IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Impact Of Medical Waste On Human Health And Environment - The Hidden Hazard

L. Vijaya Lakshmi[1], S.Annapurna[2],

[1]Lecturer in Zoology, NTR Government Degree College, Valmikipuram, Annamayya District.

[2] Lecturer in Zoology, Government Degree College for Women, Madanapalle, Chittoor District.

Abstract

Medical waste, a by-product of healthcare activities, has emerged as a significant concern in recent years due to its potential impact on both human health and the environment. Medical waste encompasses a wide range of materials often leading to inadequate disposal methods that pose serious risks to public health and ecological balance and global health crises. One of the primary concerns associated with medical waste is its potential to spread infectious diseases. Improperly dispose, can cause injuries and even the general public, potentially transmitting blood-borne like HIV and hepatitis. The toxins released from heavy metals can persist in the environment for extended periods, contaminating soil and water sources. The World Health Organization (WHO) has reported that incineration of medical waste is known carcinogens and can cause reproductive and developmental problems in humans and wildlife. Improper disposal of expired or unused medications can lead to their presence in water bodies, affecting aquatic ecosystems and potentially entering the human food chain. Hazardous substances can leach into the soil, ecosystems and agricultural productivity. Radioactive waste from medical procedures, poses unique challenges. We can mitigate the risks associated with medical waste and work towards a healthier, more sustainable future.

Key words- Medical waste, WHO, pathogens, Radioactive waste

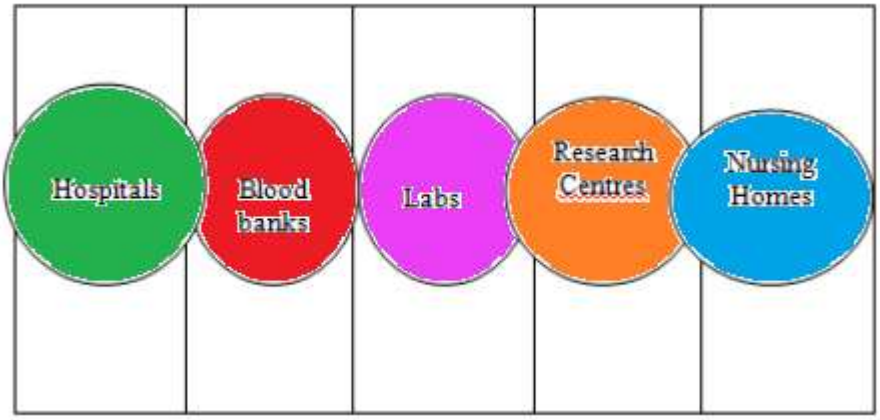
Introduction

Medical waste, a by-product of healthcare activities, has emerged as a significant concern in recent years due to its potential impact on both human health and the environment(Manyele and Mujuni 2010).Health care activities generate waste, some of which can adversely impact health. This review article explores the multifaceted consequences of improper medical waste management and disposal, highlighting the urgent need for improved practices in the healthcare sector.Medical waste encompasses a wide range of materials, including used syringes, contaminated personal protective equipment, expired pharmaceuticals, radioactive substances,cytotoxic waste or broken thermometersused in diagnostic procedures (W. A. Rutala and D. J. Weber 2015). The volume of medical waste generated globally has increased dramatically, particularly in light of recent global health crises. This surge in waste production has put unprecedented pressure on

existing waste management systems, often leading to inadequate disposal methods that pose serious risks to public health and ecological balance.

Hospital waste generation, practices, and management

Biomedical waste, sometimes known as BMW, is produced in hospitals, research centers, and other healthcare establishments. Clinics, laboratories, blood banks, animal shelters, and veterinary institutes are all instances of healthcare educational institutions (I. B. Singh and R. K. Sarma, 1996). The waste generated from different sources varies regionally, internationally, and among hospital networks. Indian cities are facing biomedical waste management problems



Depicts the major sources of biomedical waste (A. Mehta and S. Singh,2019)

