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Research Article

A Comparative Study on Perception about Biomedical Waste Management among the Undergraduate and Postgraduate Students in a Tertiary Care Teaching Hospital in South Delhi

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A B S T R A C T

Background: Biomedical waste poses a great risk of infection and damage. Improper waste management could have major public health repercussions. Medical students are exposed to various biomedical wastes during their training in the hospital. Their lack of awareness about biomedical waste management is hazardous to their health and the health of others. The purpose of this study was to examine undergraduate and postgraduate students' understanding of biomedical waste management in a study setting.

Method: A cross-sectional study was conducted among 350 undergraduate and postgraduate students at a tertiary care hospital in South Delhi in 2019. Data were collected using a self-structured and administered questionnaire after taking informed consent. Data were analysed using SPSS 20.0 software.

Results: 86% of participants were aware of the BMW legislation. 79% always practised BMWM guidelines and 65% had correctly identified biohazard symbols. Postgraduate students had better knowledge about colour coding and disposal methods of biomedical waste than undergraduate students including interns.

Conclusions: Undergraduate and postgraduate students were aware of biomedical waste but finer details for its management were far from perfection. Sensitisation about BMW hazards, regular training, continuous monitoring, and feedback are recommended to improve their biomedical waste management practices.

Keywords: Biomedical Waste, Healthcare Facility, Knowledge, Undergraduate, Postgraduate

Introduction

Today with the tremendous advancement in global healthcare facilities, Biomedical Waste (BMW) becomes a universal issue.[1] The term Biomedical Waste (BMW) has been defined as "any waste generated during diagnosis, treatment or immunisation of human beings or animals, or in the research activities pertaining thereto or in the production or testing of biological orin health camps.[2] Today nearly 10-25% of BMW is regarded as hazardous and may lead to numerous health risks.[3] Biomedical waste is claimed to be more hazardous than other wastes as its improper management from hospitals, clinics and other facilities may create risks to patients, doctors, waste handlers, and the general public. It might contaminate water, air and soil, thereby affecting all forms of life.[4] The acceptable Biomedical Waste Management (BMWM) process includes vital steps i.e., handling, segregation, mutilation, disinfection, storage, transportation, treatment, and disposal. The main purpose of BMWM is to decrease waste generation and ensure its efficient collection, handling, and safe disposal.[5]

Although there is an increased global awareness among healthcare professionals about risk and appropriate management techniques, the degree of awareness is still not much satisfactory. Poor biomedical waste management is a problem in most developing countries and it is mainly because of a lack of information and trained clinical staff. Poor knowledge and improper handling of healthcare waste presenta tremendous risk to the health of patients and healthcare personnel, especially thosehandling it like doctors, nursing staff, ward boys, sanitation workers, postgraduate students, interns, etc.

Medical students are an integral part of the healthcare system. They should have an adequate understanding of biological waste management, which should be evaluated on a regular basis. Various studies have been undertaken to measure healthcare personnel's knowledge, attitude, and practice regarding biological waste management,[6,9] but studies regarding knowledge, awareness, and practice about BMWM among undergraduate medical students, interns, and postgraduate students arecomparatively limited. Thus, the present study was conducted to assess the knowledge regarding BMWM among undergraduate and postgraduate students.

Methodology

The present study was a descriptive cross-sectional study conducted in 2019 at a tertiary care hospital in South Delhi. The study population was undergraduate medical students in 2nd professional and above including interns and postgraduate students of all the departments. There was a total of 350 students, i.e., 260 undergraduate students including interns and 90 postgraduate studentswere recruited. The study was conducted from April 2019 to September 2019. Students who were willing to participate in the study were included. A structured questionnaire was prepared based on BMWM Guidelines 2016 issued by MOEF,[10] to comprehensively cover different aspects of biomedical waste management. The questionnaire consisted of two parts. The firstpart contained sociodemographic variables e.g., age, gender, and academic year. The secondpart contained various aspects of BMW management. Study variables were age, gender, academic year, awareness about BMW legislation, BMWM class attended, knowledge about bio-hazard symbol, category of BMW, andcorrect methodof waste bag disposal. Questionnaires were distributed among medical students in lecture halls, hostels, and hospitalsafter obtaining informed verbal consent. The questionnaires were filled by the participants themselves on the spot and subsequently collected by the investigators. Data werecompiled using MS Excel 2007 and analysed using SPSS 20.0 version. Chi-square test was applied to calculate the statistical association between different variables. The study was approved by the Institutional Ethics Committee.

