

# Awareness of Bio-medical Waste Management Among Dental College and Hospital Employees-A Panoramic View

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## ABSTRACT

The Bio-medical waste (Management and handling) Rules 1988 lay down clear methods for disposal of bio-medical waste, defined as “any waste generated during the diagnosis, treatment or immunization of human beings or animals or in research activities used in the production or testing of biologicals.”

The current scenario in the country reveals partial or no segregation at the time of generation, which at times is done by the contractors, or the rag pickers. However, the improper practice of segregation at the site of origin has been observed which causes mixing of infectious and non-infectious waste. A study was therefore, conducted to understand the awareness amongst the employees as regards to Bio-Medical Waste (BMW) Management practices, policies and to assess their attitude towards it, in a premier tertiary level research and referral Institute in Haryana (India).

**Keywords:** Awareness, Bio-Medical Waste, Waste Management

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## INTRODUCTION

Hospital is one of the complex institutions which are frequented by people from every walk of life in the society without any distinction between age, sex, race and religion. This is over and above the normal inhabitants of hospital i.e. patients and staff. Over the years there have been tremendous advancements in the health care system. However it is ironic that the health care settings, which restore and maintain community health, are also threatening their well-being. Poor waste management practices pose a huge risk to the health of the public, patients, professionals and contribute to environmental degradation.

It is reported that for the first time the biomedical waste management issue was discussed at a meeting convened by the World Health Organization regional office for Europe at Bergen, Norway in 1983. This was fuelled by reports of “beach washing” of medical waste on the coasts of Florida and Gulf, and the “recycling” of dispos-

able articles in developing countries (1). The reports and figures available from developed countries indicate that approximately 1-5 kg of waste is generated per bed per day, with substantial inter country and inter specialty differences (2). The data available from developing countries also indicate that the (range is essentially similar but the figures are on a lower side with 1-2 kg per day per bed. In India, it is estimated to be 2.0 kg/ bed/ day (3). The concerns regarding the medical waste is mainly due to the presence of pathogenic organisms and organic substances in hospital solid wastes in significantly high concentrations. The substantial number of organisms of human origin in solid waste suggests the presence of virulent strains of viruses and pathogenic bacteria in undetected numbers (4). Therefore improper handling of solid waste in the hospital may increase the airborne pathogenic bacteria, which could adversely affect the hospital environment and community at large (5). Improper Hospital Waste Management has serious impact on our environment (6). Apart

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from risk of water, air and soil pollution, it has considerable impact on human health due to aesthetic effects.

Investigation carried out by the Environment Protection Agency (EPA) of USA in this regard culminated in the passing of Medical Waste Tracking Act (MwTA), Nov. 1988. With the passage of time the problem has evolved as a global humanitarian issue. In our country, this issue has attracted the attention of the Hon'ble Supreme Court of India and guidelines have been issued. The Bio-medical waste (Management and handling) Rules 1988 lay down clear methods for disposal of bio-medical

waste, defined as "any waste generated during the diagnosis, treatment or immunization of human beings or animals or in research activities used in the production or testing of biologicals." Pollution control boards of every state have been given the task of authorizing and implementing the rules (7). Some of the salient features of these rules are reproduced as under:

**Short title and commencement - (1)**

These rules may be called the bio-medical waste (Management and Handling) Rules, 1998.

● **Application** - These rules apply to all

persons who generate, collect, receive, store, transport, treat, dispose, or handle bio- medical waste in any form.

