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## Biomedical Waste Disposal: Practice, Knowledge, and Awareness among Dentists in India

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### Abstract:

**Background:** In the course of curing health problems, the health care sector generates a large amount of biomedical waste (BMW) which may be hazardous to all those who come in contact with this waste. This study was planned to evaluate the awareness and management of BMW and knowledge of color-coded disposing bags among dentists, dental auxiliaries, and attenders.

**Materials and Methods:** A cross-sectional survey was conducted among 88 Dentists, 19 auxiliaries and 51 attenders working at 85 dental clinics in Karnataka, India. Data were collected through a structured questionnaire, and the dentists were approached personally. A self-administered pre-tested questionnaire was used to record age, sex, attitude, knowledge, practices on dental waste and any additional training or programs attended by dentists, dental auxiliaries, and attenders. Results were expressed as a number and percentage of respondents for each question and were analyzed using the SPSS version 17 software. Chi-square test was performed. A 95% confidence level was used, and the level of significance was set at  $P < 0.05$ .

**Results:** The 29% dentists and 1% dental attenders identified different colored bags used for BMW collection correctly, and 29% dentists and 2% dental attenders know about the use of mercury spill kit. Needles destroyer was available at 48% clinics and only 59% clinics had a tie up with waste management companies. 52% dentists and 10% dental attenders were aware that any plastic bag cannot be used for waste disposal. 71% dentists and 92% dental attenders responded that developer and fixer can be drained into the sewer. Among the dental clinics surveyed 53% clinics were using yellow bags for disposing anatomical waste and black color-coded bags for disposing the other waste and only at 7% clinics different color-coded bags (red, yellow, general garbage, blue, puncture

proof container, and black colored BMW bags) were available. Only 23% dentists and 4% attended an educational program or training for BMW disposal. Significant differences existed in relation to the educational qualification of respondents in knowledge and practicing methods.

**Conclusions:** Although most of the dentists are aware of the hazardous effect of improper disposal but still a large proportion of them do not practice proper methods of health-care waste disposal. Thus, there is a requirement to educate the dental practitioners regarding the effects of improper waste disposal of infectious waste and regulatory bodies should insight into the matter for enforcement of the guidelines so that healthcare providers practice proper methods of biomedical disposal.

**Key Words:** Biomedical waste, dental practitioners, hazard

### Introduction

The health care sector endows the responsibility to reduce health problems and establishment of a disease free environment for public health. In the course of curing health problems, the health care sector generates a large amount of biomedical waste (BMW) which may be hazardous to all those who come in contact with this waste.<sup>1</sup> The Ministry of Environment and Forest, Government of India, in order to protect the environment and community from these hazards, issued a notification on BMW (management and handling) rules 1998 under Environment (protection) Act.<sup>2</sup> According to the above rules of the Indian Government, "BMW" refers to any waste, that 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 biologicals, and including categories mentioned in Schedule I of the guidelines.<sup>3,4</sup> BMW generated in dental clinics include sharps such as needles, body tissues that includes extracted teeth, chemical fixers, lead foils, silver thiosulfate, mercury, fresh mix of amalgam, scrap amalgam, etc., and other used dental materials.<sup>5</sup> It has also been specified in the notification of the Government of India 1998 that hospital waste management is a responsibility of hospital hygiene and maintenance work. This includes management of a range of activities, such as collection, transportation, operation/treatment of processing systems, and disposal of waste. If the infectious component gets mixed with the general non-infectious waste, the entire mass becomes potentially infectious.<sup>6</sup> However usually, in dental hospitals the general wastes and BMWs are allowed to mix due to negligence and lack of attention thus, in that way depicting the general waste also toxic and hazardous to the mankind and environment. This study was planned to evaluate

the awareness and management of BMW and knowledge of color-coded disposing bags among dentists, dental auxiliaries, and attenders.

## Materials and Methods

The study comprised of 88 dentists, 19 auxiliaries and 51 attenders working at 85 dental clinics in Karnataka, India. A self-administered pre-tested questionnaire was used to record age, sex, awareness, knowledge, attitude, practices among dentists, dental auxiliaries, and attenders, and any additional training attended on dental waste disposal (Table 1). The verbal and informed consent was taken from the study group, and confidentiality of the participants was maintained by coding of the questionnaires. The survey form consisted of a questionnaire to evaluate the awareness and management of BMW and knowledge of color-coded disposing bags among dentists and staff at the clinics. The questionnaire was pilot tested on a small group of dentists who were requested to complete it and to indicate any questions that they found unclear. The dentists and auxiliary staff were accessed personally by visiting the dental clinics. The results were expressed as a number and percentage of respondents for each question and were analyzed using the SPSS Version 17 software. Chi-square test was performed, and the level of significance was set at  $P < 0.05$ .

