

## A study of biomedical waste management at a tertiary care hospital in Goa, India

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### Abstract

**Objectives:** To study the management of biomedical waste and to also evaluate knowledge, attitudes and practices regarding management of biomedical waste among health care personnel at a tertiary care hospital.

**Materials and Methods:** A cross sectional study was conducted to study biomedical waste management at the tertiary hospital and to study the knowledge, attitudes and practices among health care personnel. Study participants consisted of 200 health care personnel. To study the management of biomedical waste, different sections of the hospitals were visited and data was recorded on a researcher designed checklist. Knowledge, attitudes and practices were evaluated using a pretested structured questionnaire. The data was analyzed using SPSS software. Approval of the institutional ethics committee was taken prior to the conduct of the study.

**Results:** Overall 96.5% were aware about biomedical waste generation and its various other components. About 96% of the respondents were aware of the need to segregate biomedical waste. Around 34.5% of the participants expressed the opinion that the hospital doesn't follow correct biomedical waste practices. Safe handling of biomedical waste was not an extra burden on their daily routine work for majority of the study participants (77.5%). Majority of the study participants (86.7%) reported practicing segregation of waste at source. Other findings were improper use of colour coded bins, recapping of needles and non-use of puncture proof containers for sharps.

**Conclusion:** Knowledge and attitude among doctors and interns was higher than other health personnel, while it was lowest among Class IV employees making them vulnerable to infection which can spread through any mishandling of biomedical waste.

**Keywords:** Biomedical waste, Knowledge, Practices, Tertiary hospital.

### Introduction

During patient care activities in any health-care setting, waste is produced which has the potential to harm human beings and environment. As reported by Rajiv Kumar et al.<sup>1</sup> the quantum of such waste generated in India is estimated to be 1-2 kg per bed per day in a hospital.

Improper healthcare waste management is known to cause environmental pollution, and infectious waste could lead to the transmission of several pathogens like typhoid, hepatitis B, hepatitis C, HIV, Escherichia coli, Staphylococcus aureus and Pseudomonas aeruginosa.<sup>2</sup> Hence safe disposal and subsequent destruction of biomedical medical waste is a key step in the reduction of illness or injury through contact with such potentially hazardous material and in the prevention of environmental contamination.

The proper management of healthcare waste depends on good and responsive administration along with adequate legislation and active participation of well trained staff. Thus, enacted legislations in various countries have mandated a healthcare facility to manage its waste in a scientific manner which encompasses the practice of waste segregation, sorting and resource recycling and recovery.

The study of biomedical waste at a health care facility would help to identify any shortcomings in the management of biomedical waste and help to point out the most vulnerable points in the process of management of biomedical waste. It would help in advocating a safe, efficient, sustainable, and

economical technology to the hospital authorities. Study of knowledge and practice of different categories of healthcare workers would reveal the level of awareness regarding BMW, this in turn would help in designing suitable training program meson biomedical waste management.

Hence, this study was conducted to study the management of Biomedical Waste at a tertiary care hospital in Goa, to observe whether standards protocols for biomedical waste management are being followed and to evaluate the level of awareness among healthcare workers.

### Materials and Methods

**Study Setting** a tertiary care hospital.

**Study Design:** A cross-sectional study design was used to study knowledge, attitudes and practices among health care personnel regarding biomedical waste management. And to study biomedical waste management practices at the tertiary hospital Study participants: Knowledge and practices regarding biomedical waste was evaluated in 200 health care personnel these included forty participants from each category of health care personnel namely resident doctors, nurses, interns, class IV (housekeeping) employees and laboratory personnel. Participants from each category were selected randomly. The study was conducted in the year 2016.