Result

A total of 350 medical students were studiedusinga self-administered questionnaire. The majority of the study population wasin the age group of 19-23 years (56%) and male (57%). The meanage of the study population was 22.68 years (±2.74 SD). Maximum participants were undergraduate students (74.3%) Table 1. 86% of the total study participants were aware of BMW legislation. Among the UG students, 86.9% and among the PG students, 83.3% were aware of BMW legislation Figure 1.

Table 1.Sociodemographic Profile of Study Population (N=350)

Characteristics	Number	Percentage
Age (in years)		
19-23	196	56.0
24-27	105	30.0
28-31	49	14.0
Gender		
Male	199	57.0
Female	151	43.0
Academic Year		
Undergraduate (UG)	260	74.3
2nd professional	102	29.14
3rd Professional (Part I)	70	20.0
3rd Professional (Part II)	44	12.5

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Intern	44	12.5
Postgraduate (PG)	90	25.7

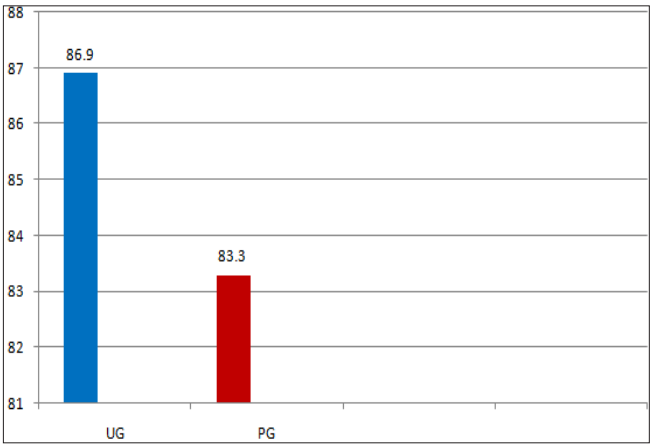

Figure 1.Distribution of Undergraduate & Postgraduate Students based on Awareness about Biomedical Waste Legislation (n=350)

A total of 217 students (62%) had attended the BMW management class. 45% of 2nd professional, 37% of 3rd professional Part I, 68% of 3rd professional Part II, 100% of interns, and 80% of postgraduate students attended the class.

Table 2.Distribution of Study Population according to Practice of BMWM Guidelines among those who Attended the Class (N=217)

Frequency of Following Instructions taught in BMW Management Classes as reported by Students	Number of Students	Percentage of Students
Always	171	79
Sometimes	43	20
Never	03	1

Of the students who attended the BMWM class, 79% always practised BMWM guidelines, 20% practised them sometimes and 1% never practised BMWM guidelines Table 2. 90% of students attended the BMWM class because they thoughtit is useful, 6.4% of students attended this class despite their thinking that it is not useful, and 3.6% of students who attended this class were not sure about its utility. 133 students (38%) did not attend the BMWM class. 80% of these wanted to attend this class in future, 11% did not want to attend classes in the future, and 9% were not sure whether they wanted to attend this class or not Table 3.

80.8% of UG students and 91.1% of PG students had correct knowledge about yellow category waste and this relation was found to be significant. 62.3% of UG students and 86.7% of PG students had correct knowledge about red category waste and this relation wasalso found to be significant. 33.1% of UG students and 53.3% of PG students had correct knowledge about white category waste and this relation was also found to be significant. 31.8% of UG students and 44.7% of PG students had correct knowledge about translucent category waste but this relation wasnot significant Table 4.

