Journal of Applied Dental and Medical Sciences
NLM ID: 101671413 ISSN:2454-2288
Volume 2 Issue 2 April - June 2016

Original Article

Compliance to Biomedical Waste Management among dental postgraduate students in Bengaluru city- A cross-sectional study

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ARTICLE INFO

Keywords: attitude, biomedical, compliance, dental students, knowledge, waste management

ABSTRACT

Introduction: Developments and growing number of health care systems increases the generation of Biomedical Waste (BMW). Adequate knowledge about the biomedical waste with the positive attitude and proper management can curtail the risk and hazard to the health personnel and the environment.

Objective: To assess the knowledge, attitude and practices of dental postgraduate students regarding biomedical waste management in Bengaluru.

Methods: A cross-sectional study was conducted among 250 dental postgraduate students using a validated questionnaire in Bengaluru. The questionnaire comprised 35 questions in English with 5 general questions and 10 in each domain (knowledge, attitude and practice). Analysis of Variance (ANOVA) and Post hoc were used. A *p*-value <0.05 was considered as statistically significant.

Results: The proportions of study participants scoring knowledge questions correctly ranged from 12.0%-94.8%. Most of the study participants (58.0%-90.0%) exhibited positive attitudes. With regard to practice questions, 32.0%-70.4% of study participants had correct practice. There was no significant difference between the gender, year of study and specialties concerning knowledge and attitude. However, significant differences existed in practice between specialties (*p*=0.001).

Conclusions: Participants had poor to moderate knowledge and practice while faring moderate to good in the attitude domain that vary by year of study, gender and specialty. Training and workshops are required to have better compliance of biomedical waste management in all the dental institutes.

Introduction

Advances and increasing number of health care systems upsurges the generation of Biomedical Waste (BMW) which poses a huge risk to the health of the public, patients, and professionals and contribute to environmental degradation.[1] There is an increase in the number of dental colleges in the last fifteen years with the escalated production of dental undergraduate and postgraduate students[2] thereby increases in production of more biomedical waste.

Biomedical waste is any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological and including categories mentioned in schedule I of the Bio-Medical Waste (Management and Handling) Rules, 1998.[3] The indiscriminate and erratic handling and disposal of waste within health-care facilities is now widely recognized as a source of avoidable infection.[4] Managing waste requires effective management of people who produce the waste and not just those who handle it. Biomedical Waste Management (BMWM) protocol cannot be successfully implemented without the willingness, self-motivation, and co-

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operation from all sections of the employees of any health care setting.[5]

Dental clinic and dental institutes constitute one of the minor sources of health care waste.[4] Dental hospitals use instruments and materials that are directly exposed to blood and saliva, the potential sources of infection.[1] Hazardous wastes such as lead foil film backing, mercury, chemical solutions and scrap dental amalgam could cause harm to the environment.[6] Dentists are primarily responsible for waste generation in dental setting. It is imperative that waste should be segregated and disposed of in a safe manner to protect the environment, as well as human health.[7]

A study among dental health care personnel showed lack of knowledge,[1] attitude, and practices of BMW management.[5,8] However studies among healthcare personnel including dental doctors and students[9] were observed to have good theoretical knowledge and practices[10] while other studies revealed favourable attitude about biomedical waste management among the faculty members, staffs[11] and students with comparatively low knowledge and practice[12]. Studies among private practitioner reported adequate knowledge about management of waste but were not practicing diligently[13] and there was negligence in execution of correct practices.[7] A systematic review on studies among the dental students, dental staffs, private dentists, class IV employee found inadequate knowledge and awareness with considerable variation in practice and management.[14] A few published literatures are available about the knowledge, attitude and practice among dental postgraduate students.

Dental postgraduate students constitute a major workforce in dental colleges providing extensive preventive, diagnostic and curative care. They play vital roles in dentistry rendering conventional services catering varieties of patients with different needs and demands and in finding out the recent advances as well as a part of their research works.

