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GTM4Health

Market Insights

Medical Waste Management Market Insights:

An Overview

https://gtm4health.com

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Introduction

The term “medical waste” is used in many countries, such as the US, South Korea, and China, while the European Union and World Health Organization (WHO) refer to it as “healthcare waste”.

The World Health Organization (WHO) defines healthcare waste (medical waste) as any waste or by-products from hospitals and health care facilities for humans and animals used for diagnosis, treatment, or immunization, e.g., used syringes, needles, metal sharps, dressings, blood samples, body parts, pharmaceutical, chemical, radioactive materials, and devices.

Generally, medical waste makes up about 2-3% of the total amount of waste, but this is one of the most hazardous waste. Therefore, the issue of their disposal is taken very seriously all over the world.

Estimates of waste data from around the world show that hospitals generate about 0.5 kg of waste per hospital bed per day. However, this figure and the basic waste composition vary greatly depending on local conditions.

Picture 1: Medical Waste Management

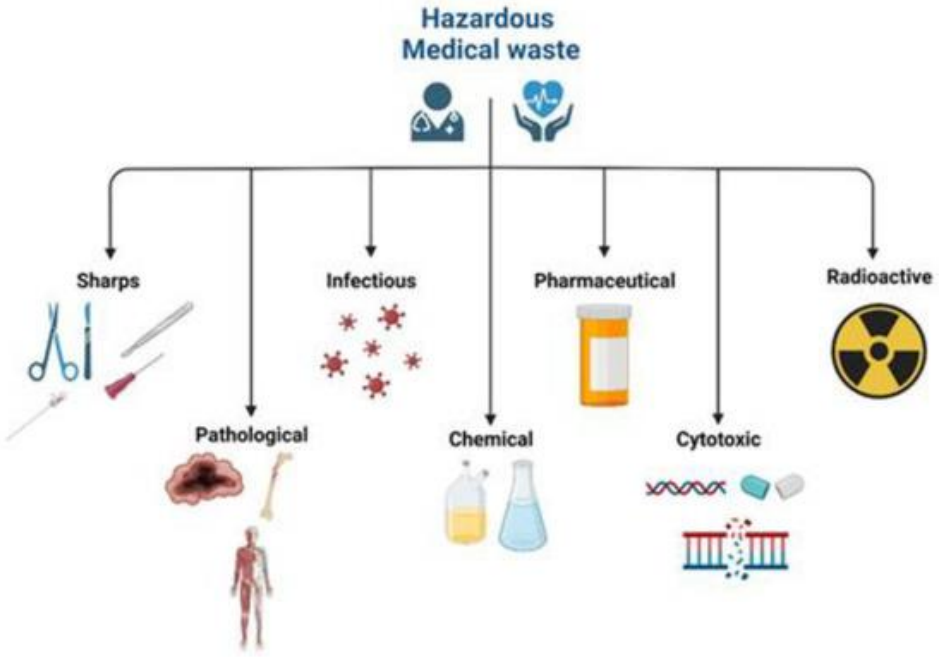
For example, higher-income countries generate much more waste and plastic, often accounting for more than half of all medical waste. Because of this huge difference, there is no single best medical waste management solution. Therefore, each country has its own expert staff dealing with the problem in local realities.

On the same line improper treatment and disposal of healthcare waste poses serious hazards of secondary disease transmission due to exposures to infectious agents among waste pickers, waste workers, health workers, patients, and the community in general where waste is improperly disposed.

Open burning and incineration without adequate pollution control exposes waste workers and the surrounding community to toxic contaminants in air emissions and ash.

Classification of Medical Waste

Estimates by the WHO, 15 to 20% of medical wastes can be classified as hazardous materials due to their infectivity, toxicity, and, sometimes, radioactivity. However, medical waste management practices are not constant or standardized in all countries because this categorization is not very clear or decisive.



Picture 2: Types of Hazardous medical waste
Ref: A Review on Medical Waste Management: Treatment, Recycling, and Disposal Options

The broadest definition of medical waste can include office paper and hospital sweeping waste. The list below displays the most common waste categories as identified by the World Health Organization.

- **Sharps:** This kind of waste includes anything that can pierce the skin, including needles, scalpels, lancets, broken glass, razors, ampules, staples, wires, and trocars.

