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Awareness and knowledge on biomedical waste disposal of dental materials among dental students

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Abstract---Introduction: Management of waste generated from the medical sector is a challenging task and it is a critical issue because it acts as a hazard for human health as well as the environment. The waste generated from dental clinics are sharps, glasswares, metallic implants, blood, mercury, lead, biodegradable wastes, non biodegradable wastes and chemical wastes. It is important to segregate and transport these wastes using the proper guidelines. Aim: To assess the knowledge, attitude and practice of biomedical waste disposal among dental students. Materials and methods: Self administrated questionnaire was designed and distributed through an online google forms link. The Study population included 100 dental undergraduate students belonging to the age group of 18 to 24 years. The participants were explained about the purpose of the study in detail. The questions were carefully studied and the corresponding answers were marked by the participants. The data were collected and statistically analysed using SPSS software version 22.0. Chi- Square analysis was performed and $p < 0.05$ was considered as statistically significant. Results: From the obtained data it was concluded that 87 % of the people were aware of biomedical waste and the methods and techniques to handle the biomedical waste. 84 % of them were aware of the guidelines to be followed for the biomedical waste disposal. The year of study had no significant association with the responses on biomedical waste disposal, colour coding and hazards of biomedical waste ($P > 0.05$). Conclusion: In the present study students were aware of the biomedical waste disposal and the color coding for the disposal

of waste. Most of the participants were following the guidelines issued by the government to limit the health hazards caused by the wastes.

Keywords---biomedical waste, waste disposal, hazardous, management, eco friendly, guidelines, innovative technology.

Introduction

Biomedical waste is the waste that is obtained during the immunization, diagnosis and treatment of any diseases or human/animal research activities. Quantification, characterization, transport, storage, segregation and treatment of biomedical waste is important. The main principle of management of biomedical waste is to reduce, recycle and reuse. It is important to reduce the generation of waste materials rather than disposing of it (1). Good health care facilities are an integral part of our society. In the process of curing diseases, health care sectors produce a large amount of biomedical waste. Improper disposal of the waste may cause hazardous consequences. Hazardous waste management remains challenging for every health care organization (2).

Large amount of biomedical waste is generated in the dental sector. Huge amounts of latex, plastic, glass, waste paper, much of which is contaminated with the body fluids have been obtained. Surgical instruments like local anesthetic needles, scalpel blades and suture needles are also contaminated. Mercury, Silver, Chemicals and various solvents are also obtained from dental practices. It is important to dispose of it in a proper way following the rules and regulations of waste management (3). Disposal of waste materials can be divided into two main categories. First, Hazardous biomedical waste causes environmental burden and pollution. Second, Potentially infectious materials confronting the individuals handling the waste. As a health care provider it is important to act ethically and responsibly. When an activity raises any threat or harm to the environment or human health it is necessary to take precautionary measurement. Safe disposal of waste is considered to be the duty and responsibility of every health care worker (4).

Production of biomedical waste may lead to adverse health effects. Most of these wastes are dangerous which leads to hospital acquired diseases. Some of the wastes which are more dangerous are infectious waste, sharp waste, body part waste, pharmaceutical waste, chemical waste, radioactive waste and cytotoxic waste (5). It is important to treat the infectious medical waste by incineration, autoclaving, chemical treatment, microwaving, compacting and shredding. Management of medical waste must consider the factors like environment, financial, technical and feasibility in treating the waste. As a health care worker it is important to contemplate the best environmental practices, technical feasibility and cost effectiveness (6).

Effective and safe management of biomedical waste is not only a legal requirement but also a social responsibility. It is crucial for the health care workers to know the hazards of biomedical waste in the health care sector and it is important for them to manage the safe waste disposal and dispose of it in an effective, efficient and scientific manner (7). Our team has extensive knowledge and research experience that has translated into high quality publications (8–1718–21)(22–26)(27). The aim of the study was to assess the awareness and knowledge on the safe biomedical waste disposal among the dental college students.

