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Proper Hospital Waste Management for the Protection of Human Health and Environment: A Review

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Abstract

The present review paper sensitizes the reader about improper waste management and their adverse impacts on human health and environment. Furthermore, it highlights the proper hospital waste management [HWM] practices/methods step-by-step in order to protect the life from future threats/harms.

Hospitals are the places where the sick and injured people are treated but at the same time it is also a source of both hazardous [Infectious waste, pathological waste, chemical waste] and non-hazardous wastes [Cardboards, paper, Packaging materials]. In this paper HWM is discussed in detail along with all the steps that are necessary for the proper HWM.

Hospital waste management methods and processes may be differ from hospital to hospital and country to country. Waste generated from hospitals can be hazardous, toxic and even lethal because of their high potential for diseases transmission. Mismanagement of these wastes can result in environmental and human health related risks.

Proper collection, segregation and separation of the Hospital waste at a source is very essential step towards mitigating environmental and health risks and minimizing the overall cost of the HWM in order to take the world towards sustainable management of such harmful wastes.

Keywords: Hospital waste; Waste management; Technology; Human health; Environment; Color coding

Abbreviations: HWM: Hospital Waste Management; WHO: World Health Organization; WMH: Waste Management Hierarchy; ICU: Intensive Care Unit

Introduction

Anything which is not intended for further use is termed as a waste. In general wastes are unwanted or unusable materials/substances that is discarded after the primary use, or is worthless, defective and of no use. As hospitals are the places where the human beings are treated against diseases and their health is restored, their lives are saved but at the same time hospitals generate a lot of hazardous waste. Hospital waste refers to the waste, that is generated or produced in the course of health care activates during the treatment, diagnosis and immunization of human beings or animals and while doing study/research activities [1].

Hospital waste management means the management of waste produced by the hospitals using different kinds of techniques that will check the spread of diseases [2]. Before going towards understanding the concept of proper HWM, first let's take a look on the concept of waste hierarchy/Waste management hierarchy [WMH].

In WMH we move from more desirable method at the top towards least desirable method at the base.WMH includes different methods such as reuse, reduce and recycle. The main focus of this concept is that the waste should be minimized or tackled at the source rather than going towards the solutions after the problem begins/happens.

Different kinds of hazardous waste are generated from hospitals. Mismanagement of these wastes can results in environmental and human health risks [3]. Hence, proper HWM is very substantial.

Sources of hospital waste

- Governmental and private hospitals
- Nursing homes and dispensaries
- Autopsy and mortuary centers
- Physician's and dentist offices
- Blood banks and collection centers
- Transfusion and dialysis centers

- Animal research and testing
- Laboratories and research organizations [1]

Types of hospital waste

Basically there are two types of hospital wastes; one is the risk waste and the other one is non-risk waste.

Risk waste: Risk waste has the potential to cause any harm or injury to the person when he comes in contact with it. It is also known as hazardous waste. It includes infectious waste, pathological waste, pharmaceutical waste, chemical waste, pressurized containers, sharps, Genotoxic / cytotoxic waste and radioactive waste **(Table 1)**, [4,5,13].

Non-risk waste: Non-risk waste is similar to the normal domestic garbage and we can call it as the waste that doesn't have greater risk. It is also known as non-hazardous waste. It includes paper, wrapper, cardboard, packaging material, food waste and general sweeping waste **(Figure 1)** [4,5].

Table 1: Detail description of risk waste types.