● **Definitions**

◆ **Authorization:** Means permission granted by the prescribed authority for the generation, collection, reception, storage, transportation, treatment, disposal, and/or any other form of handling of bio-medical waste in accordance with these rules and any guidelines issued by the central government

◆ **Authorized person:** Means an occupier or operator authorized by the prescribed authority to gener-

**Table 1: Categories of Bio-Medical Waste (Schedule-I)**

Option	Waste Category	Treatment and Disposal
Category No. 1	Human Anatomical Waste(human tissues, organs, body parts)	Incineration @/deep burial*
Category No. 2	Animal Waste(animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals, colleges, discharge from hospitals, animal houses)	Incineration@/deep burial*
Category No. 3	Microbiology and Biotechnology Waste(Wastes from laboratory cultures, stocks or micro-organisms live or vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer of cultures)	Local autoclaving/micro-waving/incineration@
Category No. 4	Waste Sharps (needles, syringes, scalpels, blade, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps)	Disinfection (chemical treatment @ @ @/autoclaving/microwaving and mutilation/shredding##
Category No. 5	Discarded Medicines and Cytotoxic drugs(Waste comprising of outdated, contaminated and discarded medicines)	Incineration@/destruction and drugs disposal in secured landfills
Category No. 6	Soiled Waste(items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, lines, bedding, other material contaminated with blood)	Incineration@autoclaving/microwaving
Category No. 7	Solid Waste (Waste generated from disposal items other than the sharps such as tubings, catheters, intravenous sets etc.)	Disinfection by chemical treatment@ @ autoclaving/microwaving and mutilation/shredding##
Category No. 8	Liquid Waste(Waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)	Disinfection by chemical treatment@ @ and discharge into drains
Category No. 9	Incineration Ash (Ash from incineration of any bio-medical waste)	Disposal in municipal landfill
Category No. 10	Chemical Waste (Chemicals used in production of biologicals, chemicals used in disinfection, as insecticides, etc.)	Chemical treatment@ @ @ and discharge into drains for liquids and secured landfill for solids
<b>Note :</b>		
@ There will be no chemical pretreatment before incineration. Chlorinated plastics shall not be incinerated.		
* Deep burial shall be an option available only in towns with population less than five lakhs and in rural areas.		
@ @ Chemicals treatment using at least 1% hypochlorite solution or any other equivalent chemical reagent. It musts be ensured that chemical treatment ensures disinfection.		
## Mutilation/shredding must be such so as to prevent unauthorized reuse		

Table 2: Color Coding of Container for Disposal of BMW (Schedule-II)			
Color Coding	Type of Container	Waste Category	Treatment options as per Schedule-I
Yellow	Plastic bag	Category 1, 2 and Category 3, 6	Incineration/deep burial
Red	Disinfected container/Plastic bag	Category 3, 6, 7	Autoclaving/Microwaving/Chemical Treatment
Blue/White translucent	Plastic bag/puncture proof container	Category 4, 7	Autoclaving/Microwaving Chemical Treatment and destruction/shredding
Black	Plastic bag	Category 5, 9 and Category 10 (solid)	Disposal in secured landfill
<b>Note :</b> <ul style="list-style-type: none"> <li>● Color coding of waste categories with multiple treatment options as defined in Schedule-I shall be selected depending on treatment option chosen, which shall be as specified in Schedule-I.</li> <li>● Waste collection bags for waste types needing incineration shall not be made of chlorinated plastics.§ Categories 8 and 10 (liquid) do not require containers/bags.</li> <li>● Category 3 if disinfected locally need not be put in containers/bags</li> </ul>			

ate, collect, receive, store, transport, treat, dispose, and/or handle bio-medical waste in accordance with these rules

- ◆ **Bio-medical waste:** Means any waste, which is generated during the diagnosis, treatment or immunization of the human beings or animals or in research activity pertaining thereto or in the production or testing of biologicals, and include categories mentioned in Schedule I (Table 1)
- ◆ **Biologicals:** Means any preparation made from organisms or micro-organisms or product of metabolism and biochemical reactions intended for use in the diagnosis, immunization or the treatment of human beings or animals or in research activities pertaining thereto.

