



RESEARCH ARTICLE

KNOWLEDGE, ATTITUDE AND PRACTICE ABOUT BIOMEDICAL WASTE MANAGEMENT
IN LABORATORY STAFF IN A TERTIARY CARE CENTRE IN NORTH INDIA: A CROSS
SECTIONAL STUDY

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ABSTRACT

Background: Waste generated if not disposed off properly can become a potential health hazard to health care workers, patients, waste handlers, community and to environment by increasing chances of infections, toxicity, polluting environment. A significant amount of hospital waste is generated from the laboratories, hence, the staff needs to be trained properly for the waste handling and management.

Objectives: To understand the knowledge, awareness and to assess the practice of BMW management in staff members in Department of Pathology and other associated laboratories in a tertiary health care centre in North India

Materials and Methods: This study was a cross-sectional questionnaire based survey. Target population was various consultants, Resident doctors, laboratory technicians and other health care workers in Department of Pathology and other associated laboratories, King George's Medical University Lucknow. This included 19 consultants, 44 resident doctors, 36 Laboratory technicians, 20 laboratory assistants, 29 laboratory attendants, 18 class IV employees and 6 research students. Knowledge, awareness and practice of BMW management was assessed in them with the help of a predesigned questionnaire.

Results: Only 47.67% of staff members were trained on BMW management. None of the class IV employees were trained. Only 55.81% staff was using personnel protective measures like apron and gloves while at work. 94.4 % of class IV employees were not aware of correct colour coding of BMW management. Knowledge about diseases transmitted by improper handling of BMW was minimal amongst Laboratory assistants and class IV employees.

Conclusion: Regular training and awareness programmes regarding BMW management should be conducted for all the health care workers in laboratories with special emphasis on technical staff and class IV employees.

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INTRODUCTION

Health care facilities have been existing since time immemorial but there has never been so much concern about waste generated by them. Hospitals, diagnostic centres, research centres and dental centres produce an enormous amount of biomedical waste which includes human anatomical parts, chemicals, mercury, blood products, needles, plastics, food materials etc. Waste generated in health care centres is much more complex than the general municipal solid waste as it is a direct threat to humans and environment. Waste generated if not disposed off properly can become a potential health hazard to health care workers, patients, waste handlers, community and to environment by increasing chances of infections,

toxicity, polluting environment. (Boss *et al.*, 2013) The Bio-medical waste management issue was discussed for the first time at a meeting convened by the WHO Regional office for Europe at Bergen, Norway in 1983. The seriousness of the issue was brought to the limelight during "Beach wash-ups" of summer 1988. Investigation carried out by the Environmental Protection Agency of USA in this regard culminated in the passing of Medical Waste Tracking Act (Mwta) November 1988. The rules framed by the Ministry of Environment and Forests (MoEF), Govt. of India, known as 'Biomedical Waste (Management and Handling) Rules, 1998,' notified on 20th July 1998, with subsequent amendment (June 2000, September 2003, 2011) under the provision of Environment Protection Act 1986. The Bio-medical Waste (Management & Handling) Rules 1998 lay down clear methods for disposal of Bio-medical Waste. Pollution Control Boards of every state have been given the task of authorizing and implementing the rules. (Kaur *et al.*,

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2015) Thus, Bio-medical waste (BMW) collection and proper disposal has become a significant concern for both the medical and the general community. Since the implementation of the Bio-medical Waste Management and Handling Rules (1998), every concerned health personnel is expected to have proper knowledge, practice, and capacity to guide others for waste collection and management, and proper handling techniques.³ Biomedical waste can lead to cross infections as they contain harmful microbes that can lead to HIV and Hepatitis B. Numerous surveys and studies have shown that incidence of Hepatitis B developing after needle stick injuries from HbsAg patients is approximately 2.0% compared with estimate of 0.4% following similar exposure to the HIV. Material waste that contains chlorine e.g. gloves, when burnt even by incineration produce dioxin. Dioxin can cause cancer, reproductive and developmental defects other effects include neurotoxic, hormonal and immune system disorders. (Gupta *et al.*, 2014) There are many studies on infection control programmes in hospitals across India, but there are very few studies on attitude and awareness of biomedical waste disposal in Pathology laboratory of a tertiary care centre.

