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Protection Measures for Staff Handling the Biomedical Waste - An Overview

Sharma Mukta^{1*} and Sindu Anandveer Singh²

¹School of Life Science and Technology, IIMT University, Meerut (U.P.), India

²Meerut College, Meerut (U. P.), India

*Corresponding Author

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Abstract: Effective confinement of Biomedical waste (BMW) and safe handling measures provide significant health protection. The handling of waste entails health risks for staff throughout the chain. The protective measures reduce the risks of accident/exposure or the consequences. This review focuses on protection measures for staff handling the BMW with respect to: (1) personal protective equipment (PPE); (2) personal hygiene; (3) vaccination; (4) measures taken in accidental exposure to blood (AEB); (5) emergency measures in the event of spills/contamination of surfaces and contamination of persons; and (6) training of hospital staff.

Keywords: Biomedical waste, Hospital staff, Personal hygiene, Personal protective equipment, Training of hospital staff, Vaccination

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Introduction

Waste generated within health-care facilities (HCF), research centres and laboratories related to medical procedures along with waste originating from minor and scattered sources, including waste produced in the course of health care undertaken in the home (e.g. home dialysis, self-administration of insulin, recuperative care) is referred to as Biomedical waste (BMW) (WHO, 2014; Odumosu, 2015).

According to the Basel Convention, hospital solid waste (HSW) is the second most dangerous waste after nuclear and radioactive wastes (Basel

Convention, 1989; Bhatia and Paul, 2017). Chandrappa and Das (2012) and Ansari *et al.* (2019) stated that the changing trends of human lifestyle, consumption habits, use of harmful compounds, and urban activities have affected the quantitative and qualitative characteristics of municipal solid waste (MSW) (Ozeler *et al.*, 2006; Das *et al.*, 2020). The hazardous and complex wastes in MSW such as materials generated in hospitals is the major threat to the public health and the environment (Zhang *et al.*, 2010; BMW Rules, 2016).

Health care waste is a risk to all and it affects us in different ways such as air pollution, infection acquired from hospital, scavenging by ragpickers and animals, untreated hospital water/liquid waste, and diseases like AIDS, Hepatitis, T. B. etc. Infections and diseases spread due to improper waste management of BMW include tuberculosis, pneumonia, diarrhoeal diseases, tetanus, whooping cough etc (Babu *et al.*, 2009; Datta *et al.*, 2018).

The health care staff do not receive occupational safety education and are not fully aware about the unsafe handling of hazardous substances. They do not receive adequate technical training for using personal protective equipment and have a casual attitude with regard to emergency procedures like spillages and accidents. Hospital cleaners and waste handlers are the worst victims of the poor occupational safety procedures. Training on the correct procedures for handling, loading, and unloading waste bags and containers is neglected (Franka *et al.*, 2009; Joshi, 2013; Latimer, 2015).

Therefore in the present study, an overview of protection measures for staff handling the BMW with respect to personal protective equipment (PPE), personal hygiene, vaccination, measures taken in accidental exposure to blood (AEB), emergency measures in the event of spills/contamination of surfaces and contamination of persons and training of hospital staff is considered.

The present paper provides an overview on the major issues and debate, gaps in knowledge and way to bridge the gap related to BMW with respect to protection measures for staff handling the BMW (Table 1).

Research methodology:

Review method adopted was based on the scientific literature survey from databases such as Medline, Embase, PubMed Central, ScienceDirect, Proquest and Medscape. The keywords used for reviewing the literature were the ones that refer to the issues concerning the BMW. For literature

search, keyword "biomedical waste" is combined with protection measures for staff handling the BMW.

Protection Measures for Staff handling the BMW:

The handling of BMW entails health risks for health care staff. Various types of risk includes the risk of infection, chemical risks, mechanical risks involved with machinery/plants, risk of burns (incinerators, autoclaves), risks associated with physical load or the absence of ergonomic principles, risk of falling when working in wet areas, etc. Protective measures reduce the risks of accident/exposure or the consequences. Types of protective measures depend on the risk concerned (ICRC, 2011).

Preventive measures are divided into two categories: primary and secondary.

(i) *Primary prevention:* It comprises four levels of action:

- *Eliminating hazard:* By using less toxic substances, eliminating mercury, or using self-locking injection equipment.
- *Collective and technical prevention:* Using needle receptacles, ventilation.
- *Organizational prevention:* Assigning duties and responsibilities to all involved, management (sorting, packaging, labelling, storage, transport), best practices (refraining from putting the caps back on syringes), training.
- *Individual prevention:* Personal protective equipment, vaccination, washing hands.