Risk waste types	Description
Infectious waste	Infectious waste is generated from hospitals [contains pathogens or toxins that may cause diseases to persons who come in contact with it]. It includes all the discarded equipments/materials that are used for the diagnosis, treatment and prevention of different disease and also includes waste such as feces, vomit, urine, blood, pus or other body secretions such as saliva, sputum or lung secretions and microbial cultures and stocks of highly infectious agents from Laboratories are also the part of this type of waste.
Pathological waste	Pathological waste is very hazardous because it contains organs, human tissues, human fetuses, body parts or body fluids such as blood, which may be infected or not but are considered as the potential to cause effects for precautionary and disposal reasons.
Anatomical waste	Anatomical waste is a sub-group of pathological waste that includes recognizable human body parts, which may be infected or not but are considered as the potential to cause effects for precautionary and disposal reasons.
Pharmaceutical waste	Pharmaceutical waste is that type of waste that includes unused, expired, spilt and contaminated pharmaceutical products such as vaccines and drugs.
Sharps waste	Sharps waste is that type of waste that can cause cuts/puncture wounds on the body that includes syringes, needles, broken ampoules, blades, surgical aids, disposable scalpels etc and this type of waste may be infected or not but still are considered as the potential to cause effects/severe damages because they are highly dangerous.
Pressurized containers	Many surgical and medical aids are packaged in pressurized containers. It includes inhaler cans, full or emptied containers or aerosol cans with pressurized gas, liquids or finely powdered solid materials. Pressurized containers have also greater risk due to presence of special component called as propellant.
Chemical waste	Chemical wastes are the discarded chemicals which are generated from hospitals during the disinfecting/clinical procedures or cleaning processes. It includes reagents, solvents, disinfectants and heavy metals that are present in different medical devices or batteries.
Genotoxic/ cytotoxic waste	Genotoxic/cytotoxic waste is generated from drugs generally used in oncology or radiotherapy units. These types of wastes are highly dangerous because of mutagenic, cytotoxic, teratogenic or carcinogenic effects. It includes feces, vomit or urine from patients treated with cytotoxic drugs [And their metabolites] or genotoxic chemicals.
Radioactive waste	Radioactive waste includes liquids, gas and solids products contaminated by radio-nuclides including radio-therapeutic material or radioactive diagnostic materials and they emit ionizing radiations which are very harmful.

Health concerns due to improper hospital waste management

All persons who are exposed to hazardous hospital waste are potentially at risk or we can say everyone is at risk that comes in contact with hazardous hospital waste. Which includes all of those who are involve either in handling of the waste at any stage, or are exposed to it as a consequence/ result of improper/careless waste management [5,6].

Different diseases are associated with improper HWM **(Table 2)**. Entry route of exposure are either though skin or mucus membrane, through inhalation, though ingestion or through any injury/cut.

Group of persons that are at risk or exposed are health care staff, laboratory technicians, waste mangers, maintenance staff, pharmacists, patients, families, visitors, off-site transport personnel and general population that are living near the hospitals or open dumps sites [7].

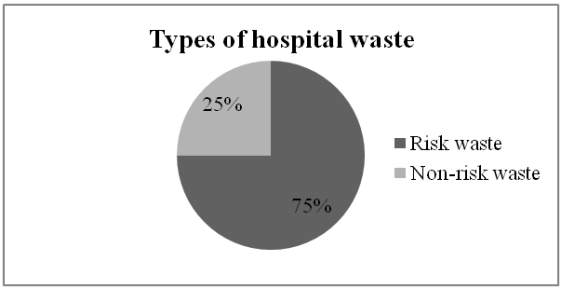

Figure1: Type of hospital waste.

HW should be managed in systematic manner to minimize the risks towards human health [8].

Table 2: Different infectious diseases [7].

Infectious diseases	Infective Agent	Transmission agent
Respiratory infections	Mycobacterium tuberculosis, Streptococcus pneumonia measles virus, etc.	Inhaled secretions, saliva
Eye infections	Herpes virus	Eye secretions
Skin infections	Streptococcus	Pus
Gastrointestinal infections	Enterobacteria	Vomit, Feces
Viral hepatitis A, B, C	Hepatitis A, B and C viruses	Feces, Blood and other biological Fluids
Hemorrhagic Fever	Lassa, Ebola, Marburg viruses	Blood and secretions

Environmental concerns due to improper hospital waste management

Improper HWM results in harmful effects on environment. To reduce these effects HWM should be done in proper way/ manner to save environment from dangerous effects and to minimize the overall impacts towards environment [8, 9].

