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Analysis of Infectious Waste Management at Dental and Oral Hospital of North Sumatra University

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ABSTRACT
Hazardous medical waste management requires sustainable practices that integrate social, economic, technical, and environmental aspects. Approximately 10–25% of medical waste is categorized as hazardous and poses significant health risks. This study aims to analyze the management of infectious waste at the Dental and Oral Hospital of North Sumatra University. The research is qualitative with a case study approach. Informants were selected using purposive sampling based on specific criteria. Data were analyzed thematically using the Miles and Huberman model. Findings show that infectious waste commonly found at the Dental and Oral Hospital of North Sumatra University includes masks, gloves, bandages, tissues, syringes, and gowns. The hospital's waste management practices align with the Indonesian Ministry of Environment and Forestry Regulation No. P.56 of 2015. Human resources involved in waste management at Dental and Oral Hospital of North Sumatra University include one Head of Medical and Non-Medical Services, Medical Support, and Nursing at Dental and Oral Hospital of North Sumatra University, two staff members, and four operational officers.The study concludes that the management of infectious waste at Dental and Oral Hospital of North Sumatra University—covering sorting, transportation, storage, destruction, and final disposal—is functioning adequately. However, improvements can still be made. It is recommended that Dental and Oral Hospital of North Sumatra University acquire its own waste destruction equipment to minimize accumulation and enhance efficiency. Additionally, increasing the number of personnel in the waste management division is advised to support more effective operations.
Keywords: *Hazardous Medical Waste, Management Waste, Infectious.*

INTRODUCTION
The rapid advancement of technology in recent years has significantly increased public awareness and concern for health and healthcare services. People now seek to maintain optimal health—physically, mentally, and spiritually—prompting a higher demand for professional and reliable medical services. This growing demand is reflected in the increased number of healthcare facilities across Indonesia. According to data from the Central Bureau of Statistics (BPS) in 2021, the number of hospitals in Indonesia rose by 5.17% from 2,959 units in 2020 to 3,112 units in 2021. This expansion of healthcare infrastructure has, in turn, led to a substantial rise in medical waste generation. The healthcare sector, including dental and oral hospital, is a major contributor to medical waste, much of which is unavoidable due to the nature of clinical procedures. Dental care plays a critical role in overall individual and public health but also results in various types of infectious and hazardous medical waste. The World Health Organization (WHO) reported that Southeast Asian countries collectively

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generate approximately 350,000 tons of medical waste annually. In Indonesia alone, as of June 2020, more than 1,100 tons of infectious medical waste had been recorded.

Medical waste—especially that categorized as hazardous (B3 waste)—poses serious health and environmental risks due to its infectious, toxic, reactive, and sometimes radioactive properties. Improper handling and disposal can lead to disease transmission, including HIV, Hepatitis B, and Hepatitis C, as well as broader ecological harm. Despite regulatory frameworks in place, the implementation of proper medical waste management practices in many Indonesian healthcare facilities remains inadequate. Issues commonly observed include improper waste segregation, insufficient containment, unsafe transport, and disposal practices that violate established protocols.

The Dental and Oral Hospital of North Sumatra University, as both a healthcare provider and a professional training institution for dentistry under Government Regulation No. 93 of 2015, holds a significant responsibility in managing the medical waste it generates. With ten operational clinical departments serving the public—including oral and maxillofacial surgery, orthodontics, prosthodontics, pediatric dentistry, and others— Dental and Oral Hospital of North Sumatra University produces a variety of clinical waste that requires careful and compliant handling.

Given the urgency of the issue, this study aims to evaluate and analyze the management of infectious medical waste at Dental and Oral Hospital of North Sumatra University. The findings are expected to provide a practical overview of current waste handling procedures and contribute to the development of a more effective, safe, and environmentally sustainable waste management system within academic hospital settings.

METHODS

This study is a descriptive research using a qualitative method. Supporting data were collected through interviews, direct observation, and document review. The primary objective of this research is to identify potential solutions and address challenges related to the management of hazardous medical waste (B3 waste) within the environment of the Dental and Oral Hospital, of North Sumatera University.

Descriptive research is designed to provide an objective and systematic overview of a particular condition or phenomenon. In this study, three informants were involved: one key informant, namely the Head of Medical and Non-Medical Services, Medical Support, and Nursing at Dental and Oral Hospital of North Sumatra University; one staff member from a third-party waste management provider; and one environmental sanitation officer from Dental and Oral Hospital of North Sumatra University.

RESULTS

The Dental And Oral Hospital Of North Sumatra University Was Established As A Facility For The Professional Education Of Dentists And Specialist Dentists Based On Government Regulation No. 93 Of 2015 Concerning Teaching Hospitals. Dental And Oral Hospital Of North Sumatra University Provides Infrastructure And Facilities In Accordance With Its Functions, Which Include Delivering Basic And Specialized Dental Medical Services, Supporting Services, Referral Services, Emergency Care, As Well As Conducting Research And Development.

