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Research Article

Assessment of Awareness and Attitude Regarding Biomedical Waste Management among Students in Dental College in Nagpur: A Cross-sectional Study

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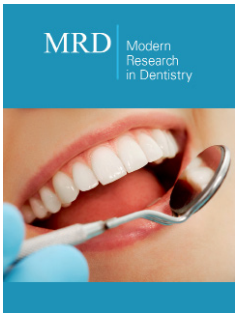

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Abstract

Aim: To assess awareness and attitude among dental interns regarding biomedical waste management in a dental institute of Nagpur.

Materials and methods: A cross-sectional questionnaire study was conducted among 308 dental interns. The questionnaire was pretested and contained in a total of 26 items of which 22 items assessed awareness and four items assessed attitude of dental interns towards biomedical waste management. The questionnaire was developed by review cycle and was finalised after obtaining 100% agreement between the authors. Descriptive statistical analysis was conducted using IBM SPSS version 21 for the responses obtained. Good awareness and positive attitude were considered if more than 50% of the dental interns responded correctly.

Results: Good awareness among dental interns was presented regarding guidelines and hospital policies for biomedical waste, responsibility of waste disposal, color coding and waste segregation, biohazard symbol and disposal of few dental waste materials. Poor awareness was present regarding disposal of plastic material, sharps, impression materials, and storage limit of biomedical waste. The responses displayed positive attitude among majority of the dental interns towards undergoing training sessions to enhance their awareness on biomedical waste management.

Conclusion: Dental interns have a positive attitude regarding biomedical waste management but lack thorough knowledge regarding the disposal of different types of wastes into the color-coded bags.

Keywords: Awareness; Attitude; Biomedical waste management; Dentistry; Undergraduates

Introduction

There has been remarkable advancement in science and technology in the past few years. This advancement has led to exposure of the people to advanced medicines, treatments and medical equipment. Alongside, the lifespan of people has increased and so has the quality of life. People are now more aware about their health and thus a large population can now be seen seeking healthcare facilities to maintain and improve their overall health [1]. This increase in accessing health care facilities has also increased the waste generation from the hospitals, medical teaching institutes and clinics. Healthcare facilities are producing a disproportionately significant volume of potentially infectious and harmful waste [2]. As per the Indian Society of Hospital Waste Management Report, waste produced per bed/day in the clinic of a general practitioner is 600g and that in hospital is 1-2kgs. Further, this amount has tremendously increased from 4,15,429kg per day in 2011 to 4,84,271kg per day in the year 2013. Among all the states Karnataka has ranked highest in waste generation followed by Maharashtra and Kerala. During the time of Covid-19 in 2020, there was 139 tonnes of waste production associated with Covid-19 which drastically increased to 203 tonnes per day by 2021. As a result, COVID-19 has unquestionably left India's system for managing biological waste in a terrible situation [3].

A biomedical waste can be defined as any waster that may be solid, liquid of in fluid form, including the product as well as its container that are used in the screening, diagnosing, treatment or immunization against diseases [4]. Dental waste is a subcategory of this hazardous biomedical waste which deals with routine products and materials used in dentistry along with some harmful materials like; mercury in silver amalgam and chemical solvents, extracted teeth and excised tissues [5]. A proper disposal of biomedical waste is necessary as it is directly proportional to the increased risk of diseases among health care professionals, patients as well as waste handling personnel due to cross-contamination. Literature reports hazards such as, injuries due to sharps, development of nosocomial infections in patients, particularly Human Immunodeficiency Virus (HIV), Hepatitis B and C, and emergence of resistant strains of microorganisms due to improper waste management [6]. Proper waste management does not just include waste disposal, but it initiates from the time the waste is generated and how it is segregated at the source of generation into color coded bags. Following this the waste has to be transported and stored as per the rules and regulations of waste management. Finally, the step also comprises of treatment of the waste followed by disposal.

Inspite of associated health issues to the patients, health care professionals, waste pickers and waste handlers, the management of such waste is not optimal. The dental waste like liquid and solid generated from the laboratories is not disposed considering the standard protocol. Reason that has been documented for these actions are negligence by the dentists, lack of supervision from the higher authorities regarding the disposal at the source of generation and segregation, scarce facilities available at the clinics, hospitals and institutes for proper disposal, and the non-conducive attitude among the health care professionals [7,8]. Considering the scenario, it is of prime importance to inculcate awareness among the dentists at the undergraduate level itself. To undertake any program the first focus should be to know the current awareness, and attitudes among the undergraduates in the Dental institutes. The present study was thus aimed at assessing the knowledge and attitudes among the interns of a dental institute regarding biomedical waste management.

