



# Surveillance of Biomedical Waste Practices in a Multi Speciality Hospital, its Evaluation and Audit

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## **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## **ABSTRACT**

**Aims:** To assess the knowledge of Biomedical waste (BMW) categories, colour coding, transport, storage & disposal of Biomedical waste among the healthcare workers.

**Study Design:** Cross sectional.

**Place and Duration of Study:** Multi speciality Hospital, Pune, over the duration of 1 month.

**Methodology:** A predesigned questionnaire containing closed-ended questions was used to conduct this cross sectional study on HCWs. The data related to awareness & knowledge about various aspects of Biomedical waste amongst the Healthcare workers was collected.

**Results:** Out of total 100 Healthcare workers (HCWs), 40 doctors were correctly knowing all the categories of Biomedical waste. 45 doctors & 40 nursing staff (total 85 out of 100 HCWs) could answer correctly the questions on colour coding of BMW. Only 30 doctors & 21 nursing staff could answer correctly about BMW transport. 25 doctors & 18 nurses could answer correctly the questions related to BMW storage & disposal.

**Conclusion:** The vigorous & repeated training & evaluation is needed to bridge the observed knowledge gaps amongst the HCWs.

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**Keywords:** BMW rules 2016; HCWs; knowledge; colour coding; segregation; BMW disposal; BMW transport.

## 1. INTRODUCTION

People of any age, sex, race and religion utilize healthcare services when they are medically unfit. Hospitals, in addition to patients, also consist of doctors and other healthcare workers [1]. Since the earlier times, the hospitals aid in treating unhealthy people but unknowingly without people being aware about the bad effects of the waste generated in the process on the environment & mankind. It is a well-known & entrenched that hospital waste is an inherent health hazard to the health care workers working in the facility as well as to the people in the vicinity & ecosystem present. HIV/AIDS, Hepatitis B and C are the blood borne pathogens which have a great transmission capacity through the waste generated by health care systems. The term "biomedical waste" has been defined as "any waste that is generated during diagnosis, treatment or immunisation of human beings or animals, or in the research activities pertaining to or in the production or testing of biologicals and includes categories mentioned in schedule I of the Government of India's Biomedical Waste (Management and Handling) Rules 1998" [2,3]. Hospital waste (Biomedical waste) is dangerous due to its hazardous and infectious nature in comparison to the other kind of wastes. Almost 75-90% of waste produced by hospitals, nursing homes etc. is non-risk in nature as it is generated from administrative and general housekeeping. Remaining 10-25% of waste is regarded as 'hazardous' and may create variety of health risks due to its infectious nature [4]. As per gross annual estimate, about 0.33 million tonnes of hospital waste is generated in India the pace of which ranges from 0.5 to 2.0 kg per bed per day approximately [5]. A valid & sound way of tacking biomedical waste is a mandate in healthcare facility. Efficient & sound management of biomedical waste is a legal,ethical & social liability of each & every individual working in healthcare. Ideal biomedical waste management (BMWM) process has pivotal steps (segregation, storage, transportation, treatment, and disposal) [6,7] which requires unique inquisitiveness [8-10].

Haphazard disposal of Biomedical waste and exposure to such an irresponsibly disposed waste carries a grave menace to the environment and to overall mankind. It is statutory that appropriate pre treatment is carried

out on the biomedical waste prior to its final disposal. Furthermore the high prevalence of diseases such as human immunosuppressive virus (HIV) and hepatitis B and C also emphasize the need of proper handling of the BMW [11].

10% of all fatal/life-threatening diseases in the South-East Asia region is attributed to the Hospital-acquired infections which indirectly points out to the improper management of hospital waste [12].

Improper biomedical waste practices lead to change in the ecosystem and spread of antimicrobial drug resistance hence the most suitable method for disposal involves implementation of apt methods especially for the disposal of toxic substances from hospital to environment.

In the above context, the study was planned out with the main objective of assessing knowledge, attitude, and practices among the doctors & nurses in the field of health care waste management till final disposal including BMW categories, segregation, color coding, storage ,transport & disposal of BMW.

## 2. MATERIALS AND METHODS

the cross sectional study was conducted over the duration of 1 month, in the Multi speciality Hospital, Pune using a predesigned & pre validated questionnaire based on BMW rules 2016 & amendments 2018 & 2019, with closed-ended questions.

Inclusion criteria- HCWs (doctors & nurses) willing to participate in the study.

