMW) practices, setup, and framework explored that almost 82% of primary, 60% of secondary, and 54% of tertiary health-care facilities had no trustworthy BMW management system. This study aimed to improve the knowledge and practice of BMW management among housekeeping staff of a tertiary care center, Rishikesh. **Materials and Methods:** One group pre-test post-test quasi-experimental study was conducted on 139 housekeeping staff. A self-structured knowledge questionnaire and practice checklist through the interview method was used for data collection. Virtual teaching tools (video about BMW management and e-pamphlet) were developed for the study and used. **Results:** After the intervention, in post-test it was found that the majority of participants had excellent knowledge (111; 79.8%), some (24; 17.3%) had good, and only few (4; 2.9%) had moderate knowledge. None of the participants were found to have poor knowledge after the intervention. There is significant difference in pre-existing (15.89 ± 2.49) and post-test (21.20 ± 4.61) knowledge score, pre-existing practice (21.67 ± 2.13), and post-test (24.95 ± 2.42) practice. There was association between educations their work area with knowledge and significant relationship between work area and past training programs with practice. There is a significant correlation between pre-test knowledge and practice (p=0.00) and post-test knowledge and practice (P = 0.01). **Conclusion:** It is evident that a virtual teaching tool that comprises video and e-pamphlet is useful in improving the knowledge and practice of housekeeping staff on BMW management.

Keywords: Biomedical waste management, Housekeeping staff, Knowledge, Practice, Virtual teaching tool

Asian Pac. J. Health Sci., (2021); DOI: 10.21276/apjhs.2021.8.4.33

INTRODUCTION

The municipality corporation treats the general waste in a similar way as household waste.[1] A previous study estimated that approximately half of the world's population is at risk of hazards due to improper bio-medical waste (BMW) management either through impact at work in the environment or impact on public health.[2] Forty microbes have been registered to be carried by BMW, out of which 3 microbes, namely, human immunodeficiency virus, hepatitis B virus, and hepatitis C Virus.[1] Improper handling of BMW became a serious problem and is essential to exercise due care while handling and disposing it.[3] According to the American hospital association, 951,045 staffed hospital beds in a country generate 5.9 million tons of garbage annually.[4] The annually 1400 lakhs tons wastes produce by Uttarakhand according to protection and pollution control boards.[5] The BMW rules, 2016 classified into four bins Red, Yellow, White, and Blue.[6] The BMW disposal, waste generated in color code yellow ranged from 64.25 to 27.345 g/day/bed, in red color code from 19.37 to 10.97 g/day/bed, and in blue color code from 3.295 to 3.82 g/day/bed.[7] An increased amount of mercury leads to hatching of egg before their normal time which decreases the number of live birds.[8] The infectious waste should not get mixed with non-infectious waste as this would infect entire waste.[9] Most of the housekeeping staffs who handles and transport BMW are usually unskilled and uneducated and they have little or no knowledge of segregation and disposal of BMW.[9] The main reason behind needle stick injury was hollow bore and improperly disposed needles.[10] The health-care personnel should have good knowledge concerning BMW management.[11] Needle stick and sharps injuries (NSSIs)

College of Nursing, All India institute of Medical Sciences, Rishikesh, Uttarakhand, India

Corresponding Author: Dev Narayan, V/p-Mangalwad, Dungla, Chittorgarh, Rajasthan, Uttarakhand, India. Phone: +91-8561815445. E-mail: eternal.dev06@gmail.com

are one of the major risk factors for blood-borne infections in any health-care facility and also examine the current prevalence of NSSIs among housekeeping workers who are engaged in the handling and disposal of BMW.[12] The knowledge regarding BMW disposal among housekeeping staff was good but still there is a need for continuous education for the effective management of BMW.[13] The present BMW practices, setup, and framework in primary, secondary, and tertiary health-care facility (HCF) in India across 20 states, explored that almost 82% of primary, 60% of secondary, and 54% of tertiary HCFs had no trustworthy BMW management system.[14] In Gujarat, India, in the year 2009, 240 people got infected with hepatitis B due to the reuse of unsterilized syringes.[15] After reviewing several studies, we concluded that the majority of studies was conducted on knowledge and practice regarding BMW management among doctors and nursing officers rather than housekeeping staff

who are the prime handlers. Hence, it was felt beneficial to conduct the study to assess effectiveness of virtual teaching tools on knowledge and practice of BMW management among housekeeping staff of a tertiary care center.