Hence this study was designed to assess the knowledge, attitude and practices of dental postgraduate students regarding Biomedical Waste Management (BMWM) and to suggest appropriate health education measures regarding Biomedical Waste Management.

Methods: A cross-sectional study was conducted among dental postgraduate students in Bengaluru city for a two month period from August to September 2015. The ethical approval was obtained from the Institutional Ethical Committee of Government Dental College and Research Institute, Bengaluru, India. A 35 items closed ended questionnaire was designed to assess the compliance of the Biomedical Waste Management protocols with regard to the three domains- knowledge, attitude and practices. The content of the questionnaire was checked by three subject experts and the content validity was determined using Aiken index.[15] Reliability of the questionnaire was checked after 15 days using test retest methods.

A pilot study was conducted among 30 dental postgraduate students; about 62% of the participants had adequate knowledge. The sample size was calculated, using the formula: $n=4pq/L^2$, where p= prevalence of knowledge; q=1-p; L^2=10% of the prevalence. The sample size was found to be 245, which was rounded off to 250.

Five dental colleges were randomly selected from the list of dental colleges obtained from the Rajiv Gandhi University Health Sciences (RGUHS) website.[16] Permission to conduct the study and consent were

Table 1: Distribution of study participants according to gender, age, the year of study and specialty

Socio-demographic variables	Number (%) N=250
Gender	
Male	99 (39.6)
Female	151(60.4)
Age (in years)	
23-26	140 (56.0)
27-30	101 (40.4)
≥31	09 (3.6)
Year of study	
First	85 (34.0)
Second	83 (33.2)
Third	82 (32.8)
Specialty	
Oral medicine	28 (11.2)
Oral surgery	34 (13.6)
Periodontics	30 (12.0)
Conservative and Endodontics	32 (12.8)
Pedodontics	30 (12.0)
Orthodontics	26 (10.4)
Prosthodontics	35 (14.0)
Oral pathology	15 (6.0)
Public Health Dentistry	20 (8.0)

obtained from the head of the institutions and the participants respectively. Data were collected from the dental postgraduate students who were present on the day of the study using the self-administered questionnaire. The study participants were asked to tick the correct options in the questionnaire and were collected on the same day.

Statistical analysis

The data were analysed using the Statistical Package for Social Science 21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp). A *p*-value <0.05 was considered as statistically significant. Descriptive statistics was done using frequency, percentage, mean and standard deviation analysis. ANOVA test and Post hoc analysis was used.

Results

The study comprised postgraduate students from all the specialties. The majority of the study participants were female (60.4%). More than half of the participants (56.0%) belonged to the age group 23-26 years with similar proportions from all the year of study (Table 1).

Only one fourth (24.4%) of the participants had attended training or workshop on Biomedical Waste Management. But 31.6% of the participants felt that they have adequate knowledge on BMWM. Half of the participants (52.8%) were aware of the institutional tie up with BMWM companies, but only 34.0% knew about the Effluent Treatment Plant (ETP) in their institute. More than half of them (53.2%) felt that BMWM was adequate in their institute (Figure 1).

Almost all the participants (94.8%) knew the BMWM rules are applicable to dentists while only 12.0% were fully aware of the guidelines about the BMWM. Most of the participants (74.0%) had correct knowledge about the