Table 3.Distribution of Students who attended BMW Management Classes based on their Perception of Usefulness and Willingness to attend the Class

Usefulnessof BMW Management Class as Perceived by Students(n=217)	Number of Students (n=217)	Percentage of Students
Useful	195	90
Not useful	14	6.4
Not Sure about its Utility	08	3.6
Willingness of Students to attend BMW Management Classes in the Future (n=133)		
Want to Attend Classes	106	80
Don't want to attend Classes	15	11
Not Sure	12	9

Table 4.Distribution of Study Population based on Correct Knowledge regarding Segregation of Biomedical Waste into Various Categories (BMWM 2016 Guidelines)

	Yellow	Red	White	Translucent
UG	80.8%	62.3%	33.1%	31.8%
PG	91.1%	86.7%	53.3%	44.7%
Chi-square test	5.172	18.408	11.61	0.825
P-value	0.023	0.002	0.001	0.364

Table 5.Distribution of Study Participants based on Correct Knowledge about Method of Waste Bag Disposal

	Yellow Non-chlori-nated Plastic Bag	Red Non-chlorinated Plastic Bag/ Container	Puncture-proof, Leak-proof, and Tamper-proof Conta-iners	Card-board Boxes with Blue Coloured Marking
UG	55.4%	66.9%	71.5%	51.3%
PG	68.9%	73.3%	75.6%	67.8%

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Chi-square test	5.035	1.275	0.542	2.732
p value	0.025	0.259	0.462	0.312

55.4% of UG students and 68.9% of PG students had correct knowledge about the method of yellow non-chlorinated plastic bag disposal and this relation was found to be significant. 66.9% of UG students and 73.3% of PG students had correct knowledge about the method of red non-chlorinated plastic bag disposal and this relation was not significant. 71.5% of UG students and 75.6% of PG students had correct knowledge about puncture-proof container disposal and this relation was also found to be not significant. 51.3% of UG students and 67.8% of PG students had correct knowledge about the disposal of cardboard boxes with blue coloured markingsand also this relation was not significant Table 5. 227 students (65%) had correct knowledge about the symbol of biohazard. 56.2% of UG students and 91.9% of PG students had correct knowledge about the symbol of biohazard and this was found to be significant (pvalue 0.01).

Discussion

Undergraduate and PG students are future doctors and intend to provide the best treatment to their patients. So, inadequate knowledge and practice of BMWM are dangerous for their own health, their patients, and also those in the society and environment.[11,12] In this study, 86% of study participants were aware of biomedical waste legislation which was similar to the studies done by Sharma S and Deori TJ[13] and Ajmera V and Jayalakshmi LS[14] in which 86.2% and 84.17% of participants respectively were aware of BMW legislation. Our findings are a little contrary to the studies done by Chudasama RK et al.,[6] BasuM et al.,[7] Vohra P et al.,[15] Soumya S et al.,[16] and Haidar S et al.,[17] in which 54.1%, 94.4%, 42%, 22%, and 70.83% participants respectivelyhadheard about BMW rules. The difference in awareness may be because our study only includes undergraduate and postgraduate students while other studies also include nursing and other healthcare staff along with medical students. In this study, 86.9% of UG students and 83.3% of PG students were aware of biomedical waste legislation which was consistent with the study done by Singh S et al.[11] in which 100% of UG students and 80% of PG students were aware of BMW legislation.

In ourstudy, 62% of the study participants had attended the BMWM class. Studies done by Chudasama RK et al.,[6] Kumar M et al.,[11] and Haidar S et al.[17] showed that alesser percentage of participants (44.7%, 35.5%, and 20% respectively) received any training regarding BMWM, while a study done by Medaduwage IN et al.[18] in Malaysia showed that 90.7% of students attended a class on BMWM. These differences are probably due to differencesin the study setting, study participants, etc. Regarding attending the BMWM class, in our study, the maximum percentage was of interns followed by PG students and UG students. 90% of students attended the BMWM class because they thought it is useful, 6.4% of students attended the class despite their thinking that it is not useful and 3.6% of students who attended this class were not sure about its utility.