The goal of this document is to explore various technologies for treating infectious medical waste, particularly in developing countries.A large number of waste handlers and cleaners are casual labours and never receive any type of such training to deal with occupational risks to which they are exposed. Training on the correct procedures for handling, loading, and unloading waste bags and containers is neglected.One of the primary concerns associated with medical waste is its potential to spread infectious diseases. Improperly disposed of sharps, such as needles and scalpels, can cause injuries to waste handlers, sanitation workers, and even the general public, potentially transmitting blood-borne pathogens like HIV and hepatitis(Nejad et al. 2011). Moreover, contaminated materials can serve as breeding grounds for disease-causing microorganisms, contributing to the spread of infections within healthcare facilities and beyond. The inadequate disposal of biomedical waste is highly nonhygienic for the environment and causes a serious health threat for inhabitants. Health care activities generate waste, some of which can adversely impact health. While most of this waste is similar to household waste, certain types pose higher risks, such as infectious waste (15%–25% of total health-care waste). Notably, sharps waste (1%), body part waste (1%), chemical or pharmaceutical waste (3%), and radioactive/cytotoxic waste or broken thermometers (less than 1%) require special handling. Hospital trash not only endangers patients and healthcare workers, but also poses a significant risk to public health and the environment. Hospitals, nursing homes, clinics, dispensaries, animal houses, pathological labs, and other facilities (P. Vohra, N. Sharma.et al. 2017) .The disposal of hospital trash can pose significant risks, this can lead to heightened environmental pollution, as well as significant public health hazards such as AIDS, Hepatitis, plague, cholera, and other similar diseases (S. M. Soliman and A. I. Ahmed, 2017). The waste is fully loaded with harmful microorganisms that infect hospital

patients, healthcare workers, and the general public. The infectious wastes, if not managed properly, leads to infections, infertility, genital deformities, hormonally triggered cancers, mutagenicity, dermatitis, asthma, and neurological disorders among people along with children. The noxious substances present in biomedical waste have the prospective to harm the atmosphere, bodies of water, and soil, hence leading to health issues for the nearby population.The environmental impact of medical waste is equally alarming. When incinerated, certain types of medical waste release harmful pollutants into the atmosphere, including dioxins, furans, and heavy metals.The presence of appreciable quantity of heavy metals such as Cd, Zn, Pb, and Cu, all of which may ultimately end-up in the soil and leached down the soil profile, may cause damage as well (Huiying and Huaqing 2002).. These toxins can persist in the environment for extended periods, contaminating soil and water sources. Internationally, the most frequently using treatment method is incineration but World Health Organization (WHO), has reported that incineration of medical waste is a significant source of environmental dioxins, which are known carcinogens, volatile organic compounds (B. R. Babu, A. K. Parande, ,2009) and can cause reproductive and developmental problems in humans and wildlife.Although hospitals protect and save human life, the by-products generated causes great damage to the environment (Manyele and Mujuni). Mastorakis et al. (2011) presented a critical review of biomedical waste management and stressed that responsible planning of collecting, transporting, processing, and disposing of hazardous and non-hazardous biomedical waste. Management of biomedical waste incorporating an appropriate waste reduction and neutralization component needs to be developed.Pharmaceutical waste presents another critical challenge. Improper disposal of expired or unused medications can lead to their presence in water bodies, affecting aquatic ecosystems and potentially entering the human food chain. (Al Raisi et al. 2014) assessed and found that heavy metals in leachate were exceeding the drinking water standards. Studies have shown that trace amounts of pharmaceuticals in water sources can have detrimental effects on fish and other aquatic organisms, altering their behaviour and reproductive patterns. Furthermore, the presence of antibiotics in the environment contributes to the growing problem of antibiotic resistance, a major threat to global public health.The impact of medical waste on soil quality is also a cause for concern. When medical waste is dumped in landfills without proper treatment, hazardous substances can leach into the soil, affecting its chemical composition and fertility(Demie and Degefa ,2015). This contamination can have long-lasting effects on local ecosystems and agricultural productivity, potentially impacting food security in affected areas.The improper disposal of biomedical waste may cause negative impact on the water quality as different pollutants may leach out from the waste dumping sites into the ground water. Radioactive waste from medical procedures,(Priyadarshini et al. 2016) though generated in smaller quantities, poses unique challenges. Improper handling and disposal of radioactive materials can lead to radiation exposure, causing serious health issues for humans and wildlife. The long half-life of some radioactive isotopes means that their impact on the environment can persist for generations.Subrammani, Anitha, and Sekar (2014) reported that in India, healthcare waste is a big issue. The process of incineration may only transform solid and liquid toxic waste into gaseous emissions particulate matters, oxides of nitrogen, and oxides of sulphur. This may cause acute effects such as eyes and respiratory irritation