(ii) *Secondary prevention:*

- Measures in the event of an accident (accidental exposure to blood, spills).

Types of Protection Measures:

- Personal protective equipment (PPE)
- Personal hygiene
- Vaccination
- Measures taken in accidental exposure to blood (AEB)

Table 1: Structure of the review paper

Subsection	Details
Introduction and Definition	• Introduction and Definition of Biomedical waste (BMW). • Goal of the present review paper.
Research methodology	• Scientific literature survey from databases. • Medline, Embase, PubMed Central, ScienceDirect, Proquest and Medscape.
Protection Measures for Staff handling the BMW	• Protection Measures for Staff handling the BMW • Personal Protective Equipment (PPE) • Personal hygiene • Vaccination • Measures taken in accidental exposure to blood (AEB) • Emergency measures in the event of Spills/contamination of surfaces and contamination of persons • Training of Hospital Staff

- Emergency measures in the event of:
 - (a) Spills or contamination of surfaces
 - (b) Persons have been contaminated
- Training of hospital staff

Personal Protective Equipment (PPE) (ICRC, 2011)

Choice of protective equipment will depend on the activity involved. Table 2 and Figure 1 illustrate personal protective equipment is generally available.

Personal hygiene (ICRC, 2011):

Personal hygiene is important for reducing risks of infections and breaking the infection chain when medical waste are being handled. At storage and treatment areas. wash basins with hot water and soap should be installed.

When should one wash one's hands?:

- When going on and off duty.
- After any contact with wastes.
- After removing gloves, mask or respirator.
- Before/after routine actions (eating, using the toilet, blowing one's nose).

How should one wash one's hands?:

- Wet the hands and wrists and apply a dose of liquid soap.
- Lather the soap by rubbing the hands.

- Parts between the fingers, around the nails and to the thumbs be rubbed for 40-60 sec.
- Rinse, dab dry and do not use a brush.

Vaccination (ICRC, (2011):

Staff handling wastes must be appropriately protected by vaccination against hepatitis A and B and tetanus. Vaccines are effective in preventing all of the forms of infection with hepatitis B virus. Though vaccination is safe, effective and cost-efficient, it is still under-used. Taking immunization against hepatitis B and tetanus are important universal precautions.

Measures taken in accidental exposure to blood (AEB):

The objective of an AEB prevention policy is to reduce the risk of accident for staff handling body fluids, wastes and to reduce the risk of contamination whenever an accident occurs. 50% of accidental exposures to blood (AEB) are avoidable. AEB management should comprise of:

- Measures to be taken during an accident must be displayed on a poster.
- Wash the contaminated area with soap and water.
- Do not make the area bleed.
- Disinfect the area with freshly diluted bleach (0.5%), active chlorine, Betadine, 70% alcohol

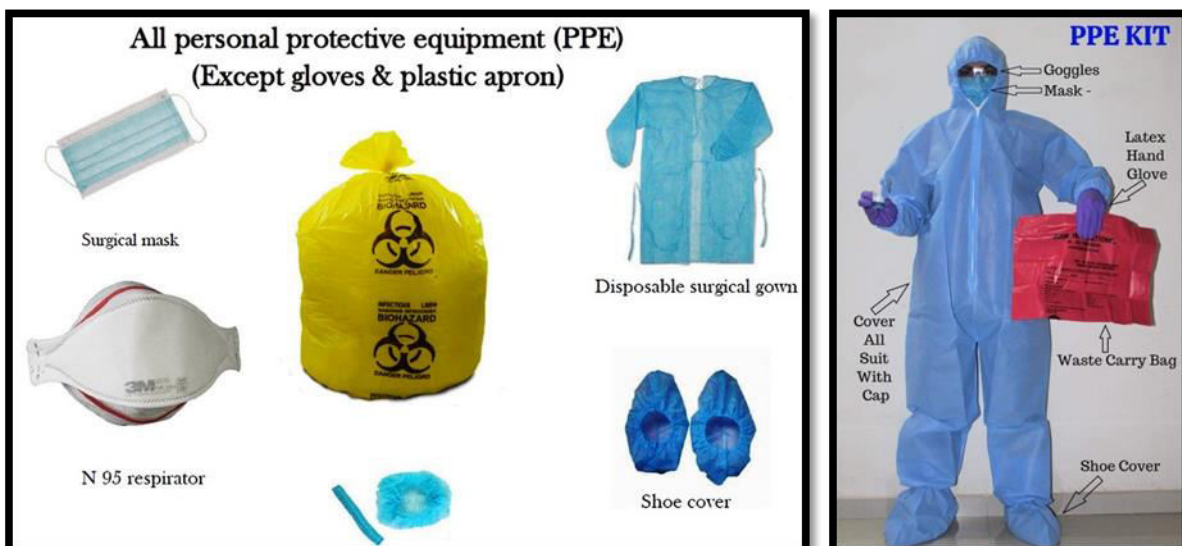


Fig. 1: Personal Protective Equipment (PPE) for health care staff.