Materials and Methods

Self administered questionnaires were designed based on the attitude and knowledge of the participants. The questions were circulated to the age group of 18 to 24 years and circulated among 100 dental college students. It was circulated using the Google forms link and a list of output variables were included. A statistical test was done using the software SPSS version 22.0. Statistical tests used descriptive analysis and frequency percentage. Descriptive variables like age, year of study, gender and explanatory variables like knowledge, attitude and practice were also included.

Each output variable was collected as ordinal data and the collected data were represented as pie charts. Exclusion criteria of the study were participants not willing to participate. Some of the inclusion criteria was participants above 18 years of age, dental college students and participants who can understand and fill the questionnaire. Chi-Square analysis was performed and $p < 0.05$ was considered as statistically significant. Saveetha Research Board issued the ethical approval for the study.

Table 1: Table representing the responses and percentage of the knowledge and attitude of the participants

QUESTIONS	RESPONSES	PERCENTAGE
1) Gender		
Male	52	52%
Female	48	48%
2) What do you mean by biomedical waste ?		
Waste from household	9	9%
Waste from clinical setup	87	87%
Don't know	4	4%

3) How should biomedical waste be disposed of ? Dump directly into garbage bins Waste management agency Don't know	9 87 4	9% 87% 4%
4) Are there any guidelines for biomedical waste disposal by the Government in India ? Yes No Don't know	84 10 6	84% 10% 6%
5)According to the government guidelines, untreated biomedical waste should not be stored beyond: 24 hours 48 hours Don't know	42 49 9	42% 49% 9%
6)Glassware and metallic body implants are disposed of? Blue White Yellow Red Don't know	73 8 10 4 5	73% 8% 10% 4% 5%
7) Infectious sharps and needles are disposed of? White Blue Yellow Red Don't know	76 5 11 2 6	76% 5% 11% 2% 6%

8) Infectious biodegradable waste is disposed of ? Yellow Red Blue White Don't know	 70 11 11 3 5	 70% 11% 11% 3% 5%
9) Infectious non biodegradable wastes are disposed of ? Yellow Red Blue White Don't know	 4 72 11 5 8	 4% 72% 11% 5% 8%
10) Do you follow colour coding while disposing of waste during your preclinical / clinical postings ? Yes No Sometimes	 79 12 9	 79% 12% 9%
11) Can inappropriate biomedical waste disposal cause health hazards ? Yes No Don't know	 78 15 7	 78% 15% 7%

Results

The present Study was conducted among dental college students (Table 1) among them 36 % were 1st year, 28% of them were 2nd year, 16% of them were 3rd year, 11% of them were 4th year and 9 % of them were interns . It included 52 % of male and 48% of female (Figure 1). It was good to know that most of the college students are aware of the safe disposal of biomedical waste. Among the 100 participants 87 % of them reported that biomedical waste is generated from medical and dental set up during diagnosis or treatment of diseases (Figure 2). 87% of them reported that waste should be handed over to the waste management agent (Figure 3). 84 % of the participants reported that they follow the guidelines for biomedical waste disposal issued by the Government of India (Figure 4). 49% of them reported that untreated biomedical waste should not be kept over more than 48 hours. 73 % of the participants are aware that glassware and metallic implants should be disposed of in blue coloured bins. 76 % of them

are aware that infectious sharps and needles are disposed of in white coloured bins . 70 % of them are aware that infectious biodegradable waste is disposed of in yellow coloured bins . 72 % of them are aware that infectious non-biodegradable waste is disposed of in red coloured bins. 79% of the participants reported that they follow colour coding during their preclinical and clinical postings. 78 % of them reported that inappropriate biomedical waste disposal causes serious health hazards. Among 100 participants comparatively first year students have learnt more about the guidelines on waste disposal (Figure 5). It is reported that 29% of the first year students follow colour coding during the waste disposal process (Figure 6). 26 % of the first year students were aware of the health hazards related to the improper biomedical waste disposal (Figure 7).

