

A CROSS-SECTIONAL STUDY ON KNOWLEDGE OF BIO-MEDICAL WASTE MANAGEMENT AMONGST NAÏVE MEDICAL STUDENTS: THE NEED FOR EARLY INTERVENTION.

Microbiology

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ABSTRACT

Introduction: Biomedical waste (BMW) generated during diagnosis, treatment or immunization is infectious, hazardous, and deleterious for humans, animals, and the environment. A cross-sectional study with Pre-test and Post-test assessment was carried out on 115 newly enrolled first-year MBBS students as study subjects. The study aimed to assess and impart knowledge regarding BMW management to naïve Medical Students. Also considering them to be representative of the community, we assessed this knowledge among the community. **Methods and Material:** A pre-designed Performa consisting of multiple-choice questions related to BMW management, for a pre-test and post-test assessment was used for data collection. A score was assigned for each correct response. Accordingly, participants were categorized as having Good, Average, or Poor knowledge regarding the subject. The data were statistically analyzed using paired "t" test with Wilcoxon correction by Graph Pad Prism. **Results:** The P-value was statistically significant (p-value<0.5). The knowledge was good during pre and post-assessment but to translate the knowledge into Attitude and Practice (KAP) there is a need to conduct regular periodic training among healthcare workers (HCWs). **Discussion:** BMW is considered to be infectious and/or hazardous and has reached the community beyond hospital settings. Thus, adequate KAP is essential for HCW and the general population. There is a need to educate HCW and the community to handle BMW. The initiatives should start from the initial training days. Periodic training and monitoring of practice towards BMW management are needed to improve public health.

KEYWORDS

biomedical waste, tertiary care hospital, medical students, Pre-test and Post-test assessment

INTRODUCTION

"Bio-medical waste"(BMW) is generated during the diagnosis, treatment, or immunization of human beings or animals or research activities pertaining thereto, or in the production or testing of biological or health camps.^[1] BMW "Management" includes segregation, collection, receiving, storage, transport, handling, treatment, or disposal to ensure the protection of health and the environment.^[2]

According to statistics (2018), approximately 608 TPD of BMW was generated in India, and Bihar alone contributed to about 34,812.9 Kg/day.^[3,4] Only 10-25% of BMW is hazardous.^[5] Rest 75-90% is non-hazardous. But if they get mixed, then 100% of the waste becomes harmful.

In India, the Ministry of Environment and Forests (MoEF) formulated the BMW rule in 1998, functioning until 2016.^[6] Under the newer BMW guidelines which came into effect in 2016, with amendments made in 2018, the concerned person must have proper knowledge, attitude, and practice about BMW management. Any laxity in knowledge, attitude, and practice may lead to indiscriminate disposal of bio-medical waste, thus seriously jeopardizing the health of the community and environment.^[7] Studies in India showed that healthcare personnel's knowledge, practice, and attitude toward BMW management are relatively low.^[8,9] Timely intervention can bring a big change not only in the healthcare sector but also in the general population.

The rationale of our study is to assess and impart knowledge to the study subjects regarding BMW, as they have to handle BMW in the future. Also, in the present scenario of the ongoing pandemic with home isolation and quarantine centers, the BMW generation has reached the community beyond the hospital boundaries. Hence considering the naïve medical students coming from different regions of India, to be representative of the community, we also assessed this knowledge among the community. Also due to the ongoing pandemic,

the importance of proper BMW management has been highlighted through various print and electronic media. The present study also assessed the knowledge gained by the general population.

MATERIAL AND METHODS

The present study is a Cross-Sectional interventional study intended to assess and improve the knowledge of the first-year medical students of an educational institute cum tertiary care center in Patna, Bihar (India). Out of the 121 enrolled first-year medical students, only 115 participated in the study. There were 32 girls and 89 boys from different states across India. The students were 18 to 21 years of age, with an intermediate degree, qualified, pre-medical competitive examinations with no experience in the hospital environment. The questionnaire was prepared in English as all the participants could read, write, speak and understand English. A pre-designed performa consisting of multiple-choice questions related to different aspects of biomedical waste management was used for data collection. The questions were related to color coding, waste segregation, and hazards associated with biomedical waste. The study subjects answered the questionnaire as a pre-test and post-test assessment. One mark was assigned for each correct response. Participants were categorized as having Good, Average, or Poor knowledge regarding the subject depending upon the marks and scored a score of 10. Participants scoring more than eight were graded as Good, 5 to 8 as Average, and less than 5 were categorized as having poor knowledge. To assess the improvement in knowledge between pre-test and post-test assessment and the effectiveness of structured teaching data was statistically analyzed using paired "t" test with Wilcoxon correction by Graph Pad Prism. The P-value was statistically significant (p-value<0.5)

RESULTS

The study has been designed for 121 participants, but six did not turn up. Results of the pre-test assessment showed that the majority (85.2%) scored 5-8 (average knowledge), and only 10.4 % scored less than 5 (poor knowledge). However, some of the participants (4.3%) scored more than 8 (good knowledge). After a practical demonstration

of proper ways for BMW segregation post-test assessment was conducted, the results of the post-test assessment showed tremendous improvement in participants' knowledge. In the post-test assessment, about 89.6% scored more than 8 (good knowledge), and 10.4% scored 5-8 (average knowledge) [Table 1].

