SHORT ARTICLE

Perception regarding Bio-medical Waste Management among medical students in a Tertiary Care Hospital

Shikhar Singh[1], Neha Sharma[2], Prabhakar Mishra[3]

[1]Senior Resident, Department of Community Medicine, Dr Ram Manohar Lohia Institute of Medical Sciences, Vibhuti Khand, Gomti Nagar, Lucknow; [2]Assistant Professor, Department of Community Medicine, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Jolly Grant, Dehradun; [3]Associate Professor, Department of Biostatistics & Health Informatics, Sanjay Gandhi Post Graduate Institute of Medical Science, Rae Bareli Road, Lucknow.

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Corresponding Author

Address for Correspondence: Dr Neha Sharma, Assistant Professor, Department of Community Medicine, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Jolly Grant, Dehradun, Uttarakhand - 248016
E Mail ID: dr_neha2402@yahoo.com

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Abstract

Background: Bio-medical waste is perilous and can be a health hazard. There is considerable role of medical undergraduates, interns and post-graduates in preventing hazardous consequences from mishandling of bio-medical waste. **Aims & Objectives**: To assess the knowledge, attitude and practice about Bio-medical waste management among medical undergraduates, interns and post-graduate students. **Methodology**: A cross-sectional study was carried out among 75 participants including MBBS students, interns and post-graduate students (25 from each group) at King George's Medical University, Lucknow through purposive sampling technique over a period of one month. A structured self-administered questionnaire was used for data collection. Data were analyzed using Chi-square, Fischer-exact, one-way ANOVA and Post Hoc (Tukey) Tests. **Results**: MBBS students had more knowledge and the better attitude towards BMW management guidelines as compared to interns and post-graduates(p<0.001), while post-graduate students were more aware of the needle-stick injury and were correctly practicing BMW management as compared to MBBS students and interns(p<0.001). **Conclusions**: Knowledge, attitude and practice regarding BMW management is still inadequate among MBBS students, interns and post-graduates, so repeated training-retraining and supportive supervision regarding the same should be foster. Strict regulations and surprise perusals might be a strong impetus for medical students and other health personnel.

Keywords

Introduction

"Let the wastes of the sick not contaminate the lives of the healthy" quoted by K Park, afflatus us to conduct the present study.(1) "Bio-medical waste means any waste, which 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 in health camps".(2) Latterly, BMW has become a

burning topic of discussion. The fundamental liability of the generator becomes imperative in proper disposal of bio-medical waste, as meager bestowal would not suffice the required need. The hazardous consequences due to improper BMW management can be deleterious.(3) Several studies have also indicated that the inappropriate handling and disposal of hospital waste poses health risks to health workers.(4,5,6,7) Globally, BMW management awareness is increasing day by day, but in Indian context the knowledge and awareness regarding the same is still in mediocre stages among the health care personnel.(8,9,10)

The prior perusal on eliciting knowledge, awareness and practice about hazards and management of bio-medical waste comparatively among undergraduate students, interns and post-graduate students is limited. Thus, the present study was planned with an aim to make the medical students fathom the importance of bio-medical waste management.

Aims & Objectives

1. To know the existing knowledge and awareness regarding biomedical waste management (BMW) and needle stick injury among undergraduate medical students, interns and postgraduate medical students.
2. To assess their attitude and practices related to biomedical waste management (BMW).

Material & Methods

Study Type: Cross-sectional study, Study Area- King George's Medical University, Lucknow, Study Population- Medical students (MBBS, Post-graduates and interns), enrolled in the institute between 2012 to 2016 **Study Duration:** January 2017, **Sample size**: 75 students i.e 25 undergraduates, 25 interns and 25 postgraduates were recruited in the study. **Inclusion Criteria**: Undergraduate medical students from MBBS 2013-2015 batch and Interns of batch 2012 while postgraduate students from all departments who were present at the time of data collection and gave consent for the study. **Exclusion Criteria**: Students of MBBS Batch 2016 as they were new in the medical college and have partial or no knowledge about bio medical waste.