MATERIALS AND METHODS

Study Design and Setting

The quasi-experimental, one-group pre-test and post-test design was conducted to assess the knowledge and practice regarding BMW management among housekeeping staff of a tertiary care hospital, Rishikesh between April 2019 and March 2020.

Study Participants

Housekeeping staff (N-139) of both genders was willing to participate, and those who can speak and understand Hindi were included in the study. Those who did not have android mobile phones were excluded. A simple random technique was adopted for the present study.

Ethical Clearance

Ethical approval was obtained from the institutional ethics committee vide letter no. AIIMS/IEC/19/782 dated 12 April 2019. The purpose of the study was informed to all the study participants before data collection and informed written consent was obtained. Data anonymity was maintained.

Development of the Tool

The research tool comprises socio-demographic variables, a self-structured questionnaire, and a practice checklist. Socio-demographic variables included age, gender, educational qualification, working area, working experience, previous training on BMW management, and Hepatitis B Vaccination. Structured knowledge questionnaire on BMW management with 25 items was used to assess the level of knowledge regarding BMW management among housekeeping staff. BMW practice checklist for housekeeping staff with 30 items was utilized to assess the practices of housekeeping staff related to BMW management. The video and the e-pamphlet were shown which included various biohazard symbols, management of needle stick injury and the segregation and transportation of BMW. All the tools including the virtual teaching tool was validated by the seven experts in the field.

Data Collection Procedure

Data collection was done after explaining the purpose, process, and probable implications of the study. During the pre-test, knowledge regarding BMW management was assessed using a structured questionnaire, and the practice of BMW was assessed by on-site observation of the participants using checklist. Later interventional tool that is video and e-pamphlets were distributed to participants using SHAREit in their android mobile phones. After ensuring that all participants have watched the video and the e-pamphlet, post-test was conducted using self-structured knowledge questionnaire and practice checklist.

Data Analysis

Data were analyzed using descriptive and inferential statistics. SPSS Statistics version 23 was used for the data analysis. Descriptive statistics, namely, mean, standard deviation, percentage, and frequency were used to describe the demographic characteristics of the study participants. A Chi-square test was used for finding an association between socio-demographic variables and knowledge and practice scores. A t-test was used to compare the baseline data of the participants. We set the statistical significance level at $P < 0.05$ and a 95% confidence interval.

RESULTS

Socio-demographic Characteristics of the Participants

It reflects that out of 139 participants majority of them 67 (48.7%) were between the age group of 17 and 26 years, and only 3 (2.1%) were above 44 years. Most of the participants 99 (72.1%) were male and the remaining 40 (28.2%) were female. A maximum number of participants were educated up to high school 50 (36%) and only 12.9% had passed secondary education. Many of the participants 60 (43.16%) were working in AYUSH, boys hostel, college of nursing, director office, field, lab, medical college, and nursing hostel while only 3 (2.1%) of the participants were working in emergency and trauma. The majority of the participants 118 (84.9%) were exposed to the training of BMW management during their job tenure while 21 (15.1%) had never undergone any training program. Majority of the participants 128 (92.1%) have been vaccinated against hepatitis B while only 11 (7.9%) participants were deprived of it [Table 1].

Pre-test Knowledge and Practice

It was found that out of the total participants, the majority of the participants have good (54; 38.8%) and moderate 53 (38.1%) levels of knowledge. However, some 24 (17.3%) had poor and only few participants had excellent 8 (5.8%) level of knowledge [Table 2].

Table 1: Demographic profile of housekeeping staff (*n*=139)

Characteristics	Variables	Frequency
Age	17–26 years	67
	27–35 years	47
	36–43 years	22
	44–52 years	3
Gender	Male	99
	Female	40
Education qualification	Illiterate	28
	Primary and Middle	43
	High School	50
	Secondary Education	18
Area of work	OPD	17
	OT	13
	Ward	46
	Emergency	3
	Any other	60
Experience of housekeeping staff	<1 year	35
	2–3 years	72
	4–5 years	12
	>5 years	20
Training of bio-medical waste management	Yes	118
	No	21
Hep. B Vaccination	Yes	128
	No	11

Table 2: Frequency, percentage, mean, and standard deviation of pre-test knowledge (*n*=139)

Knowledge score	Frequency (%)	Mean±SD	t value	P value
Pre-test				
Poor	24 (17.3)	15.89±2.49	21.63	0.00[a]
(0–13 score)				
Moderate	53 (38.1)			
(14–16 score)				
Good	54 (38.8)			
(17–19 score)				
Excellent				
(20–25 score)	8 (5.8)			
Total	139 (100)			