On further analysis of the pre-test assessment, all (100%) of the students were well aware of the full form of BMW (Q.1). Only 6% of students knew that the majority of BMW is non-infectious (Q.2). About 40.86% of students knew the color coding for BMW segregation (Q.3). Knowledge of waste segregation at the point of generation was found in 54.8% of students (Q.4). About three fourth (75.6%) of students knew safe disposal of used masks in the yellow bag (Q.5), and about two-thirds (62.6%) students were aware of who segregates the waste (Q.6). Approximately 59% of the students knew the fate of BMW (Q.7). The majority (94.8%) of the students knew the Bio-hazard symbol (Q.8). Only 44.3% knew about the cytotoxic symbol (Q.9) [Figure 1]. About 92% of the students knew the consequences of improper bio-medical waste management (Q.10). [Table 2]

DISCUSSION

Appropriate knowledge of BMW management among healthcare workers is essential. The WHO observed that poor management of BMW will cause a threat to human lives and destabilize ecological balance. The present study was conducted to assess the improvement in the pre-test knowledge of participants after teaching. It also points towards the educational value of a structured teaching method.

The present study observed that in the majority (85%) of students, overall pre-test knowledge of different aspects of BMW management was average (score 5-8), while in about 10% of the students, it was poor (score <5). However, 4% of students had good pre-test knowledge (score >8). After classroom teaching, the results of the post-test assessment showed tremendous improvement in the knowledge of students. In the post-test assessment, about 89.6% of the students scored more than eight, and the rest, 10.4%, scored 5-8 (average knowledge). Thus, we can interpret our findings that modeled classroom teaching significantly impacts acquiring new knowledge.

On further analysis of students' responses to particular questions given in the pre-test assessment, we found that all (100%) of the students were well aware of the full form of BMW (Q.1). This could be because other options were not related to medical sciences. Only 6% of students knew that a more significant percentage of BMW is non-infectious (Q.2). A probable reason behind the students' poor knowledge could be the general concept of the infectious nature of BMW in the community.^[10] Only about 40.86% of participants knew the color coding for BMW segregation (Q.3). This may be because of the non-practicing of color-coded bins/containers for waste segregation in peripheral hospitals and communities.^[11,12] Knowledge about waste segregation (Q.4) and the persons involved in this (Q.6) was poor among the students. Only 54.8% of students were aware that segregation occurs at the point of generation, and about (62.6%) of students were aware of segregating the waste. It could be because of the general mindset that waste is often collected and segregated by sweepers in the hospital.^[11] About three fourth (75.6%) of students knew safe disposal of used masks in the yellow bag (Q.5). A high level of awareness may be due to the impact of proper mask use on the ongoing SARS-CoV-2 pandemic. Approximately 59% of the students knew about the fate of BMW (Q.7). The majority (94.8%) of the students knew the bio-hazard symbol (Q.8). Only 44.3% knew about the cytotoxic symbol (Q.9). This disparity in students' knowledge about symbols used in the hospital may be due to the widespread display of bio-hazard symbols on collection bags, sites, transport vehicles, and public places compared to the limited display of cytotoxic symbols [13]. The majority (92%) of the students knew about the consequences of improper BMW management (Q.10). It could be due to general awareness created by electronic media about the adverse impact of waste on public health and the environment.

More than 90% of students were aware in the pre-test assessment, but only about a few aspects of BMW, i.e., terminology, bio-hazard symbol, and consequences of improper management. About 40-70% of students were not aware of various other aspects of BMW. The other studies have also reported average pre-test knowledge of BMW management.^[14,15] Pre-test has its importance, and it has an impact on post-test performance. Pre-test helps to improve their focus on the

lecture and for better performance. This could be due to the self-realization of their loopholes and lacunae. Hartley suggested that pre-tests can be orienting and motivational and hence teaching functions in addition to the sought-for testing function.^[16] However, Hill concluded that the pre-test did not result in a measurable increase in learning.^[17]