Exclusion criteria- HCWs (doctors & nurses) not consenting to participate in the study.

This study included 100 Health Care Workers (HCWs) including doctors & nurses. Identity of healthcare workers was kept confidential & closed by allotting them numbers to avoid bias. A questionnaire was distributed amongst 100 Healthcare workers of the hospital, which includes doctors & nurses. The data in regards with the awareness & knowledge about various aspects of Biomedical waste amongst the Healthcare workers from different wards & OPDs in a hospital was collected based on this

questionnaire. A questionnaire was prepared with the purpose being to gain a knowledge regarding the current waste generation till final disposal policy which is being pursued and understanding the obstacles hindering the implementation of said policy of waste management. Training session for all these healthcare workers will be organized after assessing the knowledge of questions in questionnaire after the slowdown of Covid 19 pandemic in near future.

Data was collected from the answers of questionnaire & was entered into excel. Data was analyzed by using IBM SPSS software version 18.0 (IBM Corp, USA, 2010). Bar graphs were used to compare the knowledge analysis between doctors & nursing staff.

### 3. RESULTS AND DISCUSSION

#### 3.1 Distribution of Healthcare Workers

A total 100 questionnaires were analyzed. This questionnaire assessed different aspects of Biomedical waste knowledge amongst various categories of Healthcare workers. We included 50 doctors & 50 nursing staff in this study (Fig. 1).

##### 3.1.1 Demographic profile of Health care workers

We included equal number of male & female HCWs in our study. Age distribution & professional experience amongst them was as shown in Table 1.

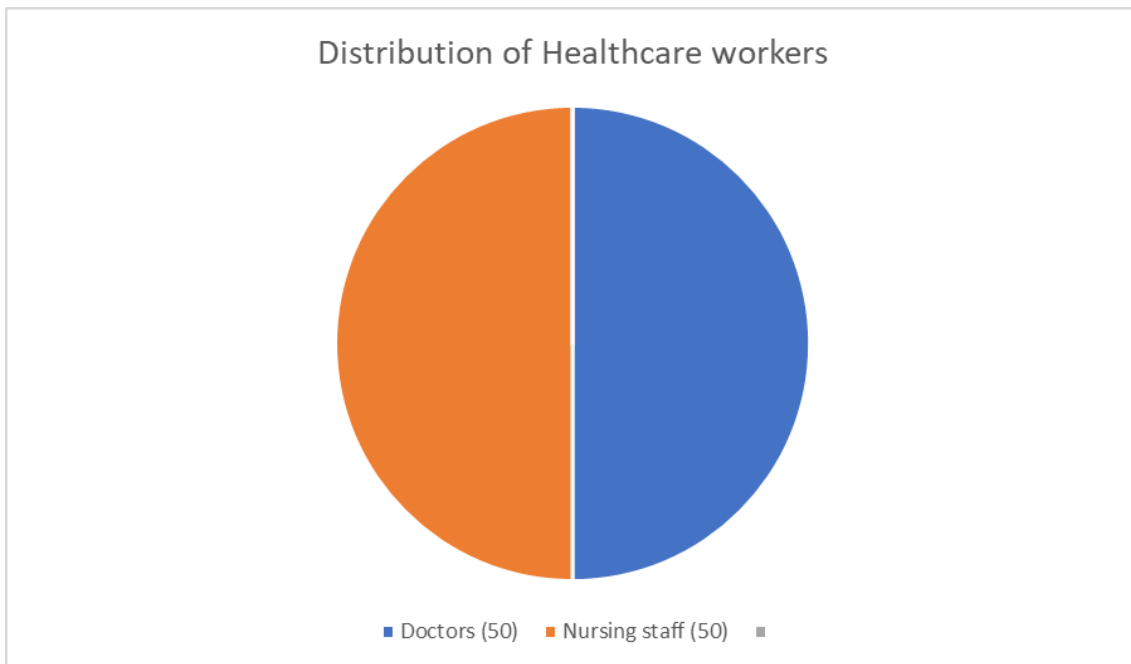


Fig. 1. Distribution of HCWs-( n=100)

Table 1. Age distribution & professional experience amongst health care worker

Parameter	Doctors (n=50)	Nursing Staff (n=50)
Age		
25-40 yrs	40	35
40-55 yrs	10	15
Sex		
F	25	25
M	25	25
Professional Experience in years		
0-5	15	30
5-10	20	10
10 & above	15	10

### 3.2 Assessment of Knowledge of BMW Categories among Healthcare Workers

Out of 50 doctors, 40 were correctly knowing all the categories of Biomedical waste. A gap in the knowledge of BMW categories, was observed in nursing staff as only 28 out of 50 nursing staff was having knowledge about BMW categories (Fig. 2).