Table 2: Types of Personal Protective Equipment (PPE)

PPE	Protection	Application
Visor	Face protection	- Worn during all activities where body fluids or chemicals are liable to be splashed. - For work at an incinerator.
Safety goggles	Eye protection	
Masks (Surgical) and Respirators (FFP ₁ , FFP ₂ or FFP ₃)	Respiratory protection	- Activity that generates dust (removing ash, sweeping out the waste storage facility). - For staff handling waste from patients suffering from tuberculosis.
Aprons, Protective suits	Body protection	For staff involved in collecting, transporting and treating wastes.
Gloves	Hand protection	- Disposable gloves for care staff or cleaning staff (vinyl or nitrile). - Disposable gloves for laboratory staff (nitrile). - Heavy-duty protective gloves for staff involved in transporting and treating wastes.
Boots, Shoes	Foot and leg protection	- Closed, non-slip shoes for all staff. - Puncture-proof safety shoes or boots.

or stabilized Dakin's solution.

- Telephone number at which competent help is available at all times.
- A competent person must take charge of the situation.
- Registration of incidents/accidents, investigation and corrective action.
- Post-exposure prophylaxis reduces the risk of the HIV disease by 80%.

Emergency measures in the event of Spills/contamination of surfaces:

Most accidents involving the spilling of chemicals or infectious material occur in laboratories. Accidents can also involve mercury waste (breaking a thermometer, blood pressure gauge or glass receptacle containing mercury) or they can occur during the transport of chemical wastes (knocking over poorly closed cans, breaking glass bottles), or if bags containing infectious wastes tear.

Spills of infectious biological material on a mattress or on the floor:

- Change gowns and clothes that are visibly soiled immediately.
- Warn the other colleagues present and protect the contaminated area.
- Wear disposable gloves, goggles and respirator for protection from particles.
- Cover the contaminated area with absorbent paper soaked with disinfectant.
- Cover the contaminated area with a disinfectant, working in concentric circles from the edges towards the centre.
- Avoid spraying or pouring the disinfectant from a height to prevent production of aerosols.
- Let the disinfectant take effect, depending on its properties (3 min).
- Sponge the area and dispose of all of the wastes and soiled material in the infectious wastes.
- Fragments of sharps must be picked up with tweezers and placed in the sharps container.
- Disinfect all items on the mattress, surface of furniture or equipment that might have been contaminated.
- Remove PPE and dispose contaminated material in autoclave or incinerator.
- Disinfect your hands.
- Register the accident.

Chemical spill procedure:

- Warn people in the immediate area.
- Put on gown, gloves and protective goggles.
- Avoid breathing fumes.
- Switch off all sources of ignition and heat.
- Open the windows and air the area; close the doors of the affected rooms.
- Cover the spill with absorbent material,

working from the edges towards the centre in concentric circles.

- Mix gently with a wooden spatula until all of the spilled chemical has been completely absorbed.
- Dispose of the granules or cloth as special waste.
- Clean the soiled area thoroughly with water (unless the chemical concerned is incompatible with water).

Mercury spill procedure:

- Mark out the area to be decontaminated and prohibit access.
- All mercury that has been spilled should be gathered without dispersing it.
- Wear disposable (single-use) gloves.
- Use a mercury sponge, a glass or plastic pipette, or two sheets of paper to pick up the mercury beads.
- Put the mercury and gathering equipment in a leak-proof container.
- Close the container tightly and label it as special mercury waste and take it to the pharmacy.
- Shine a beam of light on the area (using a flashlight) to check that all the mercury beads have been collected.

Emergency measures in the event of contamination of persons:

Splashing of chemicals onto the skin and eyes:

- Rinse the exposed areas with water for 15 minutes, without rubbing.
- If the chemical has gone into the eye, rinse the eye with running water for 10-30 minutes. Consult an ophthalmologist urgently.
- Using gloves, remove contaminated clothing with care.
- Seek medical attention urgently.

Procedure in the event of chemical ingestion:

- Rinse out the mouth thoroughly with water.
- Do not induce vomiting or give the person anything to drink.
- Seek medical attention urgently.

Procedure in the event of inhalation of toxic gases:

- Leave the contaminated area immediately.
- Seek medical attention urgently, even if there are no symptoms.