This study was therefore conducted to understand the knowledge, awareness and to assess the practice of BMW management in laboratory staff members in Department of Pathology and other associated laboratories in a tertiary health care center in North India.

MATERIALS AND METHODS

This study was a cross-sectional questionnaire based survey. Target population was various consultants, Resident doctors, laboratory technicians and other health care workers in Department of Pathology and other associated laboratories, King George's Medical University Lucknow. This included 19 consultants, 44 resident doctors, 36 Laboratory technicians, 20 laboratory assistants, 29 laboratory attendants, 18 class IV employees and 6 research students. A verbal consent was obtained from each of the participants of the study. The data collection was done by a pretested, predesigned self administered questionnaire containing questions about knowledge, awareness and practices of Biomedical waste, its hazards, management, the colour coding for segregation and methods used for disposal. The questionnaire was distributed to all the health care personnel in Department of Pathology under the supervision of the investigator. The class IV workers who were not able to read were helped to understand the items in the questionnaire and answer. The questionnaire was collected back after the stipulated time. Information collected through questionnaire included (1) General information on respondents including age, education etc. (2) knowledge regarding waste management (3) attitude regarding waste management (4) practices regarding waste management.

RESULTS

Demographic characteristics

61% respondents were females. 10% respondents were more than 60 years of age, 31% were between 41-50 years of age, 40% were between 31-40 years of age and 19 % were between 21-30 years of age. 172 questionnaire were collected from 19 consultants, 42 junior residents, 2 senior residents, 36 Lab technicians, 20 lab assistants, 29 lab attendants, 18 class IV employees, 6 research students. Average waste collected per

day from various laboratories in Department of Pathology was 69.5 kilogram. This included Histology laboratory 10 kilogram in black bag, 5 Kilogram in red bag, 5 Kilogram in yellow bag. Haematology Laboratory 8 kilogram in black bag and 2 Kilogram in red bag, coagulation laboratory 3 Kilogram in red bag, Lymphoma-Leukemia laboratory 4 Kilogram in red bag and 9 kilogram in black bag, Neuropathology laboratory 4 Kilogram in black bag, biochemistry laboratory 18 Kilogram in black bag, 1.5 Kilogram in red bag. Sharps were collected separately.

Awareness and knowledge on waste management

Table 1 shows the results of knowledge and awareness about waste management. Although 53.48 % respondents had knowledge about biomedical waste management, only 47.67% had received training on BMW management. None of the class IV employees were trained on BMW management. Also the knowledge of the BMW symbol was minimum amongst class IV employees. 52.6 % of consultant doctors, 62 % of resident doctors had received training on BMW management. Knowledge about diseases transmitted by improper handling of BMW was minimal amongst Laboratory attendants, Laboratory assistants and class IV employees (Table 1). In practice, 48.25 % respondents were maintaining BMW record at the work site and 50.58 % were using the correct segregation methods (Table 2). 62.79 % respondents had knowledge about disease transmitted through improper handling of waste (Table 1). In spite of this only 55.81% staff was using personnel protective measures like apron and gloves while at work (Table 2). 53.69 % of Laboratory attendant and 94.4 % of class IV employees were not aware of correct colour coding of BMW management (Table 1). Although 65.1% respondents were aware of correct disposal of waste generated in pathology laboratory like cotton swabs, needles, syringes, human tissue etc. but only 58.14% were correctly following it (Table 1 and 2). 81.97% respondents had knowledge about needle stick injuries but only 76.74% knew about post exposure prophylaxis. But in practice, out of 34.88% staff with needle stick injury only 5.23% reported it and received post exposure prophylaxis. Knowledge about needle stick injury was minimal amongst class IV employees. 51.74% respondents were immunised against Hepatitis B. 53.49% respondents were practising correct method of disposal of sharps (Table 1 and 2). 74.4% respondents had correct knowledge about presterilisation and sterilisation of test tubes, slides, bone marrow needles etc (Table 1). 63.37 % of employees were practicing the correct method of presterilisation storage, washing of equipments (with Hypochlorite/detergent), test tubes etc. and almost similar percentage was following that correct sterilisation method for test tubes, slides, bone marrow needles etc (autoclaving at 121^oc for 1 hour) (Table 2).