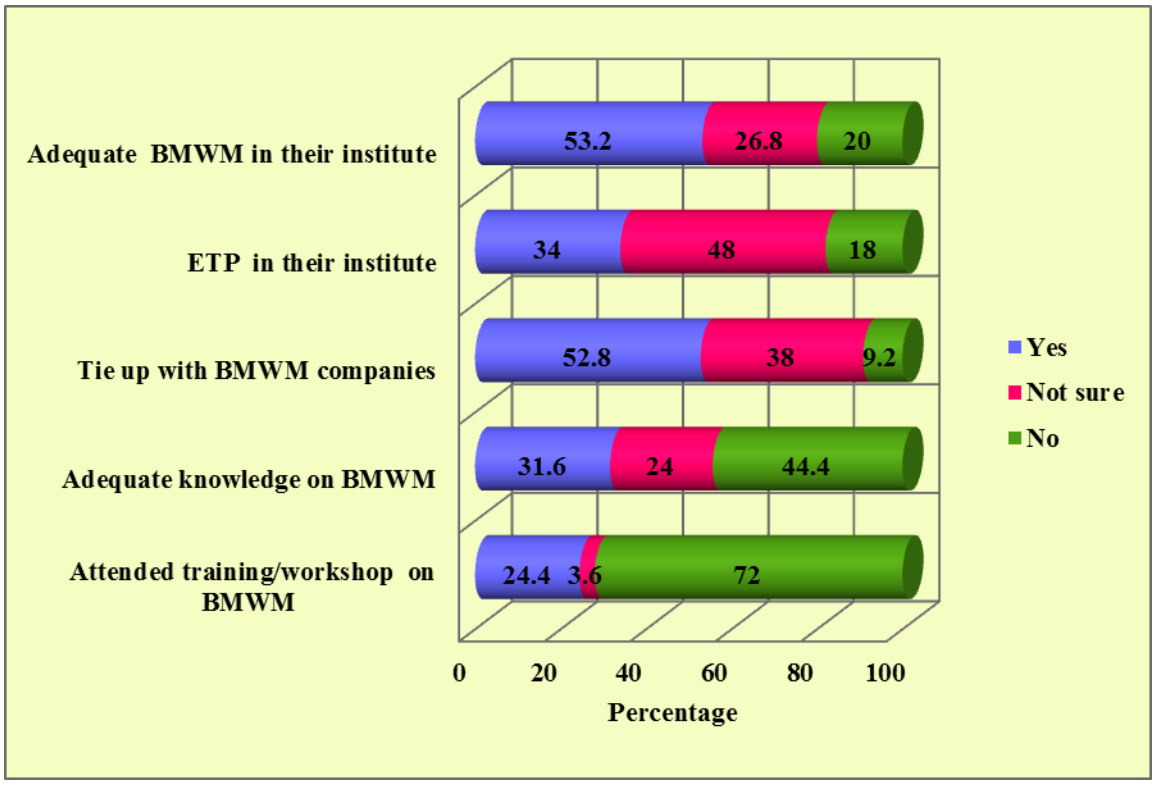

Figure 1: Responses of the participants to general information

transmission of diseases from biomedical waste while slightly more than one third (36.0%) knew about the storage duration of BMW. The majority of the participants (76.4%) had the correct knowledge about the disposal of infectious waste and only 18.0% knew about lead waste disposal (Figure 2).

Most of the participants (93.6%) agreed that all producers as well any person handling BMW are legally, ethically and financially responsible. With regard to implementation of BMWM, the majority of the participants (80.4%) showed a favourable attitude that lack of scientific certainty should not be an excuse for postponing cost-effective measure to prevent environmental degradation. More than two third of the participants, (70.4%) disagreed that Dental Health Care (DHC) waste is negligible while one third of the participants (30.4%) disagreed that safe BMWM increases the financial burden on institute. Most of them (89.6%) agreed that college should organize continuing dental education program on BMWM (Figure 3).

Only 28.4% of the study participants followed the correct frequency of cleaning the dental suction unit. The majority of the participants (70.4%) did not dispose all kinds of waste into general garbage. Only 40.0% correctly disposed the extracted teeth with amalgam filling in a scraped amalgam container. With regard to colour coding for disposal of waste, half of the participants (51.6%) disposed plaster of Paris in a black bag while only 23.6% of the participants disposed used disposable plastic items in the red bag (Figure 4).