A. Characteristics of Infectious Waste Generated at the Dental and Oral Hospital of Universitas Sumatera Utara.

Observations indicate that the types of infectious waste commonly found at Dental and Oral Hospital of North Sumatera University include used face masks, gloves, gauze, tissues, syringes, and disposable gowns (Ngete et al., 2020).

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B. Analysis of Infectious Waste Management at the Dental and Oral Hospital of North Sumatera University

This study involved three informants: one key informant who serves as the Head of Medical and Non-Medical Services, Medical Support, and Nursing Dental and Oral Hospital of Universitas Sumatera Utara.; one staff member from a third-party waste management provider; and one environmental sanitation officer from Dental and Oral Hospital of Universitas Sumatera Utara.

C. Analysis of Infectious Waste Management at the Dental and Oral Hospital of North Sumatera University

1. Segregation and Containment

This stage involves separating infectious waste from non-infectious waste and placing it into appropriately labeled and color-coded containers in accordance with standard health protocols (Andri et al., (2021).

2. Transportation

Waste is transported from the point of generation to a temporary storage area using designated trolleys or containers that ensure safety and prevent contamination (Zulhijah et al., (2022).

3. Storage

Infectious waste is temporarily stored in a designated, secure, and well-ventilated area before being handed over to an authorized waste disposal service (Come et al., (2022).

4. Destruction

Destruction of infectious waste is typically carried out through incineration or other approved treatment methods that ensure complete neutralization of hazardous components. (Andri et al., (2021).

5. Burial and Landfilling

Residual waste that cannot be further treated may be disposed of through burial or landfilling in compliance with government regulations and environmental standards (Ciawi et al., 2024).

D. Observation Results on the Management of Infectious Waste at RSGM USU in Relation to the Regulation of the Minister of Environment and Forestry No. 56 of 2015

The observation results regarding the management of infectious waste at the Dental and Oral Hospital of North Sumatera University were assessed in reference to the Regulation of the Minister of Environment and Forestry No. 56 of 2015. The complete findings of this research are presented in Table 4.6 below.

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Stages	No	Criterion	Realization	Analysis Results
Sorting and Containerization	1	Sorting at the source (producer) of waste, carried out as close as possible to the source of waste, sorting is carried out during collection, storage and transport	√	appropriate
	2	Sorting is carried out by separating B3 waste based on type, group, and/or characteristics of B3 waste	√	appropriate
	3	Accommodating B3 waste according to the waste group	√	appropriate
	4	The container used is made of rust-resistant, waterproof, strong and resistant to sharp objects	√	appropriate
	5	The container or trash can has a lid that is easy to open, coated with a plastic bag as a garbage wrapper according to the category and is distinguished between medical and non-medical trash cans	√	appropriate
	6	The trash can is always lined with plastic bags with colors according to the waste group	√	appropriate
	7	The trash can is given a symbol according to the waste group	√	appropriate
	8	Only medical B3 waste is put in a container lined with a yellow plastic bag with the symbol "biohazard"	√	appropriate
Transport	1	The process of transporting solid medical waste from the garbage can to the temporary shelter using a conveyor in the form of a trolley or a container resistant to sharp objects, is easy to load and unload waste, and easy to clean	√	appropriate
	2	Vehicles used to transport solid medical waste must not be used to transport other materials	√	appropriate
	3	If there is no means of transport, a separate tub or bag must be provided to which the bag must be tied	√	appropriate

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	4	Solid medical waste collection from containers is carried out when it is 3/4 full or no later than 12 hours then packaged and tied tightly	√	appropriate
	5	Medical B3 waste that has been tied every 12 hours in containers must be transported and stored in a B3 waste disposal or special place	√	appropriate
	6	Waste transport officers are required to use complete PPE	√	appropriate
Storage	1	The solid medical waste storage location is a flood-free area and not prone to natural disasters	√	appropriate
	2	The garbage collection must have a floor that is watertight, with concrete or cement floors with a good drainage system and is easy to clean and disinfect	√	appropriate
	3	Water source available for cleaning, easily accessible for waste storage and lockable to avoid access by uninterested parties, easily accessible by waste transport vehicles	√	appropriate
	4	Inaccessible to animals, insects and birds, equipped with good and adequate ventilation and lighting, being far from food storage or preparation	√	appropriate
	5	Cytotoxic waste should be stored separately from other waste and placed in a safe storage location	√	appropriate
	6	For solid medical waste that cannot be processed directly, the waste can be stored using a freezer / coldstrorage which can be set to a temperature below 0°C in the temporary garbage shelter	√	appropriate
Destruction	1	Solid medical waste treatment can use incinerators/autoclaves/micro ng races. In an emergency, the use of such equipment is exempt from having a permit	√	appropriate
	2	For health facilities that use autoclaves/microwaves, the residue agar is packaged in a	√	appropriate