Sampling Methodology: To select the study participants, purposive sampling technique was adopted,

Data Collection: Data was collected in structured, self-administrated questionnaire which was designed in English language after thorough review of literature. Questionnaire was designed to assess the knowledge, attitude, and practices on various aspects of BMW such as its hazards, rules, management, the color coding for segregation and methods used for disposal, needle stick injury and prophylactic vaccination. Questionnaire had 4 section:

1. Section-A had 7 Questions on "Knowledge of Biomedical Waste Generation and Legislation"
2. Section- B, had 6 Questions on "Knowledge About Needle Stick Injury"
3. Section- C, had 6 Questions on "Assessment on Attitude Towards Biomedical Waste Management"
4. Section- D, had 6 Questions on "Assessment on Practices Related to Biomedical Waste Management"

Consent- The questionnaire was personally administered after taking consent, and the students were explained regarding the motive of the study and how to complete the questionnaire. It was emphasized that the confidentiality of the responses made by them would be strictly maintained.

Ethical Approval- Before commencing the study, ethical approval was taken from institutional ethical committee of the university. Written informed consent was obtained from all individual participants included in the study.

DATA ANALYSIS: Questions were marked right or wrong. For every right answer four marks was given so that maximum number was 100. Scoring was done for each section. Maximum marks for section A were 28 and for section B, C and D maximum marks were 24. Scores of each question were converted to percentages and graded into three categories section-wise and overall as:

1. Percentage Score ≥75% - Good
2. Percentage Score 50-75% - Average
3. Percentage Score <50% - Poor

Descriptive statistics are presented in mean ± SD (for quantitative data). Findings are also presented through graph. Normality of the data was checked using Kolmogorov Smirnov test, Histogram and Q-Q plot. Chi-square and Fisher Exact test was used to check the association between the BMW questions related to KAP with the three groups. One-way ANOVA test was used to test the significant level for the mean difference between the three groups. For significant One-way ANOVA test, further Post-Hoc

test (Tukey method) was performed to identify the significant pairs between means difference was significant. A minimum two-sided 95% confidence interval or p value <0.05 was considered as statistically significant. Statistical package for social sciences, version 23 (SPSS-23, IBM, Chicago, USA) was used for data analysis

Results

Out of total 75 study participants, mean age was 22.34±3.7 years (range: 19-29 years) with 43 (57%) were females. Proportions of the females were 48.0%, 72% and 52.0% in MBBS, interns and post-graduate students.

[Table-1] depicts section-wise questions with their correct responses given by MBBS students, post-graduates and interns. Majority (range: 64.0% - 100.0%) of MBBS students had better knowledge about BMW guidelines, its legislation, about segregation of BMW and bio-hazard symbol as compared to post-graduates and interns. Interns had least (12.0%) knowledge about the post-exposure prophylaxis after injury.

All study participants agreed that bio-medical waste should be segregated into different categories. Almost every participant felt that BMW management should compulsory be made part of the undergraduate curriculum. However, Majority (81.0% - 96.0%) medical students and interns told that they need further training on BMW management. In section-D, Only 8.0 percent interns and 28.0 percent post-graduate students rightly dispose metallic sharps in white bin. And not even 50.0 percent medical students and interns correctly dispose syringes in red bin.

In the [Table-2], mean score of the section: A, B, C, D and overall score was compared among three students' groups using one-way ANOVA test. Result showed that mean difference in scores of the three groups were statistically significant for the all the individual sections as well as overall. Post hoc test showed that in the section A and section C, mean difference was statistically significant (p<0.05) between MBBS students and post-graduates as well as between MBBS students & Interns but insignificant between post-graduates and Interns (p>0.05). In section B, mean difference was statistically significant between post-graduates and interns only (p<0.05). In section D, mean difference was statistically significant (p<0.05) between MBBS students & Interns as well as between post-

graduates & Interns but insignificant between MBBS and post-graduates (p>0.05). For overall, in all the pairs, mean difference was found to be statistically significant (p<0.05).

The percentage scores (section-wise & overall) of the medical students (n=75) regarding Knowledge, attitude and practice of BMW management depicted that, in section-A (Knowledge of Biomedical Waste Generation and Legislation) most (58.7%) of the medical students had average knowledge, while regarding needle-stick injury (section-B) majority (68.0%) had good knowledge. In section-C, majority (60.0%) medical students had average attitude towards BMW management. In respect to practices related to biomedical waste management, one-third medical students were poorly practicing/handling the bio-medical waste.