### 3.3 Assessment of Knowledge of Colour Coding of BMW

Knowledge of healthcare workers was found pretty good in regards to color coding of biomedical waste. 45 doctors & 40 nursing staff (total 85 out of 100 HCWs) could answer correctly the questions on colour coding of biomedical waste (Fig. 3).

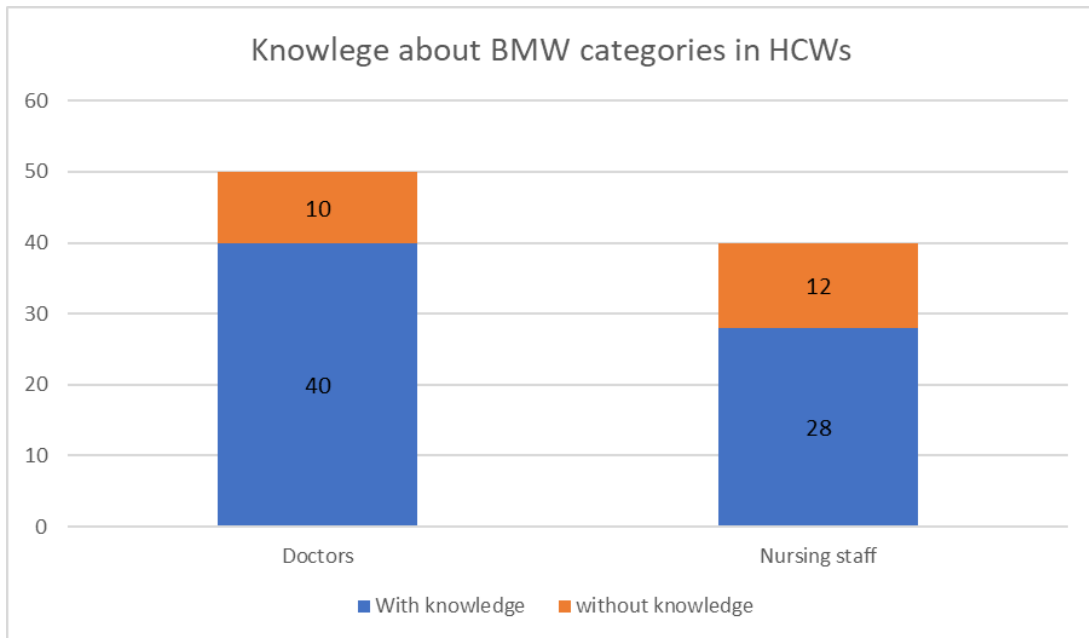


Fig. 2. Distribution of HCWs having knowledge about BMW categories

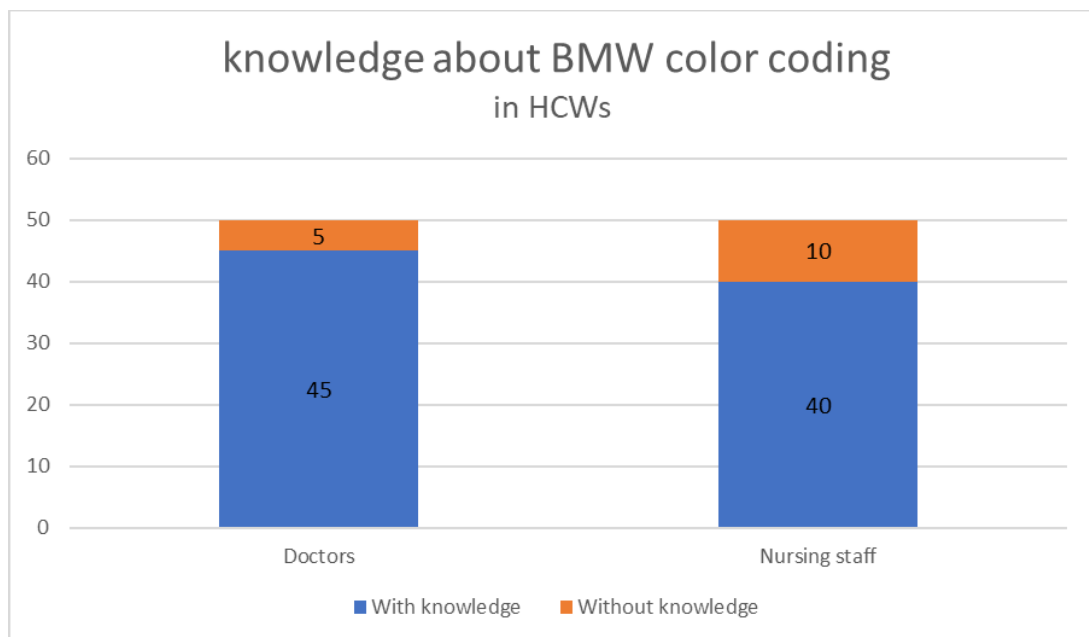


Fig. 3. Distribution of HCWs having knowledge about BMW colour coding

### 3.4 Assessment of Knowledge of BMW Transport

From the answers obtained from the questionnaire regarding transportation aspect of biomedical waste, it was observed that there need to be a lot of education to be given to all healthcare workers including doctors regarding details of transport of biomedical waste within the hospital & transport outside the hospital as there

was deficiency observed in the knowledge about it. Only 30 doctors & 21 nursing staff could answer regarding the transport of BMW (Fig. 4).

### 3.5 Assessment of Knowledge of BMW Storage and Disposal

25 doctors & 18 nursing staff could answer correctly the questions related to BMW storage & disposal. (Fig. 5).