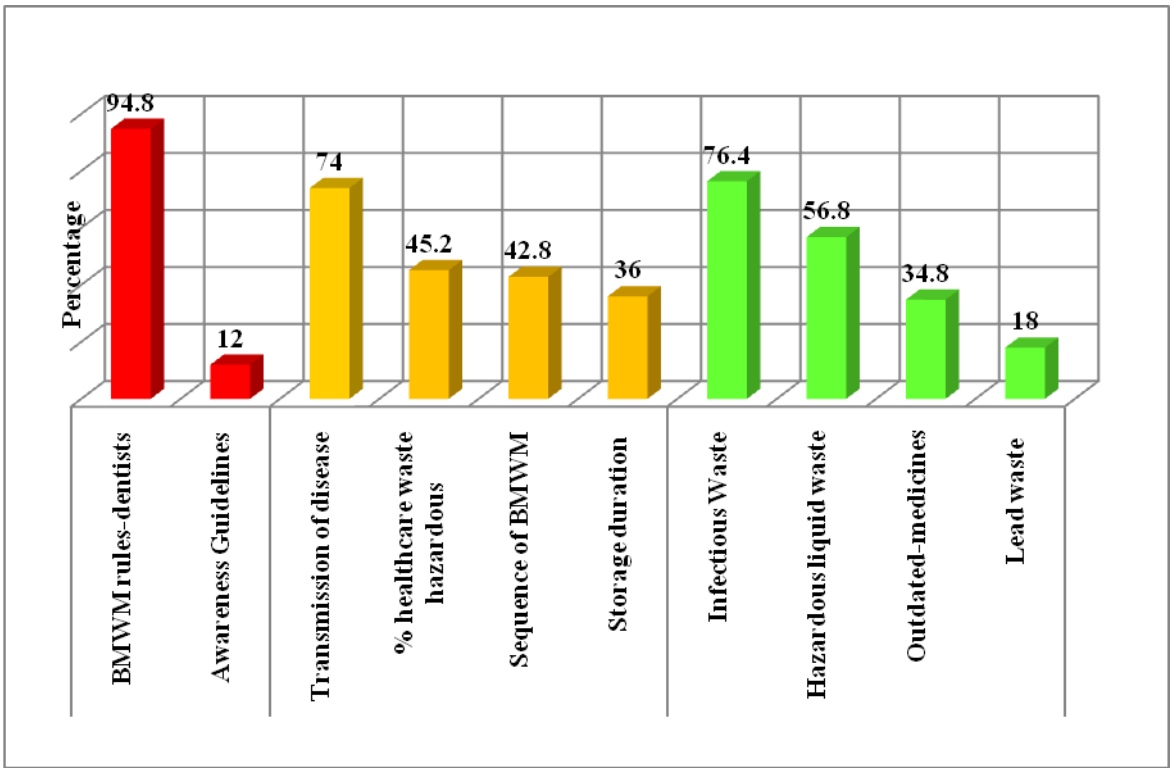

Figure 2: Responses of the participants to Knowledge questions

Gender-wise, male had more knowledge than female, but females had more favourable attitude and practice (p>0.05). In the year of study, second year dental postgraduates had more knowledge than first and final year. But first year had more favourable attitude and practice than second and third year. A significant difference was observed between specialties regarding practices only, (Table 2).

Discussion

BMW contains infectious agents, toxic or hazardous chemical or pharmaceutical, sharps and it may be genotoxic or radioactive; it is potentially risky for persons who are exposed to it and to the general population and the environment as a whole.[17]

Legislations and guidelines in India concerning biomedical waste management have been laid down (BMWM 1998) to protect the environment and the community, but considerably less importance is given to BMW management.[5] WHO emphasized that "The human's element is more important than the technology. Almost any system of treatment and disposal that is operated by well-trained, and well-motivated staff can provide more protection for staff, patients and the community than an expensive or sophisticated system that is managed by staff who do not understand the risks, and the importance of their contribution" (WHO, 2000).[18]

