STUDY ON ASSESSMENT OF BIOMEDICAL WASTE MANAGEMENT PRACTICES IN A TERTIARY CARE HOSPITAL IN A DISTRICT OF ASSAM

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ABSTRACT

BACKGROUND
Biomedical waste management is an important issue for public health. Biomedical waste not only causes health hazard to medical personnel, but also is an important threat to the public and to the environment.

The objective of the study is to assess the biomedical waste management practices and to evaluate the knowledge regarding biomedical waste management practices among healthcare workers.

MATERIALS AND METHODS
This cross-sectional study was conducted in Assam Medical College and Hospital, Dibrugarh, Assam during April '17 – Sept '17. Using purposive sampling method, a total of 138 healthcare personnel were selected, with three groups of 46 each of doctors, nurses and grade IV workers working in the hospital. Data was collected using a pre-tested, structured questionnaire. Data compilation and analysis was done by using Microsoft Excel 2007.

RESULTS
The study has found that the highest numbers of blue/ white bins (96.2%) and yellow bins (90.7%) were correctly located. Red bags were available sufficiently and only 90 (7%) (yellow bags) were available. Collection, separation, storage and transportation of all the bags in the hospitals were done 100% daily. The usage of personal protective equipment was also found to be satisfactory, but all the personal protective equipment was not available 100%. The training of the health care workers was also found to be inadequate in the hospital. The knowledge and practices of biomedical waste management among the healthcare workers were also found to be inadequate in the hospital. Hepatitis B vaccination status among the health care workers was also found to be inadequate.

CONCLUSION
The study concluded that the biomedical waste management practices among the healthcare workers/ personnel was found to be average. There must be proper implementation of management policy as well as training and immunisation among the health workers in the health facilities.

KEY WORDS
Biomedical Waste, Health Hazard, Infected Waste.

BACKGROUND
Biomedical Waste (BMW) is defined as any waste, which is generated during the diagnosis, treatment or immunisation of human beings or animals or in research activities pertaining thereto or in the production or testing of biological products.[1] Biomedical waste management nowadays has become an important health issue to not only the hospital, but also to the environment. Because of lack of awareness or due to less concern on these problems, the biomedical waste management problems are still in nuisance state. After implementation of Biomedical Waste (Management and Handling) Rules in 1998 by Govt. of India, it became an important health issue to the hospital staff and general public. Each day hospitals generate large volumes of waste as a by-product of a variety of health services and procedures carried out in different ways and activities. It is estimated that about 10 to 15 percent of health care waste is 'infected waste.'[2] A survey done in Bangalore revealed that the quantity of solid waste generated in hospitals and nursing homes generally varies from 1/2 to 4 kg per bed per day in Govt. Hospitals, 1/2 to 2 kg per bed per day in private hospitals and 1/2 to 1 kg per bed per day in nursing homes.[3] More than 2 billion people worldwide have evidence of past or current HBV infection and every year 3 - 4 million people are infected with the hepatitis C virus. Throughout the world, an estimated 16 billion injections are administered annually.[3] Risks in hospitals or health care settings are very high. Medical-related waste is disposed off illegally into the garbage and into the sewers (NYDEC 1998).[4]

According to the MRD report, the hospital has average daily attendant about 1782 and average bed occupancy of 91.74 as well as average daily death of 8.82 and average daily admission of 184. The wastes generated from the hospitals were found to be 0.5775 kgs/ day.[5] This is comparatively less

than as suggested by previous studies, which suggests that most hospitals in India generate 1 - 2 kgs per day.[6] According to WHO 85% of hospital waste is non-hazardous, 10% infective and remaining 5% non-infective but hazardous.[4] Taking great importance on biomedical waste management and this type of study was not done before. The present study had been conducted with the aim to assess the biomedical waste management practices and to evaluate the knowledge on BMW management practices among health care workers at Tertiary Care Hospital in Dibrugarh town of Assam.