problems. This process also contributes to acid rain, and may increase the toxic effects to heavy metals. The process of plastic waste made up of chlorine may create dioxins that are known as human carcinogens.

On Human Health

Medical waste, often referred to as healthcare or bio hazardous waste, comprises a variety of materials generated during the diagnosis, treatment, or immunization of patients. This waste can include items such as needles, surgical instruments, and contaminated materials, which pose significant risks to human health if not managed properly. The inappropriate disposal and management of medical waste can lead to various negative health outcomes for both healthcare workers and the general public.

One of the primary health risks associated with medical waste is the potential for infection. Items like needles and scalpels can harbour pathogens, including bacteria and viruses that can cause severe diseases. Improperly discarded needles can lead to accidental needle-stick injuries, increasing the risk of transmission of blood borne pathogens such as HIV and hepatitis B and C. According to the World Health Organization (WHO), approximately 16 billion injections are administered each year, with a significant percentage potentially resulting in unsafe disposal practices, leading to infections.Moreover, medical waste can contribute to environmental pollution, which can indirectly affect human health. When medical waste is cremated, it can release harmful toxins into the air, including dioxins and furans, which are known to have carcinogenic effects. Additionally, if medical waste is landfilled or dumped inappropriately, it can leach harmful chemicals into the soil and groundwater, potentially contaminating drinking water supplies. This environmental contamination can lead to long-term health issues, including respiratory diseases and cancers.The improper management of medical waste not only threatens individual health but also poses a broader public health concern. Communities near healthcare facilities may experience increased exposure to hazardous waste, leading to a higher prevalence of health issues. Vulnerable populations, such as children and the elderly, are particularly at risk. Studies have shown that exposure to medical waste can lead to increased rates of respiratory illnesses, skin infections, and other health complications in these populations.To mitigate the risks associated with medical waste, it is crucial to implement effective waste management strategies. This includes proper segregation of medical waste at the point of generation, safe transportation methods, and adequate treatment and disposal processes. Healthcare facilities must follow regulations set by organizations like the WHO and the Environmental Protection Agency (EPA) to ensure that medical waste is treated as hazardous waste and handled accordingly. Education and training for healthcare workers on the risks of medical waste and proper disposal methods are also essential components of an effective waste management program.

On The Environment

Medical waste, often defined as any waste generated in healthcare facilities that can pose a risk to public health or the environment, has become a significant issue in today's society. The improper disposal and management of medical waste can lead to severe consequences for ecosystems, human health, and even local economies. As healthcare continues to expand globally, the volume of medical waste is rising, necessitating urgent attention to its environmental impact.Medical waste is categorized into several types, including infectious waste, hazardous waste, radioactive waste, and non-hazardous waste. Infectious waste,

such as used syringes, blood-soaked bandages, and surgical waste, poses a direct threat to human health if not handled properly. When disposed of in landfills or incinerated without appropriate safeguards, these materials can emit harmful pathogens into the environment. Contaminated soil and water sources can lead to outbreaks of disease, impacting both wildlife and human populations.