### Data Collection and Study Tools

To study the management of BMW in terms of generation, segregation, collection, transport and disposal different sections of the hospitals were visited such as casualty, waste collection section of wards, Ward treatment Rooms, Intensive Care Units, OPDs and Operation Theatres. Data was recorded on a pre-designed checklist which covered various aspects of BMW management at source of generation of waste. Primarily, four broad functions were studied; usage of four color-coded bins, Segregation of waste, Mutilation of recyclable waste, Disinfection of certain categories of waste like plastics and sharps For the study of knowledge and practices regarding biomedical waste management among the health care personnel, the participants were interviewed using a pretested structured questionnaire. Statistical analysis and Ethics clearance: the data was analyzed using SPSS software and approval of the institutional ethics committee was taken before the conduct of the study.

### Results

**Demographic Characteristics:** Out of the 200 participants, majority were females (74%) compared to males (26%).

Females were in majority across all categories of health personnel. Among interns 82.5% were females, 70 % of resident doctors were females. Among laboratory technicians, nurses and class IV participants 62.5%, 95.0% and 60% were females respectively. As far as age distribution was concerned, 40 (100%) Interns and 40 (100%) resident doctors belonged to age group of 21-30 years. twenty (50%) of class IV employees belonged to 31-40 years age group. Twelve Lab technicians (30%) and seven nurses (12.5%) were from 31-40 years similarly twelve lab technicians (30%) and 15 Nurses (37.5%) belonged to 41-50 years age group respectively.

**Knowledge and Awareness of Biomedical Waste Generation, Hazards and Legislation:** All interns (100%) were aware about biomedical waste generation and its various other components while 92.5% doctors, 97.5 % lab technicians, 95% nurses and 97.5% class IV employee were aware about it. As far as awareness of biomedical waste handling rules was concerned, majority of the interns (87.5%), resident doctors (92.5%), and laboratory technicians (82.5%) were aware compared to nurses (52.5%) and class IV staff (37.5%). (Table 1)

**Table 1: Knowledge about biomedical waste among study participants**

Knowledge	Intern No. (%)	Resident Doctor No. (%)	Laboratory Technician No. (%)	Nurses No. (%)	Class IV No. (%)	Total No. (%)	$\chi^2$ value p value
<b>Do you know about biomedical waste generation?</b>							
Yes	40 (100)	37 (97.5)	39 (97.5)	38 (95)	39 (97.5)	193 (96.5)	$\chi^2=9.8$ p= 0.2
No	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.5)	1 (0.5)	
Not sure	0 (0)	3 (7.5)	1 (2.5)	2 (5)	1 (2.5)	6 (3.0)	
<b>Do you know about biomedical waste handling rules</b>							
Yes	35 (87.5)	37 (92.5)	33 (82.5)	21 (52.5)	15 (37.5)	143 (71.5)	$\chi^2=60.8$ p= 0.000
No	5 (12.5)	0	0	16 (20.0)	0	54 (27.0)	
Not Sure	0	3 (7.5)	7 (17.5)	3 (7.5)	25 (62.5)	3 (1.5)	
<b>Knowledge of need to segregate biomedical waste</b>							
Present	40 (100.0)	40 (100.0)	40 (100.0)	40 (100.0)	32 (80)	192 (96.0)	$\chi^2=37.2$ p= 0.000
Absent	0	0	0	0	8 (20)	8 (4.0)	
<b>Correct knowledge of proper disposal of sharps</b>							
Present	15 (37.5)	20 (50.0)	8 (20.0)	9 (22.5)	19 (47.5)	71(35.5)	$\chi^2=54.5$ p= 0.000
Absent	25 (62.5)	20 (50.0)	32 (80.0)	31 (77.5)	21 (52.5)	129 (64.5)	
<b>Which agency/authority regulates biomedical waste generation and disposal in Goa</b>							
State Pollution Control Board	16 (40.0)	26 (65.0)	32 (80.0)	31 (77.5)	15 (37.5)	120 (60.0)	$\chi^2=54.5$ p= 0.000
College authorities	18 (45.0)	6 (15.0)	8 (20.0)	2 (5.0)	2 (5.0)	36 (18.0)	

Overall 96% of the respondents were aware of the need to segregate biomedical waste. However the knowledge of need to segregate biomedical waste was lower among class IV staff compared to others. Correct

knowledge of disposal of sharps was present in only 35.5% of the study participants.