## Results

A total of 88 dentists, 19 auxiliaries and 51 attenders participated in the present study of which 81% were male, and 19% were female. Among the dentists, 83% were BDS and 17% were MDS.

Among the respondents 61% dentists and 21% dental attenders and auxiliaries correctly identified the biohazard symbol. All dentists were aware of a generation of BMW by dental clinics, only 38% respondents among dental attenders were aware of the same. 44% dentists and 30% dental attenders know that yellow plastic bag is used to discard human anatomical waste and 35% dentists and 25% attenders know that yellow plastic bag is also used to discard microbiology and biotechnology waste. 37% dentists and 22% dental attenders know that red plastic bag is used to discard microbiology and biotechnology waste. 66% dentists and 32% dental attenders know that plastic black bags are used for disposal of discarded medicines and cytotoxic waste. 17% dentists and 12% dental attenders

know about different methods for BMW management and segregation and only 19% dentists were aware of 10 categories of BMW disposal. 29% dentists and 1% dental attenders identified different colored bags used for BMW collection correctly, and 29% dentists and 2% dental attenders know about the use of mercury spill kit. Needles destroyer was available at 48% clinics, and only 59% clinics had a tie up with waste management companies. 52% dentists and 10% dental attenders were aware that any plastic bag cannot be used for waste disposal. 71% dentists and 92% dental attenders responded that developer and fixer can be drained into the sewer. Among the dental clinics surveyed 53% clinics were using yellow bags for disposing anatomical waste and black color-coded bags for disposing the other waste and only at 7% clinics different color-coded bags (red, yellow, general garbage, blue, puncture proof container, and black colored BMW bags) were available. Only 23% dentists and 4% attended an educational program or training for BMW disposal. Significant differences existed in relation to the educational qualification of respondents in knowledge and practicing methods (Table 2).

## Discussion

It is the responsibility of every occupier of an organization generating BMW which includes a hospital, nursing home, clinic, by whatever name called to take all required steps to ensure that such waste is managed and disposed without any harmful effect to community health and the environment. According to guidelines of BMW management and handling rules, 1998 of India, occupier in relation to any institution generating BMW, which includes a hospital, nursing home, dental clinic, dispensary, pathological laboratory, veterinary institution, animal house, blood bank by what's so ever name called, means a person who has control over that institution and/or its premises.<sup>7</sup> In the present study, 17% dentists and 12% dental attenders know about different methods for BMW management and segregation and only 19% dentists were aware of 10 categories of BMW disposal. 29% dentists and 1% dental attenders identified different colored bags used for BMW collection correctly, and 29% dentists and 2% dental attenders know about the use of mercury spill kit.

According to BMW (Management and Handling Rules, 1998, Schedule I), all the substances sent to incinerator/burial, should be placed in yellow colored bags, e.g., microbiological waste, human anatomical waste, and soiled plastic waste. All the BMW, which needs to be autoclave/microwave/chemical treated should be placed in red colored bags that includes infected plastic syringes, rubber dam sheets, tubings, and gloves. Any waste which is sent to shredder after autoclaving/microwaving/chemical treatment should be placed in blue/white translucent bags or containers that include sharp containers for needles and used files.<sup>8-10</sup> In the present study, 47% dentists know that yellow plastic bag is used to discard human anatomical waste which includes extracted teeth.

Table 1: Questionnaire consisting of demographic data.

Name:	Age:	Sex:
Qualification:	Dentist: BDS	MDS (branch)
Dental auxiliary (qualification):		
Dental attainer (qualification):		
Are different colored bags used to dispose BMW clinic at your dental:		
(A) Yes	(B) No	
Educational program/training for BMW:		
(A) Yes	(B) No	
BMW: Biomedical waste		

Table 2: Awareness and attitude among dentists, dental auxiliaries and attenders regarding BMW disposal.