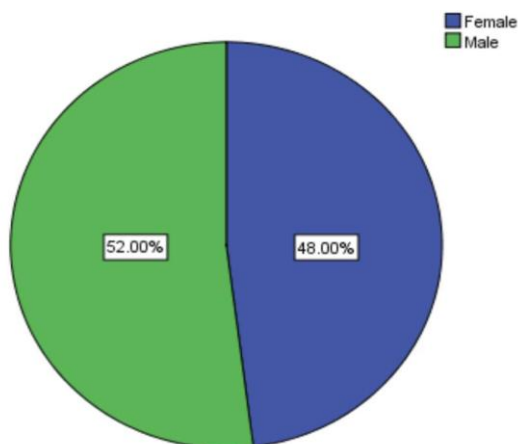


Figure 1: Pie chart showing percentage distribution of gender of the participants. 52% of the population were male (green) and 48% of them were female (blue).

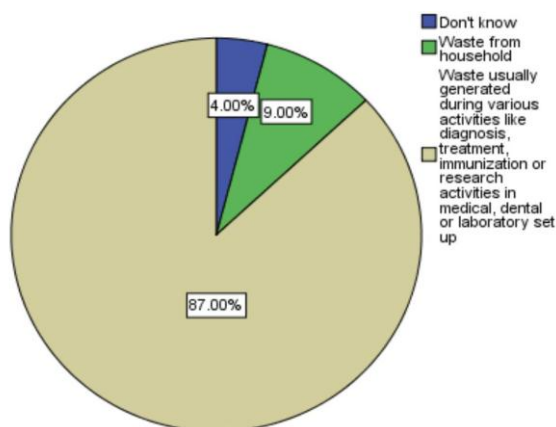


Figure 2: Pie chart showing percentage distribution of responses to the definition of biomedical waste. 87% of the population reported waste generated from medical or dental setup during diagnosis or treatment of diseases (beige), 9 % of them reported it is a waste from households (green) and 4% of them reported that they don't know (blue).

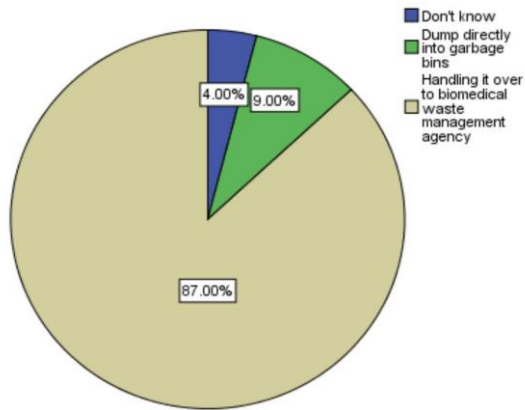


Figure 3: Pie chart showing percentage distribution of responses to the disposal of biomedical waste. 87% of the population reported they hand over the waste to the waste management agency (beige), 9% of them reported they dump the waste directly into the garbage bins (green) and 4% of them reported they don't know (blue).

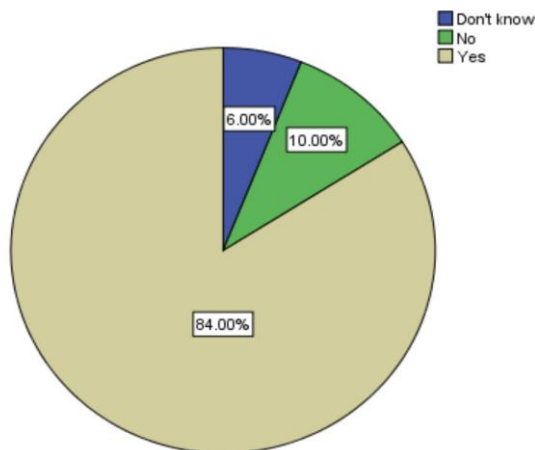


Figure 4: Pie chart showing percentage distribution of awareness on the guidelines of waste disposal. 84% of the population reported that they are aware of waste disposal guidelines (beige), 10% of them reported they are not aware of waste disposal guidelines (green) and 6% of them reported they don't know (blue).

