



## RESEARCH ARTICLE

### STEER A SHIP KNOWING THE DESTINATION"- A SURVEY TO ASSESS THE KNOWLEDGE & ATTITUDES OF DENTAL PERSONNEL TOWARDS BIOMEDICAL WASTE MANAGEMENT IN GODAVARI DISTRICTS OF ANDHRAPRADESH, INDIA

<sup>1</sup>Dr. Lakshmanarao Bathala, <sup>\*2</sup>Dr. Rachuri Narendra Kumar, <sup>3</sup>Dr. Nibha Kumari Singh, <sup>4</sup>Dr. Dal Singh, V., <sup>5</sup>Dr. Rayapati Srinivasarao and <sup>6</sup>Dr. Mirna Garhnayak

<sup>1,2,3,4</sup>Lenora Institute of Dental Sciences, Rajahmundry, A.P., India, <sup>5</sup>Teerthanker Mahaveer Dental College and Research Centre, Moradabad, U.P. <sup>6</sup> Institute of Dental Sciences, SOA University, Bhubaneswar

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#### ABSTRACT

Stern public health effects and a notable influence on the environment may be seen due to Indecorous and scanty handling of biomedical waste. A number of bio-medical waste materials generated by the dental set up are problematic, which includes, scrap amalgam, photochemical waste (developer and fixer), lead foil from traditional X-ray packets, blood-soaked materials, human tissue, and disinfectant solutions. If the hazardous and non hazardous wastes are mixed, the entire mixture must be consider and should be treated as hazardous waste. With indigent waste management, there may be a peril risk of nosocomial infections, and the unprofessional waste management can steer to spread of antibiotic resistance too. The dental fraternity in many countries is not following the ideal bio-medical waste execution diligently, hence this survey aimed at the knowledge of the dental personnel towards the biomedical waste and its secured disposal ways in Godavari districts of Andhrapradesh, India.

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#### INTRODUCTION

The segregation, disinfection, and dispose of bio-medical waste in an eco-friendly manner, was made mandatory by Bio-medical waste (management and handling) rules 1998 in India (Gazette of India, 1998). The waste can be treated according to the peril of the waste and it is possible only by means of segregation system, which is the duty of every waste generator to follow correct segregation system (Department for Environment, Food and Rural Affairs, 2012), (Thota et al., 2014). Having similar risks of different bio-medical waste groups combine in one main group by means of fixed colour and according to the hazardous nature, to identify easily the different waste groups have different colour for the containers/bags (Thota et al., 2014), with this segregation and disposal will become easy. To avoid the amalgam waste delivered in to the sewer through drains, the clinicians should install amalgam separators in the dental chairs. It is inevitable to protect the general public and environment from this infectious biomedical waste material. During therapeutic and diagnostic procedures as well as handling the waste, all the dental personnel should follow ubiquitous safety measures and appropriate protective measures. Nonregulated waste like used masks, gloves and gowns can be added to the regular trash.

\*Corresponding author: Lakshmanarao Bathala,  
Lenora Institute of Dental Sciences, Rajahmundry, A.P., India.

Before sending for the final disposal, the waste should be noninfectious, hence the waste should be disinfected. It is the duty of the generator to assess, whether that is dangerous waste or not. If not the entire waste will be considered as unsafe (ABCs of Dental Waste, 2012).

#### MATERIALS AND METHODS

The present study was a descriptive cross sectional study. The study location was at Godavi Districts of Andhrapradesh, India. A pre-tested self administered questionnaire was developed after literature search and review [Appendix-1]. The questionnaire was distributed to a total of 456 dental personnel includes 54 faculty, 86 post graduate students, 148 interns & Clinical Students and 168 practicing dental surgeons in two Godavari Districts of Andhrapradesh, for a period of 5 months from April 2017 to August 2017. A total 407 people responded. 11 faculty members, 3 post graduate students and 19 practicing Dental Surgeons were rejected the forms, 7 interns responded after 5 months, and 9 incomplete questionnaires from under graduate clinical students, which were excluded from the study.

#### Statistical Analysis

The data collected was entered in Microsoft Excel 2007 and data analysis was done using Statistical Package for Social

Sciences (SPSS) 19 (SPSS inc., Chicago, IL, USA). Descriptive statistics were done to assess frequency and percentage for responses of the participants. Categorical data was analysed using Chi-Square test ( $X^2$ ), and P value  $\leq 0.05$  was set as significant.