Methodology

The present prospective cross-sectional questionnaire study was initiated after obtaining approval from the Institutional Ethics committee of a Dental Institute. The study was thus performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. A written informed consent was obtained from all the participants before the study proceedings.

Participant's selection and study instrument

A census sampling technique was used and all the interns (n=308) of dental institute of Nagpur were enrolled in the study to assess their awareness and attitude towards biomedical waste management. The questionnaire regarding awareness and attitude were framed considering the past literature and through develop and review cycle. Conceptual framework of the questionnaire was done by preparing question items for awareness were framed under the domains of waste management guidelines, waste segregation via color coded systems, type of waste generated, responsibility of waste management whereas, the questionnaire for attitude were framed under the domain of their own perspective towards waste management, changes in the curriculum and future continuous education programs to enhance the overall knowledge regarding biomedical waste management. One author developed the questionnaire, and they were reviewed by other two authors till an agreement of 100% was achieved between the authors. A total of 26-item closed ended structured questionnaire was developed by the end of the review cycle.

Data collection

The questionnaire was then distributed among the interns of dental institute of Nagpur by the author with proper prior instructions. The average time taken to answer the questionnaire was 25 minutes. The set of questionnaires were then taken from the dental interns for further analysis.

Analysis and interpretation

The responses obtained from the dental interns were then entered into a Microsoft Excel data spreadsheet 2010. A master char of responses and coding was prepared, and the data was then subjected to statistical analysis. Descriptive statistical analysis was conducted using IBM SPSS version 21 (IBM Corp., Armonk, N.Y. U.S.A).

Results

A total of 308 interns completed the questionnaire survey. Table 1 presents responses of interns depicting their awareness and positive attitude. For awareness, good awareness with more than 50% of the interns responding correctly to the questionnaire was found for; guidelines for biomedical waste laid down by government, responsibility of disposing the waste, rule concerning BMW disposal, hospital policy regarding BMW disposal, segregation of BMW as per color coding, disposal of extracted human teeth, disposal of patient's confidential information, disposal of hazardous liquid waste, autoclaving of the waste before its disposal, use of biohazard symbol, government guidelines on BMW, and storage of untreated BMW. However, poor awareness with less than 50% of the interns responding correctly was also reported regarding; hazards associated with BMW, storage system as per the rules of handling and managing biomedical waste, the effect of mercury on contamination of the lake, disposal of materials like plastic, soiled dressing, used impression materials, sharps and needles, plaster of paris, and discarding developer and fixer solution (Figure 1).

Table 1: Frequency distribution of participants having awareness regarding biomedical waste management.

Sr. No.	Questionnaire	Frequency	Percentage
Awareness			
1	Are there any guidelines laid down by Government of India for BMW management?	272	88.31
2	Are all healthcare wastes hazardous?	107	34.74
3	Safe management of biomedical waste is the:	269	87.34
4	According to the Biomedical Waste (Management & Handling) Rules, waste should not be stored beyond:	130	42.21
5	Are you aware that biomedical waste management rules are applicable to dentists?	277	89.94
6	Is your hospital/clinic having biomedical waste disposal policy?	272	88.31
7	One gram of mercury (source from dental amalgam) contaminates how much surface area of a lake:	80	25.97
8	Do you know about colour-coding segregation of BM waste?	241	78.25
9	Where do you dispose plastic items (e.g., catheter)	69	22.4
10	Where are soiled dressings and used impression materials disposed?	69	22.4
11	Where are sharps and needles disposed?	86	27.92
12	Where are extracted teeth and human tissue disposed?	172	55.84
13	Plaster of Paris is disposed of in:	41	13.31
14	Documents with confidential patient information are to be disposed of into the paper recycling bins.	161	52.27
15	How do you discard the used developer or fixer solution?	32	10.39
16	How do you dispose the hazardous liquid waste?	262	85.06
17	Do you think that infectious waste should be sterilised from infections by autoclaving before shredding and disposal?	283	91.88
18	Do you have any knowledge about the different colour coding used by GOI for segregation of Bio medical waste?	234	75.97
19	Do you have knowledge about biohazard symbol displayed on the container?	244	79.22
20	Is there any guideline by GOI for BMW management?	285	92.53
21	Is there any biomedical waste management policy in your hospital/clinic?	285	92.53
22	Untreated bio-medical waste can be stored maximum for 48hrs?	263	85.39
Positive Attitude			
1	Is your knowledge regarding biomedical waste management adequate?	198	64.29
2	Do you require any further training on biomedical waste management?	263	85.39
3	Do you think that the educational institute should organise separate classes or a continuing dental education programme to upgrade existing knowledge about biomedical waste management?	284	92.21
4	In future you would like to attend voluntarily programmes that enhance and upgrade your knowledge about waste Management?	272	88.31