Effective training on BMW and infection control with

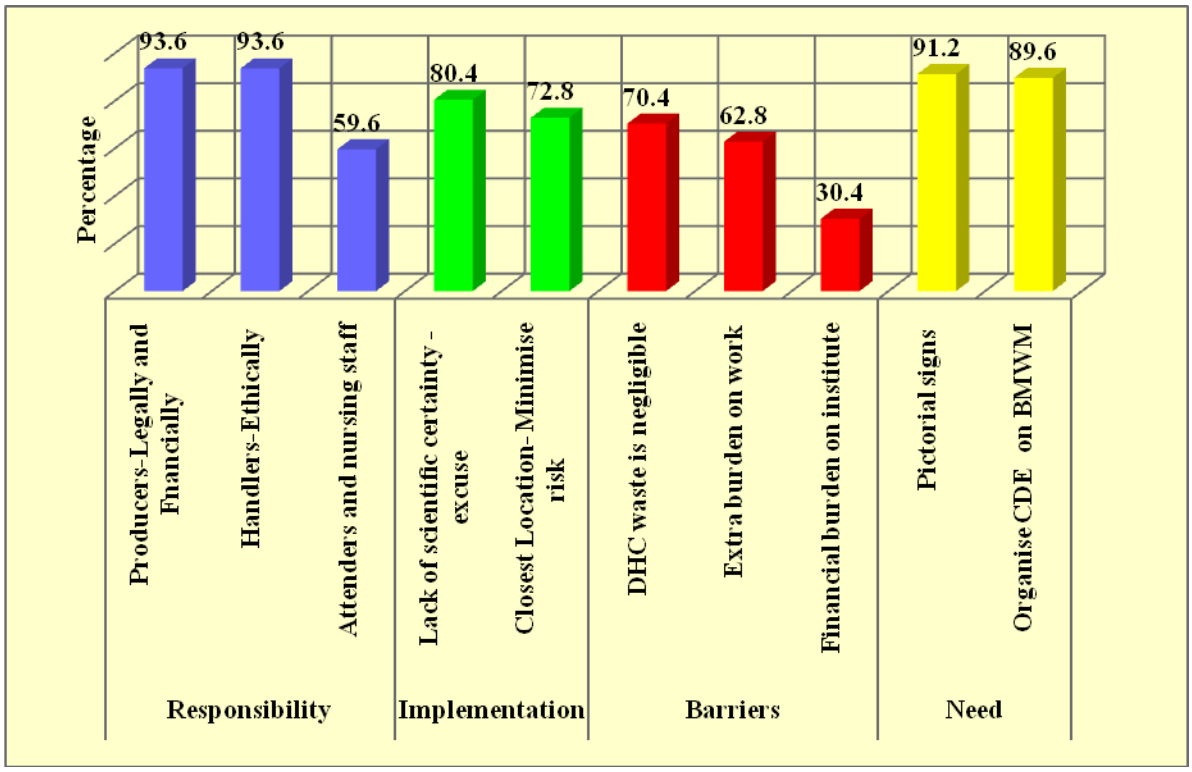

Figure 3: Proportions of study participants with favorable attitude

supervision of personnel involve is one of the vital parts management of hazardous waste which are generated from different sources.[6,7] Lack of professional training is a major cause of failure for proper waste management.[19] Studies have reported there is urgent need to train and educate to adopt an effective waste management practice.[9,10] The proportion of participants (24.4%) who had attended training or workshop is higher than a study (16.3%) reported in the literature.[12] Likewise the proportion of postgraduates who felt they had adequate knowledge (31.6%) and awareness about institute tie up with BMWM companies (52.8%) were higher compared to a study reported in a literature (17.8% and 19.3%). Only one third of the participants (34.0%) knew the institute effluent treatment plant in the institute and is lower than a study, 58.7%.[12]

