



## BIOMEDICAL WASTE MANAGEMENT AWARENESS AND PRACTICE AMONG HEALTH CARE PERSONNEL

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### ABSTRACT

**Purpose:** Biomedical waste is a hazard to people handling them, the society and the environment. Hence, Government of India has laid the biomedical waste management rules & guidelines. Hospitals are a major source of biomedical waste. Good awareness and proper practice of these rules & guidelines among health care personnel can prevent the hazards of biomedical waste. Hence, this study was conducted to assess the awareness & level of practice of biomedical waste management among them. **Method:** The awareness and practice among four groups of health care personnel that is doctors, nurses, lab-technicians and cleaning staff of a tertiary care hospital, was assessed using a questionnaire. **Result:** Of the total 154 responses, 71 were doctors, 27 nurses, 38 lab-technicians & 18 cleaning staff. 80.6% of the respondents were aware of biomedical waste management whereas 19.4% were unaware. 98.6% of the doctors, 77.8% of the nurses and 60.5% of the lab-technicians were aware. There was no awareness among cleaning staff. The practice of biomedical waste management was good among 35.5%, average among 33.1% & bad among 31.5% of all the respondents. Only 40.8% of doctors, 55.6% of nurses & 26.3% of the lab technicians practiced it well. Practice was bad among majority of the cleaning staff. **Conclusion:** Majority of health care personnel are aware of biomedical waste management but are not practicing it well. This holds good with all categories of health care personnel. Reasons for bad practice despite being aware have to be found out and appropriate actions must be taken to attain a good level of practice among health care personnel.

**KEYWORDS:** Biomedical waste, Awareness, Practice, Health care personnel.

### INTRODUCTION

As per the definition given in the Biomedical Waste Management (BMWM) Rules 2016, "bio-medical waste (BMW)" means any waste, which is generated during the diagnosis, treatment or immunisation of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps.<sup>[1]</sup>

The annual report on Biomedical Waste Management for the year 2020 as per Biomedical Waste Management Rules, 2016, reported that the total number of health care facilities in that year was 3,52,014 and the total amount of bio-medical waste generated was 774 Tonnes/day.<sup>[2]</sup>

This helps us understand the burden of bio-medical waste being generated by large number of hospitals.

In developing countries, the waste generated in hospitals falls into three categories: general waste which amounts to 85% and is non-hazardous, infectious waste (10%) and chemical or radioactive waste (5%). The latter two together constitute the bio-medical waste amounting to

15% of hospital waste and are hazardous if not managed properly.<sup>[3]</sup>

Inappropriate and inefficient disposal of BMW can lead to infectious hazards, malignancies, malformations, and environmental (air, land and water) pollution – not only to the current generation but also for future generations.<sup>[3]</sup>

Pathogens in infectious waste can cause gastrointestinal, respiratory, skin infections etc in the healthcare workers. Infectious sharps can be a cause of transmission of blood borne viruses such as hepatitis B, C and HIV.<sup>[3]</sup>

Knowing the potential of BMW to cause various hazards though it constitutes only a small percentage of total hospital waste, it needs to be managed and disposed off properly.

Since hospitals are major producers of BMW, it is necessary that all the health care personnel be aware of the bio-medical waste management rules and guidelines.

Knowledge without practice is of no use, similarly being aware of BMW rules but not practicing it is of no use. Healthcare personnel need to practice according to the BMW Rules 2016 to ensure safety of all.

Hence, this study was conducted to assess the awareness and practice of BMW among health care personnel.

## MATERIALS AND METHODS

This was a cross-sectional study carried out with a pre-tested structured questionnaire, over a period of one month in a tertiary care hospital in Hyderabad.

### Inclusion criteria

Health-care personnel like doctors, nurses, lab-technicians and cleaning staff personnel working in the hospital and willing to take the questionnaire.

### Exclusion criteria

Other staff of the hospital like administrative staff, pharmacist etc and health-care workers not willing to take the questionnaire.

### Questionnaire design

Each questionnaire consisted of a section for demographic details followed by two sections with a total of eleven questions.

The questions were close-ended.