## RESULTS

Out of 456, a total of 407 participants which includes 43 faculty members, 83 post graduate students, 132 interns & U.G. Students (Clinical Students of Third and IV BDS), and 149 Practicing Dental Surgeons were responded in this survey [TABLE-1]. TABLE-2: Shows the participant's knowledge on law about biomedical waste (management & handling) rules 1998, only smattering number of participants (32.4%) knows about the legislative act which looks after safe management of the biomedical waste. Surprisingly among all the participants, 42.4% of the interns and undergraduate clinical students claimed that they know about the law. The results obtained were statistically significant [ $P=0.022$ ]. A handful of participants (33%) only know regarding the maximum 48hrs time limit, one can store the BM waste before transporting to common area. The results obtained were statistically significant [ $P=0.022$ ]. TABLE-3: Reveals the knowledge of the participants on following colour coding for BM Waste. Greater part of the personnel [88.5%] mentioned that they use different color coding bags/containers for different categories of BM waste. Again 100% interns & UGs claimed positively followed by practicing Dentists about 75.8%. The results obtained were statistically highly significant [ $P<0.000$ ]. TABLE-4: Depicts the awareness about the regulation of safe transport of biomedical waste. The majority of the participants (67.6%) mentioned that the municipal corporation will take about the safe transport of BM waste. Only a few percentages (42.4%) were in favor of Pollution control board and among all the participants, the interns & ug students claimed that the pollution control board will look after the matter. The results obtained were statistically significant [ $P<0.022$ ]. TABLE-5: Related to awareness of biohazard symbol, a preponderance of the total participants [98%] was accepted that they know the correct symbol which is mandatory to identify the potentially infectious material. The results obtained were statistically highly significant [ $P<0.000$ ]. A large percentage of participants (86%) accepted that they does not know the importance of segregation in relation to waste management [ $P=0.000$ ]. TABLE-6: Related to knowledge on disposal of amalgam waste along with regular waste, chief part of the participants (98.5%) accepted that the

amalgam waste which is generating in their dental set up dispose in to the regular trash only and nobody sending for recycling. The results obtained were statistically significant [ $P<0.001$ ]. Nearly all the participants (99.2%) claimed that they do have neither amalgam filters nor the separator facilities in their clinical area, to avoid direct mixing of amalgam waste in to the sewer system [ $P=0.008$ ]. TABLE-7: Depicts the knowledge of dental personnel towards the method of disposing used x-ray fixer and developer, almost all the participants (99.3%) stated that they are directly pouring in to the drain, but not sending for recycling. The results obtained were statistically significant [ $P=0.008$ ]. TABLE-8: Related to the attitude of the participants towards having issues related to safe management of health care issues, only 47.4% participants agreed that there are some issues related to safe management. 100% of faculty and PG students under the opinion that there are issues which should be addressed properly. The results obtained were statistically significant [ $P<0.000$ ]. TABLE-9: Denotes the opinion of the participants on team work required for waste management, main part of the respondents [99.3%] were perceive that, the team work can do a better performance. The results obtained were statistically significant [ $P=0.008$ ]. TABLE-10: Depicts the opinion regarding waste management will increase financial burden on the health care set up, a predominant part (93.9%) agreed that there will be an extra financial burden. The results obtained were statistically highly significant [ $P<0.000$ ]. A good portion of the participants (72%), agreed that biomedical waste management is an extra burden of work [ $P=0.000$ ]. TABLE-11: About the opinion of the respondents on responsibility of the generator for safe management of waste, a total of 72.7% of the participants under the opinion that, the generator should take the responsibility for safe transport of the biohazard material which was generated by them. The results obtained were statistically highly significant [ $P<0.000$ ]. TABLE-12: Revealing the attitude towards attending a training /workshop on biomedical waste management, a biggest share of the participants (67.6%) not showed interest towards attending a training/workshop. Among all the positions of the participant's interns and undergraduate clinical students shown more interest (42.4%). The results obtained were statistically significant [ $P<0.022$ ]. A lion's share of the participants (88.5%), revealed that they have not attended any training programme on biomedical waste management previously [ $P=0.000$ ]. Also a preponderance (98.0%) of the participants under the opinion that, BMW training required only for auxiliary staff but not for them [ $P=0.000$ ].