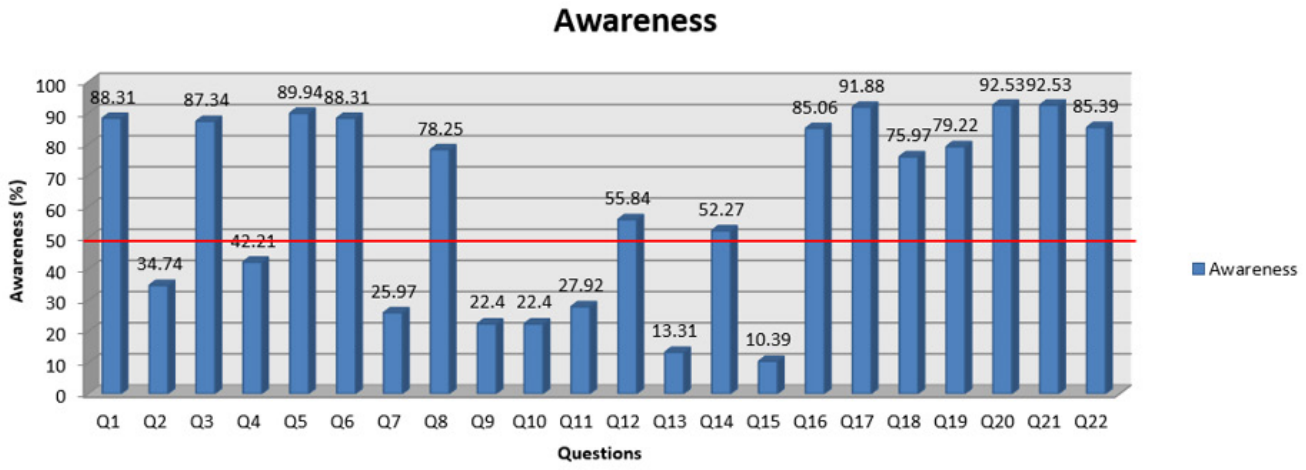

Figure 1: Bar diagram representing awareness among the dental interns regarding biomedical waste management.