Proper knowledge regarding health care waste management is important for a healthy dental practice.[19] Most of the participants (94.8%) knew that BMWM rules were applied to the dentists whereas a study found 72.7%.[12] More participants in this study had correct knowledge about the duration of storage (36.0%) than a study with only 9.5% participants. With regard to the method of disposal of hazardous liquid waste, 56.8% had correct knowledge which was lower than a study, 67.4%.[12] Nearly half (45.2%) of the participants knew the proportion of infectious waste generated from health care facilities while a study reported only 10.5% of the study participants.[5]

Willingness and motivation with favourable attitudes of

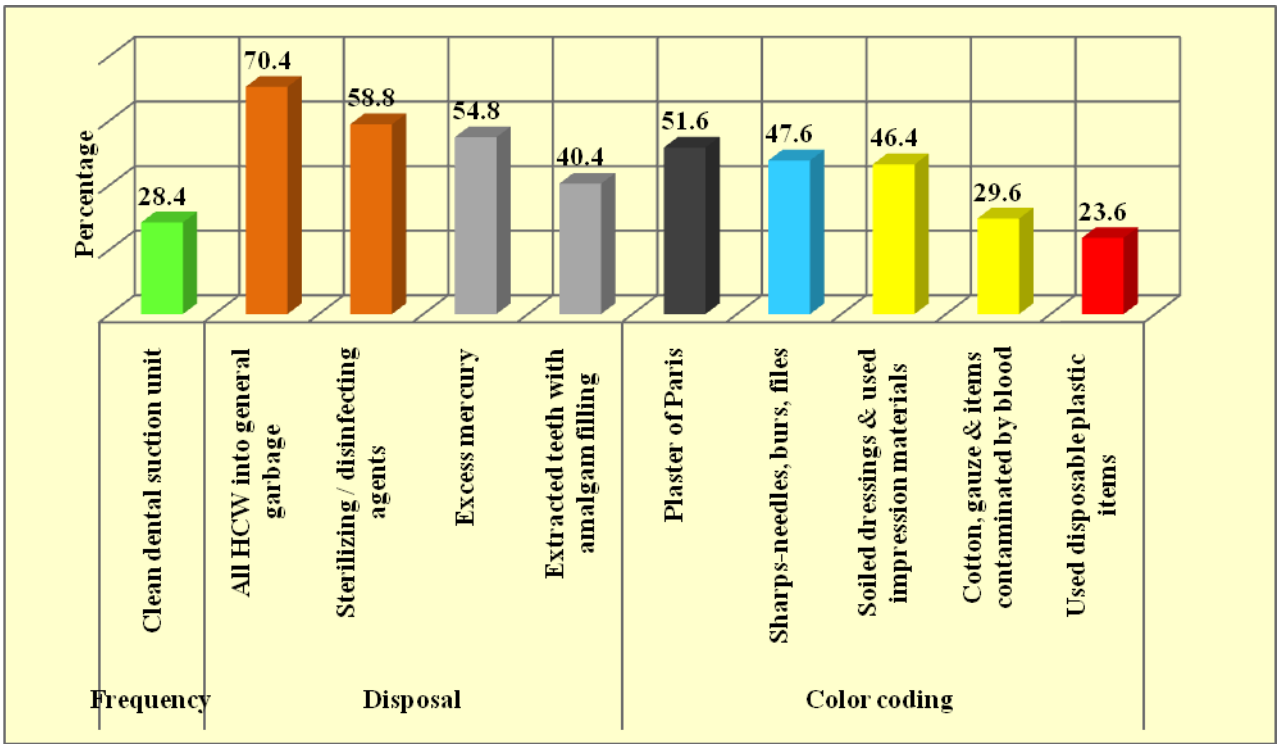

Figure 4: Proportion of study participant with correct practices

the personnel are required for effective BMWM.[5] In the current study, one third of the participants, (30.4%), disagreed that waste management increases financial burden while in other studies 83.3%[10] and 68.4%[5] disagreed. The majority of the participants (89.6%) agreed that the institute should organize a separate class or continuing dental education program which is more than reported in a study (57.9%).[5]