Environmental issues associated with improper waste management are water pollution, air pollution, soil/land pollution, radioactive pollution and indirect effects on the health of other organisms living in surrounding areas. Incineration method is widely used for the treatment of HW which releases different types of hazardous pollutants in the atmosphere/air such as dioxins, furans which are well known carcinogens [10]. Improper waste disposal in landfills can lead to escape of waste in to the surrounded area which in results affects the soil, surface and ground water. That's why it is the responsibility of specific authorities to make disposal landfills/ sites away from populated areas, surface and ground water resources **(Figure 2)**.

Steps in hospital waste management

As the poor management practices regarding hospital waste leads to health and environmental risks, so proper hospital waste management is required in order to reduce or minimize these risks. Following are the steps related to hospital waste management **(Figure 3)** [1].

Waste generation: Generation of waste differ/varies from hospital to hospital and country to country. The wastes generated from the health care centers/hospitals are both hazardous and non-hazardous waste **(Figure 4)** [11].

Waste segregation/separation: Waste segregation means dividing or separating waste as an earliest opportunity at the point of origin [10]. The hazardous waste should not be allowed to mix-up with the non-hazardous waste. Waste should be put in separate colored-coded and labeled bags/ containers. These color codes vary from hospital to hospital and country to country.

Color coding for the segregation of hospital waste: Different color coding has to be assigned to various wastes for effective separation/segregation [12]. Different color bags or containers are used for the collection and segregation of hospital wastes which is shown in **(Figure 5)**.

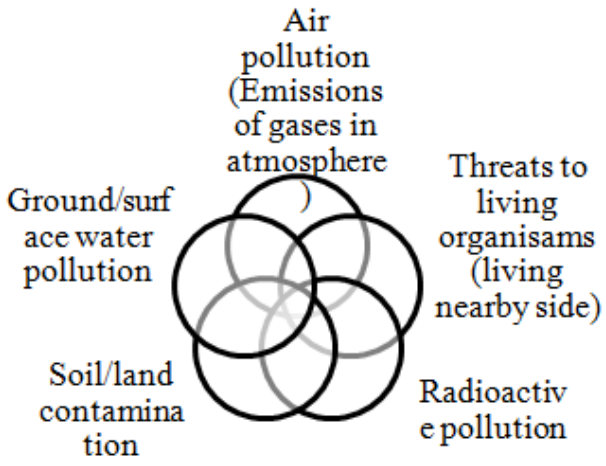

Figure 2: Effects of improper HWM.

Waste collection: During waste collection, different types of hospital wastes should be collected separately. Centralized sanitation staffs should collect the waste and collectors must wear protective materials [4,7]. Content of the container should not exceed three quarter of its capacity. The bag that is used for hospital waste collection, tie their neck tightly. Avoid throwing, dragging over the floor or holding the bottom of the containers. Garbage bin should be cleaned and disinfected regularly.

Waste storage: Waste store will be a room /area/building within the health care facility depending upon the quantity and quality of waste production and frequency of the waste collection. Storage area should be inaccessible to animals, insects and birds and it should not be situated near the water bodies, fresh food stores or food preparation areas [7,10,11]. Normally, waste should not be stored more than 24 hours.

Waste transportation: Transportation of the waste from the site of origin/collection to temporary storage area is the next step in HWM. Waste should be transported by designated trolley, through the designated route according to the time schedule given by the specific management authority. There should be separate corridors/lift in hospitals to carry and transport the waste. Transportation should be done in sealed container and also ensure for leakage. The vehicles should be cleaned and disinfected daily with an appropriate disinfectant [7].

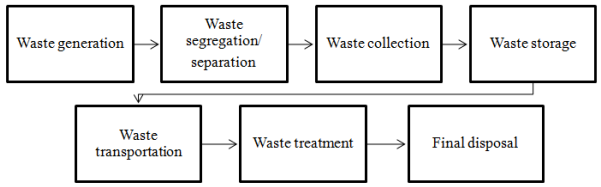

Figure 3: Flow diagram showing HWM steps

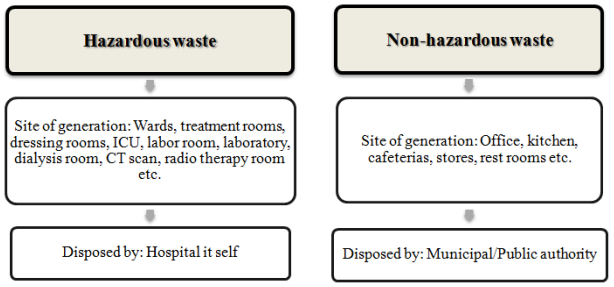

Figure 4: Generation of hospital waste.