Section I (Figure 1) consisted of 7 questions which were used to assess the awareness whereas section II comprised of 4 questions meant to assess practice.

Questions of section I were common to all the 4 categories of health-care workers whereas questions of section II (Figure 2) varied with the type of health care worker. These questions were designed based on the type of practice a particular health-care person is supposed to do.

Questionnaire used in the study by Rahul Chopra *et al.* was used as a reference to design the questionnaire in this study.

**Section I**

1. What do you mean by biomedical waste ?
  - Waste from household
  - Waste usually generated during various activities like diagnosis, treatment, immunization or research activities in medical, dental or laboratory set-up
  - Don't know
2. Are there any guidelines for biomedical waste management by Government in India ?
  - Yes
  - No
  - Don't know
3. What is the correct sequence of biomedical waste management ?
  - Segregation – collection & storage – transportation – treatment & disposal
  - Collection – transportation – disposal
  - Don't know
4. Which is the most important step in biomedical waste management ?
  - Collection
  - Segregation
  - Don't know
5. Can improper biomedical waste management cause various health hazards ?
  - Yes
  - No
  - Don't know

6. Which of the following is universally accepted symbol for biohazard ?
  - 
  - 
  - Don't know
7. According to government guidelines, untreated biomedical waste should not be stored beyond:
  - 24 hours
  - 48 hours
  - Don't know