DISCUSSION

The laboratory workers are exposed to a greater occupational risk while collecting sample and processing it. His/her health can be severely jeopardized if proper protection in specimen collection, storage or disposal is not taken. The prevention of occupational hazards in laboratories requires a thorough knowledge of the risks and practical measures to be taken. Universal work precautions involve the use of protective barriers such as gloves, gowns, aprons, masks, or protective eyewear, which can reduce the risk of the health care worker's skin or mucous membranes to potentially infective materials.

Table 1. Knowledge and awareness of biomedical waste (BMW) and its management

Awareness and knowledge question	Consultant Doctors (19)	Resident Doctors (44) and research students (6)=50	Lab technicians (36), Assistants and attendants (49)=85	Class IV employee (18)	Total (172)
Knowledge about BMW management and handling rules, 1998	14 (73.68)	34 (68)	39(45.88)	5(27.77)	92(53.48)
Recognize BMW symbol	15 (78.9)	34 (68)	37(43.53)	2(11.11)	88(51.16)
Received training on BMW management	10(52.63)	31(62)	41(48.23)	nil	83(47.67)
Knows about diseases transmitted by improper handling of BMW	17(89.47)	42(84)	45(52.94)	4(22.22)	108(62.79)
Knows about needle stick injuries	19 (100)	46(92)	70(82.35)	6(33.33)	141(81.97)
Knows about PEP	19 (100)	47(94)	65(76.47)	1(5.55)	132(76.74)
Knows about BMW training programme in institute	14 (73.68)	42(84)	47(55.29)	2(11.11)	105(61.04)
Knows about correct colour coded containers	16 (84.21)	38(76)	42(46.41)	1(5.55)	97(56.39)
Knows that the waste cannot stored for more than 48 hrs.	7 (36.84)	23 (46)	27(31.76)	1(5.55)	58(33.72)
Knows about personnel protective equipments	18 (94.7)	45(90)	48(56.47)	3(16.66)	114(66.28)
Aware about the universal precaution needed for sample collection	18(94.7)	45(90)	68(80)	2(11.11)	133(77.32)
Knows about disposal method of waste generated in Pathology (cotton swabs, needles, syringes, human tissue etc.)	15(78.94)	42 (84)	53(62.35)	2(11.11)	112(65.1)
Presterilization and sterilization of test tubes, bone marrow needle etc	18 (94.7%)	45(90)	60 (70.6)	5(27.8)	128 (74.4%)

Table 2. Practice assessment regarding bio-medical waste in pathology laboratory

Questions	Consultant Doctors (19)	Resident Doctors (44) and research students (6)=50	Lab technicians (36), Assistants and attendants (49)=85	Class IV employee (18)	Total (172)
Maintain BMW record at work site	12(63.15)	30 (66)	40 (55.29)	1(5.55)	83(48.25)
Segregation of BMW done at work site	11(57.89)	42(84)	43 (50.58)	1(5.55)	87(50.58)
Correct sterilisation methods	16(84.21)	38 (76)	41 (48.24)	1(5.55)	96(55.81)
Uses personal protective measures while working in lab	15 (78.94)	29 (58)	45 (52.94)	10(55.55)	99(55.81)
Practices correct Methods of presterilisation cleaning	15 (78.94)	38 (76)	51 (60)	5(27.77)	109(63.37)
Practices correct Methods of sterilisation of bone marrow needles, test tubes, cotton etc.	19(100)	39 (78)	55 (64.71)	4(22.22)	107(62.21)
Practices correct Methods of disposing sharps	15(78.94)	29 (58)	55 (64.71)	7(38.88)	92(53.49)
Practices correct disposal of solid organ waste	16(84.21)	30 (60)	50 (58.82)	2(11.11)	100(58.14)
Immunised against Hepatitis B	14 (73.68)	44 (88)	28 (32.94)	1(5.55)	89(51.74)
Practices the correct method of keeping slides for reuse	13(68.42)	42 (84)	55 (64.71)	5(27.77)	115(66.86)
Practices correct method of keeping glass tubes to be reused	14(73.68)	40 (80)	50 (58.82)	5(27.77)	109(63.37)
Practices correct disposal of blood infected material like blood soaked cotton swabs, guaze pieces etc.	15(78.94)	43 (86)	47 (55.29)	2(11.11)	110(63.95)
Practices hand washing before and after patient contact	15 (78.94)	30 (60)	20(23.52)	1(5.55)	66(38.37)
Had needle stick injury in the past	9 (47.36)	12 (24)	35 (41.18)	4(22.22)	60(34.88)
Reported needle stick injury and received PEP	2(10.52)	4 (8)	3 (3.53)	Nil	9(5.23)