Waste treatment: Different methods of hospital waste treatment are explained here before going towards final disposal **(Figure 6)**.

Incineration: It is the controlled method of burning waste [10]. Waste is burnt in high temperature [between 900 and 1200] producing mainly gaseous emissions. Pressurized gas containers, reactive chemical waste and high content of mercury and cadmium waste cannot be incinerated because of its high risk of toxic emissions.

Chemical disinfection: It is a method that is used to treat the hospital waste by killing the micro-organisms [7]. Chemicals like aldehydes, chlorine compounds, ammonium salts, ethylene oxide and ozone are added in waste to kill or inactive the pathogens [7]. This method is appropriate for treating liquid waste such as blood, urine, stools or hospital sewage waste can also be disinfected using chemical disinfection before disposal. Anatomical parts and animal carcasses are not disinfected.

Autoclaving: It is an efficient disinfection method/process which is done by using an autoclave [10]. Waste is treated in pressurized condition and it requires a 60mint cycle at 121 o C and 1 bar [100kpa] [7]. Reusable medical equipment [surgical, laboratory, pharmaceutical] is sterilized by this process and it is also used to sterilize solids, liquids and instruments of various shapes and sizes. It is not recommended for treating pathological waste.

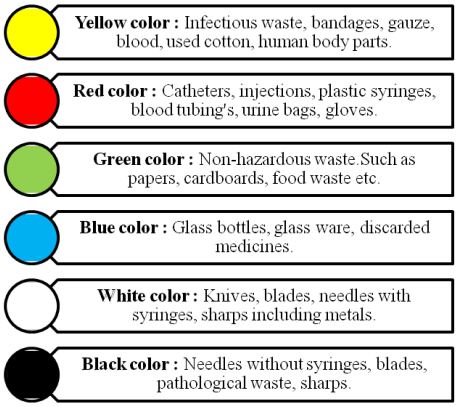

Figure 5: Color coding for hospital waste management.

Wet thermal treatment: It is also known as steam disinfection method, in which waste is exposed to high pressure and high temperature steam [7]. It is recommended for treating sharps and infectious waste but it is not used to treat pathological, radioactive and chemical waste.

Microwaving: It is a method in which microwave of frequency 2450MHZ and wave length of 12.24cm is used to destroy the microorganisms present in the waste. Water contained in the waste is rapidly heated by microwave and infectious components are destroyed by heat conduction process [10].

Inertization: It is the process/method of mixing waste with cement and other substances before disposal in order to minimize the risk of toxic substances migrating into the surface/ground water and to prevent the scavenging [11]. In this method 65 % proportion of waste, 15% of lime, 15% of cement and 5% of water is used.

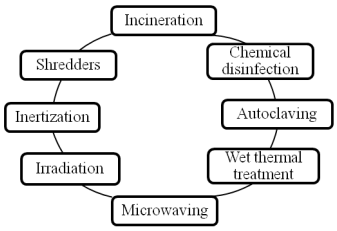

Figure 6: Different methods of waste treatment.

Irradiation: It is a method in which waste is disinfected by exposing it to gamma rays that are fatal to bacteria and other microbes [Inactivate them]. Gamma rays are used to disinfect or kill the pathogens in the waste. It is recommended for sterilization of equipments or treatment of waste.

Shredding: It is a method in which all the bulk waste of plastic including risk/hazardous waste is disinfected and cut into small piece/portions and converted into compact/hard form. It reduces the volume of waste and also reduces the risk towards humans and environment by preventing the flow or migration of waste [5,7].

Final disposal: Final step of the HWM is disposal of waste but before going towards the final disposal first must consider that the disposal of hazardous and non-hazardous waste should be done separately. Hospital wastes are disposed off either; openly or in sanitary landfills or are safe deep burial [12].