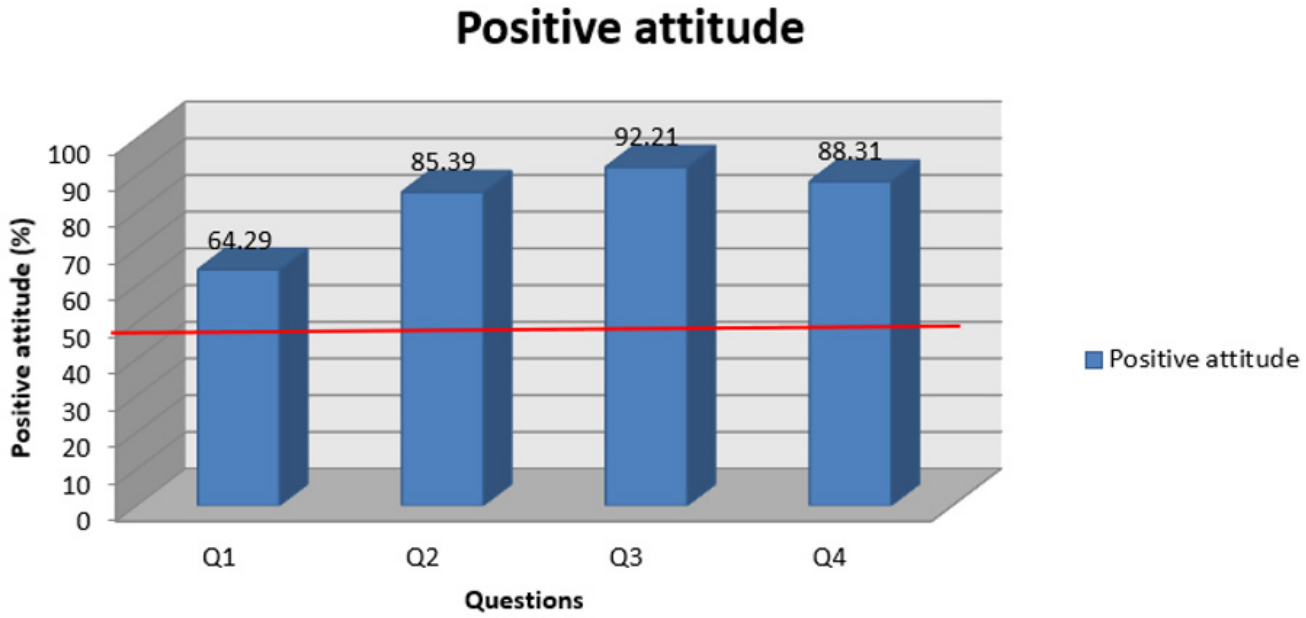

Figure 2: Bar diagram representing positive attitude among the dental interns regarding biomedical waste management.

With respect to attitude as represented in Table 1, more than 50% of the interns demonstrated a positive attitude towards; rating their BMW knowledge, interest in training programs regarding BMW in order to enhance and upgrade their knowledge (Figure 2).

Overall, the domains that scored poor among interns were disposal of different bio medical waste as per the color coding, and the understanding of the severity of hazard associated with the waste requiring special attention and none of the domains demonstrated negative attitude.

Discussion

Contrary to typical dental clinics, dental institutes have a variety of operatories and clinical departments. These are training schools; thus, it stands to reason that students learn the intricacies of patient care and other associated tasks. Since this is the learning phase and students acquire their knowledge from these institutes and mould their future dental practices, it is crucial that they are also trained regarding the administrative aspects of dental management including biomedical waste management [9].

In the present study 88.31% of the students were aware of the guidelines on biomedical waste management. A considerable number of interns were aware regarding regulations and legislations of the country on biomedical waste in a study by Ranjan et al.9 Similar was noted in the study by Al-Sayyali MA et al. [10] with 62.07% of dental students being aware about the policies laid down by their government on managing biomedical waste [10]. A contrast was observed in the study by Singh et al. [8] conducted among undergraduates of different colleges reporting awareness in less than 50% of the students regarding guidelines led down by government on biomedical waste management. The variation regarding awareness on guidelines can be attributed to the population of dental students enrolled in the study. In the initial

years of curriculum students may not be aware about it due to less exposure towards clinical practice. However, by the time they reach internship, their awareness is expected to be high.

The responsibility of disposing of the waste was considered to be teamwork by 87.34% interns of the present study. A study by Khubchandani et al. [11] reported more than 50% of the dental students thinking that biomedical waste management is teamwork, and no single person is responsible for it. The results were also found to be corresponding to the study by Al-Sayyali MA et al. [10] wherein 68.11% of the dental students felt that dental students, faculties & auxiliaries are responsible for the management of biomedical waste. In studies conducted by Lakshmikantha R et al. [12] and Jamkhande A et al. [13] 27% and 30.4% of the participants respectively expressed similar opinions. The higher percentage of students showing awareness also highlights their attitude and responsibility towards managing biomedical waste and preventing cross-infection.

Around 89.94% interns in the present study were aware that the biomedical waste management rules are applicable to dentists and 88.31% knew that their hospital and clinic had biomedical waste disposal policy. Similar was demonstrated in a study by Singh et al. [8] wherein 54.96% of the undergraduates were aware that their hospital does have a biomedical waste management policy. A higher number i.e., 97.2% of the undergraduates expressed that Biomedical Waste Management Rules are applicable to dentists in a study by Khubchandani et al. [11]. Effective dental waste segregation is critical because dentists are more susceptible to infections since most bacteria are generated from mouth secretions. Since the oral equipment and materials directly come in contact with the saliva and blood during treatment and even during routine dental check-up, it makes them potential source of infection and cross-infection.