**Figure 1: Questions to assess awareness.**

<p style="text-align: center;"><b>Section II</b></p> <p><b>DOCTORS</b></p> <ol style="list-style-type: none"> <li>Where do you discard a soiled dressing ?           <ul style="list-style-type: none"> <li><input type="radio"/> Yellow bin</li> <li><input type="radio"/> Blue bin</li> <li><input type="radio"/> Any available dustbin</li> <li><input type="radio"/> Sister takes care of it</li> </ul> </li> <li>How do you discard a used syringe ?           <ul style="list-style-type: none"> <li><input type="radio"/> Recap it &amp; throw it in any available dustbin</li> <li><input type="radio"/> Throw it in a white coloured bin</li> <li><input type="radio"/> Cut the needle with the help of a needle cutter &amp; discard the syringe in red bin and needle in the white bin</li> <li><input type="radio"/> I don't discard it. Nurse or someone else takes care of it.</li> </ul> </li> <li>Where do you discard soiled gloves ?           <ul style="list-style-type: none"> <li><input type="radio"/> Yellow bin</li> <li><input type="radio"/> Blue bin</li> <li><input type="radio"/> Red bin</li> <li><input type="radio"/> Any available dustbin</li> </ul> </li> <li>Where do you discard human tissues (like placenta, debrided tissue etc.) ?           <ul style="list-style-type: none"> <li><input type="radio"/> Yellow bin</li> <li><input type="radio"/> Red bin</li> <li><input type="radio"/> Any available dustbin</li> <li><input type="radio"/> Sister takes care of it</li> </ul> </li> </ol>	<p><b>SISTER/NURSE</b></p> <ol style="list-style-type: none"> <li>Where do you discard a soiled dressing ?           <ul style="list-style-type: none"> <li><input type="radio"/> Yellow bin</li> <li><input type="radio"/> Blue bin</li> <li><input type="radio"/> Any available dustbin</li> <li><input type="radio"/> Sister takes care of it</li> </ul> </li> <li>How do you discard a used syringe ?           <ul style="list-style-type: none"> <li><input type="radio"/> Recap it &amp; throw it in any available dustbin</li> <li><input type="radio"/> Throw it in a white coloured bin</li> <li><input type="radio"/> Cut the needle with the help of a needle cutter &amp; discard the syringe in red bin and needle in the white bin</li> <li><input type="radio"/> Cleaning staff takes care of it</li> </ul> </li> <li>Where do you discard used IV catheters. Foley's catheter, Ryle's tube etc. ?           <ul style="list-style-type: none"> <li><input type="radio"/> Yellow bin</li> <li><input type="radio"/> Red bin</li> <li><input type="radio"/> Blue bin</li> <li><input type="radio"/> Any available dustbin</li> </ul> </li> <li>Where do you discard glass ampoules ?           <ul style="list-style-type: none"> <li><input type="radio"/> Yellow bin</li> <li><input type="radio"/> Red bin</li> <li><input type="radio"/> Blue bin</li> <li><input type="radio"/> Any available dustbin</li> </ul> </li> </ol>
<p><b>LAB TECHNICIAN</b></p> <ol style="list-style-type: none"> <li>Where do you discard soiled gloves ?           <ul style="list-style-type: none"> <li><input type="radio"/> Yellow bin</li> <li><input type="radio"/> Blue bin</li> <li><input type="radio"/> Red bin</li> <li><input type="radio"/> Any available dustbin</li> </ul> </li> <li>How do you discard a used syringe ?           <ul style="list-style-type: none"> <li><input type="radio"/> Recap it &amp; throw it in any available dustbin</li> <li><input type="radio"/> Throw it in a white coloured bin</li> <li><input type="radio"/> Cut the needle with the help of a needle cutter &amp; discard the syringe in red bin and needle in the white bin</li> <li><input type="radio"/> I don't discard it. Nurse or someone else takes care of it.</li> </ul> </li> <li>Where do you discard a vacutainer ?           <ul style="list-style-type: none"> <li><input type="radio"/> Yellow bin</li> <li><input type="radio"/> Red bin</li> <li><input type="radio"/> Blue bin</li> <li><input type="radio"/> Any available dustbin</li> </ul> </li> <li>What do you do with the infected body fluids after processing them?           <ul style="list-style-type: none"> <li><input type="radio"/> Discard them in yellow bin</li> <li><input type="radio"/> Discard them in the sink</li> <li><input type="radio"/> Discharge them into separate collection system, leading to effluent treatment system</li> <li><input type="radio"/> Cleaning staff looks after that</li> </ul> </li> </ol>	<p><b>CLEANING STAFF</b></p> <ol style="list-style-type: none"> <li>When do you seal the bag used for waste collection ?           <ul style="list-style-type: none"> <li><input type="radio"/> When it is ½ filled</li> <li><input type="radio"/> When it is full to 3/4<sup>th</sup></li> <li><input type="radio"/> When it is completely full</li> <li><input type="radio"/> At the end of the day</li> </ul> </li> <li>What personal protective equipment do you wear while handling biomedical waste ?           <ul style="list-style-type: none"> <li><input type="radio"/> Face mask, heavy duty gloves, gowns, gum boots</li> <li><input type="radio"/> Facemask &amp; surgical gloves</li> <li><input type="radio"/> Gowns &amp; gloves</li> <li><input type="radio"/> Only gloves</li> </ul> </li> <li>How long do you store the bags with biomedical waste ?           <ul style="list-style-type: none"> <li><input type="radio"/> We discard them everyday, we don't store it</li> <li><input type="radio"/> 24 hours</li> <li><input type="radio"/> 48 hours</li> <li><input type="radio"/> We store it till it is handed over to biomedical waste collecting personnel</li> </ul> </li> <li>What all coloured dustbins do you put in the hospital ?           <ul style="list-style-type: none"> <li><input type="radio"/> Yellow</li> <li><input type="radio"/> Red</li> <li><input type="radio"/> White</li> <li><input type="radio"/> All of the above</li> </ul> </li> </ol>

**Figure 2: Questions to assess practice.**

### Data collection

Data was collected using the questionnaire. A google form link was generated to share the questionnaire among doctors. Hard copies of the questionnaire were distributed among nurses, lab-technicians and cleaning staff.

Questions were explained to the participants in their mother tongue who had difficulty in reading and understanding English.

### Assessment of awareness and practice

Scoring of the answers was done to assess the awareness and practice. Each correct answer was awarded a score of 1.

**AWARENESS**

Sr. No.	Score	Inference
1.	A person scoring 5 to 7 out of 7	Was considered to be aware
2.	A person scoring < 5 out of 7	Was considered to be unaware

**LEVEL OF AWARENESS**

Sr. No.	Score	Level of awareness
1.	7/7	Good
2.	5 or 6/7	Average

**PRACTICE**

Sr. No.	Score	Practice
1.	4/4	Good practice
2.	3/4	Acceptable practice
3.	≤ 2	Bad practice

**Analysis**

Data was compiled in Excel worksheet and percentage was used to interpret the results.