**Table 1. Distribution of subjects according to their position/designation**

Position	Frequency	Percent
Faculty	43	10.6
P.G	83	20.4
Interns & U.Gs	132	32.4
Practicing Dentists	149	36.6
Total	407	100.0

**Table 2. Distribution of subjects according knowledge on Legislative act of Biomedical Waste (Management & Handling) Rules**

Position	Response Yes	No	Total
Faculty	14(32.6%)	29(67.4%)	43(100.0%)
P.G	21(25.3%)	62(74.7%)	83(100.0%)
Interns & U.Gs	56(42.4%)	76(57.6%)	132(100.0%)
Practicing Dentists	41(27.5%)	108(72.5%)	149(100.0%)
Total	132(32.4%)	275(67.6%)	407(100.0%)

$X^2$  value = 9.583,  $P = 0.022$  (Significant).

**Table 3. Distribution of subjects according to knowledge on following colour coding for biomedical waste**

Position	Response Yes	No	Total
Faculty	41(95.3%)	2(4.7%)	43(100.0%)
P.G	74(89.2%)	9(10.8%)	83(100.0%)
Interns& U.Gs	132(100.0%)	0(0.0%)	132(100.0%)
Practicing Dentists	113(75.8%)	36(24.2%)	149(100.0%)
Total	360(88.5%)	47(11.5%)	407(100.0%)

$X^2$  value =42.483, P = 0.000 (Highly Significant).

**Table 4. Distribution of subjects according knowledge on regulation of safe transport of biomedical waste**

Position	Response Pollution Control Board	Municipal Corporation	Total
Faculty	14(32.6%)	29(67.4%)	43(100.0%)
P.G	21(25.3%)	62(74.7%)	83(100.0%)
Interns& U.Gs	56(42.4%)	76(57.6%)	132(100.0%)
Practicing Dentists	41(27.5%)	108(72.5%)	149(100.0%)
Total	132(32.4%)	275(67.6%)	407(100.0%)

$X^2$  value =9.583, P = 0.022 (Significant).

**Table 5. Distribution of subjects according to the awareness of bio-hazard symbol**

Position	Response Yes	No	Total
Faculty	41(95.3%)	2(4.7%)	43(100.0%)
P.G	77(92.8%)	6(7.2%)	83(100.0%)
Interns& U.Gs	132(100.0%)	0(0.0%)	132(100.0%)
Practicing Dentists	149(100.0%)	0(0.0%)	149(100.0%)
Total	399(98.0%)	8(2.0%)	407(100.0%)

$X^2$  value =19.176, P = 0.000 (Highly Significant).

**Table 6. Distribution of subjects according to knowledge on disposal of amalgam waste along with regular waste**

Position	Response Yes	No	Total
Faculty	40(93.0%)	3(7.0%)	43(100.0%)
P.G	80(96.4%)	3(3.6%)	83(100.0%)
Interns& U.Gs	132(100.0%)	0(0.0%)	132(100.0%)
Practicing Dentists	149(100.0%)	0(0.0%)	149(100.0%)
Total	401(98.5%)	6(1.5%)	407(100.0%)

$X^2$  value =15.786, P = 0.001 (Significant).

**Table 7. Distribution of subjects according to knowledge on disposal of used x-ray fixer and Developer**

Position	Response Pouring in to the drain	Sending for recycling	Total
Faculty	43(100.0%)	0(0.0%)	43(100.0%)
P.G	80(96.4%)	3(3.6%)	83(100.0%)
Interns& U.Gs	132(100.0%)	0(0.0%)	132(100.0%)
Practicing Dentists	149(100.0%)	0(0.0%)	149(100.0%)
Total	404(99.3%)	3(0.7%)	407(100.0%)

$X^2$  value =11.798, P = 0.008 (Significant).

**Table 8. Distribution of subjects according to Attitude towards safe management of health care waste having some issues**

Position	Response Agree	Disagree	Total
Faculty	43(100.0%)	0(0.0%)	43(100.0%)
P.G	83(100.0%)	0(0.0%)	83(100.0%)
Interns& U.Gs	8(6.1%)	124(93.9%)	132(100.0%)
Practicing Dentists	59(39.6%)	90(60.4%)	149(100.0%)
Total	193(47.4%)	214(52.6%)	407(100.0%)

$X^2$  value =233.928, P = 0.000 (Highly Significant).

**Table 9. Subjects opinion on requirement of team work for waste management**

Position	Response Agree	Disagree	Total
Faculty	43(100.0%)	0(0.0%)	43(100.0%)
P.G	80(96.4%)	3(3.6%)	83(100.0%)
Interns& U.Gs	132(100.0%)	0(0.0%)	132(100.0%)
Practicing Dentists	149(100.0%)	0(0.0%)	149(100.0%)
Total	404(99.3%)	3(0.7%)	407(100.0%)

$X^2$  value =11.798, P = 0.008 (Significant).