- ◆ **Operator of the bio-medical waste facility:** Means a person who owns or controls or operates a facility for the collection, reception, storage, transport, treatment, disposal or any other form of handling of bio-medical waste.
- **Duty of occupier:** It shall be the duty of every occupier of an institution generating bio-medical waste which includes a hospital, nursing home, clinic, dispensary, veterinary institution, animal house, pathological laboratory, blood bank by whatever name called to take all steps to ensure that such waste is handled without any adverse effect to human health and the environment.
- **Treatment and disposal:** Bio-medical waste shall be treated and disposed of in accordance with Schedule I

- **Segregation, packaging, transportation and storage**
  - ◆ Bio-Medical waste shall not be mixed with other wastes.
  - ◆ Bio-Medical waste shall be segregated into containers/bags at the point of generation in accordance with Schedule II (Table 2) prior to its storage, transportation, treatment and disposal. The containers shall be labeled according to schedule III (Table 3)
  - ◆ Notwithstanding anything contained in the motor Vehicle Act, 1988 or rules there under, untreated bio-medical waste shall be transported only in such vehicles as may be authorized for the purpose by the competent authority as specified by the government.
  - ◆ No untreated bio-medical waste shall be kept stored beyond a period of 48 hours.
  - ◆ The municipal body of the area shall continue to pick up and transport segregated non bio-medical solid waste generated in hospitals and nursing homes, as well as duly treated bio-medical wastes for the disposal at municipal dump site.
- **Prescribed authority:** The prescribed authority for enforcement of the provisions of these rules shall be the state pollution control boards in respect of

Table 3: Label for Bio-Medical Waste Containers/Bags (Schedule-III)	
Biohazard Symbol	Cytotoxic Hazard Symbol
 <p><b>Biohazard</b></p>	 <p><b>Cytotoxic</b></p>
Handle With Care	
<b>Note:</b> Label shall be non-washable and prominently visible.	

states and the pollution control committees in respect of the union territories.

- **Maintenance of records:** Every authorized person shall maintain records related to the generation, collection, reception, storage, transportation, treatment, disposal and/or any form of handling of bio-medical waste in accordance with these rules and any guidelines issued.
- **Accident reporting:** When any accident occurs at any institution or facility or any other site where bio-medical waste is handled or during transportation of such waste, the authorized person shall report the accident to the prescribed authority.
- **Common disposal/incineration sites:** The municipal corporations, municipal boards or urban local bodies, as the case may be, shall be responsible for providing suitable common disposal/incineration sites for the biomedical wastes generated in the area under their jurisdiction.

A Dentist and his supporting staff should be well aware of these rules as they will be polluting the environment if waste generated by them is not handled properly. The waste of environmental concern is:

**Amalgam:** Dental Amalgam particles are a source of mercury, which is known to be neurotoxic and nephrotoxic. Fe-

tuses and newborn babies are more sensitive to mercury than adults and there seems to be a great difference in sensitivity among individuals (8). Management includes disposal of amalgam scrap as hazardous waste or more aptly sent to a recycler (9-11). Waste mercury is disposed similarly. Empty amalgam capsules are to be disposed off in the garbage (12). Since amalgam decomposes on heating; amalgam scrap should not be disposed in the waste that could eventually be incinerated (13). To minimize the amount of mercury vapor emitted from waste amalgam, ADA recommends that it be stored under a small amount of photographic fixer in a closed container. It should be labeled as 'scrap amalgam' (12).

**X-ray wastes:** X-ray fixer solution: It is considered a hazardous waste because of its high silver content (11). In the environment, free ionic silver acts as an enzyme inhibitor by interfering with the metabolic processes of organisms (9). These have to be disposed off as a hazardous waste or sent to a silver recovery system (9, 12).

- ◆ X-ray developer solution: Developer solution can typically go into the waste water drain (11, 14). If mixed, they should be separated and treated independently as required (9, 12).
- ◆ X-ray cleaner solution: Many cleaners

for X-ray developer system contain chromium. If the cleaner solution used contains chromium, it should be disposed as a hazardous waste or switch to a non-chrome cleaner (12).

- ◆ X-ray lead foil / lead shields: The lead foils and lead shields contain pure lead (10, 13). Lead is a heavy metal that affects neurological development and functions and can potentially leach from landfills into the environment. These are hazardous waste unless they are recycled for their scrap metal content or disposed off as hazardous waste (9, 12).