In the present study, 78.25% interns were aware about the segregation of BMW as per color coding, 55.84% knew about proper disposal of extracted human teeth, 52.27% had knowledge about disposal of patient's confidential information into the paper recycling bins, 85.06% were aware about disposal of hazardous liquid waste generated during dental procedures like diagnosis and treatment, and 91.88% knew how important it is to autoclave the infectious waste before its disposal, use of biohazard symbol. Thus, the majority of the students were aware about quite a few things regarding disposal. A similar response was found in the study by Singh et al.8 wherein 77.06% were aware about the color coding and Al-Sayyali et al. [10] study wherein 69.56% were aware about the same. A total of 53.7% in the same study reported that they did treat the infectious waste before disposing. Likewise, 83.3% correctly responded for sterilizing the waste before shredding and disposal [11]. However, knowledge regarding disposal of extracted teeth was found to be poor in the studies with only 20.5% in Singh et al. [8] and a lowest of 7.24% in Al-Sayyali et al. [10] being aware about its disposal. The same was noted by Mayta-Tovalino F et al. [14] with only 44.6% - 55.3% correctly disposing the extracted teeth in the color-coded bag. This highlights the area of attention to be put in by the dental institutes. The labelling of the containers into different color codes is equally important as segregating the waste. Each color code has specific materials that are to be disposed and the coding is based on the severity of infection the waste material carries and the possibility of being recycled.

A small number of students were aware about the storage limit for untreated bio-medical waste being not more than 48 hours in the present study. The results were in consensus with the study by Khubchandani et al. [11] with only 22% of the participants being aware about the time limit for waste storage. The results are also supported by a study reported by Ahmed N et al. [15] wherein only 33.9% of the dental participants believed that waste should not be stored beyond a time period of 48 hours. Due to the possibility of cross contamination, dental waste management is crucial and thus should be disposed of in properly coded bags within 48 hours.

Alarming observations was recorded with poor knowledge in the present study ranging between 13.1% and 2.92% among the interns was also demonstrated in correctly disposing the dental waste like; used plastic items, soiled dressings and used impression materials, sharps and needles, and Plaster of Paris. These research findings show that students pursuing health care education are not sufficiently knowledgeable of BMW management procedures. In the current study, students' knowledge of different types of BMW and their ability to choose the proper color-coded bags for their disposal is weak. The lack of knowledge was also reflected in the study by Singh et al. [8] wherein only 12.4% were aware about disposal of soiled waste and 17.6% regarding disposal of plaster of paris. Improper disposal of plaster of paris into landfills causes production of hydrogen fumes and thus gypsum and dental wastes should under no circumstances be utilized as land fill material. It degrades the characteristics of soil by decreasing soil crusting, increasing soil aeration thereby increasing water penetration [16]. A study by Al-Sayyali et al. [10] also demonstrated extremely poor awareness regarding disposal of plastics, impression materials and sharps. Only 11.6 % were aware about disposal of plastic materials, 15.94% about soiled waste, and 43.47% regarding used needles and other sharps into correct color-coded bag. This was supported by Mayta-Tovalino F et al. [14] with only 16.6% female dental students being aware about disposal of sharp. However, the same study reported 83.3% males being aware on the sharp disposal. To prevent needlestick injuries and the spread of diseases like hepatitis and HIV in dental settings, appropriate disposal of discarded sharps like contaminated needles into puncture protected bags is especially crucial. Moreover, disposal of sharps into incorrect bags also puts waste handlers at risk at the waste management plant [16].

With respect to attitude in the present study, all the participating dental interns expressed a positive attitude towards, rating their BMW knowledge, interest in training programs regarding BMW in order to enhance and upgrade their knowledge. A study by Singh et al. reported 91.82% of the participants having positive attitude with 79.8% - 97.9% stressing importance of regular educational

programs on biomedical waste management in dental curriculum [8]. Around 90% of the participants reported that they do have knowledge about BMW management but still felt that they require additional training [11]. However, only 11.4%-46.1% received training in the form of lecture or program on BMW management [8]. To help dental students understand the significance of effective waste segregation, training should be supplemented with field visits to a BMW treatment plant in addition to the routine lecture on BMW management, particularly in dentistry schools.

The study has few limitations with first being, the participants were limited to a single institution and thus generalizability is to be made with caution. Secondly, the studies reported in literature on undergraduates were low and did not cover ample amount of data to compare awareness with respect to each of the questions.

Conclusion

Within the limitations of the study, it can be concluded that dental interns are having poor knowledge regarding hazards associated with BMW, storage system as per the rules of handling and managing biomedical waste, the effect of mercury on contamination of the lake, disposal of materials like plastic, soiled dressing, used impression materials, sharps and needles, plaster of paris, and discarding developer and fixer solution which requires a special attention. However, the best part is, the students expressed positive attitude towards learning more about BMW management which is likely a worthy point to undertake programs to enhance their knowledge in the domains they are lacking.

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