**Table 10. Distribution of subjects regarding opinion on waste management will increase financial burden on the health care set up**

Position	Response Agree	Disagree	Total
Faculty	39(90.7%)	4(9.3%)	43(100.0%)
P.G	80(96.4%)	3(3.6%)	83(100.0%)
Interns& U.Gs	132(100.0%)	0(0.0%)	132(100.0%)
Practicing Dentists	131(87.9%)	18(12.1%)	149(100.0%)
Total	382(93.9%)	25(6.1%)	407(100.0%)

$X^2$  value =19.416, P = 0.000 (Highly Significant).

**Table 11. Distribution of subjects on the opinion on responsibility of the generator for safe management of waste disposal**

Position	Response Agree	Disagree	Total
Faculty	37(86.0%)	6(14.0%)	43(100.0%)
P.G	83(100.0%)	0(0.0%)	83(100.0%)
Interns& U.Gs	81(61.4%)	51(38.6%)	132(100.0%)
Practicing Dentists	95(63.8%)	54(36.2%)	149(100.0%)
Total	296(72.7%)	111(27.3%)	407(100.0%)

$X^2$  value =49.607, P = 0.000 (Highly Significant).

**Table 12. Distribution of subjects Attitude towards attending training/workshop on biomedical waste management**

Position	Response Yes	No	Total
Faculty	14(32.6%)	29(67.4%)	43(100.0%)
P.G	21(25.3%)	62(74.7%)	83(100.0%)
Interns& U.Gs	56(42.4%)	76(57.6%)	132(100.0%)
Practicing Dentists	41(27.5%)	108(72.5%)	149(100.0%)
Total	132(32.4%)	275(67.6%)	407(100.0%)

$X^2$  value =9.583, P = 0.022 (Significant).

## DISCUSSION

The objective of this study was to explore the awareness of the dental personnel about best practices and legal aspects related to biomedical waste management and their approach towards safe and pollution free waste disposal of biomedical waste. The present study result divulge that there are very fewer participants (32.4%) aware of legal aspect. These results are commensurate with the study conducted by Dr. Bathala *et al.*, (2015), Kishore *et al.* (2000) and Bala and Narwal (2013). Whereas these results were not concurring with the research results revealed by Pandit *et al.* (2005) and Saini *et al.* (2013) in which greater part of the dental personnel were aware of the legislation. Another interesting finding of our study was a good percentage of (42.4%) of interns and undergraduate clinical students were knows about the law, these findings are tantamount with the study reports of Saini *et al.*, where as our current study results not in concurring with the study results of Bala and Narwal (2013), in which they claimed majority of the students does not know about the legislation. The majority of the dental personnel were under impression that safe transport of biomedical waste comes under the municipal corporation per view. 'Dioxins and furans' are harmful to the environment, proper care should be taken to avoid the release of these while collecting the waste and one should follow the best practice like using non chlorinated and untreatable plastic bags (Thota *et al.*, 2014). The dental fraternity in many countries is not following the ideal bio-medical waste execution diligently. There is a substantial amount of literature available on unprofessional way of throwing of dental waste in many countries. In Bangkok, most wastes were ejected in to the domestic garbage stream (Punchanuwat *et al.*, 1998), where as a national survey in New Zealand revealed that, the dental profession not following meticulous bio-medical waste disposal practices (Teasure and Treasure, 1997). The current study results were in the same line with the above studies. Before transport to common waste treatment facility area, the bio-medical waste can be stored a maximum time limit of

48hrs, as per BMW National guide lines. Simply should not be sterilized the teeth with amalgam restorations like the teeth without restoration of amalgam, by placing in biohazard bags or sharp containers, because there is liberation of mercury vapors which is very dangerous to human health as well as eco system. Hence it can be counteract by immersion in a 'tuberculocidal disinfection solution' for 30 minutes after placing in a sealed container. Later they can be placed in to the appropriate colour coded bag or sharp container (Godwin 2012), (Occupational exposure (OSHA), 2001) and (Horsted-Bindslev, 2004). The neurotoxic and nephrotoxic nature of mercury is harmful to humans. Hence before sending for final disposal, the amalgam waste should be sent for mercury recuperation process by placing in white rigid receptacle with a mercury suppressant (Mercury in dental amalgam, Epa.Gov, 2011). To avoid the amalgam waste delivered in to the sewer through drains, the clinicians should install amalgam separators in the dental chairs.