MATERIALS AND METHODS

This cross-sectional study was carried out in a tertiary care hospital of Assam during April '17 – Sep '2017. 138 health care personnel working in the hospital were included for the study. Using purposive sampling method, a total of 138 health care personnel was selected from the sampling frame, which consisted of 3 groups with 46 each of doctors, nurses and grade IV workers/ waste handlers. A pilot study was carried out before the study had been undertaken. The data had been collected using the checklist and pre-designed pretested structured questionnaire and it was collected simultaneously from various wards, outpatient departments, laboratory, ICU, OT, casualty department by the primary investigator under the supervision of faculty of Department of Community Medicine. Inclusion criteria were individuals selected by sampling method with work experience of more than one month in the current institution. Individuals who were not willing to participate in the study were excluded. Informed consent was taken from the study participants and ethical clearance was taken from the Institutional Ethical Committee.

Statistical Analysis

The responses to the questions were coded and entered into Microsoft Excel 2007. Data was analysed and results were expressed as numbers and percentages.

RESULTS

Observation	Black (%)	Yellow (%)	Red (%)	Blue/ White (%)	Total No. (%) (216)
Located at right place	51 (94.4)	49 (90.7)	54 (100)	52 (96.2)	206 (95.37)
Placed on stand	4 (7.4)	3 (5.5)	0	7 (12.9)	14 (6.4)
Contains waste as in schedule 1	35 (64.8)	46 (85.1)	41 (75.9)	45 (83.3)	167 (77.31)
Respective bins fitted with closed fitting cover	4 (7.4)	0	1 (1.8)	1 (1.8)	6 (2.77)
Labelling done properly	50 (92.5)	49 (90.7)	54 (100)	51 (94.4)	204 (94.4)
Daily disinfected of bins with 1% hypochlorite solution	0	50 (92.59)	54 (100)	54 (100)	158 (73.14)
Collected daily	54 (100)	54 (100)	54 (100)	54 (100)	54 (100)

Table 1. Observation of Colour Coded Bins at the Level of Segregation

Table No. 1 showed that 95.37% bins were located at the right place, only 6.4% were placed on stand, 77.31% contained only infected waste. 96.2% of blue/ white bins and 90.7% of yellow bins were correctly located. 12.9% blue/ white bins were placed on stand. All the bags (100%) were collected daily. 94.4% bags were correctly labelled, 2.77% bags were closed with fitting cover and only 73.14% bags were disinfected with 1% hypochlorite solution. Red bags were sufficiently (100%) available, while only 90.7% yellow bags were available.

Personal Clothing Measures	Doctors (n/%)	Nurses (n/%)	Grade IV Workers (n/%)
Gloves	46 (100)	46 (100)	46 (100)
Masks	30 (65.21)	43 (93.47)	42 (91.30)
Eye Shield	12 (26)	0	0
Gumboots	0	0	42 (91.30)
Aprons	46 (100)	46 (100)	30 (65.21)

Table 2. Showing Personal Protective Measures worn by Waste Handlers/ Health Care Workers

Table No. 2 showed that all the health care personnel used gloves 100%, 91.30% of grade IV workers used gumboots, 26% doctors used eye shields, 65.21% grade IV workers used aprons whereas 100% by doctors and nurses; 65.21% doctors, 93.47% nurses and 91.3% grade IV workers used masks.

Training and Other Particulars	Doctors (46) No. (%)	Nurses (46) No. (%)	Grade IV Workers (46) No. (%)	Total No. (%) (138)
Received any training in biomedical waste handling	35 (76.08)	25 (54.34)	27 (58.7)	87 (63.04)
Sensitisation workshop on BMW management before/ joining in service	35 (76.08)	25 (54.34)	27 (58.7)	87 (63.04)
Aware of risk involved in BMW handling	45 (97.8)	45 (97.8)	44 (95.6)	134 (97.1)
Hepatitis B vaccination received	45 (97.8)	45 (97.8)	14 (30.4)	104 (75.36)
Any injury/ infection in past 6 months	0	0	0	0
Accidents reported to higher authority	0	0	0	0

Table 3. Training and Practices of Health Care Workers/ Waste Handlers

Table No. 3 showed that only 87 (63.04%) health care personnel had received training on biomedical waste handling and 97.1% had awareness about risk involved in BMW handling. The hepatitis B vaccine received only 75.36%

by the health care workers. There was no history of injury reported to the higher authority in the health care facility.