**RESULTS**

The total responses were 154 of which, 71 were doctors, 27 were nurses, 38 were lab-technicians & 18 were the cleaning staff.

80.6% of the respondents were aware of biomedical waste management whereas 19.4% were unaware. 98.6% of the doctors, 77.8% of the nurses and 60.5% of the lab-technicians were aware. There was no awareness among cleaning staff.

Most of the health-care personnel had only an average awareness of BMW Management.

The practice of biomedical waste management was good among 35.5%, average among 33.1% & bad among 31.5% of all the respondents. Only 40.8% of doctors, 55.6% of nurses & 26.3% of the lab technicians practiced it well. Practice was bad among majority of the cleaning staff.

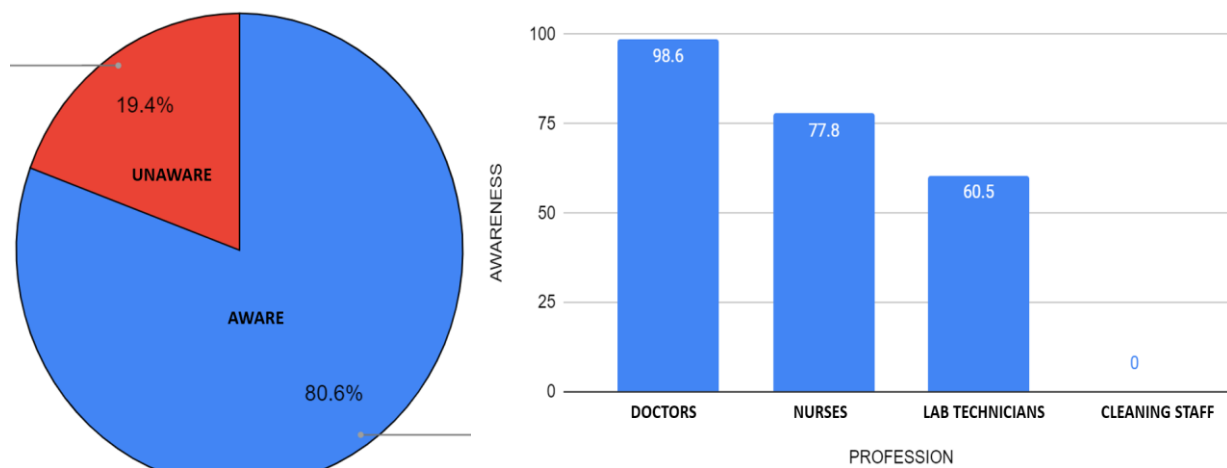


Figure 3: Awareness among health care personnel.