Discussion

Undergraduates, post-graduate medical students and interns are the budding doctors and hold the promise of providing the best treatment to the patients, thus their scanty knowledge can be dangerous for themselves and for the others too. The current study assessed the knowledge attitude and practice of MBBS students, interns and post-graduate students regarding BMW management and knowledge regarding needle-stick injuries through a structured questionnaire.

Knowledge about BMW management
Knowledge wise MBBS students and interns were better as compared to post-graduates in our study. It was not astounding to see that all MBBS students and interns knew about BMW generation &legislation, as they are theoretically graduates better informed about recent updates. However only 80% of post-graduates knew about it which was consistent with the study by Amin.P *et al* (2018) but little contrary to the study done by Basu.M *et al* (2018), Malini A *et al* (2015) and chudasama *et al* (2014) in which more than 95.0 percent residents and interns had heard about BMW legislations.(5,8,11,12) Sekar. M *et al* (2018) also in their study should that post-graduates have better knowledge than interns. (13)

In the present study, 28% post-graduates and 40% interns knew about correct duration till which bio-medical waste can be stored, the results are contrary to the study done by Malini A *et al* (2015) and Amin. P *et al* (2018) in which around 55% resident doctors

knew that bio-medical can't be stored beyond 48 hours.(11,12) This could be due to that as theoretically MBBS students are sounder and interns also keep on reading for their post-graduation exam, thus they all had better knowledge, while post-graduate students don't get enough time to study so they illustrated such kind of knowledge.

Regarding bio-hazard symbol, only 68.0% MBBS students and interns knew about the bio-hazard symbol, this is in accordance with the study conducted by Basu *et al* (2018) on interns and house-staff, however this was statistically significant in their study (p<0.05).(5) 840% post-graduates knew about bio-hazard symbol, the findings were in accord with a study done by chudasama *et al* (2014) that showed 93.5% residents and interns were aware of bio-hazard symbol, Malini. A *et al* (2018) also reported that in their study all resident knew about the symbol.(8,12) The reason for post-graduates having better (84.0%) knowledge of bio-hazard symbol than MBBS students and interns in our study might be due to that they see this symbol repeatedly while performing their duties.

Knowledge and Practice about Needle-Stick Injury

In the present study, post-graduates had better knowledge & practice regarding needle-stick injury than MBBS students and interns. Nearly three-fourth (72%) post-graduates were not recapping the used needles this result, varied with the study of Sehgal *et al*, Malini. A *et al* (2018) & Amin. P *et al* (2018) where almost all resident doctors were not recapping the used needles.(11,12,14) However, almost all study participants in our study knew that used needles should be discarded immediately which is similar to the findings of Amin P *et al*.(11) To our much surprise, less than one-third study participants only, among all three groups were aware about the correct time of initiation of post-exposure prophylaxis.

On asking about vaccination against Hepatitis B, the 88% MBBS students followed by 84% post-graduates were vaccinated. Our result was close to the figures reported by Malini. A *et al* (2018) among resident doctors.(12) Pandey A *et al* in their study showed better vaccination status among interns than in our study.(15) In our study all, post-graduates knew about the hub-cutter for needle disposal while Malini. A *et al* (2018) in their study showed that more than 80% of residents were using hub cutter to destroy the used needles. (12)

Attitude towards BMW Management

It was observed in the present study that attitude towards BMW management was better among MBBS students followed by post-graduates and interns. Sekar. M *et al* also in their study showed better attitude of post-graduates than interns for BMW management, we accede with their reason that due to affirmative options in questions of attitude they were answered easily.(13) A study conducted by Singh. R.K *et al* however showed no difference between undergraduate and post-graduate dental students.(16) The possible reason for lackadaisical approach to BMW management of interns could be that as interns are over-burdened with work and their mind is always hovered by "cracking for post-graduation entrance exam" this limits their aptitude and attitude.

