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MEDICAL LABORATORY WASTES, PROPER MANAGEMENT PRACTICES

[1]Alaa Othman Ahmad Refaei, [2]Rotana Waleed Mohammed Melibari, [3]Munirah ali Mohammed hadadi, [4]Najlaa Abdullah Noor Alddin Afghani, [5]Elaf hameed alhazmi, [6]Saleha Abdullah Minkabu, [7]Jawaher abdulaziz kalifah Alharthi, [8]Hanin Faiz Alhazmi

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Abstract:
Significant quantities of infectious waste, including microbiological debris, contaminated sharps, and pathologic wastes such as blood specimens and blood products, are generated by clinical laboratories. The majority of laboratory trash can be disposed of with normal solid waste. A literature search performed through electronic databases, for all relevant studies that were published in English language up to 2022. The present examination of laboratory waste management methods reveals that segregation was the most challenging step. This may be the result of insufficient or inconsistent laboratory manager and employee training. Due to the lack of comprehensive and generally agreed definitions of infectious waste types, certain types of domestic trash, such as soiled but not blood-saturated cotton or stool samples, are deemed contagious.

Corresponding author:
Alaa Othman Ahmad Refaei,

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INTRODUCTION:

Since the 1990s, concern over the management of chemical waste (CW) from laboratories has increased due to the potential environmental impacts of these wastes. Good waste management prevents the generation of waste and, if generation cannot be avoided, ensures adequate management to prevent environmental and human health damage [1]. Kihampa and Hellar-Kihampa (2015) analyzed [2] chemical waste management practices in six educational and research institutions in Tanzania and discovered that 72.3% of the wastes lack proper identification and 53.8% of laboratories dispose of the waste directly into the sewage drainage system. One study [3] analyzed chemical waste management in 68 laboratories at a Taiwanese university and identified 10 improvement factors required for safer waste management, such as waste classification, storage, and handling. A 60.2% improvement rate (according to ideal requirements) was identified following the implementation of suitable management actions. According to this information, research institutions and laboratories around the world have been implementing good chemical waste management practices to reduce the risk of accidents and contamination of humans and the environment [3]. For effective management of laboratory-generated CW, it is necessary to foster an environment of cooperation and exchange, allowing for the reuse of chemical reagents [4].

CWs are classified as hazardous by the US Environmental Protection Agency (EPA) [5] if they possess at least one of the following characteristics: reactivity, corrosivity, flammability, toxicity, or pathogenicity. According to the hazardous properties of chemical waste, it must be separated, stored, identified, and disposed of. In Brazil, the National Policy on Solid Waste (PNRS) [6] encourages the development of environmental management systems geared toward the reuse of solid waste. The reuse of wastes can occur in a variety of ways, including the reuse of chemical products for alternative uses and educational activities, as described in [1]. The University of Florida's chemical exchange program was examined by [7]. This program minimizes waste and reduces the quantity of surplus chemicals stored in laboratories. These expired chemicals were automatically available for exchange in each of the four laboratories included in this study. The researchers hypothesize that the laboratory with the lowest proportion of expired chemicals is the teaching laboratory due to the regularly repeated experiments that ensure a tighter control over purchases. The scientists noted that approximately 51% of program participants accepted expired substances. The weakest link in the performance of chemical exchange programs at 32 institutions in the United States was found to be inadequate accounting paperwork, which made it difficult to substantiate chemical sharing. In an effort to find an alternate method for proper waste management in accordance with environmental regulations and to reduce chemical waste, the environmental managers of the institution analyzed the prospect of reusing a significant amount of the chemical wastes. This material, which was typically past its expiration date, had the potential to be utilized in laboratory research at colleges and institutions, as well as for internal training of new collaborators, interns, or scholarship recipients. Chemical Waste Exchange (CWE) is a management method that aims to gather chemical reagents with expired dates that would otherwise be wasted and make them available to other laboratories or institutions for secondary use [9,10].

Clinical laboratories generate a significant amount of infectious waste. Mixing common non-infectious garbage with infectious waste poses possible health and economic risks. Improper waste management by clinical laboratories can increase the health hazards to individuals exposed, contaminate the sanitary waste stream, and cause environmental pollution [11]. However, formal analyses of significant infectious waste generators in Iran are absent. [13] examined biomedical waste in a clinical laboratory in Madhya Pradesh, India.