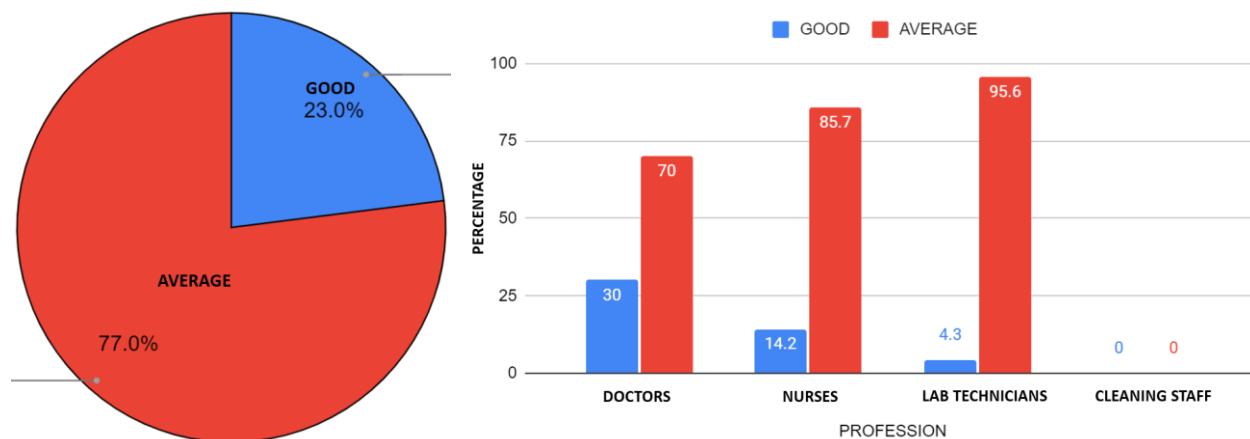


Figure 4: Grade of awareness among health care personnel.

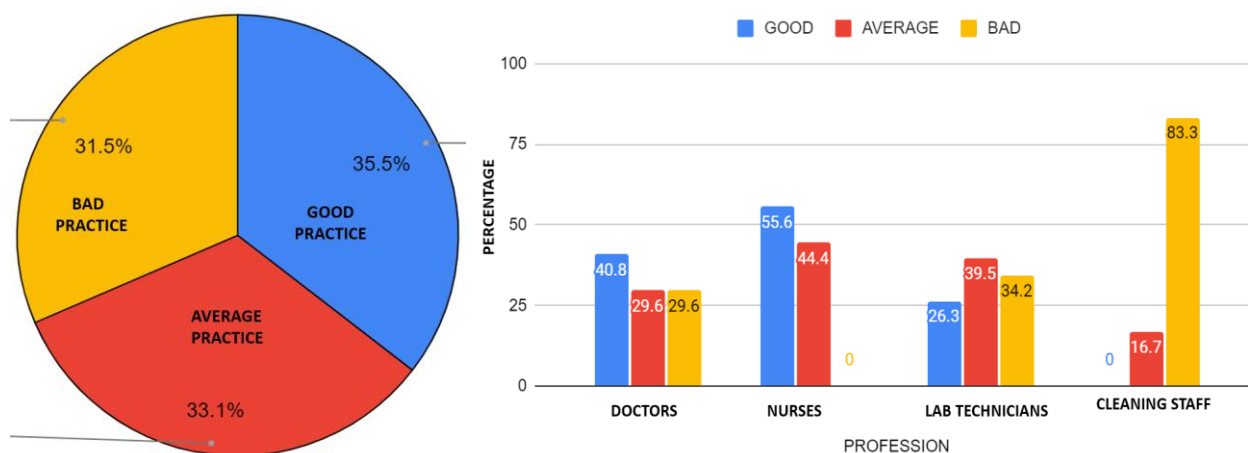


Figure 5: Practice among health care personnel.

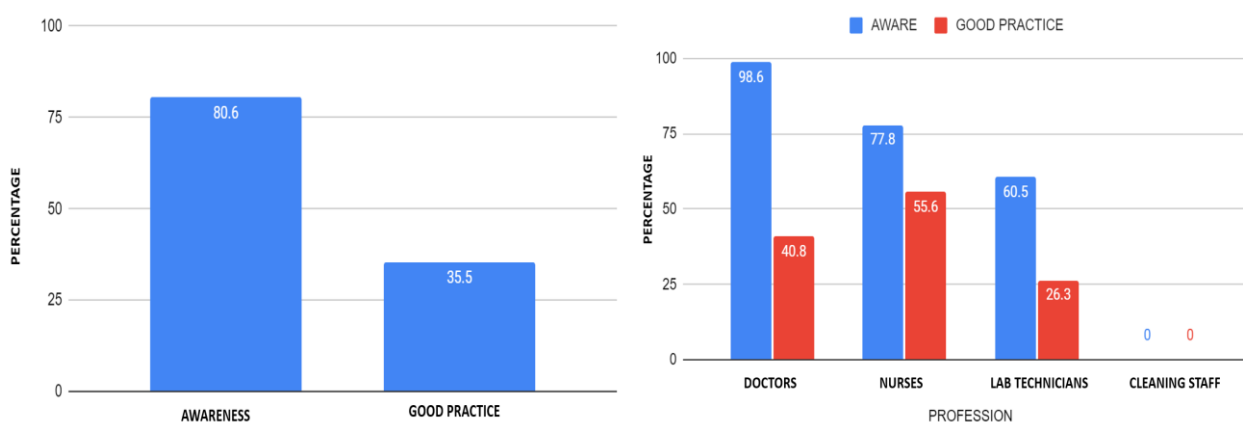


Figure 6: Awareness versus good practice of BMW management.

