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Review Article

HOSPITAL WASTE MANAGEMENT AND TREATMENT IN HEALTHCARE SECTOR: A REVIEW

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ABSTRACT:

Aim: Medical waste generation was significantly increased during pandemic due to excessive use of face masks, plastic, syringes. Many countries during pandemic successfully reduce medical waste (MW). The purpose of this current study is to highlight the management and treatment process of MW so that personnel responsible for collecting, transporting and disposing of the MW keep themselves as well as environment safe help in reducing MW and spreading infections.

Study Design: Review, Conceptual,

Material and Methods: Articles published in Scopus, Web of Science, Pub Med, and EBSCO were downloaded for literature. Different keywords such as Waste treatment, Recycling of Waste, Waste Management (WM) were used for search of literature. Articles included in this study were chosen on certain criteria. Those articles which are published between 2017-2023 were included and those which match the keywords were included in the current study. Those articles which do not match the criteria were excluded.

Results: There are five main themes emerged as the main findings of this study. These are waste generation, segregation, collection and transportation, recycling, treatment, and disposal.

Conclusion: It is concluded that authorized personnel must be allowed to touch and dispose of the MW. These personnel must be provided with adequate training so that spread of infections can be prevented.

KEYWORDS

Hospital Waste, Management of Waste, Treatment of Medical Waste, Health Sector, Recycling

1 | INTRODUCTION

Medical waste is coined as healthcare waste by World Health organization (WHO) and European Union (EU). Healthcare waste is defined as any by-product which is used for diagnosis and treatment of animals and human beings in health care organizations and health facilities such as radioactive material, needles, blood samples, syringes, dressing, and parts of body, acids and chemicals, pharmaceuticals[1]. According to WHO approximately half kg per bed of healthcare waste is generated in high income countries[2]. It has huge negative impact on public health as well as on environment. There are five types of plastic which are used to manufacture equipment for operating

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rooms these are copolymers, polyurethane (PU), polyvinylchloride (PVC), polyethylene (PE), and polypropylene (PP). The last three types of plastic can be recycled. There is general perception among healthcare professionals that this type of waste is not contaminated because this is generated before the patient arrives in surgery room[3]. In addition due to COVID-19 restrictions and regulations extensive use of face masks has made an increase in medical waste. Additional use of plastic and latex gloves in various sectors during pandemic had led to increase medical waste. Gloves are made of unrecyclable material which has a negative impact on environment and increase pollution[4]. Plastic is accounted 15% of total global carbon budget. In Netherlands three hospitals have earned approximately forty thousand pounds from recycling and reusing of refurbished tools in six months. This earning also encouraged hospitals administration to initiate recycling practices and adopt circular process of treating waste rather than linear[5]. The main purpose of this review study is as follows:

- To identify the different categories of medical waste (MW).
- To identify the steps and process in treatment of MW.
- To compare practices of managing and treating MW.

2 | MATERIAL AND METHODS

Literature published i.e. articles, thesis, reports; book chapters in renowned data bases such as Scopus, Web of science, Pub Med, EBSCO was downloaded and used in the current study. Only those articles were included which were relevant to this study. Those articles which are published since 2017 to 2023 were added in the study. Authors used specific key words such as Waste treatment, Recycling of Waste, Waste Management (WM).

3 | FINDINGS

3.1 | Medical Waste Classification

As reported by World Health Organization due to radioactivity and toxicity fifteen to twenty percent of medical waste is hazardous. Classification of medical waste in different countries is not clear therefore there no specific management process is available for medical waste management[6]. Medical waste has direct and indirect effects on human health as well as environment and source of pollution. This medical waste is generated in hospitals, pathology labs, and pharmaceutical industries. On the contrary municipal solid waste is called non-hazardous medical waste (NHMW). Hazardous medical wastes (HMW) cause different infections if it is ineffectively managed. In addition this HMW is also harmful for air, water, trees, animals. See Table 1 and Figure 1

Table 1 Categorization of Health Waste

Category	EU	WHO	Source
NHW Cytotoxic Medicines & amalgam waste	Unused medicine amalgam waste from dental centers	Pharmaceutical Tooth filling dental clinics	Hospitals, dental & laboratories

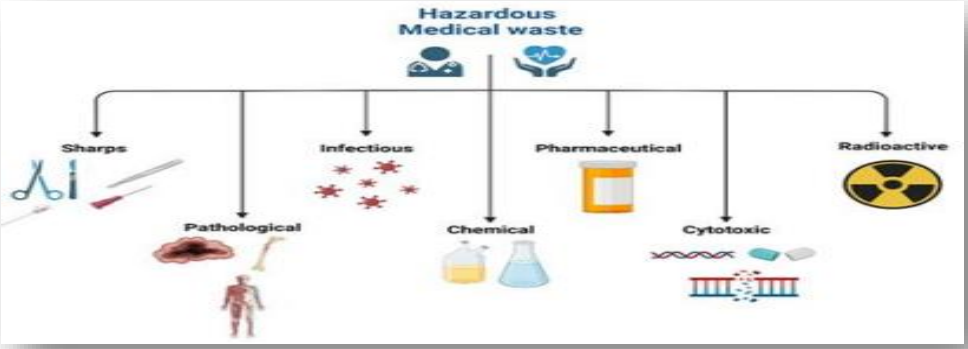

Figure 1: HMW Types Source: Adopted from[7] Attrah, Elmanadely, Akter &Rene (2022)

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3.2 | Management of Medical Waste

It is the step wise process which starts from generating point till safely disposed of. Figure 2 presented complete process of managing medical waste (MW). There are six steps involved in figure 2 for managing MW and among those steps waste treatment has four more sub stages which are discussed in detail below.