Highest level of knowledge was among resident doctors (50%) followed by class IV workers (47.5%).

Surprisingly lowest level of knowledge about disposal of sharps was among laboratory technicians (20%) followed by nurses (22.5%) and interns (37.5%).

As far as knowledge of agency which regulates biomedical waste was concerned only 60% of the study participants aware that State Pollution control board regulates biomedical waste generation and disposal. Laboratory technicians (80%), nursing staff (77.5%) and resident doctors (65%) had higher awareness on this aspect compared to Interns (40%) and Class IV staff (37.5%).

#### Assessment of Attitudes of Health Care Providers Towards Biomedical Waste: Regarding acquiring

further knowledge about biomedical waste generation and disposal was concerned all doctors, interns and laboratory technicians (100%) had positive attitudes compared to Nurses (97.5%) and class IV workers (95%).

Majority of the study participants (77.5%) were of the opinion that safe handling of biomedical waste is not an extra burden on their daily routine work. Positive attitudes towards treatment of waste before disposal to reduce infectivity of waste was seen among 92.5% interns, 77.5% doctors, 87.5% nurses and 82.5% class IV employees. (Table 2)

**Table 2: Attitudes of health care providers towards biomedical waste management.**

Attitudes	Interns No. (%)	Resident Doctor No. (%)	Laboratory Technician No. (%)	Nurses No. (%)	Class IV No. (%)	Total No. (%)	$\chi^2$ value p value
<b>Safe management of biomedical waste increase burden on daily work</b>							
Agree	13 (32.5)	0 (0)	6 (15.0)	5 (12.5)	10 (25.0)	34 (17.0)	$\chi^2=28.7$ p= 0.000
Disagree	23 (57.5)	40 (100)	32 (80.0)	30 (75.0)	30 (75.0)	155(77.5)	
Not sure	4 (10.0)	0 (0)	2 (5.0)	5 (12.5)	0 (0)	11 (5.5)	
<b>My hospital follows correct biomedical waste management practice</b>							
Agree	3 (7.5)	10 (25.0)	10 (25.0)	17 (42.5)	28 (70.0)	68 (34.0)	$\chi^2=51.1$ p= 0.000
Disagree	15 (37.5)	19 (47.5)	14 (35.0)	9 (22.5)	12 (30.0)	69 (34.5)	
Not sure	22 (55.0)	11 (27.5)	16 (40.0)	14 (35.0)	0 (0)	63 (31.5)	

Around 34.5% of the participants were of the opinion that the hospital doesn't follow correct biomedical waste practices, 34% were of the opinion that hospital indeed follows all the correct practices, whereas 31.5% chose not to comment.

**Practices of Health Care Providers Regarding Biomedical Waste Management:** Most of the study participants (86.7%) reported that they segregated waste at source. Majority of the participants (91.5%) reported that they followed safety measures while handling biomedical waste. (Table 3)

**Table 3: Practices regarding biomedical waste management**

Practices	Intern No. (%)	Resident Doctor No. (%)	Laboratory Technician No. (%)	Nurses No. (%)	Class IV No. (%)	Total No. (%)	$\chi^2$ value p value
<b>Segregates biomedical waste at source</b>							
Yes	40 (100)	37 (92.5)	19 (47.5)	40 (100)	40 (100)	176 (88)	$\chi^2=51.1$ p= 0.000
No	0 (0)	3 (7.5)	21 (52.5)	0 (0)	0 (0)	24 (12)	
<b>Follows safety measures during handling of biomedical waste</b>							
Always	40 (0)	34 (85)	40 (0)	39 (97.5)	30 (75)	183 (91.5)	$\chi^2=33.2$ p= 0.000
Sometimes	0 (0)	6 (15)	0 (0)	1 (2.5)	6 (15)	13 (6.5)	
Never	0 (0)	0 (0)	0 (0)	0 (0)	4 (10)	4 (2)	