[a]*P* is significant at <0.05 level

Table 3: Frequency, percentage, mean, and standard deviation of pre-test practice (*n*=139)

Practice score	Frequency (%)	Mean± SD	T value	P value
Pre-test				
Poor		21.67±2.13	8.44	0.00[a]
(0–13 score)	10 (7.2)			
Moderate				
(14–23 score)	63 (45.3)			
Good				
(24–26 score)	56 (40.3)			
Excellent				
(27–30 score)	10 (7.2)			
Total	139 (100)			

[a]*P* is significant at <0.05 level

The pre-existing BMW management practice of the participants showed that maximum of them were having moderate 63 (45.3%) and good 56 (40.3%) competency score. However, few participants 10 (7.25%) were having poor and excellent practice level with the mean ± SD (21.67 ± 2.13) [Table 3].

Difference between the Pre-existing and Post-interventional Knowledge and Practice

It was found that the mean pre-existing knowledge was 15.89 ± 2.49 and the mean of post-test knowledge was 21.20 ± 4.61. In the post-test majority of subjects were having excellent 111 (79.9%) knowledge. Only a few 4 (2.9%) were having a moderate level of knowledge and none were found to have poor knowledge after the intervention [Table 4]. It was found that there was a significant difference in the practice of BMW management ([Pretest 21.67 ± 2.13] and post-test [24.95 ± 2.42]) [Table 5].

Association of Knowledge and Practice of BMW Management among Housekeeping Staff with their Selected Demographic Variables

It was found that there was a significant association of knowledge with the area of work (*P* = 0.00) and education (*P* = 0.02). While there was no association of knowledge with age (*P* = 0.51), gender (*P* = 0.08), experience (*P* = 0.10), training in BMW management (*P* = 0.52), and hepatitis B vaccination (*P* = 0.91) [Table 6]. There was a significant association of practice with an area of work (*P* = 0.00) and training in BMW management (*P* = 0.01). While there was no association of practice with age (*P* = 0.75), gender (*P* = 0.76), education (*P* = 0.51), experience of housekeeping staff (*P* = 0.33), and hepatitis B vaccination (*P* = 0.42) [Table 7].

Correlation between Post-test Knowledge and Practice of BMW Management

There was a positive correlation in the knowledge and practice of BMW management but it was too weak [Table 8].

Discussion

In the present study, the level of existing knowledge revealed that 17.3% had poor knowledge, 38.1% had moderate knowledge, 38.8% had good knowledge, and 5.8% had excellent knowledge regarding BMW management. Out of total participants, 7.2% had poor, 45.3% had moderate, 40.3% had good, and 7.2% had an

Table 4: Frequency, percentage, mean, and standard deviation of pre-test and post-test knowledge (*n*=139)

Knowledge	Frequency (%)	Mean±SD	P value
Pre-test			
Poor		15.89 ± 2.49	0.00[a]
(0–13 score)	24 (17.3)		
Moderate			
(14–16 score)	53 (38.1)		
Good			
(17–19 score)	54 (38.8)		
Excellent	8 (5.8)		
(20–25 score)			
Post-test		21.20 ± 4.61	
Poor			
(0–13 score)	-		
Moderate			
(14–16 score)	4 (2.9)		
Good			
(17–19 score)	24 (17.3)		
Excellent			
(20–25 score)	111 (79.9)		
Total	139 (100)		

[a]*P* is significant at <0.05 level

Table 5: Frequency, percentage, mean, and standard deviation of pre-test and post-test practice (*n*=139)

Practice	Frequency (%)	Mean± SD	P value
Pre-test			
Poor		21.67±2.13	
(0–13 score)	10 (7.2)		0.00[a]
Moderate			
(14–23 score)	63 (45.3)		
Good			
(24–26 score)	56 (40.3)		
Excellent			
(27–30 score)	10 (7.2)		
Post-test			
Poor		24.95±2.42	
(0-13 score)	-		
Moderate			
(14–23 score)	39 (28.1)		
Good			
(24–26 score)	62 (44.6)		
Excellent			
(27–30 score)	38 (27.3)		
Total	139 (100)		

[a]*P* is significant at <0.05 level.

excellent level of practice regarding BMW management among housekeeping staff. While, literature revealed that the level of knowledge on BMW management among the Group D health

Table 6: Association between knowledge with selected demographic variables (*n*=139)