**AIMS AND OBJECTIVES**

The Aim of the study was to get background information about the disposal of hospital wastes with the following objectives:

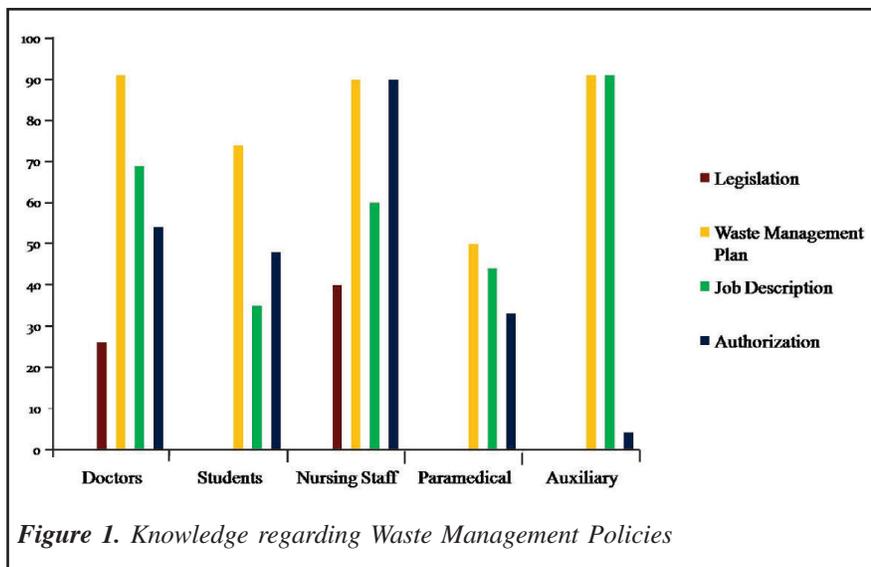
- To determine the awareness regarding waste management policy.
- To determine the awareness regarding waste management practices.
- Attitude assessment towards waste management.
- To document the waste management practices.
- Suggest possible remedial measures, if required.

**METHODOLOGY**

- **Study population:** Study population consisted of various categories of employees of Dental College and Hospital, like Doctors, Interns (trainee students), Nursing staff, Paramedical staff (Laboratory Technicians and Chair side assistants) and Auxiliary staff.
- **Data Collection Tool:** The tool used for collection of data was an anonymous questionnaire developed after literature search and review. The questionnaire had semi-structured format with a set of 15 items concerning the knowledge and was designed to suit various categories of personnel associated with health care settings.
- **Data Collection Technique:** A total of 152 questionnaires were utilized for collecting data from various categories

**Table 4: Demographic Characteristics**

Variable	Doctors (n=35)	Students (Interns) (n=31)	Nursing Staff (n=10)	Paramedical Staff (n=18)	Auxiliary Staff (n=22)
<b>Education</b> :Illiterate	Nil	Nil	Nil	Nil	04
Primary	Nil	Nil	Nil	Nil	10
Secondary	Nil	Nil	01	Nil	08
Graduation	23	31	09	18	Nil
Post Graduation	12	Nil	Nil	Nil	Nil
<b>Gender</b> :Male	14	14	Nil	13	17
Female	21	17	10	05	05
<b>Age</b> :< 25	11	31	Nil	02	02
25-34	20	Nil	06	10	06
35-44	03	Nil	03	02	09
> 45	01	Nil	01	04	05



of employee. The respondents were asked to indicate their views on waste management policy, practices and their attitude related to the issue. Opportunity was also given to give details regarding certain questions asked. The answers were analyzed as positive and negative answers and then percentage positive and negative answers per group were calculated and percentage was used to draw statistical status of the groups.