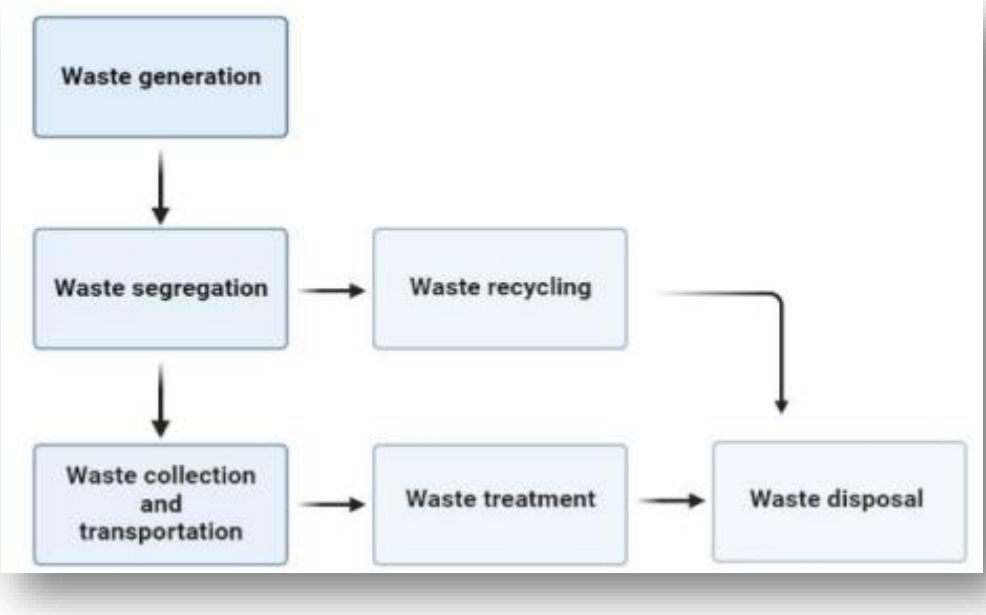

Figure 2: Process of Managing Medical Waste Source: Adopted from[7] Attrah, Elmanadely, Akter & Rene (2022)

3.2.1 | Waste Generation

The main purpose of this step is to keep the people safe from the MW form where it is generated. Healthcare organizations must raise awareness and hire those employees who have knowledge how to efficiently use the medical resources so that waste can be minimized and resources can be saved for future. Resources can be save by recycling and stock management. Reuse of materials such as table cloth, refill containers, in addition recycling of plastic and metals which are not harmful and stock management help the staff to prevent duplication and replication of medicines and buying those products whose expiry is near would help in reducing waste[8].

3.2.2 | Waste Segregation

In this different MW are collected using separate color bags and bins. This stage can be difficult for those who are collecting the waste due to lack of standardization of colors. This can increase time and cost of labor. Segregation normally takes place at treatment facility. Sharp objects must be separated at source. Medical staff must be provided with adequate training so that they can feel safe and keep their selves safe from infections. Unauthorized people should not be allowed to touch MW[8].

3.2.3 | Collection and Transportation

Medical waste should be collected from the source on daily basis otherwise accumulation can spread infections and diseases. Staff responsible for collection must be equipped with safety measures. Waste collected form health facility and transported to treatment facility carefully for disposal, treatment and recycling must be by authorized personnel[9].

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3.3 | Waste Treatment

In treating hospital waste and medical before disposal it was taken into consideration to reduce effect of hazardous material on environment. Otherwise following effects might occur such as fungal infections, toxins into atmosphere, habitats destruction. It is recommended that during manufacturing phase there must be a production by keeping in mind the life cycle analysis (LCA) of each product. The benefit of this LCA is that during disposal process minimum amount of carbon dioxide gas is released[10]. There are four methods of treatment See Table 2.

Table 2 Treatment Methods

Method	Advantage	Disadvantage
Chemical Disinfection	Time Efficient	High cost
Incineration	Heat recovery	High maintenance cost
Microwave Disinfection	No liquid Discharge	Unknown air emission
Autoclave Disinfection	Low operation cost	Inapplicable for all waste types

3.4 | Recycling

Recycling used by-products for similar purposes. Non-hazardous Waste produced by hospitals is disposed in landfills. These landfills can be reduced if glass, paper, plastic, batteries and metals are recycled. For compositing food and organic waste can be used while fly ash can be used in concrete mixture[11].

3.5 | Disposal

Landfills are not best solution to dispose of MW as they have negative effect on environment. It can create water and soil pollution. The best practices are to reduce the waste being disposed of and achieve circular economy guarantee. Preventive and safety measures must be taken into account while disposing MW which is as follows, cover waste, bottom must be water proof, no disposal of chemicals such as hazardous material[12].

4 | DISCUSSION

Most of the economies in the World achieved their objectives of reducing WM which was increased during pandemic. There was significant increase in medical waste due to increase in use of face masks, sanitizers, syringes, plastic, manufacturing of vaccines. Only in China 24% increase in MW was observed. On the contrary one study reported that China successfully reduced 30% medical waste[13]. Wuhan China daily produced 190 tons of medical waste daily but during pandemic it was increased to 240 tons per day. This MW is a big source and contributor of spreading infections.

5 | CONCLUSION

It is concluded that MW is not only harmful for environment but human being as well, waste of resources would lead towards degradation of natural resources, if healthcare organizations want to achieve sustainability they have to pay adequate attention to management of waste and their treatment methods which must be cost and time efficient.

6 | LIMITATIONS AND FUTURE DIRECTIONS

The current study has few limitations. First limited numbers of studies are cited therefore it is recommended to add more volume of studies in future. Second this study is conceptual or qualitative in nature therefore it is recommended for future scholars to conduct empirical testing through survey.

Ethical Approval
No ethical approval was required for this study.
Conflict of Interests
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None

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