Demographic variables	Knowledge score				χ^2	P value	Sig.
	Poor	Moderate	Good	Excellent			
Age					7.95	0.51[b]	NS[b]
17–26 years	9	25	29	4			
27–35 years	17	17	18	3			
36–43 years	6	10	6	0			
44–52 years	0	1	1	1			
Gender					6.60	0.08[b]	NS[b]
Male	12	39	42	6			
Female	12	14	12	2			
Education					18.34	0.02[a]	S[a]
Illiterate	8	12	4	0			
Primary education and middle	12	14	22	5			
High school	8	14	21	11			
Secondary education	0	3	3	2			
Area of work					35.91	0.00[a]	S[a]
OPD	1	5	11	0			
OT	0	3	8	2			
Ward	3	18	3	5			
Emergency	0	0	20	0			
Any others	20	27	12	1			
Experience of housekeeping staff					13.41	0.10[b]	NS[b]
<1 year	5	12	18	0			
2–3 years	13	23	30	6			
4–5 years	1	7	3	1			
>5 years	5	11	3	1			
Training in BMW management					2.21	0.52[b]	NS[b]
Yes	18	46	47	7			
No	6	7	7	1			
Hep.B: Vaccination					0.77	0.91[b]	NS[b]
Yes	23	48	49	8			
No	1	5	5	0			

[a]*P* value significant at < 0.05 level, [b]NS: Non-significant

Table 7: Association between biomedical waste management practices with selected demographic variables (*n*=139)

Demographic variables	Practice score				χ^2	P value	Sig.
	Poor	Moderate	Good	Excellent			
Age					5.91	0.75[b]	NS
17–26 years	4	27	32	4			
27–35 years	4	21	17	5			
36–43 years	2	13	6	1			
44–52 years	0	2	1	0			
Gender					1.15	0.76[b]	NS[b]
Male	6	44	41	8			
Female	4	19	15	2			
Education					8.0	0.51[b]	NS[b]
Illiterate	0	11	14	3			
Primary education and middle	4	23	14	2			
High school	4	20	21	5			
Secondary education	2	9	7	0			
Area of work					33.20	0.00[a]	S[a]
OPD	0	8	7	2			
OT	0	3	8	2			
Ward	0	17	26	3			
Emergency	0	0	2	1			
Any others	10	35	13	2			
Experience of housekeeping staff:					9.45	0.33[b]	NS[b]
<1 year	0	19	14	2			
2–3 years	7	28	31	6			
4–5 years	0	6	6	0			
>5 years	3	10	5	2			
Training in BMW management					11.31	0.01[a]	S[a]
Yes	8	47	53	10			
No	2	16	3	0			
Hep. B: Vaccination					2.63	0.42[b]	NS[b]
Yes	10	55	53	10			
No	0	8	3	0			

[a]*P* value significant at <0.05 level. [b]NS: Non- significant

Table 8: Correlation between post-test knowledge and practice of biomedical waste management among housekeeping staff

Post - test	Mean ± SD	Pearson correlation coefficient	P value
Knowledge	21.20 ± 2.13	0.21	0.01[c]
Practice	24.95 ± 2.42		

[c]Correlation is significant at 0.05 level

workers in Sri Ramakrishna Hospital, Coimbatore, found very good knowledge (78%), good knowledge (22%), and no participant had poor knowledge regarding BMW management.[12] Whereas another study revealed that 5% of Class IV employees had excellent, 50% had good to average, and 45% had a poor level of knowledge regarding BMW management among health-care personnel in Jaipur, India.[16]

In the present study, the pre-test mean knowledge score which was 15.89 increased to 21.20 and the pre-test mean practice score increased from 21.67 to 24.49 after virtual teaching. A study findings support the present study that pre-test knowledge mean score which was 17.383 regarding BMW management increased to 26.033 after video assisted teaching program, it indicates significant improvement in knowledge regarding BMW management.[17]

In the present study, there is a significant association between practice and selected demographic variables, that is, working area or department and training whereas no relationship with age, gender, education, experience, and hepatitis B vaccine. The calculated Chi-square is significant at a 0.05 level of significance. Whereas, a study found no association ($P > 0.05$) between practice regarding BMW management and demographic variable.[18,19]

There is a weak positive correlation between knowledge and practice in the present study. If a similar study could be conducted using a larger sample size or on a bigger scale, then possibly a better positive correlation can be achieved. A study supports present study with identification of a weak positive correlation between knowledge and practice regarding BMW management among housekeeping staff.[19]

CONCLUSION

This study revealed that virtual teaching tool was found to be effective in enhancing the knowledge and practice of housekeeping staff. Hence, frequent refresher training and educational session on BMW management are required to increase the knowledge and performance of housekeeping staff regarding BMW even if they had any training previously.

ACKNOWLEDGMENTS

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