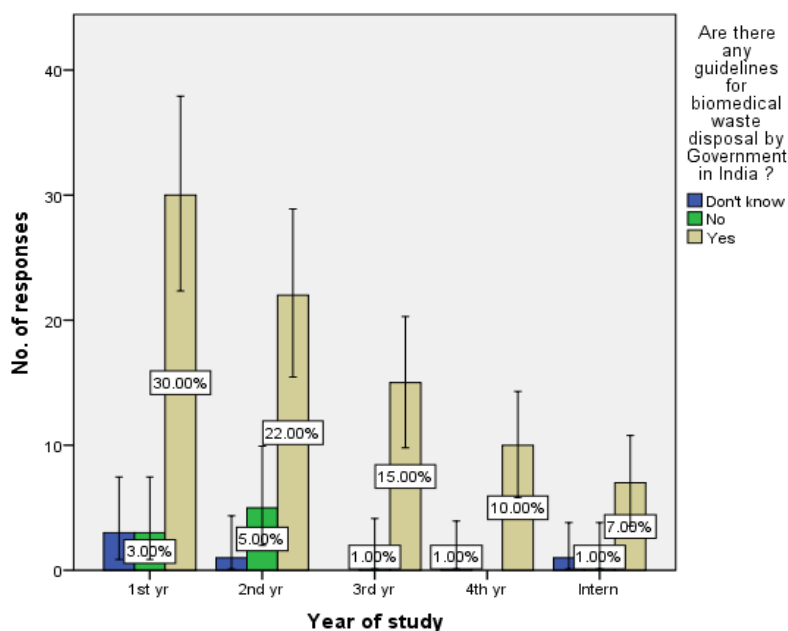


Figure 5: Bar graph represents the association of the year of study and responses to awareness on guidelines of waste disposal. X axis denotes year of study and Y axis denotes number of responses. Beige denotes yes, green denotes no and blue denotes don't know. Majority of the respondents were aware of the guidelines in all the groups. (Chi square test; P value = 0.886 > 0.05- statistically not significant).

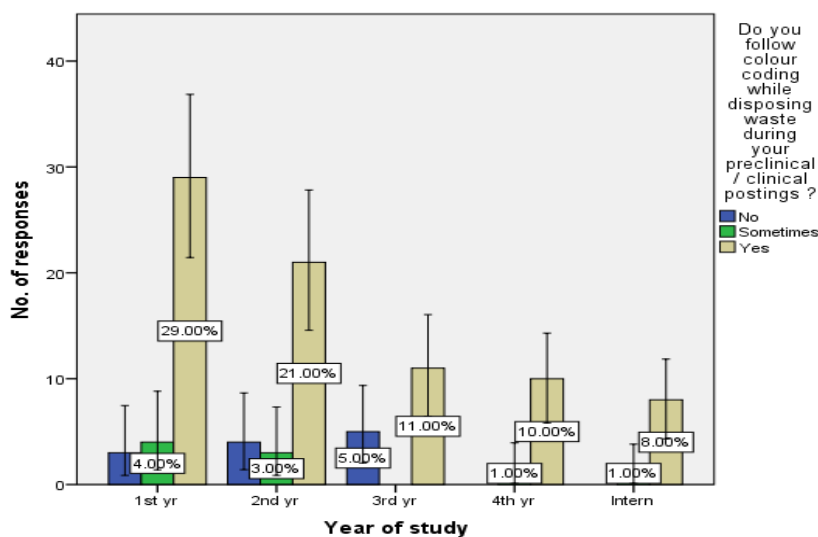


Figure 6: Bar graph represents the association of the year of study and responses to population following color coding in clinics for waste disposal. X axis denotes year of study and Y axis denotes number of responses. Beige denotes yes, green denotes sometimes and blue denotes no. Majority of the respondents followed

colour coding in clinics for waste disposal in all the groups. (Chi square test; P value = 0.333 > 0.05- statistically not significant).