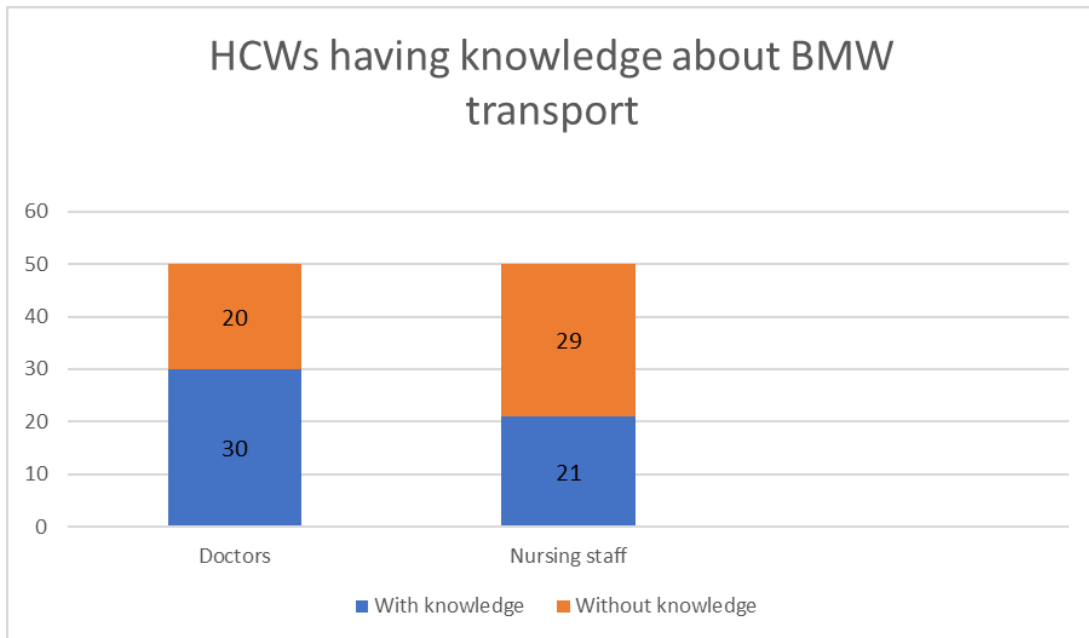


Fig. 4. Distribution of HCWs having knowledge about BMW transport

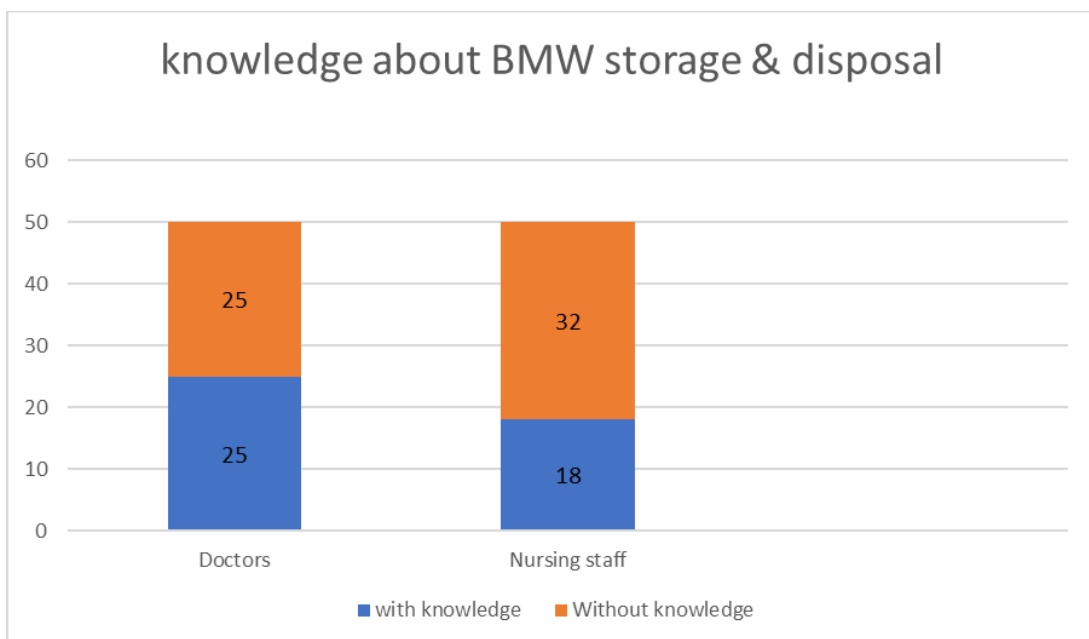


Fig. 5. Distribution of HCWs having knowledge about BMW storage & disposal

The data obtained was compiled and entered in Excel spreadsheet and analyzed using SPSS software version 16.0. Proportions along with 95% Confidence Interval was used to express the results.

### 3.6 Discussion

This questionnaire assessed different aspects of Biomedical waste knowledge amongst various categories of Healthcare workers. A gap in the knowledge of BMW categories, was observed in nursing staff as only 56% (28 out of 50) nursing staff was having knowledge about BMW categories. This gap in the knowledge could be attributed to lack of professional experience of these nursing staff as many were freshly passed out nurses with 5-6 months of work experience. In the section of BMW storage & disposal, we assessed the knowledge & awareness among HCWs about the various aspects of storage of biomedical waste within the facility & disposal of BMW including final methods of disposal.

We found a huge gap in the knowledge & awareness amongst the doctors & nursing staff about storage & disposal including final disposal of BMW generated in the hospital. This knowledge gap regarding BMW storage & disposal may be due to huge workload, lack of sufficient time to focus upon this aspect as there is no direct involvement of doctors & nurses in this aspect of BMW management.