DISCUSSION:

Infectious waste comprises of germs that may cause illness in those who come into touch with it, such as surgical waste, infected patients, and those who come into contact with contaminated equipment, tissues, etc [14]. Anatomical and pathological waste consists of removed body tissues, organs, blood and body fluids, fetuses, etc. Sharps include needles, knives, blades, scalpels, etc. Pharmaceutical waste includes not just unused, expired medications but also additional materials, such as contaminated bottles and cartons [15]. Genotoxic waste comprises of unused genotoxic substances and cancer-fighting medications [15]. Laboratory compounds, film developer, solvents, expired or unnecessary disinfectants, etc. are examples of chemical waste. Heavymetal trash contains metal-containing equipment. Examples include abandoned blood pressure monitors, batteries, and thermometers. There are three types of pressurized containers: gas cylinders, aerosol cans, and gas cartridges [15].

Radioactive waste consists of unencapsulated radionuclides and wasted radiotherapy solutions (). In addition to the aforementioned wastes, numerous research have focused on dental solid waste, which is divided into three primary categories: infectious waste, non-infectious waste, and domestic trash [16]. However, [17] categorized the dental solid waste into four types based on their proportional contribution to the total trash. I domestic (11.7%); (ii) potentially infectious (80.3%); (iii) chemical and pharmaceutical (6.3%); (iv) poisonous (1.7%). hospitals, healthcare facilities (dispensary, outpatient departments and offices, facilities for blood transfusion or dialysis, emergency team, autopsy facilities), labs and research centers were cited as the primary MW generators. Taghipour and Mosaferi (2009) [18] noted that hospital trash was also generated by administrative, cleaning, and maintenance tasks performed on hospital grounds. The process of infectious waste generation can be split into three phases: the location of waste production, the infectious diseases carried by the garbage, and the waste's physical composition [19]. The amount of HCW generated relies on the structure, location, and capacity of the healthcare facility, established waste management systems, reusable products used in healthcare, level of instrumentation, hospital specialization, MW segregation system, and daily number of patients treated [19,20]. Studies on HCW waste generation indicate that the rate of waste creation varies not just from nation to country, but even within a single country based on the form and location of healthcare facilities. The rate of HCW production is greater in high-income nations than in low-income ones because high-income countries provide more and better healthcare facilities [21]. Based on the examined literature, the authors determined that 75–90% of the trash produced by healthcare facilities was nonhazardous. The remaining 10–25% of MW was deemed dangerous and posed a variety of significant health hazards. If this relatively tiny amount of infectious MW is combined with ordinary trash, the entire waste stream becomes hazardous. According to a study conducted by Bazrafshan and Mastafapoor (2011) [22] in Iran, the majority of hospitals are not appropriately segregating MW at the site of creation. Therefore, in order to minimize the spread of infections in the environment, it is essential to separate MW from other waste. Miyazaki and Une (2005) [19] claimed that infectious trash might be rendered noninfectious by using methods such as sterilizing and incineration. After undergoing this process, infectious trash can be buried in a sanitary landfill. Despite the fact that many countries and government agencies, including the World Health Organization (1983), the US Environmental Protection Agency (1986, 1991), the US Centers for Disease Control and Prevention (1978), and Germany, have established strict guidelines for hospitals and medical institutions regarding the collection, transportation, storage, and disposal of HCW, little attention is paid to the management of HCW, and rules are largely unenforced. 18% to 64% of healthcare facilities in 22 developing countries, according to a report conducted by the World Health Organization [23] use unsuitable waste disposal practices.