Observation	Yes	No
Trolley used for transportation of BMW separately	Yes	-
Separate room/ area for storing waste after collection	Yes	
Separate route for transportation of BMW	-	No
Waste not stored for more than 48 hrs.	Yes	
Weighing machine present in storage room/ plant	Yes	
Table 4. Observation at Level of Transportation and Storage Facilities of BMW		

Table No. 4 shows that there were separate trolleys used for transportation of BMW at the health care facility. Also observed that the BMW was not stored for more than 48 hrs. There was no separate route for transportation of BMW.

Correct Knowledge Regarding Biomedical Waste	Doctors (n/%)	Nurses (n/%)	Grade IV Workers (n/%)	Total No. and %
Is there any rules/ legislation for BMW management in India	45 (97.8)	45 (97.8)	44 (95.6)	134 (97.1)
Colour coding for waste disposal	45 (97.8)	45 (97.8)	44 (95.6)	134 (97.1)
Knowledge regarding BMW management adequate in the health facilities	46 (100)	46 (100)	46 (100)	138 (100)
Segregation at source of BMW	45 (97.8)	45 (97.8)	44 (95.6)	134 (97.1)
Storage of BMW waste (duration)	23 (50)	30 (65.21)	44 (95.6)	97 (70.2)
Diseases transmitted through BMW (Hep-B/C/tetanus/HIV/AIDS)	46 (100)	40 (86.95)	20 (43.47)	106 (76.81)
Identification of biohazard symbol	46 (100)	45 (97.8)	45 (97.8)	136 (98.55)
Table 5. Knowledge regarding Biomedical Waste among the Health Care Workers				

Table No. 5- The table showed that the knowledge on legislation for BMW management in India was found to be 97.1% among health care workers and found to be satisfactory. The knowledge on colour coding for waste disposal and segregation at source of BMW was 97.1%, on storage of BMW waste duration 70.2%, on disease transmission 43.47% among grade IV workers and 86.95% among nurses. On biohazard symbol, 97.8% among nurses and grade IV workers.

DISCUSSION

In the present study conducted at tertiary care hospital, 138 health care personnel were included from the various departments, wards, OTs, ICUs, OPDs, casualty department, blood banks etc. In the study, we found that the blue/ white bags were located (100%) and yellow bags (90.7%), 12.9% (blue/white) bags were correctly placed on stand, but Srivastav et al[6] found that the colour-coded bins were not placed on stand as well as closed fitting covers on them were missing in majority of wards. About the availability of red

bags (100%) and yellow bags (90.7% were observed and 94.4% of the bins were correctly labelled. In the study done by Ismail IM[7] et al, observed that only one-third of the study participants used the colour coded system. Muluken A et al (2011)[8] found that only 31.9% of health care workers segregated wastes by their type with the available dust bins. In this study, wastes were collected daily and transported to the designated central storage sites. For transportation of wastes from collected sites, mostly wheeled trolley was used by the health workers. But in a study conducted by Umar Rn AB et al[9] found that collection of hospital waste using bare hands by the hospital cleaners and infectious wastes were not labelled by biohazard symbols. These might be due to lack of awareness as well as poor implementation of policies and management of biomedical waste management in those areas. The knowledge regarding biomedical waste management among the health care were found to be satisfactory in this study (100%), where 90% among doctors was found by Ismail IM. Most of the health care workers used the personal protective measures except eye shields (26%) by doctors and gumboots (91%) by grade IV workers. In a study conducted by Shyamala R (2016)[10] found that only 88% of the health care workers used protective measures to prevent health hazards. Pandit NB et al (2005)[11] found that lack of knowledge about waste management among doctors, which affects the safe practices for management. In a study conducted in Iran in the University Hospitals of Fars Province also found insufficient training of health personnel, insufficient personal protective measures and lack of knowledge regarding the proper use of such equipment. The training on biomedical waste among the healthcare were (63.04%) unsatisfactory in this study. So, periodic training as well as sensitisation workshop on biomedical waste management must be done by the health care workers. In a study done by Muluken A et al (2011)[8] in Northwest Ethiopia, also found only 53.1% of health care personnel had training on biomedical waste management. In another study conducted by Srivastav S et al (2009),[6] found only 14% by Dohare S et al[12] (4.2%) in 2007 - 2008 by Ananthachari K et al (2016) 29.8% only[13] among health care workers received training on BMW management. By Ismail IM et al found none of the health care personnel were trained on biomedical waste. In this study, the knowledge on biomedical rules/ legislation among health care personnel were found to be 97.1%, whereas in a study done by Sharma A et al[14] found to be 36% among nurses. But in a study conducted in New Delhi in 2000,[15] reported that majority of the study participants were not aware of the proper clinical waste management regulations. Similar findings reported by Sharma et al (2010),[16] which indicated a lack of knowledge and awareness towards legislation on BMW. In the present study, 97.1% health care workers had awareness regarding risks associated with biomedical waste, but in a study done by Pandit NB et al (2005) found 30%, 10% by Srivastava S et al (2009), by Mathur V et al[17] 27% and Bansal M et al[18] 43%. The knowledge on colour coding of bags for waste disposal was found to be 97.1% among health care workers in present study, by Sharma N et al[19] in their study at Jabalpur found that 95% were aware of the colour coding for waste segregation but did not have any clear idea of what should be disposed in which bin. Basu M et al[20] mentioned that only 76.4% and Ismail MI 35.5%[8] knew about various types of