In this study, 79% of the participants who attended the BMWM classalways practisedBMWM guidelines, 20% practised them sometimes, and 1% never practised them. A similar finding where 79.3% of healthcare professionals always followed BMWM guidelines was reported by Jalal SM et al.,[19] in their study. Also, a study was done by Sharma S et al.,[12] where 82% of participants were practising segregation of BMW. Chudasama RK et al.,[6] in their study, showed that practices regarding different domains of BMWM varied between 63-87.9%. According to Kumar M et al.,[11] 65.5% of HCW spractised segregation of waste.

In our study, postgraduate students had better knowledge about the four categories of waste as compared to undergraduate students including interns. These findings are similar to the finding in a study by Sharma S and Deori TJ[13] where 78.5% of participants (postgraduate students) knew about the correct categorisation of waste. In a study done by Kumar AP et al.,[4] postgraduate students had better knowledge than interns. Singh S et al.,[12] in their study reported that postgraduate students and undergraduate students including interns have almost equal knowledge about colour coding.Contrary to our study, Haidar S et al. reported in their study that nursing students had better knowledge about colour coding systems than permanent nursing staff. This may be due to the better the oretical knowledge or clinical training of nursing students from the first year onward.[17]

In our study, postgraduate students had better knowledge about methods of waste disposal than undergraduate students. This difference is natural because undergraduate students and interns have more theoretical knowledge about disposal methods while postgraduate students generally practised it. An almost similar finding was reported by Singh S et al.[11] and Sekar M et al.[20] in their study.

In this study, 65% of the participants had correct knowledge about the symbol of biohazard. A similar finding was observed by Basu M et al.[7] and Saumya S et al.[16] (67.9% and 61% respectively). Studies contrary to our finding are Chudasama RK et al.[6] (87.6%), Kumar M et al.[10] (85.5%), Sharma S and Deori TJ[13] (83.8%), and Kahn PS et al.[21] (78%). This difference may be due to different study participants and their levelsof knowledge. In our study, 91.9% of PG

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students and 56.2% of UG students had correct knowledge about the symbol of biohazard.These findings are nearly similar to the findings of Singh S et al.[11] where 84% of PG students and 68% of UG and interns had correct knowledge about the symbol of biohazard.

In a previous study done among dental students by Kishore J et al.,[22] the awareness about biomedical waste management and segregation was found to be poor. A study in a nursing home by Kishore J et al.[23] found poor awareness (<50%) and fair practice (<70%) of segregation of biomedical wastes in nursing homes.This variable knowledge and practice could be attributed to the lack of mandatory training and practice. The management of biomedical waste requires immediate in-service training. BMW management guidelines must be rigorously followed in the healthcare facility to avoid hazards.

Conclusion

This study showed that overall postgraduate students have better knowledge about BMWM than undergraduate students. Most of the participants knew about BMW legislation,but still, nearly 14% of participants had poor knowledge about BMW guidelines. Surprisingly, 35% of participants had no knowledge about biohazard symbols. 62% of participants hadreceived training regarding BMWM. It is good to see that among theparticipants who had not attended any class on BMWM, 80% wanted to attend class in the future. This reflects the importance of BMWM in view of the participants.

Recommendation

There is a need forintensive training programmes at regular intervals to repeatedly train and retrain all staff with special emphasis on medical undergraduates, interns, and postgraduates, which may include question-raising and problem-solvingapproaches.There should be periodicalsensitisation sessions for behaviour modification to improve awareness and update knowledge and practice of BMWM. In medical practice, we cannot achieve the desired goal only with guidelines for BMWM, without promoting and monitoring using Behaviour Change Communication (BCC) and changing the mindset of the people in medical practice.

Limitations of the Study

"Misinformation bias" could not be ruled out as students tried to project good knowledge and awareness in questions asked on segregation and training.

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