Moreover, hazardous medical waste, which includes chemicals, pharmaceuticals, and heavy metals, can contribute to soil and water pollution. When these substances leach into groundwater, they can contaminate drinking water supplies, posing serious health risks to communities. Number of works have shown that exposure to hazardous waste can lead to various health problems, including respiratory issues, neurological disorders, and even cancer.The incineration of medical waste, while a common method of disposal, also presents environmental challenges. Incinerators can release toxic emissions into the atmosphere, including dioxins and furans, which are known to have detrimental effects on air quality and can contribute to climate change. In addition, the energy-intensive nature of incineration processes often leads to a larger carbon footprint, exacerbating global warming concerns.To mitigate the environmental impact of medical waste, healthcare facilities must adopt better waste management practices. This includes implementing strict segregation protocols, where different types of waste are sorted at the source, and investing in advanced waste treatment technologies that minimize hazardous emissions. Additionally, recycling programs for non-hazardous materials can significantly reduce the overall volume of waste generated.Public awareness and education are also crucial components of a comprehensive strategy for managing medical waste. Healthcare professionals, policymakers, and the general public must understand the importance of proper waste disposal methods. Governments can play a pivotal role by enacting regulations that mandate safe disposal practices and providing support for research into sustainable waste management solutions.

On Air, Water, and Soil

Medical waste, often generated from healthcare facilities, incorporates a variety of materials including piercing, infectious waste, and chemical waste. This waste poses significant environmental challenges, particularly concerning air, water, and soil toxification. Understanding the ramifications of improper discarding and management of medical waste is crucial for promoting sustainable practices within the health care sector.

Air Pollution

Burning of medical waste is a common method of disposal that can lead to the release of harmful pollutants into the atmosphere. When medical waste is burned, it can emit toxic gases and particulate matter. These substances can cause respiratory problems, cardiovascular diseases, and other health issues in nearby populations. Additionally, the release of volatile organic compounds (VOCs) contributes to the formation of ground-level ozone, which can aggravate air quality problems and impact public health.

Water Contamination

Medical waste that is not properly disposed of can leach hazardous substances into the soil and, eventually, into groundwater sources. Such as, pharmaceuticals, which are often present in medical waste, can contaminate water supplies through improper disposal methods, such as flushing down toilets or disposing of them in landfills. The presence of these substances in water can disrupt aquatic ecosystems, harm wildlife,

and pose health risks to humans who consume contaminated water or fish. Additionally, wastewater from healthcare facilities can introduce pathogens and chemicals into local water bodies, leading to broader public health concerns.

Soil Degradation

The improper disposal of medical waste can also lead to soil adulteration. When waste is dumped in landfills or improperly managed sites, hazardous materials can leach into the soil, affecting its quality and the health of local flora and fauna. Contaminants such as heavy metals, chemicals, and biological agents can persist in the soil, leading to long-term environmental consequences. This degradation can affect agricultural practices, as contaminated soil can produce crops that are unsafe for consumption.

Fundamental Principles of a Waste Management Program

The hospital project manager holds the primary responsibility for ensuring that hospital waste management complies with national laws and international standards.

Duties of the Hospital Project Manager

- Establish a committee to draft the waste management plan.
- Appoint a local waste manager to oversee daily operations.
- Define roles and responsibilities.
- Allocate financial and human resources.
- Implement the waste disposal plan.
- Conduct audits and continuously improve the waste management system.

Duties of the Water and Habitat Engineer

The water and habitat engineer is tasked with:

- Assessing the current waste situation.
- Proposing a waste management plan aligned with national policies.
- Planning the construction and upkeep of waste storage and disposal facilities.
- Evaluating the environmental impacts of waste management (e.g., contamination monitoring).
- Regularly assessing risks to personnel.
- Supervising the local waste manager.
- Providing training.

Duties of the Hospital Administrator

The hospital administrator is responsible for:

- Ensuring a steady supply of consumables (bags, containers, protective gear).
- Evaluating costs and managing contracts with third parties.
- Advising on purchasing policies to minimize the use of harmful items (e.g., mercury-free products).
- Overseeing the implementation of protective measures.
- Acting in the absence of the water and habitat engineer.

Duties of the Head Nurse

The head nurse's responsibilities include:

- Training care staff on waste management, especially new employees.
- Overseeing sorting, collection, storage, and transport in various wards.
- Monitoring protective measures.
- Ensuring hygiene standards and infection control.

Duties of the Chief Pharmacist

The chief pharmacist is accountable for:

- Managing medicine inventories and minimizing expired stock.
- Handling waste containing mercury.
- Delegating responsibilities to the hospital administrator in their absence.