**Discrete Observation of Bio-Medical Waste Management Practices at the Hospital:** Management of biomedical waste was observed in 33 inpatient wards, 17 outpatient department (OPDS) and four laboratories. In all the 33 wards and 17 OPDs and four laboratories facilities inspected colour coded bins were present. Posters promoting the use of the colour coded bins were also found displayed in all facilities. Bins were found to be covered in 75.8% of the wards and 76.5% of the OPDs and in all (100%) the laboratories.

At the time of discrete observation, segregation was found to be carried at all the facilities. Five of the 33 wards did not follow colour coding in disposal of waste and out of 17 OPDs three OPDs didn't follow colour coding. In all the laboratories (four out of four) disposal of biomedical waste was as per colour codes. As far as sharps were concerned, recapping of needles was found to be done in 75.8% of the wards 76.5% of the OPDs and 75% of the laboratories. One of the four laboratories was not using puncture proof container for needle disposal.

Biomedical waste storage was for 12-24 hours however waste was stored in open corridors. Transport of different colour coded bags was done separately as per set schedule and workers transporting waste were found to use all safety measures and equipment.

## Discussion

This study conducted at a tertiary care hospital in Goa. Both medical (interns and doctor) and paramedical staff (nurses, lab technicians and class IV employees) reported that they have adequate knowledge about biomedical waste generation, hazards and rules governing biomedical waste.

Class IV employees were least aware of biomedical rules compared to lab technicians, nurses, interns and resident doctors. Knowledge about segregation of waste was high among doctors, nurses, lab technicians and interns while it was less among class IV employees. These findings were similar to study conducted in Tamil Nadu<sup>3</sup> by Kumar R et al Lab technicians (80%) had highest level of knowledge and class IV employees (37.5%) had the least level of knowledge about agency controlling biomedical waste at health care facilities. Thus in most aspects class IV employees lacked knowledge which is in concurrence with the study conducted in north India<sup>4</sup> and Bangalore<sup>5</sup>.

Attitude based questions were well responded by all the health personnel. It was accepted by all the health personnel that team work is important for disposal of biomedical waste, this was in accordance with study conducted in Lucknow<sup>6</sup>. A study conducted by Pallavi V. Tenglikar in Gulbarga city<sup>7</sup>, it was reported that the attitude towards any health behavior depended mainly on the knowledge level of the individual as regards biomedical waste management and in proportion with the knowledge score. In this study too, the positive attitude towards healthcare waste management was highest amongst doctors followed by nursing staff, lab technicians and housing keeping staff.

With existing knowledge health personnel know the need of training programmes which was also reported in other studies.<sup>3,5,8</sup> Everyone was very doubtful about the correctness of waste management practice at their own hospital.

As far as practice was concerned biomedical waste was collected in colour coded bins and segregation was done at source this was known to all health personnel except lab technicians who did not practice segregation of waste. Also, disposal site for biomedical waste was known to almost all health personnel. Similar results were obtained in study conducted in lucknow<sup>6</sup>.

## Conclusion

Knowledge and attitude among doctors and interns was higher than other health personnel while in practice they lagged behind as compared to nurses which because there is a tendency among medical doctors to overlook proper waste management and there is a

common perception that dealing the issues of medical wastes is not a doctor's responsibility; therefore, most of the time they neglect this issue.

Class IV employees are highly vulnerable to infection which can spread through any mishandling of biomedical waste. Thus, lack of knowledge among them is a serious concern.

## Recommendation

Since environmental pollution has become a major concern with respect to the future of life on our planet. It is duty of the management of the health care institution to ensure that bio-medical waste is managed properly without putting extra burden on health care staff in their duties and without causing any adverse impacts on human health or environment. Thus, each and every one will have to join hands and work together for safe collection and disposal of biomedical waste.

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