Practice related to Bio-medical waste Management

"Practice makes the man perfect" an old English proverb always stand true in almost every circumstance of life but "Good practice makes a man very perfect" as practicing in a wrong way without knowing that it is right or wrong, then that practice can be wasteful. In this study also, this was proved as post-graduate students made good practice of correctly disposing bio-medical waste in appropriate bins than MBBS students & interns. Because of the continuity of wrong practice without correct knowledge very few (6%, 8% & 16% respectively) interns were correctly disposing broken bottles, metallic sharps and papers in appropriate bins. Sekar *et al* and Amin P *et al* also showed similar results in their studies, but Basu *et al* reported different findings in their study.(5,13) The probable reason could be that there is no check on interns as to where they are disposing the bio-medical waste, neither are they being warned about hazardous practice of not throwing the bio-medical waste in the right bins.

Overall knowledge, attitude and practice regarding BMW management was average among MBBS students, interns and post-graduate students in the present study.

Conclusion

The current study divulges that overall medical undergraduates, interns and post-graduates students have average knowledge, attitude and practice in respect to BMW management. While most of the students knew about the BMW legislations and its symbol still there were 21.3

percent students and interns who had poor knowledge about BMW guidelines. Surprisingly majority (68.7%) of students and interns overall had good knowledge about needle-stick injury but very few MBBS students (23.3%) and interns (16.7%) were practicing of not re-capping the used needle. All participants agreed that BMW should be segregated into different categories and BMW management guidelines should be made compulsory in the undergraduate curriculum. Very few interns and post-graduate students (10.5% and 36.8%) were correctly disposing metallic sharps. 61.3% medical students & interns were average in correctly practicing BMW management rules. MBBS students had more knowledge and attitude towards BMW management as compared to interns & post-graduates, while post-graduate students had more knowledge about needle-stick injury and were correctly disposing the BMW in the appropriate bins as compared to MBBS students and interns. Despite the full efforts by interns they are still not able to execute the required performance which is expected from them.

Recommendation

Along with supportive supervision and surveillance for BMW management activities, training and re-training including technical knowledge and sensitization for behavioural modification should be emphasized to improve the awareness and update knowledge on biomedical waste among health personnels.

Limitation of the study

"Misinformation bias" and "Acquiescence bias" could not be ruled out as students tried to project good knowledge and awareness and in questions asked on segregation & training. Generalizability is an issue due to small sample size.

Relevance of the study

Conducting training and promoting prizes and consolations to undergraduates and postgraduates based on their performance in proper handling of BMW can be motivating and rewarding and will also decrease the health hazards due to improper management of BMW.