Thus, pre-test evaluation before the lecture would increase the attention, curiosity, and eagerness to acquire new knowledge among healthcare workers. Our results also revealed that pre-test assessment helped the majority (n=110, 95.6%) of the students acquire knowledge about BMW management which was unknown earlier. [Table 1] Improvement of knowledge after pre-test assessment is confirmed by improvement in post-test score. Hence our findings are in agreement with other published studies.^[18,19] Post-test assessment after teaching showed that the majority (89.6%) of the students scored more than 80%. There was a marked improvement in knowledge regarding biomedical waste management among the students, which is reflected in the post-test score compared to the pre-test score (4.3% Vs 89.6%) (p-value = 0.0039). None of the students performed poorly in the post-test assessment compared to the pre-test assessment, in which approximately 10% of students had poor performance. This suggests that the participants were attentive to the lecture, understood the lecture's critical content, and benefited from the same. Our findings are in concordance with similar observations seen in the other studies.^[19,20,21] Pre- and post-test assessment designs are frequently used tools in behavioral research. The measurement of change provides a vehicle for assessing the impact of interventions.^[22] Thus, the present study supports the concept of pre-test assessment, structured teaching methods, and post-test assessment to acquire new knowledge and improve performance.

Currently, BMW management is receiving more attention due to evolving knowledge and modification in its regulation. The summarized rules address segregation, storage, transportation, and treatment of waste. There is a need for the involvement of multi-stakeholders, the use of technology, and appropriate training programs of health care workers (HCWs) for appropriate BMW management. Awareness regarding BMW, its health hazard, and its management are highly essential for the excellent health of the community.

CONCLUSION

Bio-medical waste management is an essential component of health management. Also due to the ongoing pandemic and newer advancements in the health sector with many patients being treated in home isolation or home care facility, the BMW generation is not limited to hospital settings but has reached the community. Thus, adequate KAP of BMW is essential not only for HCW but also for the general population. The initiatives for inculcating the correct attitude among HCWs should start from the initial training days. Also, the government has taken initiatives for educating people through various school training programs and mass media communication. Early and appropriate KAP from the initial training days will bring a revolution in the health system. Our study assessed as well as imparted necessary knowledge among the study subjects. There is also a need for regular periodic training and monitoring of the behavior & practice of HCW to keep updated about BMW management to improve public health.

Table 1: Pre and Post-test assessment of first-year MBBS students (BMW management).

Score (Grade)	Pre-test n (%)	Post-test n (%)
<5 (Poor)	12(10.4)	0(0)
5-8 (Average)	98(85.2)	12(10.4)
>8 (Good)	5(4.3)	103(89.6)
Total	115 (100)	115 (100)

Table 2: Knowledge of first-year MBBS students about different aspects of biomedical waste management in Pre-test assessment and Post-test assessment.

Q.NO	Questionnaire	Percentage of students with correct answer pre-test (%)	Percentage of students with correct answers post-test(%)	P value
Q.1	Full form of BMW	100	100	P = 0.0039
Q.2	Hospital waste is majorly non-infectious	6.08	75.65	
Q.3	Color coding of bins or containers	40.86	95.65	

Q.4	Waste segregation at point of generation	54.8	91.30
Q.5	Used mask disposed of in yellow bag	75.6	93.91
Q.6	Who segregates the waste	62.6	98.26
Q.7	Fate of BMW	59.1	97.39
Q.8	Bio-hazard symbol	94.8	99.13
Q.9	Cytotoxic symbol	44.3	94.78
Q.10	Consequences of improper BMW management	92.1	99.13

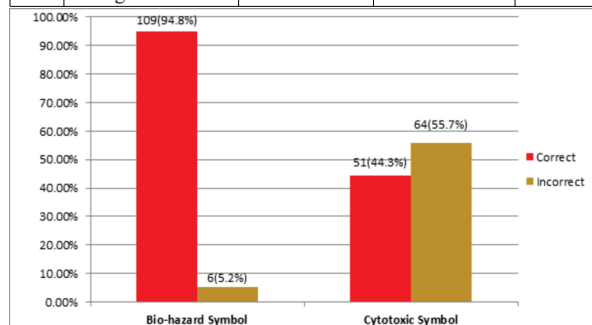


Figure 1. Students' responses to question no.8&9 (bio-hazard and cytotoxic symbol) in the questionnaire. (n=115)

Limitations of Study

This study is conducted at a single center with a limited number of participants representing only a subset of healthcare workers. Hence, a replication of this study can be conducted with more participants, including other healthcare workers in various healthcare settings, including private and public healthcare centers. Also, we have only assessed the knowledge and not the attitude and practice. Thus, after acquiring the knowledge, we need to assess whether it is being practiced or not.

Declaration of interest: The authors declare no conflicts of interest

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