colour coded bags for collection of biomedical waste. The knowledge about BMW storage duration in this study was found to be 50% among doctors, 65.21% among nurses, 95.6% among grade IV workers in comparison with a study by Anand P found to be as 54.2% among doctors, 36.4% nurses and 13.3% among grade IV workers and 36.6%, 70% and 30% by Ismail MI[8] in his study. In the present study, only 30.40% of grade IV workers were found to be vaccinated with hepatitis B vaccine. This may be due to lack of awareness of the health care workers and proper information to the health authorities. A study done by Deb A 2016[21] found 88.6% of intern doctors were vaccinated with hepatitis B and 100% with Tetanus and by Ananthachari KR et al[13] found 70.7% with hepatitis B. In the present study, there was no history of injury recorded following handling of bio-medical waste. Similar findings also reported by Dohare S et al[12] (2007 - 2008) in their study. Injury reporting due to sharps by Mathur et al found to be 60% among doctors and Stein et al[22] found to be 37% in their study population. In the present study, the knowledge on BMW storage time among nurses were found to be 65.21% in comparison to 39.36% by Balamurugan SS et al[23] in their study.[16] The knowledge about the diseases transmitted through BMW was highest (100%) among doctors, 86.95% among nurses and 43.47% among grade IV workers in our study. Similar findings were also reported by Anand P et al[24] of about 91.6% by doctors, 81.8% by nurses and 41.6% by grade IV workers. The knowledge on biohazard symbol was found to be 100% by doctors, 97.8% among nurses and grade IV workers in our study, whereas by Anand P et al reported to be 87.5% among doctors, 52.7% nurses and 20% by grade IV workers.

CONCLUSION

The study concluded that the biomedical waste management practices and knowledge among the health care personnel were found to be average.

Recommendations

1. The guidelines on BMW Rules 2016 should be available to health care facilities.
2. Training on BMW of the health care workers should be strengthened.
3. The immunisation coverage to all health care workers should be done.
4. To maintain coordination with local municipality for non-hazardous waste handling in order to reduce waste load.
5. There must be strict supervision and surveillance of hospital waste management activities by the hospital authorities.

The main strengths of our study are as follows. We found that the knowledge regarding availability of manual/ guidelines and plan is 100% among all healthcare workers. 97.1% of the healthcare workers were found to have knowledge about the hazardous wastes and risks involved in handling such wastes, while the knowledge among grade IV workers was 95.6%, 97.1% health care workers practiced segregation of waste at source which is also another important point and lastly 97.1% of health care workers were aware of biohazard symbol. The limitations of our study are 1. limited time period. 2. Findings may not be generalised to the whole population since purposive sampling was done. 3. details of vaccination coverage was not fully found by the health care workers   4. sensitisation workshops on BMW management had received response from only 63.04% of healthcare workers.

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