Authors Contribution

Acknowledgement

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Tables

TABLE 1 ITEMS AND RESPONSE OF STUDENT

S No.	Question	Response	MBBS (n-25)	Intern (n-25)	Post-Graduates (n-25)	p-value
SECTION-A Knowledge about Bio-Medical Waste Management						
1	Do you know about Bio Medical waste generation and Legislations?	Yes	25 (100.0)	25(100.0)	20 (80.0)	0.009
2	Bio Medical Waste (Management & Handling) Rules were First proposed in India in which year?	1998	17 (68.0)	15 (60.0)	8 (32.0)	0.028
3	According to the Biomedical Waste (Management & Handling) Rules, Bio Medical waste should not be stored beyond?	48 Hours	16 (64.0)	10 (40.0)	7 (28.0)	0.033
4	One gram of mercury (source from dental amalgam) is enough to contaminate the following surface area of a lake?	20 Acres	14 (56.0)	7 (28.0)	5 (20.0)	0.019
5	Do you know about how to segregate the biomedical waste according to colour coding	Yes	25 (100.0)	24 (96.0)	25 (100.0)	1.000
6	Can any plastic bag be used for waste disposal?	No	19 (76.0)	11 (44.0)	13 (52.0)	0.059
7	Which of the following is the universally accepted symbol for biohazard?	☣	17 (68.0)	17 (68.0)	21 (84.0)	0.370
SECTION-B Knowledge and Practice about Needle-Stick Injury						
8	Are you aware of consequences of needle-stick injury?	Yes	25 (100.0)	23 (92.0)	25 (100.0)	0.324
9	Do you re-cap the used needle?	No	7(28.0)	5 (20.0)	18 (72.0)	<0.001
10	Do you discard the used needle immediately	Yes	25 (100.0)	25(100.0)	23 (92.0)	0.324
11	After injury, within how much time PEP (POST EXPOSURE PROPHYLAXIS) should be started?	72 Hours	8 (32.0)	3 (12.0)	8 (32.0)	0.172
12	Have you been fully vaccinated against hepatitis B?	Yes	22 (88.0)	19 (76.0)	21 (84.0)	0.645
13	According to you, how is used needle disposed?	Hub Cutter	19 (76.0)	16 (64.0)	25 (100.0)	0.005
SECTION-C Attitude Towards Bio-Medical Waste Management						
14	Do you agree that biomedical wastes should be segregated into different categories?	Agree	25 (100.0)	25(100.0)	25(100.0)	NA
15	Do you feel that biomedical waste management should compulsorily be made part of Under graduate curriculum?	Yes	25 (100.0)	25(100.0)	24(96.0)	1.000
16	Do you think your knowledge regarding biomedical waste management is adequate?	Adequate	24 (96.0)	18(72.0)	14(56.0)	0.005
17	Do you think you require any further training on biomedical waste management?	Required	24 (96.0)	21 (84.0)	21 (84.0)	0.372
18	Do you dispose all kinds of waste into general municipal garbage?	No	18 (72.0)	12 (48.0)	15 (60.0)	0.223
19	Do you think that reporting of a needle stick injury is an extra burden of work on you?	No	23 (92.0)	15 (60.0)	15 (60.0)	0.016
SECTION-D Practice Related to Bio-Medical Waste Management						
20	In which bin do you dispose Broken bottles/ vials?	Blue	9 (36.0)	6 (24.0)	13 (52.0)	0.121

21	In which bin do you dispose cotton, gauze and other items contaminated by blood?	Yellow	11 (44.0)	11 (44.0)	14 (56.0)	0.618
22	In which bin do you dispose METALLIC SHARP waste?	White	10 (40.0)	2 (8.0)	7 (28.0)	0.032
23	In which bin do you dispose Syringes?	Red	7 (28.0)	10 (40.0)	7 (28.0)	0.576
24	How do you dispose the hazardous liquid waste?	Chemical treatment and discharge into drains	25 (100.0)	24 (96.0)	25 (100.0)	1.000
25	In which bin do you dispose Papers?	Black	17 (68.0)	4 (16.0)	18 (72.0)	<0.001

() shows percentages within the group. p-value in bold shows statistically significant figures

TABLE 2 COMPARISON OF MEAN SCORES AMONG THE STUDENTS GROUPS

% Score	Students Groups	N	Mean	Std. Deviation	#p-value	Multiple Comparisons
Section-A	MBBS	25	76.00	15.82	<0.001	p: <0.001
	Post-graduates	25	56.57	19.55		Q: 0.010
	Interns	25	62.29	12.29		R: 0.428
	Total	75	64.95	17.93		
Section-B	MBBS	25	70.67	16.16	<0.001	P:0.078
	Post-graduates	25	80.00	15.96		Q: 0.054
	Interns	25	60.67	12.62		R: <0.001
	Total	75	70.44	16.80		
Section-C	MBBS	25	92.67	10.84	<0.001	p: 0.001
	Post-graduates	25	76.00	16.72		Q: <0.001
	Interns	25	74.67	19.32		R: 0.953
	Total	75	81.11	17.83		
Section-D	MBBS	25	52.67	14.97	0.001	p: 0.761
	Post-graduates	25	56.00	18.56		Q: 0.008
	Interns	25	38.00	16.33		R: 0.001
	Total	75	48.89	18.24		
OVERALL	MBBS	25	73.12	7.62	<0.001	p: 0.013
	Post-graduates	25	66.56	9.65		Q: <0.001
	Interns	25	59.04	6.25		R: 0.004
	Total	75	66.24	9.76		

#One Way ANOVA test used, p- value <0.05 significant
Post-hoc test (Multiple comparisons) using Tukey Method
MBBS - Post-graduates =P, MBBS - Interns =Q, Post-graduates - Interns =R

Figures

FIGURE 1 KAP REGARDING BMW OF STUDY SUBJECTS.