- **Infectious Waste:** Anything infectious or potentially infectious goes in this category, including swabs, tissues, excreta, equipment, and lab cultures.
- **Radioactive Waste:** This kind of waste generally means unused radiotherapy liquid or lab research liquid. It can also consist of any glassware or other supplies contaminated with this liquid.
- **Pathological Waste:** Human fluids, tissue, blood, body parts, bodily fluids, and contaminated animal carcasses come under this waste category.
- **Pharmaceuticals Waste:** This grouping includes all unused, expired, and/or contaminated vaccines and drugs. It also encompasses antibiotics, injectable, and pills.
- **Chemical Waste:** These are disinfectants, solvents used for laboratory purposes, batteries, and heavy metals from medical equipment such as mercury from broken thermometers.
- **Genotoxic Waste:** This is a highly hazardous form of medical waste that's either carcinogenic, teratogenic, or mutagenic. It can include cytotoxic drugs intended for use in cancer treatment.
- **General Non-Regulated Medical Waste:** Also called non-hazardous waste, this type doesn't pose any particular chemical, biological, physical, or radioactive danger.

Picture 3: Classification of Medical Waste (also known as Healthcare Waste)
Ref:https://www.medprodisposal.com/what-is-medical-waste-medical-waste-definition-types-examples-and-more/

Medical Waste Management Process

Medical waste disposal is heavily regulated. It is important to understand what is involved in this process, from collection to disposal. The hospital waste like body parts, organs, tissues, blood and body fluids along with soiled linen, cotton, bandage and plaster casts from infected and contaminated areas are very essential to be properly collected, segregated, stored, transported, treated and disposed of in safe manner to prevent nosocomial or hospital acquired infection.

The crucial steps for scientific and proper management of biomedical wastes are:

Step 1: Observation of Medical Waste: Waste should be observed carefully, from the point of generation to type of waste. Level of generation and disinfection determines the process of treatment of waste.

Step 2: Waste Segregation: Segregation identifies the various types of waste and how they can be collected separately. Different kinds of waste mean their treatment process is also not the same. Segregation is mainly achieved by separating different categories of medical waste in different colour bins or bags specified for each category. In addition, it avoids physical injury. Color coding is not only for us. It represents the basic principle that all the waste is not the same so they will not end up in the same place.

Picture 4: Segregation of medical waste in different colour bins

Red bins: It is used to store contaminated wastes that can be recycled. These bags or bins should be non-chlorinated since chlorinated bags can react with the waste.

Example: Catheters, Tubes, Cannula, Syringes, Plastic IV bottles and sets, Rubber gloves, Specimen containers, Infected plastics, Lab wastes, Microbiology culture, Used discarded blood bags/ blood products, Vaccines, etc.

Yellow bins: The yellow colored bins are used to store many type of wastes like: pathological waste, solid(infectious) waste, medical chemical waste, clinical Lab wastes, pharmaceutical waste

These waste are stored in differently marked bins. Biohazard, radioactive, and cytotoxic marks are some examples of different marks.

White bins: These are white or translucent puncture proof bags. These bags are used to store sharps like needles, syringes with fixed needles, needle from needle cutter or burner, scalpels, blades, razors, nails, contaminated sharp metal objects, etc.

Blue bins: Blue bins are used to store glassware whether medicinal or general. Some examples are - infected broken glass/ bottle, broken or unbroken glass, vials, ampules, glass IV bottles, glass injections, metallic body implants, slides, glassware used in wards, glass injections or syringes, etc.

Picture 5: Medical Waste Management Process

Step 3: Waste collection and transportation: The frequency of Medical Waste (MW) collection should be as high as once per day to avoid the accumulation of waste, which can spread infections. In addition, the personnel responsible for collection should be equipped with safety gear to prevent contaminations and infections that should be safely disposed of after.

Wastes are mobilized from the generation point to the treatment disposal site via a designated vehicle. To avoid public exposure, smell, and microbes, containers must always be covered. All the vehicles used by CBWTF operators should not be sublet. Operators cannot use a contract vehicle.

Step 4: Treatment of waste: Treatment should be at the source of generation. Treatment is making waste safe through some process to make it no longer a source of the pathogen. Some of the processes are bleaching, shredding, and chemical disinfecting.

Step 5 : Guidelines for Waste Treatment : Indian government has issued a set of guidelines for waste treatment. After treatment, the residual can be transported to their disposal site. For example, needles and syringes nozzles should shred into a needle destroyer or syringe cutter, scalpel, razor, blades, and broken glass should be stored in a puncture proof container with bleach. Then transferred into labeled plastic or cardboard boxes. These boxes should be sealed to prevent spillage, and further send it to incubators.

Step 6: Disposal of waste: Disposal methods differ in availability, efficiency, cost effectiveness and impacts on the environment. Medical waste should be pathogen free before disposal. This should ensure utmost public health and hygiene.

Disposal without treatment is non- advisable for anatomical, sharps and waste from labs. Various disposal methods are:

- **Incineration**: This is a process of burning waste at a high temperature. The temperature in incinerators ranges from 1,800 degrees F to 2,000 degrees F (982 degrees C to 1093 degrees C). Incinerators have the advantage of quick, easy disposal methods. But their major concern is due to emissions. Incineration produces fly ash and emissions such as dioxins, furans, and mercury. Dioxins and furans are considered carcinogenic, have a half-life ranging from 7 to 11 years, and are persistent footprints on the environment

- **Autoclaving:** is a treatment method using temperature and steam simultaneously to kill microbes. It is operated at a lower temperature than incineration but with pressure and steam influence to achieve disinfection. The operating conditions are 60 min, at 121 °C and 1 bar, followed by a cycle of 60 min at 134 °C to ensure the complete disinfection of waste. The following aspects govern the operation of the autoclave.