One laboratory was the only one with an incinerator for infectious trash. Prior to disposal, sharps waste was autoclaved in 33 (30.3%) laboratories. In 69 (63.3% of laboratories), autoclaving other types of infectious waste before disposal was more common. Twenty-two laboratories (20.1%) saw human tissue as contagious trash and discarded it alongside their other infectious garbage. In certain instances, blood, bodily fluids, feces, and urine were disposed of using special procedures. In 48 laboratories, blood and bodily fluids were discharged directly into a sanitary sewage system. Nine laboratories disinfected blood and bodily fluids prior to disposal in sanitary sewers [24]. 51 laboratories mixed blood and other body fluids with infectious trash. Ninety-six of the 109 laboratories that participated obtained feces and urine samples. In 4.6% and 68.2% of the instances, feces and urine were disposed of through the sewage system. Six laboratories combined feces and urine with a disinfectant solution prior to sanitary sewer disposal. In 24% of laboratories, feces and urine were disposed of with other contagious waste, and in 2.8% of laboratories, they were disposed of with residential garbage. Blood-soaked cotton and paper, as well as dirty but not blood-soaked cotton and paper, were considered infectious waste by the vast majority of laboratories (96 and 90%, respectively). No significant correlation was found between personnel training and the performance of clinical laboratories in terms of waste collection ($p = 0.073$) or waste disposal ($p = 0.776$) in the present investigation. There was no correlation between managerial training and the scores for garbage collection ($p = 0.244$) or waste disposal ($p = 0.194$) [24.25]. Discussion There is limited information regarding the treatment of clinical laboratory waste worldwide. Proper medical waste management necessitates the formulation of recommendations for waste generation, particularly with respect to internationally agreed classifications for diverse types of infectious waste and their associated disease transmission potentials [26]. The creation of medical waste differs between and sometimes even within countries. The types and quantities of trash generated can vary based on the type of medical facility, the number of beds, the socioeconomic and cultural standing of the patients, and the waste management methods. Most facilities regard as infectious microbiological cultures, human tissues and fluids, materials or solutions that contain blood that is free-flowing or expressible, and waste immediately generated during specimen processing. This is not always extended to feces and pee, though [27]. A study of 14 diagnostic centres out of 59 healthcare institutions in Bangladesh revealed a daily creation rate of 292 kg1, with 49% general waste, 19.52 percent infectious waste, and 2.06 percent sharp objects. Domestic garbage comprised the biggest portion of diagnostic center waste [28]. Similar results were discovered in this investigation. In a second research of medical waste management, 22 Brazilian clinical laboratories participated. (Da Silva et al., 2005). In 14% of the clinical laboratories, hazardous materials were segregated. There was a total production of 6380 kg month 1 of waste, including 2449 kg month 1 (38.4%) of infectious biological waste. This result closely resembles the findings of this study (infectious waste equals 43.2%). Brazilian clinical laboratory oratories collected waste between two and five times per week, which is less frequently than in the present investigation. In the study by Da Silva and colleagues, internal and outdoor storage rooms were available in around 50% and 40% of clinical laboratories, respectively. In both Brazilian and Iranian centers, sharps waste was disposed of in puncture-resistant containers.

CONCLUSION:

The method for capturing and making available expired reagents through the CWE is favorable, as it contributes to the management of waste generated periodically and liabilities discovered over the years by laboratories. The current techniques for processing, transporting, storing, and disposing of hospital and medical laboratory wastes must be altered and significantly improved. Nearly all healthcare facilities in the research area conduct inadequate waste management, and there are no recycling or environmental measures accessible. Typically, the handling of these pollutants is delegated to personnel with little education who execute all tasks without suitable training or supervision and inadequate protection. In all of the hospitals and medical laboratories assessed, segregation and categorization procedures for generated trash were found to be lacking. The healthcare waste is still discharged and commingled with household waste, which is collected, transported, and disposed of in a manner comparable to that of normal municipal solid waste.

REFERENCES:

1. Figuerêdo DV (eds) (2006) Manual para Gestão de Resíduos Químicos Perigosos de Instituições de Ensino e Pesquisa. Conselho Regional de Química de Minas Gerais.
2. Kihampa C and Hellar-Kihampa H (2015) Environmental and public health risks associated with chemical waste from research and educational laboratories in Dar es Salaam, Tanzania. Journal of Chemical Health and Safety 22: 19–25.
3. Do Couto HAR, Guimarães RR and Pamplona AMSR (2010) Normas para o Gerenciamento de Resíduos de Laboratórios da Embrapa Amazônia Ocidental - Empresa Brasileira de Pesquisa Agropecuária. Available at: https://www.infoteca.cnptia.embrapa.br/infoteca/handle/doc/882377
4. Arab M, Baghbani RA, Tajvar M, Poureza A, Omrani G and Mahmoudi M (2008) Report: the assessment of hospital waste management: a case study in Tehran. Waste Management & Research 26: 304–308.
5. Askarian M, Vakili M and Kabir G (2004a) Hospital waste management status in university hospitals of the Fars province, Iran. International Journal of Environmental Health Research 14: 295–305.
6. Askarian M, Vakili M and Kabir G (2004b) Results of a hospital waste survey in private hospitals in Fars province, Iran. Waste Management 24: 347–352.
7. Askarian M, Heidarpoor P and Assadian O (2010) A total quality management approach to healthcare waste management in Namazi Hospital, Iran. Waste Management 30: 2321–2326.
8. Bdour A, Altrabsheh B, Hadadin N and Al-Shareif M (2007) Assessment of medical wastes management practice: A case study of the northern part of Jordan. Waste Management 27: 746–759.
9. Chitnis V, Vaidya K and Chitnis DS (2005) Biomedical waste in laboratory medicine: Audit and management. Indian Journal of Medical Microbiology 23: 6–13.
10. Department for Environment, Food and Rural Affairs (Defra), 2005. Guidance on mixing hazardous waste hazardous waste regulations. London, United Kingdom.
11. Diaz, L.F., Savage, G.M., Eggerth, L.L., 2005. Alternatives for the treatment and disposal of healthcare wastes in developing countries. Waste Management 25 (6), 626–637.