A similar study carried out by Ranjan et al, in 2016, among dental students showed 44 per cent of the students were totally unaware about Biomedical waste management, while 22% showed moderate awareness, 21% showed only slight awareness, 7% showed very much awareness, and 5% exhibited highest level of awareness about the BMW management [13]. Findings of another study by L Joseph et al, showed that 53% of the recruited participants were knowing about the segregation of cytotoxic drugs, 90% were knowing about segregation and disposal of sharps, 72% about infectious plastics. Only 67% were cognizant about the different colour bags for waste segregation. 74% participants showed knowledge related to colour coding of the BMW [14]. In our study, 60% of healthcare workers including doctors & nursing staff were aware of BMW categories. 85% healthcare workers were having knowledge about color coding of biomedical waste.

Approximately half (51 %) of the study population had awareness & knowledge about transport of Biomedical waste.

Awareness & knowledge on storage & disposal of BMW was found to be less as compared with other aspects of BMW (43 %). Overall the cognizance level was less among the doctors as compared to the nurses.

Results of our study correlate with the results of the study carried out by Bhagwati et al in 2015, which also showed concordant results [15].

In a study by MC Yadavannavar et al, in 2010, 97.4% teaching staff answered correctly questions on BMW management in comparison with the nonteaching staff who answered with 80% accuracy [16].

We found discordant results as compared with some previous studies conducted by Pandit et al. [17] & Saini et al. [18]. In their studies, they have found high knowledge level on BMW rules amongst doctors & nurses whereas we found this poor in our study [17,18].