- **Gas sterilization:** In this process, medical waste is placed into an empty air-tight chamber. Treated with a sterilizing agent (such as ethylene oxide or formaldehyde). Gas emitted from these chemicals comes in contact with waste. In turn it kills harmful, infectious agents.

- **Chemical disinfection**: Chemical disinfection is used to kill microorganisms and fight off pathogens by using chemicals. It is primarily used for treating liquid infectious wastes such as blood, urine, faeces, or hospital sewage. The chemical disinfectants that are commonly used are bleach solution (1%) or a diluted active chlorine solution (0.5%). In addition, other disinfectants such as lime, ozone, ammonium salts, and peracetic acid can be used.

- **Microwave:** Microwave technology can also disinfect waste. Wastes are first placed into a shredder. These wastes are mixed with water and internally heated, which neutralizes present biologicals. Microwave units are controlled through computers. That ensures the least parameters of infection and proper equipment function. 90% of medical wastes can be autoclaved.

- **Irradiation**: This method involves waste sterilization by exposing waste to cobalt sources. Cobalt emits gamma rays that kill all the microbes in waste. Commercial companies don't use this technology due to high cobalt cost and operating costs.

- **Thermal inactivation**: This process involves heat waste at high temperatures resulting in the killing of microbes. These methods are advised for treating large amounts of liquid waste. A chamber is preheated to an intense specific temperature at a specific amount of time and then released.

Medical Waste Problem and Solution

With rapidly increasing amounts, medical waste is a major concern. To tackle the medical waste problems, one first have to understand the concerns surrounding them such as:

- **Incorrect use of colour coded bins**: Using correct bins for a particular waste type is very important. These bins are identified by specific color codes. A particular waste type should be put in a bin marked with the color code of that waste. Inappropriate knowledge of these color codes can lead to mixing of wastes in wrong bins. It has become one of the major biomedical waste problems today.

- **Not Using Proper Safety Gear**: Unavailability of proper and whole safety gear sets is also a major concern. Gear sets contain gloves, goggles, boots, rubber long jackets, head cover. But we rarely see workers wearing proper gear sets. Instead handlers mostly wear gloves while waste handling. Rag pickers themselves sometimes ignore proper safety gear.

- **Improper waste transportation**: We have commonly seen open waste vehicles. Waste transported in these vehicles are unhygienic. Such vehicles have a risk of littering of wastes on roads. These transportation increase risk of infection and spillage many folds.

- **Overflowing Bins**: We have always seen bins overflowing with garbage. It gives a breeding place to many organisms. Which in turn increases the risk of infection. Overflowing bins are unhygienic and produce foul smells. Fully loaded bins have a chance of spillage and intermixing among different wastes.

- **Irregular Inspection Process**: Irregular long-term checking of the system by responsible authorities. Long term checking always makes processes careless and workers may lack behind from their responsibilities. This can cause unnecessary delays and make the management process inefficient.

Recommended solutions:

- Mandatory staff training and educational programmes should be organized. From doctors to waste handlers everyone should be trained on how to use bins. Waste disposal and segregation knowledge should be provided to each and every one.
- Public awareness is the vital step. Because of the welfare of people all these steps are taken. So the public also should be aware about the dangers regarding biomedical waste's problems.
- Strict monitoring should be done at the time of running practices
- Responsible authorities should carry out routine checking of management procedures.
- Protective gears should be distributed to all the workers. Safety of workers should be ensured.

Conclusion

Medical waste contributes to a considerable percentage of the total waste generated in most countries, and about 75% of medical waste is non-hazardous. The rest is considered to be hazardous since it is contaminated with infectious contaminants that can cause illness and transmit various diseases; therefore, proper handling and treatment of medical waste are needed.

Better management can be implemented with appropriate laws and regulations to reduce the risk of cross-contamination and decrease levels of emitted pollution from treatment and recycling of this type of waste using incineration, considered the most widely applied method for treating medical waste.

In addition, the COVID-19 outbreak resulted in a massive surge in medical waste, especially personal protection equipment (PPE), e.g., masks, gowns, and vaccination needles and syringes that need great attention due to their dangerous environmental impacts and low degradability.

Abbreviations:

Abbreviation	Meaning
CBWTF	Common Bio-medical Waste Treatment Facility
MW	Medical Waste
PPE	Personal Protection Equipment
WHO	World Health Organization

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