12. Hijazi, A., 1998. Solid and hazardous waste management in Jordan, M.Sc. Thesis, University of Newcastle, UK.
13. Karademir, A., 2004. Health risk assessment of PCDD/F emissions from a hazardous and medical waste incinerator in Turkey. Environment International Journal 30, 1027–1038.
14. Qusus, K.S., 1988. Composition and generation rate of the solid waste of hospitals and medical laboratories in Amman – Jordan, M.Sc. thesis, University of Jordan, Jordan.
15. Rushbrook, Ph., Chandra, C., Gayton, S., 2000. Starting healthcare waste management in medical institution, practical approach. World Health Organization (WHO) Healthcare Practical Information Series No. 1.
16. SAS Institute, 1999. User's Guide: Statistics, Version 8.2. Statistical Analysis System, Inc., Cary, NC.
17. Silva, C.E., Hoppe, A.E., Ravanello, M.M., Mello, N., 2005. Medical waste management in the south of Brazil. Waste Management 25 (6), 600–605.
18. Taghipour H and Mosaferi M (2009) The challenge of medical waste management: A case study in northwest Iran-Tabriz. Waste Management & Research 27: 328–335.
19. Miyazaki M and Une H (2005) Infectious waste management in Japan: A revised regulation and a management process in medical institutions. Waste Management 25: 616–621.
20. Taru P and Kuvarega AT (2005) Solid medical waste management. The case of Parirenyatwa Hospital, Zimbabwe. Revista Biomedica 16: 153–158.
21. Tesfahun E, Kumie A, Legesse W, et al. (2014) Assessment of composition and generation rate of healthcare wastes in selected public and private hospitals of Ethiopia. Waste Management & Research 32: 215–220.
22. Bazrafshan E and Mostafapoor KF (2011) Survey of medical waste characterization and management in Iran: A case study of Sistan ans Baluchestan Province. Waste Management & Research 29: 442–450.
23. Pilkington A and Liston-Heyes C (1999) Is production and operations management a discipline? A citation/co-citation study. International Journal of Operations and Production Management 19: 7–20.
24. Bo D, Zhang F-S and Zhao L (2009) Influence of supercritical water treatment on heavy metals in medical waste incinerator fly ash. Journal of Hazardous Materials 170: 66–71.
25. Brewerton P and Millward L (2001) Organizational Research Methods: A Guide for Students and Researchers. London: SAGE Publications.
26. Chaerul M, Tnaka M and Shekdar VA (2008) A system dynamics approach for hospital waste management. Waste Management 28: 442–449.
27. Chen Y, Ding Q, Yang X, et al. (2013a) Application countermeasures of nonincineration technologies for medical waste treatment in China. Waste Management & Research 31: 1237–1244.
28. Hassan MM, Ahmed SA, Rahman KA and Biswas TK (2008) Pattern of medical waste management: existing scenario in Dhaka City, Bangladesh. BMC Public Health 8: 36.
29. Klewitz J and Hansen GE (2014) Sustainability-oriented innovation of SMEs: A systematic review. Journal of Cleaner Production 65: 57–75.
30. Longe EO (2012) Healthcare waste management status in Lagos State, Nigeria: a case study from selected healthcare facilities in Ikorodu and Lagos metropolis. Waste Management & Research 30(6): 562–571.