Behaviours depend on the individual's knowledge, beliefs, and values and require compliance.[20] According to National guidelines of BMWM rules different wastes must be disposed off in different methods after collecting in different containers with different colour coding.[3] In this study, the participants' compliance on disposal of excess mercury (54.8%), cotton, gauge and other items contaminated (29.6%) and cleaning of dental suction (28.4%) were more than a study (53.8%, 28.8% and 13.3%). However the proportions of participants who did not dispose of all kinds of dental care waste into general garbage, sharp waste (47.6%) were less than the study (72.7% and 64.4%).[12]

There was no difference in the knowledge, attitude and practice between male and female, although the female were shown to have more favourable attitude and correct practice. Comparison between the specialties regarding knowledge and attitude did not find any significant difference. But significant difference in the practice domain was observed between the specialties. More patient contact in providing treatment with generation of dental wastes in some specialtiess might have made them more aware and complied to the BMW protocols.

Overall, this study demonstrated varying knowledge, attitude and practices which may have its impact on the compliance to BMWM. Hence, efforts directed towards

Table 2: Mean knowledge, attitude and practice scores among study participants

Variables	Knowledge	Attitude	Practice
Gender			
Male	1.99±0.44	2.33±0.47	1.89±0.62
Female	1.95±0.53	2.44±0.53	2.03±0.73
Year			
First	1.97±0.49	2.48±0.50	2.09±0.73
Second	2.00±0.44	2.33±0.50	1.92±0.69
Third	1.92±0.54	2.37±0.51	1.89±0.61
Specialty*			
Oral Medicine	2.07±0.47	2.43±0.50	1.68±0.67†
Oral Surgery	1.91±0.38	2.35±0.54	1.97±0.58
Periodontics	1.93±0.45	2.27±0.45	1.60±0.62‡
Conservative& Endodontics	2.00±0.57	2.53±0.50	2.03±0.47
Pedodontics	1.88±0.35	2.43±0.50	2.27±0.52†‡
Orthodontics	2.04±0.53	2.35±0.49	2.46±0.71† ‡§
Prosthodontics	1.97±0.51	2.29±0.46	2.09±0.78
Oral pathology	1.87±0.64	2.33±0.62	1.67±0.72 §
Public Health Dentistry	2.00±0.65	2.70±0.47	1.80±0.70 §

***ANOVA*p=0.001; Post hoc test †, ‡, § Oral Medicine –Pedodontics p=0.016; Orthodontics p=0.001; Periodontics-Pedodontics p=0.002; Orthodontics p=0.001; Orthodontics- Oral pathology p=0.005; Public Health Dentistry p=0.017**

favourable knowledge, attitude and practice are needed with periodic reinforcement and re-evaluation. Effective management of BMW is not only a legal obligation but also a social responsibility.[10]

The study has some limitations being a cross sectional in design and suffers from biases inherent in a questionnaire based study that is social desirability bias and central tendency bias. The data were collected only from the participants who were present on the day of the study and who were willing to participate. But efforts

were made by to include the colleges from different parts of Bengaluru City. Further studies are recommended for assessing the long term compliance and practice in the dental institutes.

Suggestions

1. Continuing dental education and workshop on BMWM protocols.
2. Orientation of BMWM protocol for the postgraduates at the time of entry into postgraduate programme followed by periodic reinforcements.
3. Supervision and evaluation to ensure maximum compliance.

Conclusion

Participants had poor to moderate knowledge and practice while faring moderate to good in the attitude domain that varied by year of study, gender and specialty. Training and workshops are required to have a coherence of biomedical waste management in all the dental institutes. Adequate knowledge coupled with the positive attitude of the dental professionals can curtail the risk and hazard of biomedical wastes.

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Source of support: Nil Conflict of Interest: None
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