To focus at environmentally accountable dental profession among dental undergraduates on amalgam recycling, concepts, pathway and application, all the dental academic institutions or dental authorities may incorporate in their teaching curriculum as prepared by Environmental Protection Agency (EPA) and Marquette University's School of Dentistry, to educate dental students on proper amalgam waste management, that is the 'GRIT' steps which includes, use gray color bags for collection [G-gray bag it]; selecting proper recycling method for amalgam retrieval [R- recycle it]; amalgam separators should be installed in the dental set up [I-install it] and teaching and coaching regarding better organization of dental amalgam [T- teach it] (Mercury in dental amalgam, EPA.GOV, 2011). The used fixer solution contains more amount of silver, which is harmful and should not pour directly in to the drain, after 'de-silvered' from recovery unit, dilute with water and then it can be poured in to drain. After diluting with water the used developer can be poured in to the sewer directly. Lead may leach out from the

unused x-ray films, hence should be sent for recycling. The mutilated sharps should be disinfect in 1% Naocl in a puncture proof sharp container, where as needles should be destroyed before placing in the puncture proof containers (National guidelines on Hospital waste Management, 2011), (Management of sharps, 2010). Sharps are judged as extremely dangerous health care waste. The blood borne pathogens which includes HIV, Hepatitis Band C may likely to communication through infected sharps (Darwish and Al-Khatib, 2006). The team work which require for biomedical waste management always draws better performance than the individual. Based on the results from the present study, which is in concomitance with the findings of Bala and Narwal (2013) study.

A research work revealed that (Bala and Narwal, 2013) 92% of the respondents accepted in respect of safe management of health care having some issues, while our study results also agreed with the above study, that around 48% participants under the conclusion of biomedical waste management having issues. Our present research found that, the waste management will increase financial burden as well as a major portion (93.9%) of the respondents perceive that an extra financial burden on the dental set up. This has been underpinning by another study (Bala and Narwal, 2013) where 50% people agreed for the same.

### Recommendations

1. Avoid using 'reusable items';
2. Shift to 'digital x-rays' rather than conventional ones;
3. Avoid amalgam usage whenever possible and slide to alternative restorative materials;
4. The concerned dental regulatory bodies or the Universities can try to introduce the "GRIT" type of teaching curriculum for under graduate students;
5. The entire dental profession needs awareness on legislation of biomedical waste (management & handling) rules 1998.

### Conclusion

Improper disposal of infectious dental waste is a current problem in many developing countries and if it is not managed properly it will become disrespect to the environmental health. No dental set up in Godavari districts having separate amalgam separators/filter provisions. In majority of dental set ups the used x-ray fixer/developer directly pouring in to the drain.

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**Survey questionnaire****Appendix-1****Tick the appropriate Answer**

1. Your Position/Designation:

- a. Faculty       b. Postgraduate Student       c. Intern & Clinical Students (3<sup>rd</sup> and 4<sup>th</sup> BDS)   
 d. Private Practitioner

**Knowledge on biomedical waste management :**

2. Do you know about legislation on BMW (Management &amp; Handling) rules 1998?

Yes       No 

3. As per the BM W national guidelines, the maximum 48 hrs time limit for which biomedical waste can be stored before transporting to common waste treatment facility.

Yes       No 4. Do you follow colour coding for BMW ?    Yes       No 

5. Who regulates the safe transport of BM Waste?

- a. Pollution Control Board       b. Muncipal Corporation

6. Do you aware of Bio-Hazard symbol?      Yes       No 7. Segregation is the- 'key for waste management'    Yes       No 8. Are you disposing amalgam waste directly in to regular waste?    Yes       No 9. Do you have amalgam filters or separators facilities in your health care set up?    Yes       No 10. Where do you dispose used X-ray fixer and Developer?    a Pouring in to the drain       b. Sending for recycling **Attitude assessment towards BM Waste management**

11. Safe management of health care waste is having some issues .

Agree       Disagree 12. Waste management needs team work ?      Yes       No 13. Waste management is an extra burden of work ?      Yes       No 

14. BMW management- will increase financial burden on the health care set up ?

Yes       No 15. BMW training required to whom?    a. Auxiliary Staff       b. For everybody 16. Are you attended any workshop/training on BMW ?    Yes       No 17. Are you interested to attend any training/workshop on BMW ?    Yes       No 

18. Safe management of waste disposal is the responsibility of the generator?

Yes       No 

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