

Effects Of Medical Wastes On The Environment

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Introduction

Medical waste is the waste that is generated from healthcare facilities such as hospitals, laboratories, clinics, blood banks, mortuaries, nursing homes, and research centers. It may include used syringes, bandages, tissues, blood products, medicines, chemicals, radioactive materials, and contaminated equipment. Some medical waste is similar to ordinary household waste, while other materials are infectious, toxic, sharp, or radioactive and require special handling.

Improper management of [medical waste](#) can harm healthcare workers, patients, waste handlers, communities, animals, and the environment. Waste may spread infection, cause injuries, contaminate soil and water, release toxic chemicals, and produce air pollution. Safe management requires segregation, collection, storage, transport, treatment, and final disposal according to the characteristics of each waste type. (World Health Organization, 2014)

Types of Medical Waste

Infectious Waste

Infectious waste contains or may contain pathogens. Examples include materials contaminated with blood or body fluids, laboratory cultures, and waste from patients with communicable diseases.

If infectious waste is mixed with general waste, the amount requiring special treatment increases. Segregation at the point of generation is therefore essential.

Sharps

Sharps include needles, syringes with attached needles, scalpels, blades, and broken glass. They can cause cuts and puncture wounds and may transmit blood-borne infections such as hepatitis B, hepatitis C, and HIV.

Sharps should be placed immediately in puncture-resistant, leak-resistant containers. Needles should not be recapped or handled unnecessarily.

Pathological Waste

Pathological waste includes human tissues, organs, body parts, and animal carcasses used in research. This waste requires respectful, secure, and appropriate treatment.

Pharmaceutical Waste

Pharmaceutical waste includes expired, unused, contaminated, or spilled medicines and vaccines. It also includes containers and materials contaminated with drugs.

Improper disposal of antibiotics can contribute to antimicrobial resistance. Medicines entering waterways may affect aquatic organisms and drinking-water sources.

Cytotoxic Waste

Cytotoxic waste is associated with medicines used in cancer treatment. These substances may damage genetic material, affect reproduction, and cause cancer. Staff handling them require special training and protective equipment.

Chemical Waste

Chemical waste includes disinfectants, solvents, laboratory reagents, heavy metals, and cleaning agents. Mercury from broken thermometers and other devices is particularly harmful to the nervous system and environment.

Radioactive Waste

Radioactive waste may come from diagnostic imaging, cancer treatment, laboratories, and research. It requires management according to radiation safety regulations and may need storage until radioactivity decreases.

General Waste

General waste includes paper, packaging, food, and materials that are not contaminated. It usually makes up the largest portion of healthcare waste and can be managed through ordinary municipal systems if properly separated.

Effects on Human Health

Healthcare workers and waste handlers face direct exposure. Needle-stick injuries can transmit serious infections. Contact with contaminated materials may cause skin, respiratory, or gastrointestinal disease.

Communities may be exposed when waste is dumped in open areas. Children and informal waste pickers may search through waste for reusable materials and suffer injuries or infection. Reuse of contaminated syringes or medical equipment creates additional risks.

Burning medical waste in open fires can release smoke, particulate matter, and toxic compounds. People living near disposal sites may experience respiratory problems and long-term health effects.

Soil Contamination

Medical waste disposed of on land may release chemicals, medicines, heavy metals, and pathogens into soil. Contamination can affect plants, microorganisms, and animals.

Sharps and plastics remain in the environment for long periods. Rain may carry pollutants from dumping sites into nearby agricultural land and water bodies.

Water Pollution

Liquid waste from hospitals and laboratories may enter sewage systems without adequate treatment. It can contain pathogens, pharmaceuticals, disinfectants, and chemicals.

Wastewater treatment plants may not remove every medicine or antimicrobial compound. These substances can reach rivers, lakes, groundwater, and coastal areas. Antibiotic residues create conditions that may support antimicrobial resistance. (United Nations Environment Programme, 2019)

Air Pollution

Incineration can destroy infectious waste and reduce volume, but poorly operated incinerators may produce air pollution. Burning materials containing chlorine can generate dioxins and furans, while metals may be released in ash or emissions.

Open burning is especially dangerous because temperatures and air pollution controls are inadequate. Modern incinerators require proper design, operation, emission control, and monitoring.

Impact on Wildlife

Animals may consume medical waste or become injured by sharps. Medicines in water can affect fish and other aquatic organisms. Hormones and pharmaceutical compounds may alter reproduction, growth, and behavior.

Plastic waste can be swallowed by animals or break into microplastics. Contaminated waste may also attract insects and rodents that spread disease.

Medical Waste During Epidemics

Epidemics and pandemics increase the use of masks, gloves, gowns, syringes, testing materials, and other disposable products. Waste systems may become overwhelmed.

During COVID-19, large quantities of personal protective equipment and testing waste were generated. Emergency responses sometimes prioritized infection control without sufficient attention to environmental impacts.