**DISCUSSION**

Bio-medical waste management awareness and practice among health care personnel is of paramount importance to prevent the hazards of BMW on people, society and environment. Assessment of awareness and practice among HCWs not only helps us understand the management being done in hospitals but also helps us to find out solutions to tackle improper management. Hence, this study was carried out to assess the awareness and practice of BMW among health-care personnel.

In the present study majority of the participants were doctors (71), followed by lab-technicians (38), nurses (27) and the cleaning staff (18).

Majority of the health-care workers had awareness of BMW. In the individual categories of health-care workers, almost all the doctors, a fair number of nurses and average number of lab-technicians were aware whereas the cleaning staff had no awareness.

In a study done by Bathma Vishal et al in Bhopal, it was observed that the overall awareness about BMW was highest among medical professions. The study concluded that doctors were good in theoretical aspects of BMW than the practical aspects of it whereas in case of nurses and lab-technicians the reverse was true.<sup>[4]</sup>

Study by Alok Sharma et al in Jaipur showed that the level of knowledge of BMW generation, hazards & legislation among health care personnel were as follows: 75% among the dentists, 64% among nurses, 60% among lab-technicians and 55% among class IV employees. In this excellent knowledge was seen in only 20% of dentists, 16% of nurses, 5% of lab-technicians and 15% of class IV employees.<sup>[5]</sup>

A study done in a private medical college in Uttar-pradesh by Rahul Chopra et al showed that about 82% of postgraduates had good & 18% had fair awareness regarding BMW. Among undergraduates 43% and 39% had good and fair awareness of BMW respectively.<sup>[6]</sup>

On the contrary in a study done by Dr. Shashwati Nema et al at a tertiary care hospital in Bhopal the knowledge and practice of health care personnel about BMW was low compared to their attitude about BMW, which was high.<sup>[7]</sup>

In a study by Ananthachari et al in Calicut, Kerala, it was seen that the knowledge of BMW was more among nursing staff compared to doctors, interns & laboratory technicians, which was due to lack of adequate training in the later groups.<sup>[8]</sup>

A good percentage of awareness seen among doctors, nurses and lab-technicians in the present study could be due to the reason that they undergo a formal education before their profession wherein they are taught about BMW and its management. Even in their practice they get trained sometimes on these aspects.

Whereas most of the cleaning staff are usually illiterate or have preliminary education. On top of it these people are also neglected during the training sessions of BMWM in hospitals and hence land up being unaware of BMWM.

On assessing the level of awareness among the people who were aware, it was seen that most of them had only an average level of awareness. Similar results were also seen in the study done by Alok Sharma *et al.* wherein the percentage of healthcare personnel having excellent knowledge in BMWM was less compared to those having good to average and poor knowledge.<sup>[5]</sup> This could be due to many reasons.

One can get some insights of the possible reasons from the studies done previously.

In the study by Alok Sharma *et al.* 29% subjects agreed that safe management of healthcare waste was not an issue.<sup>[5]</sup> Even though this is a small percentage, it shows that, there exists an attitude of ignorance towards BMWM among some healthcare workers.

It was observed that only 30.5% of the practitioners in Kanchipuram had undergone some training on BMWM and 69.5% had no training.<sup>[9]</sup> In the study by Ananthachari K. R. *et al.* only 29.8% of participant healthcare workers received training for BMWM in last 5 year period of which 20.8% were nursing staff, 2.9% laboratory technicians, 3.7% interns and 2.8% were doctors.<sup>[8]</sup> Only two Government hospital doctors attended seminar on BMWM according to the study done by N.B. Pandit *et al.*<sup>[10]</sup>

This suggests inadequate training of healthcare workers on BMWM could also be one of the reason.