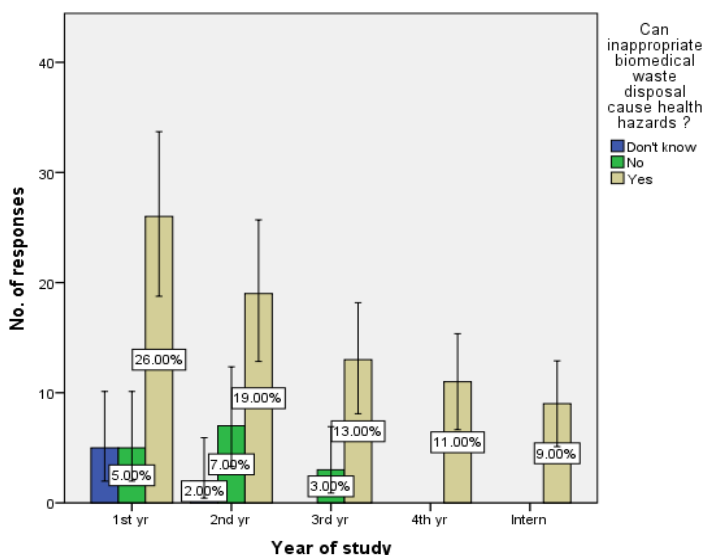


Figure 7: Bar graph represents the association of the year of study and responses to awareness on biomedical waste causing health hazards. X axis denotes year of study and Y axis denotes number of responses. Beige denotes yes, green denotes no and blue denotes don't know. Majority of the respondents were aware of the health hazards caused by biomedical waste. (Chi square test; P value = 0.437 > 0.05- statistically not significant).

Discussion

In the present study 87 % of the people were aware about the biomedical waste and the techniques to dispose of the biomedical waste. More than half the population of the study i.e. 84 % of them were aware of the guidelines to be followed for the biomedical waste disposal issued by the Government of India. Only 5 % to 9 % of the participants were not aware about the colour coding for the proper waste disposal and 78 % of the people were aware about the health hazards caused by the biomedical waste.

In an previous study done by Ashima and co workers reported that though most of them are aware of biomedical waste only 67 % of the population follows the rules and regulations issued by the government of India on biomedical waste management whereas in present study it is reported that 79 % of the population follow the colour coding and the rules and regulations of waste management which shows the increased awareness and knowledge. They also reported that 21% of the population dispose of sharp needles in yellow, red and black bags whereas in the current study 76% of the participants reported that infectious sharps and needles are disposed of in white coloured bins (28).

In a study done by Bhalendra and coworkers 96.2% of them were aware that needles and syringes are more hazardous than other materials in a dental clinic

set up whereas in a current study it is reported that 75 % of the population responded that all biomedical waste is equally hazardous and harmful. He also reported that 75 % of the population were aware of biomedical waste disposal guidelines. In the current study it is reported that 84% of the participants are aware about the waste disposal guidelines which indicates the increased knowledge, practice and awareness among the dental college students (29) . In a study done by Raghuwar and coworkers, 38.7 % of the population were not aware about proper color coding and they were not aware about it. In the present study only 24 % of them are not aware about the proper color coding (30).

There were some limitations that should be noted in the study. The limitations of the study were less sample size, homogeneous population, response bias and survey fatigue. And it is noteworthy to mention the future scope of the present study. It reduces the serious health implications caused by the hazardous biomedical waste. Spreading knowledge and awareness among the health personnels prevents the transmission of diseases in the society as well as it protects the public health and the environment.

Conclusion

In the present study students were aware of the biomedical waste disposal and the color coding for the disposal of waste. Most of the participants were following the guidelines issued by the government to limit the health hazards caused by the wastes. Proper management of biomedical waste is important both in government agencies and Non governmental organizations. Toxic and hazardous materials should be disposed of properly by following the guidelines issued by the government. Ineffective and inefficient transportation and segregation of waste materials can cause serious health problems. It not only affects the health of an individual, it causes environmental pollution. It is a social responsibility to manage the waste disposal in a safer way. To properly process, separate and isolate the waste well- characterized rules should be implied and it must be implemented. The rules should be followed properly which can reduce the hospital acquired diseases.

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Conflict of interest: NIL

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