Duties of the Head of Laboratory

The head of the laboratory is charged with:

- Managing chemical inventories and reducing chemical waste.
- Overseeing the handling of chemical wastes.

This structured approach to waste management ensures that all personnel involved understand their roles, which is crucial for maintaining health and safety standards in healthcare facilities.Addressing the challenges posed by medical waste requires a multifaceted approach. Healthcare facilities must implement comprehensive waste management strategies that prioritize waste segregation, proper treatment, and safe disposal. This includes investing in technologies such as autoclaving and microwave treatment for infectious waste, and utilizing specialized facilities for the disposal of pharmaceutical and radioactive waste.Education and training of healthcare workers, waste management personnel, and the general public are crucial in mitigating the risks associated with medical waste. Raising awareness about proper waste handling and disposal practices can significantly reduce the incidence of accidents and environmental contamination.This article highlighted that inadequate and unscientific management of biomedical waste is linked with risks to people who are directly and indirectly associated with this profession. Biomedical waste has caused challenge to maintain the quality of water, air, and soil. Policy makers and regulatory bodies play a vital role in establishing and enforcing standards for medical waste management. Stricter regulations, regular audits, and penalties for non-compliance can incentivize healthcare facilities to adopt more sustainable waste management practices.

Conclusion

In conclusion, the impact of medical waste on human health and the environment is a pressing issue that demands immediate attention. As the global healthcare sector continues to expand, the volume of medical waste generated is likely to increase, exacerbating existing challenges. By implementing comprehensive waste management strategies, investing in sustainable technologies, and fostering a culture of environmental responsibility, we can mitigate the risks associated with medical waste and work towards a healthier, more sustainable future. Effective waste disposal solutions in these settings must be sustainable, taking into account environmental, financial, and technical feasibility. Therefore, proper handling and disposal of

biomedical waste, especially in hospitals and healthcare facilities, is an essential component of safeguarding the environment and public health. Therefore, proper handling and disposal of biomedical waste, especially in hospitals and healthcare facilities, is an essential component of safeguarding the environment and public health. The recommendations highlight the significance of government intervention in the management of biomedical waste, including highlight the importance of segregating, cleansing, and ecologically appropriate disposal of waste in healthcare institutions. Furthermore, the involvement of the community, healthcare practitioners, and waste management staff is vital in guaranteeing the secure and appropriate disposal of biomedical waste. The recommendations highlight the significance of government intervention in the management of biomedical waste, including highlight the importance of segregating, cleansing, and ecologically appropriate disposal of waste in healthcare institutions. Furthermore, the involvement of the community, healthcare practitioners, and waste management staff is vital in guaranteeing the secure and appropriate disposal of biomedical waste. The impact of medical waste on human health is a pressing issue that requires immediate attention. The risks of infection, environmental pollution, and public health concerns highlight the necessity for stringent waste management practices. By prioritizing safe disposal methods and educating healthcare professionals, society can significantly reduce the negative health impacts associated with medical waste. The impact of medical waste on the environment is a pressing issue that requires immediate action. By improving waste management practices, enhancing public education, and advocating for stronger regulations, we can protect our ecosystems and safeguard public health. The responsibility lies not only with healthcare providers but also with individuals and communities to ensure a cleaner, safer environment for future generations. The impact of medical waste on air, water, and soil is a pressing environmental issue that necessitates immediate attention. Effective waste management practices, including proper segregation, treatment, and disposal, are essential to mitigate these risks. As future healthcare providers and policymakers, it is imperative to advocate for sustainable practices that protect our environment and public health.

References:

1. Al Raisi, S. A. H., H. Sulaiman, F. E. Suliman, and O. Abdallah. 2014. Assessment of heavy metals in leachate of an unlined landfill in the Sultanate of Oman. International Journal of Environmental Science and Development 5(1):60–63.
2. Alavi, N., &Khodadadi, M. (2019). The effect of incineration and alternative methods on medical waste management. *Waste Management*, 89, 256-264.
3. A.Mehta and S. Singh, A review on biomedical waste, its effects and management, Adv. Innov. Res., p. 112, 2019.
4. B.R.Babu, A. K. Parande, R. Rajalakshmi, P. Suriyakala, and M. Volga, Management of biomedical waste in India and other countries: a review, J. Int. Environ. Appl. Sci., vol. 4, no. 1, pp. 65–78, 2009.
5. Centers for Disease Control and Prevention (CDC). (2020). Guidelines for Environmental Infection Control in Health-Care Facilities. Retrieved from CDC website.