Training of Hospital Staff (ICRC, 2011):

Purpose of Training:

- To develop skills and to raise awareness.
- To highlight the role(s) to be played by each individual staff member.

Way of Training:

- Training be targeted at a multidisciplinary group.
- Provided at the workplace so as to promote best practices and teamwork.
- Groups should not exceed 20 participants.
- Refresher courses should be held regularly to inform staff of any changes that have taken place in the waste management plan and training courses for new members of staff.
- Training can be provided by the water and habitat engineer, the hospital administrator or an external body.

Content of Training:

- Waste management plan
- Risk associated with wastes
- Protective measures
- Role and responsibilities of each member of staff
- Technical instructions concerning the activities carried out staff.

Additional Training to staff:

- Care staff: Emphasis must be laid on sorting, sharps management and AEB management.

- Staff handling waste: Emphasis must be laid on sorting, collection and transport procedures, cleaning and personal hygiene, PPE, protective measures when handling bags and measures in the event of an accident.

- Staff in charge of waste treatment plants or sanitary landfills: Plant operation, maintenance, environmental impact.

- Management and Administrative staff: Emphasis must be laid on national legislations and international conventions, responsibilities and purchasing/minimization policy.

Conclusion

It is recommended to keep hospitals clean and safe by identifying hazards and risks of biomedical waste. Follow the standards for treatment and transportation of BMW as per Schedule II of BMW Rules, 2016. Remember that safety is first. Use of protective gear by all healthcare workers and follow guidelines for handling and disposing BMW from health care facilities.

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References

- Ansari M, Mohammad HE, Mahdi F and Ehsan A. (2019) Dynamic assessment of economic and environmental performance index and generation, composition, environmental and human health risks of hospital solid waste in developing countries; A state of the art of review. *Environ Int.* 132: 105073.
- Babu B, Ramesh A, Parande K, Rajalakshmi R, Suriyakala P and Volga M. (2009) Management of biomedical waste in india and other countries: A review. *J Int Environ Appl Sci.* 4(1): 65-78.
- Basel Convention (1989) Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. <https://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConventionText-e.pdf>
- Bhatia D and Dibyendu P. (2017) Biomedical Waste Management (BMW) and it's Awareness in India (In accordance with BMW Rules, 2016). ENVIS RP

- Centre, North Eastern Hill University, Shillong, Meghalaya, pp. 27.
- Biomedical Waste Management Rules 2016 (2016) Published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-Section (i), Government of India Ministry of Environment, Forest and Climate Change. Notification; New Delhi, the 28th March, 2016.
- Chandrappa R and Das DB. (2012) Solid Waste Management. Chapter 6, Biomedical Waste. Springer-Verlag Berlin Heidelberg. doi: 10.1007/978-3-642-28681-0_6.
- Das A, Garg R, Ojha B and Banerjee T. (2020) Biomedical waste management: The challenge amidst COVID-19 pandemic. *J Lab Physicians* 12(2): 161-162.
- Datta P, Gursimran KM and Jagdish C. (2018) Biomedical waste management in India: Critical appraisal. *J Lab Physicians* 10: 6-14.
- Franka E, El-Zoka AH, Hussein AH, Elbakosh MM, Arafa AK and Ghenghesh KS. (2009) Hepatitis B virus and hepatitis C virus in medical waste handlers in Tripoli, Libya. *J Hospital Infection* 72(3): 258-261.
- ICRC. (2011) Medical Waste Management. International Committee of the Red Cross, 19, avenue de la Paix 1202 Geneva, Switzerland, pp. 164.
- Joshi HD. (2013) Health care waste management practice in Nepal. *J Nepal Hlth Resh Council* 11(23): 102-108.
- Latimer G. (2015) The health and environmental impacts of hazardous wastes. Impact Profiles, Final report, Project # 15001AG Date: 7th June 2015. Department of the Environment. Prepared by: Ascend Waste and Environment Pty Ltd, pp. 243.
- Odumosu BT. (2015) Biomedical Waste: Its Effects and Safe Disposal. Chapter 4: 81-93. In: *Environmental Waste Management*, (ed). Ram Chandra, Boca Raton, CRC Press.
- Ozeler D, Yetis U and Demirer GN. (2006) Life cycle assessment of municipal solid waste management methods: Ankara case study. *Environ Int.* 32: 405-411.
- WHO. (2014) Safe management of wastes from health-care activities. ISBN 978 92 4 154856 4.
- Zhang DQ, Tan SK and Gersberg RM. (2010) Municipal solid waste management in China: status, problems and challenges. *J Environ Manag.* 91: 1623-1633.