Questions	Percentage of dentists response (total n=88)	Percentage of dental attenders (including auxiliaries) response (total n=19 auxiliaries+51 attenders=70)
Recognized bio hazard symbol	61	21
P value (educational qualification)	0.003	0.005
Is present hospital generates BMW	100	38
P value (educational qualification)	-	0.398
Do you know different color bags are used for BMW collection	81	41
P value (educational qualification)	0.89	0.764
Yellow plastic bag is used to discard human anatomical waste	47	30
P value (educational qualification)	0.021	0.075
Yellow plastic bag is used to discard microbiology and biotechnology waste	35	27
P value (educational qualification)	0.03	0.005
Red plastic bag is used to discard microbiology and biotechnology waste	37	22
P value (educational qualification)	0.003	0.043
Plastic black bags used for discarded medicines and cytotoxic waste	66	32
P value (educational qualification)	0.936	0.02
Identification methods for BMW management	17	12
P value (educational qualification)	0.001	0.067
Know all BMW management categories	19	0
P value (educational qualification)	0.045	-
Identified all colored bags used for BMW collection	29	1
P value (educational qualification)	0.01	0.079
Know about use of mercury spill kit	20	6
P value (educational qualification)	0.003	0.005
Availability of needles destroyer at the clinics	57	-
P value (educational qualification)	0.049	0.055
Can any plastic bag be used for waste disposal? (%)	Yes=36 No=64	Yes=60 No=40
P value (educational qualification)	0.465	0.753
Does your clinic have a tie up with waste management (%)	59	-
P value (educational qualification)	0.543	0.891
Can developer and fixer drained into sewer (%)	Yes=71	Yes=92
P value (educational qualification)	0.042	0.545
Are different colored bags used to dispose BMW (%)	7	-
P value (educational qualification)	0.002	-
Availability of yellow colored bags to dispose BMW (%)	53	-
P value (educational qualification)	0.049	-
Availability of black colored bags to dispose BMW (%)	100	-
P value (educational qualification)	-	-
Attended any educational program/training for BMW (%)	23	4
P value (educational qualification)	0.003	0.001

BMW: Biomedical waste

The results are similar to study carried out by Arora *et al.*<sup>8</sup> in Chhattisgarh State, India, reported that only 44% of the dentists disposed bloody or body waste according to set guidelines; while 56% disposed as general waste. In a study carried out by Singh RD, only 29.4% correctly responded that yellow bag is used to dispose anatomical waste. In the present study, 36% dentists surmised that any plastic bag can be used for waste segregation. In a study carried out by Sanjeev *et al.*<sup>1</sup> in Kerala, Charania and Ingle<sup>11</sup> in Tamil Nadu and Sudhir<sup>12</sup> in Karnataka 14%, 28%, and 27%, respectively, opined that any plastic bag can be used for waste segregation. The plastic bags that are used for waste disposal are particular bags that are non-chlorinated and thus can be incinerated. Normal plastic bags if used for incineration causes release of dioxins and furans resulting in environment pollution.<sup>8</sup>

In the present study, 59% clinics had a tie up with waste management companies. In a similar study conducted by Sudhakar and Chandrashekar<sup>13</sup> in the same city, the corresponding figure was 47.6%. Bansal *et al.*<sup>14</sup> carried out a cross-sectional survey among private dental practitioners in Tricity (Chandigarh, Panchkula and Mohali) and reported that 12% of the dentists were not aware about the color coding system used to dispose the waste according to category and 14% of them were not having knowledge about different categories of the waste generated in their clinics. About 26% of them practiced wrong methods to dispose sharps and extracted tooth respectively, and 32% of them were not disposing outdated and expired medicines according to the guidelines. In the present study, 71% dentists and 92% dental attenders responded that developer and fixer can be drained into the sewer. The results



are in contrast with a study carried out by Singh *et al.* which reported that 45% dentists disposed the developer and fixer solutions by letting them into the sewer. Developer solution does not contain silver as a component thus, it can be diluted and drained into sewer whereas fixer solution contains silver and so if drained into sewer will result in increase of metal load within the sewer which is not permitted as per environmental protection rules. Spent fixer solution contains about 4000 mg of silver recovery units as retrieval silver. It should be kept separately and handled over to certified buyers who will retrieve silver from it.<sup>2</sup>

“BMW (Management and Handling) Rules 1998 was appraised by the Ministry of Environment and Forests to halt the inappropriate practices of BMW management. These rules were proposed to safeguard the society, patients and health care workers from the hazardous effect of infectious waste. The most crucial module of the waste management scheme is to evolve a system and culture via education, training and constant motivation of the health care staff.<sup>9</sup>

### Conclusion

The present study and the studies carried out in the various parts of the country shows variation regarding awareness, attitude, and knowledge of BMW management norms and rules among dentists. Within the limitations of the study, it can be concluded that although most of the dentists are aware of the hazardous effect of improper disposal but still a large proportion of them do not practice proper methods of health-care waste disposal due to negligence. Thus, there is a requirement to educate the dental practitioners regarding the effects of improper waste disposal of infectious waste and regulatory bodies should insight into the matter for enforcement of the guidelines so that healthcare providers practice proper methods of biomedical disposal.

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