### 4. CONCLUSION

The vigorous & repeated training & evaluation is needed to bridge the observed knowledge gaps amongst the HCWs. Hands on sessions on various aspects of BMW management under supervision need to be organized separately involving each category of HCWs as well as for the frontline staff (Pharmacists, billing, reception) in every healthcare organization to improve the compliance amongst all stakeholders.

### 5. LIMITATIONS OF THE STUDY

Sample size was small in this study. Hence, studies involving large sample size will be needed to provide broader knowledge & deep insight of the current BMW handling & management situation in health care organizations. Also we could include only doctors & nursing staff in this study. Study involving broader category of HCWs like paramedics, class IV workers & Housekeeping staff would be more appropriate to draw a better conclusion.

### CONSENT

Written informed consent was obtained from the study participants for publication of this study.

## ETHICAL APPROVALS

we conducted our research after obtaining institutional ethical committee approval (UH/IEC/2021/115).

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Rao SKM, Ranyal RK, Bhatia SS, Sharma VR. Biomedical waste management: An infrastructural survey of hospitals, Medical Journal Armed Forces India. 2004;60:379–382.
2. Government of India, Ministry of Environment and Forests. Bio-Medical Waste (Management and Handling) Rules. Gazette of India; 1998. Available:<http://envfor.nic.in/legis/hsm/bio med.html>
3. Government of India, Ministry of Health and Family Welfare (MoHFW). National Guidelines on Hospital Waste Management Based upon the Bio-Medical Waste (Management and Handling) Rules, 1998. New Delhi: MoHFW; 2002.
4. Srivastav S, Mahajan H, Mathur BP. Evaluation of biomedical waste management practices in a government medical college and hospital. National Journal of Community Medicine. 2012; 3(1):80-84.
5. Patil AD, Shekdar AV. Health-care waste management in India. J Environ Manage 2001;63:211-20
6. Asadullah MD, Karthik GK, Dharmappa B. A study on knowledge, attitude and practices regarding biomedical waste management among nursing staff in private hospitals in Udupi city, Karnataka, India, International Journal of Geology, Earth and Environmental Sciences. 2013;3(1):118–123.
7. Singh A, Kumari R, Wakhlu A, Srivastava K, Kumar S. Assessment of biomedical waste management in a government healthcare setting of North India, International Journal of Health Sciences and Research. 2014;4(11):203–208.
8. Chakraborty S, Veeregowda B, Gowda L, et al. Biomedical waste management, Advances in Animal and Veterinary Sciences. 2014;2(2):67–72.
9. Food, Medicine and Healthcare Administration and Control Authority (FMHACA), Healthcare Waste Management Directive, FMHACA, Addis Ababa, Ethiopia; 2005.
10. Federal Ministry of Health (FMoH), Healthcare Waste Management National Guidelines, Hygiene and Environmental Health Development, FMoH, Addis Ababa, Ethiopia; 2008.
11. Palwankar PV, Singh A. Safety and measures for auxiliary staff associated with hospital waste disposal. Indian Journal of Dental Sciences. 2012;4:104-106.
12. Ozbek M, Sanin FD. A study of the dental solid waste produced in the school of dentistry in Turkey. Journal of Waste Management. 2004;25:339-345.
13. Ranjan R, Pathak R, Singh D, et al. Awareness about biomedical waste management and knowledge of effective recycling of dental materials among dental students. J IntSocPrev Community Dent. 2016;6(5):474–479.
14. Joseph L, Paul H, Premkumar J, Rabindranath, Paul R, Michael J. Biomedical waste management: Study on the awareness and practice among healthcare workers in a tertiary teaching hospital. IJMM. 2015;33(1):129-131.
15. Yadavannavar M, Berad AS, Jagirdar P. Biomedical Waste Management: A Study of Knowledge, Attitude, and Practices in a Tertiary Health Care Institution in Bijapur. Indian J Community Med. 2010;35:170–1.
16. Bhagawati G, Nandwani S, Singhal S. Awareness and practices regarding bio-medical waste management among health care workers in a tertiary care hospital in Delhi. Indian Journal of Medical Microbiology. 2015;33(4):580-582.
17. Pandit NB, Mehta HK, Kartha GP, Choudhary SK. Management of biomedical waste: Awareness and practices in a

- district of Gujarat. Indian J Public Health. 2005;49:2457.
18. Saini S, Nagarajan SS, Sarma RK. Knowledge; Attitude and Practices of Bio-Medical Waste Management Amongst Staff of a Tertiary Level Hospital in India. J Acad Hosp Adm. 2005;17:2.

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