Land disposal/open dump: Hospital wastes are openly dumped but it is not the safe method of disposal. Disposal of waste should not be done around/on open dumps.

Sanitary landfills: Properly designed and managed landfills should be utilized to prevent the contamination of soil, surface, ground water and direct contact with public.

Safe deep burial: Hospital waste can be safe by deeply burying it, but the burial site should be lined with a material of low permeability such as clay to prevent leakage.

Importance of training and awareness in HWM

Awareness and training sessions should be conducted or organized for the proper HWM. Proper knowledge about waste management is provided to the health care workers and staffs that deal with waste in order to minimize its overall impacts. There is requirement of special training of the health care workers, hospital staff and every one that is involve either in waste collection, segregation, treatment, transportation and disposal of waste [14]. This training and knowledge prevent any accidental spill of hospital waste and ensure the safety of the people dealing with such waste. Moreover, such awareness practices also play crucial role in preventing the environmental and human health risks exerted by hazardous hospital waste [15,16].

Conclusion

For efficient management practices of hospital waste, proper plans, rules, regulations and guidelines should be made and they should be strictly implemented in order to minimize the overall impacts towards humans and environment. Awareness programs/sessions should be conducted regarding proper HWM. All the staff dealing or handling the waste should made aware about details of waste management and color coding practices should be done in proper manner to stop mixing of hazardous and non-hazardous wastes. Proper budgetary allocation and continuous training must be made compulsory for the heath protection. Regular monitoring of the hospital waste management practices should be conducted in order to minimize its impacts and to achieve the goal of sustainability. Furthermore, it is not only the responsibility of a single person to do something to save human health and environment from future threats but also the responsibility of every person to do something in efficient manner to protect human health and environment from the risks/effects of improper HWM. Let the Waste of the “Sick” Not Contaminate the Lives of the “Healthy” (K.PARK).

References

1. Tambe VH, Ali FM, Patil K, Parasant MC (2013) Awareness towards biomedical waste management: a review. Critical Rev Pharm Sci 2(3): 2319-1082.
2. Mahmood M, Shahab S, Malik R, Azim W (2001) A study of waste generation, collection and disposal in a tertiary hospital. Pakistan J Med Res 40: 13-17.
3. Ali S (2015) Current hospital waste management practices in Pakistan. Public Health Prev Med 1(3): 125-129.
4. Guidance on Health-Care Waste Management (2006) Life-Environment ‘ EMAS and information technology in hospitals’LIFE04 ENV/GR/000114.
5. Khan JA (2006) Hospital waste management issues and steps taken by the government of Pakistan, Ministry of environment.
6. Sapkota B, Gupyta GK, Mainali D (2014) Impact of intervention on health care management practices in a tertiary care governmental hospital of Nepal. BMC Public Health 14(1): 1005.
7. International Committee of the Red Cross. (November, 2011). Med Waste Manag.
8. Arshad N et al. (2011) Hospital Waste Disposal, J Pharm Sci and Res 3(8): 1412-1419.
9. Sherani SH (2019) Public Health and Environment in Pakistan. J Environ Sci Public Health 3(4): 483-486.
10. Khobragade DS (2018) Health Care Waste: Avoiding Hazards to Living and Non Living Environment by Efficient Management. Fortune J Health Sci 2(2): 14-29.
11. World Health Organization (2018) Health care waste.
12. Khan JA (2006) Hospital waste management issues and steps taken by the government of Pakistan, Ministry of Environment.
13. Hirani DP, Villaitramani KR, Kumbhar SJ (2014) Bio-medical waste: An introduction to its management. Int J Innov Res Adv Eng (IJIRAE) (8): 82-87.
14. Kumar R, Sheik BT, Somrongthong R, Chapman RS (2015) Practices and challenges of infectious waste management. Pakistan J Med Sci 31(4): 795-798.
15. Abah SO, Ohimain EI (2011) Health care waste management in Nigeria: A case study. J Public health Epidem 3(3): 99-110.
16. Akter N (2011) Medical waste management: A review. Int J Sci Pharm Edu Res 1: 53-61.