**RESULTS AND DISCUSSION**

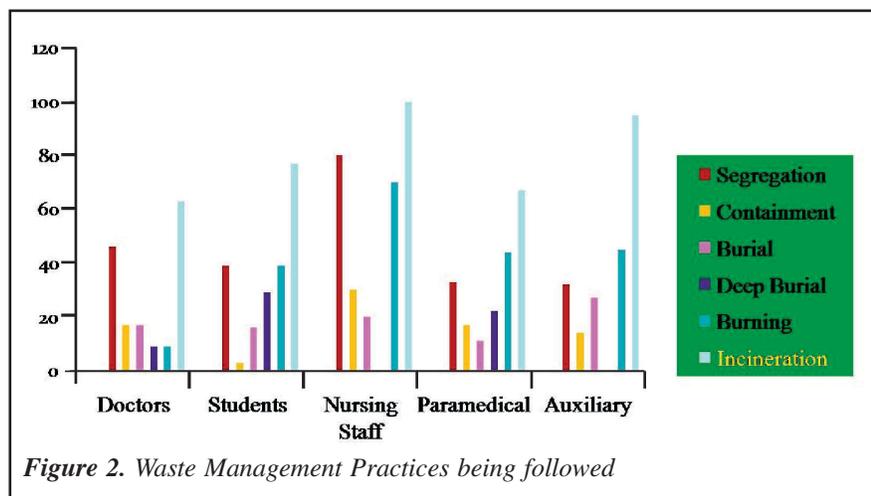
Health care settings covered included Dental College and Hospital. A total of 152 proformas were distributed to various categories of employees, the overall response

rate was 76%. Sample consisted of a total of 116 employees and constitution of sample was, doctors (n=35), students (n=31), paramedical staff (n=18), nursing staff (n=10), auxiliary staff (n=22). The demographic characteristics are shown in Table 4, Most of the sample was educated up to graduate level(77%),12 were post graduates in category of doctors, while in the auxiliary staff 4 were illiterate,10 were having education up to secondary level and 8 were educated up to primary level only. Sample was in the age range of 25-56 years with maximum distribution in the range of 25-34 years with equal distribution of sexes that is, 58 males and 58 females.

Regarding waste management policy (Fig-

ure 1) it is alarming to note that more than half (67%) the sample was not aware of the legislation applicable to hospital waste management and only 33% knew that there is some legislation. None of the respondents was able to list the legislative act when asked.79% reported that they followed a waste management plan in their health care settings, out of which 91% were from doctors and auxiliary staff, 90% were from the nursing staff, 79% were students and minimum awareness was found among the paramedical staff (50%).Waste management responsibilities were included in the job description of their employees by 54% of the respondents. Most of them (46%) of them were not aware of Authorization. Maximum awareness regarding the waste management policy was found to be among the nursing staff and auxiliary staff and very low among the students, paramedical staff.

Analyzing the data on waste management practices (Figure 2), it was found that Incineration was the most widely followed practice (80%) followed by Autoclaving (55%).Other practices reported were Segregation (46%), Burning(41%), Burial (18%), Containment (16%) and Deep burial (10%). An overwhelming majority (76%) reported that waste should be segregated but were not clear as to who should do the segregation. Majority (62%) reported that segregation was the responsibility of auxiliary staff. Only a very small number (8%) were of the view that doctors have a role in segregation.67% of them reported that they did not color code the wastes. Only five respondents were able to match the color codes correctly, they were 3 from the nursing staff, one was doctor and one was from the auxiliary staff. Employees were provided the colour coded containers with Bio-hazard symbol by hospital administration and the charts on waste disposal are put on the walls in hospital but only 12% of the employees were able to use them correctly. Rest of them are using colour coded containers indiscriminately. Respondents from indoor reported that they maintain a register for waste disposal and waste audit is done regularly for them along with surprise checks.



**Table 5: Waste Disposal Methods being used**

Variable	Doctors (n=35)		Students (Interns) (n=31)		Nursing Staff (n=10)		ParamedicalStaff (n=18)		AuxiliaryStaff (n=22)	
	f	%	f	%	f	%	f	%	f	%
Dumping in corporation Bin	00	00	05	16	00	00	02	11	00	00
House to house waste Collection	00	00	00	00	00	00	00	00	00	00
Authorized Hospital Waste Collection	35	100	26	83	10	100	15	83	22	100

Regarding the disposal of wastes (Table 5), majority (93%) the respondents reported that authorized waste collection is done, 5% of the respondents said that of dumping the wastes in corporation bin is the method used for waste disposal.