Preparedness plans should estimate waste volumes, identify treatment capacity, train staff, and secure supplies before emergencies.

Segregation

Segregation means separating waste according to type at the place where it is generated. Color-coded containers and clear labels help staff identify infectious waste, sharps, pharmaceuticals, and general waste.

Mixing general and hazardous waste increases cost and risk. Segregation also supports recycling of uncontaminated materials.

Collection and Storage

Waste containers should be closed when full and collected according to a regular schedule. Storage areas must be secure, ventilated, protected from weather, and inaccessible to unauthorized people and animals.

Infectious waste should not remain in storage for excessive periods, particularly in warm climates. Records should track quantities and movement.

Transportation

Vehicles used for medical waste should prevent leakage and allow cleaning. Workers need protective equipment, training, and emergency procedures for spills or accidents.

Transport routes should minimize exposure to communities. Hazardous waste transferred between organizations requires documentation and regulatory oversight.

Treatment Methods

Autoclaving

Autoclaves use steam, pressure, and heat to disinfect infectious waste. Treated waste may then be shredded and disposed of. Autoclaving is suitable for many materials but not for every chemical, pharmaceutical, or pathological waste.

Incineration

Incineration uses high temperatures to destroy waste. It may be appropriate for pathological and certain pharmaceutical wastes. Environmental controls are necessary to reduce harmful emissions.

Chemical Treatment

Chemical disinfectants can treat some liquid waste and equipment. The chemicals themselves may create hazards and must be used at correct concentrations.

Microwave Treatment

Microwave systems use heat generated from electromagnetic energy to disinfect waste. Waste is often shredded before or after treatment.

Encapsulation

Sharps and some pharmaceutical wastes can be placed in containers and immobilized with cement or another material. This reduces the possibility of reuse or injury.

Sanitary Landfill

Treated waste and general waste may be disposed of in engineered landfills designed to control leachate and gases. Open dumping is not an acceptable alternative.

Recycling and Waste Reduction

Healthcare organizations can reduce waste through careful purchasing, reusable products where safe, repair, inventory management, and reduction of unnecessary packaging.

Recycling should apply only to uncontaminated materials. Reusable medical devices must be cleaned and sterilized according to validated procedures.

Waste reduction should never compromise infection prevention or patient safety. Life-cycle assessment can help compare environmental effects of disposable and reusable products.

Responsibilities of Healthcare Facilities

Healthcare facilities should have written waste-management plans, designated responsible staff, budgets, training, incident reporting, and monitoring. Employees must understand segregation and use appropriate protective equipment.

Management should audit waste streams and treatment contractors. Outsourcing disposal does not remove the facility's responsibility to ensure that waste is handled legally and safely.

Role of Government

Governments establish standards, license treatment facilities, inspect healthcare organizations, and enforce penalties. Regulations should address generation, storage, transport, treatment, disposal, occupational safety, and environmental emissions.

Public investment may be necessary where small clinics cannot operate individual treatment systems. Regional treatment facilities can provide safer and more economical services.

Developing-Country Challenges

Low-resource settings may lack treatment equipment, trained personnel, reliable electricity, transport, and engineered landfills. Waste may be burned in simple pits or dumped with municipal waste.

Solutions should match local capacity and environmental conditions. Donated equipment may fail if spare parts, fuel, or training are unavailable. Sustainable systems require operating budgets and maintenance, not only initial purchase.

Worker Protection

Workers should receive hepatitis B vaccination, protective clothing, gloves, footwear, and training. Needle-stick injuries require immediate reporting, medical evaluation, and access to post-exposure treatment.

Informal waste pickers should be protected through formal inclusion, safer employment, and prevention of hazardous materials entering general waste.

Education and Awareness

Training should be provided during employee orientation and repeated regularly. Posters and container labels can reinforce procedures but cannot replace practical instruction.

Patients and visitors should know where to dispose of masks, medicines, and sharps. Community education can reduce disposal of household medical waste in unsafe locations.

Conclusion

Medical waste protects health when it is generated through diagnosis and treatment, but it can create serious risks when managed poorly. Infectious materials, sharps, medicines, chemicals, and radioactive waste require different methods of handling and disposal.

Safe management begins with segregation and continues through secure collection, storage, transport, treatment, and final disposal. Waste reduction, worker protection, regulation, monitoring, and public education are also necessary. Healthcare systems should protect patients without transferring environmental and health risks to workers and communities. (Centers for Disease Control and Prevention, 2024)

References

World Health Organization. (2014). *Safe management of wastes from health-care activities (2nd ed.)*. <https://www.who.int/publications/i/item/9789241548564>

United Nations Environment Programme. (2019). Compendium of technologies for treatment/destruction of healthcare waste.

<https://www.unep.org/resources/report/compendium-technologies-treatmentdestruction-healthcare-waste>

Centers for Disease Control and Prevention. (2024). Regulated medical waste.

<https://www.cdc.gov/infection-control/hcp/environmental-control/regulated-medical-waste.html>