In addition, it is recommended that all health care workers take precautions to prevent injuries caused by needles, scalpels, and other sharp instruments or devices. (Gupta *et al.*, 2014) Health care waste management is a systemic effort and it requires participation of all. All the health care workers must be aware and must follow the correct segregation of waste in appropriate colour coded bins. The waste must be segregated, transported, treated with a disinfectant followed by proper containment. It is considered that 10-25% of health care waste is hazardous with the potential of creating a variety of health problems. (Kaur *et al.*, 2015) In a study by Dardi Charan Kaur *et al* they found that 89% technicians, 83% Doctors, and 70% nursing staff knew about Bio-medical waste management policy. (Kaur *et al.*, 2015) In study of Malini *et al.* reported technicians had 100%, followed by Doctors (95.2%), nursing staff (92.9%) and the study of S. Saini *et al* in their study in which Doctors had 85% knowledge; nurses 60% and Sanitary staff 14%. (Malini and BalaEshwar, 2015; Saini *et al.*, 2005) Knowledge of Biomedical waste legislation was better among consultants and resident doctors as compared to lab attendants, technicians and class IV employees. None of the class IV employees were trained on BMW. Although 3 class IV employees were aware of correct colour coding but actually only 2 of them were practicing the correct colour coding.

Universal work precautions involve the use of protective barriers such as gloves, gowns, aprons, masks, or protective eyewear, which can reduce the risk of the health care worker's skin or mucous membranes to potentially infective materials. In addition, it is recommended that all health care workers take precautions to prevent injuries caused by needles, scalpels, and other sharp instruments or devices. In the present study 66.28% respondents were aware of personnel protective equipments but only 55.5% were actually using them while working. 73.4% doctors, 88% Lab technicians and Lab attendants were immunized for Hepatitis B whereas, only one class IV employee was immunized for Hepatitis B. Similar were the results of Sehgal *et al.* (2015) In our study 34.88% of staff members had needle stick injuries but only 9% of them reported it and received post exposure prophylaxis. In our study 73.83% respondents were practicing maintenance of BMW record and segregation of waste at the generation site. Correct method of presterilisation washing with hypochlorite and washing with detergent followed by treating them with hypochlorite followed by autoclaving at 121⁰c for 1 hour if reused. This method was followed in all the laboratories. Although this practice was less in laboratory technicians, laboratory attendants and class IV employees. In the present study 63.37% respondents were practicing correct methods of slides, bone marrow needles and test tube washing by treating them with hypochlorite followed by autoclaving at 121⁰c for 1 hour if reused. 53% respondents were using correct method of disposal of sharps and 58% were practicing correct method of disposal of solid organ waste. Center of disease and control recommend that sterilization devices like autoclave; boiler must be checked at four weeks interval. (Gupta *et al.*, 2014)

Conclusion

The present study reveals appreciable knowledge about Bio medical waste management among doctors and Laboratory Technicians in a tertiary care centre in North India. However, the knowledge was less in Class IV employee which could be attributed to lesser number of training being organized for these employees. Moreover, there is deficiency in practice

regarding Biomedical waste management. Courses on BMW and continuing medical education programme can improve the outcome. Training of both technical and non technical staff is critical for proper and appropriate management of BMW.

Following recommendations are proposed:

- (i) Strict implementation of BMW rules
- (ii) Regular training of BMW for all employees
- (iii) Training of class IV employees should be specially emphasized.

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