On the whole only a minority of health-care personnel had a good level of practice of BMWM. Though more percentage of doctors and nurses had a good level of practice, this is only slightly greater than those who were practicing it averagely or poorly. And the category of cleaning staff had the highest percentage of people practicing BMWM poorly.

In a study done in Gujarat district by N.B. Pandit *et al.* the waste disposal system of 30 selected hospitals was observed. It was seen that only 8 (26.6%) out of 30, hospitals were trying to follow the segregation method. Only civil hospital of the district was using four colour containers. Out of 15 Government hospitals, 11 were using needle shredder and they disposed all sharps with

other waste. This study concluded that there was a lack of knowledge about waste management among the doctors, which affected the safe practices for its management.<sup>[10]</sup>

The study by Kokila Selvaraj *et al.* revealed that only 55% of the practitioners segregated waste at the point of generation, of whom 65.5% used colour coding while the rest have their own system of segregation.<sup>[9]</sup>

Majority (96%) respondents agreed to follow colour coding of BMW but less than 65% of them could correctly answer use of each colour coded bag in the study by Shashwathi Nema *et al.*<sup>[7]</sup>

These observations could again be due to the reasons mentioned for awareness among health-care workers.

When results of awareness and good practice of BMWM were analysed together it was observed that the percentage of people having a good practice of BMWM was always less to the percentage of people aware of it.

Awareness should ideally match with the level of practice, but a lack in practice despite being aware is more dangerous than no practice due to unawareness.

It was seen that only 20% of hospitals made committee to look after the hospital waste, in the study by N.B. Pandit *et al.*<sup>[10]</sup>

On assessing the attitude regarding BMWM in a study by Alok Sharma *et al.* it was as follows: 65% healthcare personnel agreed that waste management requires team work and no single team member is responsible. Safe management efforts by hospital staff were considered to be an extra work burden and 50% respondents agreed that it increased the financial burden on management.<sup>[5]</sup>

In a study by Qais Naik *et al.* 68.18% of the participants opined that excessive segregation of BMW is too tedious for hospital personnel.<sup>[11]</sup>

The results and conclusions of the above studies show that how ignorance and negligence of hospital administrators regarding BMWM and the attitude of healthcare personnel that BMWM is a cumbersome and difficult task, might be the possible factors for poor practice despite being aware.

This study was aimed to assess the awareness and practice of BMWM among healthcare personnel but an assessment of their attitude was not done. Assessment of attitude could have brought out the possible reasons for poor practice despite being aware.

Also the number of questions used to assess awareness and practice were few compared to other studies. More number of questions will be helpful in assessing wider aspects of BMWM.

Majority of the studies analysed awareness by calculating the percentage of healthcare workers giving correct response to an individual question. But the present study opted a scoring system for the ease of categorizing groups based on the scores obtained. Individual question assessment approach will bring out the weak area which needs to be focused which might be missed in a scoring system of analysis.

There is always a need for assessment of knowledge, practice and attitude regarding BMWM among healthcare workers in order to find out the lacks and correct them accordingly. Such studies carried out before and after training sessions will also help to assess the efficiency of the training sessions.

Apart from health care workers, the hospital administrators should also be included as participants in such studies.

### CONCLUSIONS

This study was conducted to assess the awareness and practice of BMWM among health care workers of a tertiary care hospital. It was observed that majority of health care workers were aware of BMWM excluding the cleaning staff. Most of them had only an average level of awareness. Practice of BMWM was poor among the health care workers.

The present study findings suggest a need for ongoing education and training programs for BMWM in order to improve the level of awareness and the practice among health care personnel. Assessment of attitude regarding BMWM was not done in the present study which could have highlighted still more reasons for low level of awareness and poor practice.

Further studies with attitude assessment and hospital administrators also included as study participants will help in finding out more reasons for poor practice. Apart from education and training on BMWM, regular monitoring, observational audits, organisational infrastructure, interdepartmental coordination and policies that make sure abiding of laws of BMWM are required to ensure proper practice for a safer world.

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