6. Chartier, Y. (Ed.). (2014). Safe management of wastes from health-care activities. World Health Organization.
7. Demie, G., and H. Degefa. 2015. Heavy metal pollution of soil around solid waste dumping sites and its impact on adjacent community: The case of Shashemane Open Landfill, Ethiopia. Journal of Environment and Earth Science 5(15):169–178.
8. Environmental Protection Agency (EPA). (2021). Medical Waste. Retrieved from EPA website
9. Huiying, S., and J. Huaqing. 2002. Present situation and disposal of medical wastes in China. Environmental Pollution and control-Hangzhou 24(5):312–313.
10. Harhay, M. O., Halpern, S. D., Harhay, J. S., &Olliaro, P. L. (2009). Health care waste management: a neglected and growing public health problem worldwide. Tropical Medicine & International Health, 14(11), 1414-1417.
11. I.B.Singh and R. K. Sarma, Hospital waste disposal system &technology., J. Acad. Hosp. Adm., vol. 8, no. 2–1, pp. 33–39, 1996.
12. Manyele, S. V., and C. M. Mujuni. 2010. Current status of sharps waste management in the lower-level health facilities in Tanzania. Tanzania Journal of Health Research 12(4):257–264
13. Mastorakis, N. E., C. A. Bulucea, T. A. Oprea, C. A. Bulucea, and P. Dondon. 2011. Holistic approach of biomedical waste management system with regard to health and environmental risks. International Journal of Energy and Environment 5:309–318.
14. Nejad, S. B., B. Allegranzi, S. B. Syed, B. Ellis, and D. Pittet. 2011. Health-care-associated infection in Africa: a systematic review. Bulletin of the World Health Organization 89 (10):757–765. doi: 10.2471/BLT.11.08817
15. Priyadarshini, N. R., S. Srikantaswamy, D. Shiva Kumar, and M. R. Abhilash. 2016. Characterization of biomedical waste of Mysuru city Hospitals. International Journal of Engineering Sciences & Research Technology 5(9):452–459.
16. Prüss, A., Giroult, E., &Rushbrook, P. (1999). Safe management of wastes from health-care activities. World Health Organization.
17. P.Vohra, N. Sharma, P. Mane, G. Garima, A. Sharma, and N. Singh, Awareness of biomedical waste management among MBBS students at a tertiary care teaching hospital in Mewat, Haryana, J Med SciCli Res, vol. 5, no. 9, pp. 28328–28331, 2017.
18. S.M.Soliman and A. I. Ahmed, Biomedical Wastes: Environmental Threats and Management, in Environmental Pollutants and their Bioremediation Approaches, CRC Press, 2017, pp. 427–442.
19. Subrammani, T., P. Anitha, and S. Sekar. 2014. Health-care waste management system. International Journal of Engineering Research and Applications 4(6):255–258.
20. United Nations Environment Programme (UNEP). (2019). Medical Waste: A Global Perspective. Retrieved from UNEP website
21. W.A.Rutala and D. J. Weber, Disinfection, sterilization, and control of hospital waste, Mand. Douglas, Bennett's Princ. Pract. Infect. Dis., p. 3294, 2015.

22. World Health Organization. (2018). Health-care waste. Retrieved from https://www.who.int/news-room/fact-sheets/detail/health-care-waste
23. World Health Organization. (2018). Health care waste management. Retrieved from WHO website
24. World Health Organization (WHO). (2020). Health care waste management. Retrieved from WHO website
25. Windfeld, E. S., & Brooks, M. S. L. (2015). Medical waste management – A review. Journal of Environmental Management, 163, 98-108.
26. Zubair, M., &Iftikhar, M. (2020). Medical waste management: A challenge for healthcare. *Environmental Science & Policy*, 112, 1-10.