The data on Employee Education was analyzed by giving a score of one for positive answer and a score of zero for negative answer for all categories of employees. Mean and standard deviation were calculated manually (Table 6), showed that nursing staff was the most educated lot about waste management, 80% of them have undergone training on waste management, rest categories of employees of the institution have not undergone any training on the issue. 91% reported that their health care setting does not have any annual education program on waste management. Majority (95%) of them were interested in attending a program on Bio-medical waste management.

The data on Attitude Assessment was also analyzed by giving a score of three for positive answer, a score of one for negative answer and a score of two was given to

indecisive answer for all categories of employees. There were five questions related to Attitude Assessment. Mean and standard deviation were calculated manually (Table 6), it was found that the nursing staff was having a more positive attitude while paramedical staff was having a comparatively negative attitude.

Safe management of health care waste was agreed to be an issue by the majority (82%). 67% of the respondents were of the view that it is the responsibility of the government. However there was almost total agreement (92%) that it is an issue involving team work. 56% of the respondents believed that safe management efforts will increase the financial burden and 46% of them felt that it is an extra burden on work. In the present study majority of the respondents were not aware of the legal issues involved. Vast majority had no specific knowledge about the issues involved and ways to tackle them. Safe management of health care waste has come to be recognized as being more of a problem of attitude rather than just providing technology or facilities, as observed in the present study as all the facilities for waste management

existed in the Hospital set up but they were not used properly. A notable factor in the attitude assessment was that an overwhelming percentage agreed that it is an issue that needs to be tackled and effective management is based on team work. It is time that the curriculum for medical, paramedical and dental education gives due importance to this vital issue. The academic institutions and non-governmental organizations can play a vital role in disseminating information

**SUMMARY AND CONCLUSION**

The survey presents a grim picture. No appropriate strategy exists for proper management of bio-medical waste. There is an urgent need to increase awareness about rules, regulations and procedures regarding this vital issue. Bio-medical waste programme cannot be successfully implemented without the willingness, self-motivation, and co-operation from all sections of employees of any health care setting. By sensitizing the employees to this issue coupled with effective implementation of rules by surprise visits from monitoring authorities will facilitate successful implementation of the program. It is TIME to ACT, to prevent an epidemic waiting to happen.

In the field of medical practice statutory public health guidelines for Biomedical waste Management and close monitoring of its compliance alone cannot achieve the ultimate goal, if it is not accompanied with social science approach of mass education motivation and change of mind set in all strata of medical practice.

The study has shown a definite apathy of intellectuals towards the operational aspects

**Table 6: Data on employees education and attitude assessment**

Variable	Attitude Assessment		Employees Education	
	Mean	S.D.	Mean	S.D.
Doctors	11.00	1.90	1.0	0.53
Students	12.00	1.40	1.0	0.84
Nursing Staff	12.40	1.56	2.5	0.70
Paramedical Staff	09.40	3.25	1.0	0.40
Auxiliary Staff	11.00	0.90	1.0	0.52

of the system. The medical professionals have tubular vision on patient care services and pay very little heed to support services in the overall context of comprehensive patient welfare. Nursing professionals are found to have had an edge in the attitude and understanding of the subject and it is found that they are practicing the guidelines in more responsible manner may be due to their accountability and commitment in the patient welfare. Paramedical staff including laboratory staff and house-keeping staff have relatively less understanding of the subject, but have high attitude and more practical habits which may be because of strict instructions by authorities and fear for punitive action.

#### REMEDIAL SUGGESTIONS

- Intensive training programs at regular time interval for all the staff with special importance to the new comers.
- Need for orientation programs for newcomers to understand the hospital function.

- Bio-Medical Waste Management should be a part of curriculum for medical paramedical and dental education.
- The entire waste management practices should be a part of total hygiene practice of the society rather than confining to hospital and health facility.

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