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		strong container. Residues can be buried by construction stipulated in the regulation of the Minister of Environment and Forestry P.56 of 2015		
	3	For health facilities that do not have such equipment, they can immediately carry out burials with the following steps: a. Waste is densified first with 0.5% chlorine-based disinfectant b. Waste is destroyed so that it does not have its original shape so that it is no longer used c. Buried with the construction stipulated in the Minister of Environment and Forestry Regulation P.56 of 2015	√	appropriate
Hoarding/ burial	1	The construction of the burial is in accordance with the Minister of Environment and Forestry Regulation P.56 of 2015	√	appropriate
	2	Solid medical waste treatment can use 3rd party services both for the processing process and ash from incinerator combustion	√	appropriate
	3	Solid medical waste stockpiles/volumes are recorded daily in the logbook and reported to the Environment Agency every 6 months	√	appropriate
	4	Health care facilities that have waste treatment equipment can receive medical b3 waste from other health care facilities	√	appropriate

DISCUSSION

A. Characteristics of Infectious Waste Generated at the Dental and Oral Hospital of North Sumatra University

Infectious waste includes any material contaminated with pathogens that poses a risk of disease transmission, such as used gauze, blood-stained cotton, and medical tools. At RSGM USU, the most frequently observed infectious waste items include masks, gloves, gauze, tissues, syringes, and used medical gowns. The type of infectious waste generated can vary based on the hospital's services, indicating the need for tailored waste management strategies

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to prevent cross-contamination and disease transmission (Ngete et al., 2020; Ciawi et al., 2024).

B. Management of Infectious Medical Waste at the Dental and Oral Hospital of North Sumatra University

Proper medical waste management is essential to prevent environmental pollution and reduce health the management of infectious medical waste at the Dental and Oral Hospital, North Sumatera University, follows a systematic process based on national regulations,

particularly the Indonesian Ministry of Environment and Forestry Regulation No. P.56/2015. According to the Head of Medical and Non-Medical Services, Medical Support, and Nursing at Dental and Oral Hospital of North Sumatra University, waste handling is conducted in accordance with established standard operating procedures (SOPs), including the use of personal protective equipment (PPE) such as gloves and masks. However, waste disposal is outsourced to a third-party service provider, PT Adhi Karya. The medical waste management system comprises five key stages: segregation and containment, transportation, temporary storage, destruction, and final disposal. Each stage is critical to ensuring effective, safe, and environmentally sound waste handling.

1. Segregation and Containment

The initial phase involves segregating medical waste at the source. Waste materials from different hospital units are separated and placed into color-coded containers according to their type. For example, sharps (Group B) such as syringes and scalpels are placed in puncture-proof safety boxes, while soft infectious waste (Group C) like gauze, gloves, and blood-contaminated materials are placed in red plastic bags. Non-infectious waste is stored in black bags labeled accordingly. This practice aligns with both the P.56/2015 Regulation and best practices reported in previous studies (Andri et al., 2021; Come et al., 2022). Proper segregation at this stage reduces cross-contamination risks and streamlines downstream waste handling.

2. Transportation

Infectious waste is transported using designated trolleys to specialized collection vehicles. According to interviews, the collection and transportation are handled biweekly by PT Adhi Karya under a formal agreement. Regular and scheduled transport is crucial in preventing waste accumulation and minimizing the potential for pathogen spread. These findings are consistent with previous research, such as that by Zulhijah et al. (2022), which also highlights the importance of consistent collection schedules.

3. Temporary Storage

Before final disposal, medical waste is stored temporarily in a designated Temporary Storage Facility. In some cases, cold storage units (<0°C) are used to preserve waste that cannot be immediately processed. National health regulations (Kepmenkes No. 1204/MENKES/SK/X/2004) stipulate that medical waste should not

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be stored at room temperature for more than 24 hours. However, RSGM USU stores waste for more than 24 hours due to the absence of an on-site incinerator, with disposal occurring twice a week. This situation suggests the need for investment in internal treatment facilities to ensure timely processing and reduce environmental health risks.

4. Destruction

Medical waste is incinerated by the third-party provider, PT Adhi Karya. Incineration remains the most widely adopted method in Indonesia due to its ability to reduce waste volume and destroy pathogens effectively (Syaichurrozi & Fatikhin, 2025). However, the process generates ash containing heavy metals, which requires proper post-treatment to prevent environmental contamination (Ciawi et al., 2024). Autoclaving, as an alternative method, is often considered more cost-effective and environmentally friendly for certain types of infectious waste. While RSGM USU currently relies on external incineration, internal adoption of appropriate waste destruction technologies could help reduce operational costs and improve waste handling efficiency.

5. Final Disposal (Burial and Landfilling)

The residual ash from incineration is buried in secure and designated locations in compliance with Ministry regulations. Unlike some healthcare facilities where waste residues are disposed of improperly (Andri et al., 2021), RSGM USU ensures proper burial of incinerator ash and pathological waste such as body parts and sharps, following environmental safety guidelines (Ciawi et al., 2024). Strict monitoring of these burial sites is essential to prevent contamination and ensure public safety. Overall, the infectious medical waste management system at RSGM USU largely adheres to national regulations and best practices. However, reliance on third-party services for destruction poses both financial and operational challenges. Investing in on-site treatment technologies—such as autoclaves or incinerators—could enhance efficiency, ensure regulatory compliance, and reduce long-term operational costs. Each stage of the waste management process plays a vital role in safeguarding public health and protecting the environment.

c. Characteristics of Human Resources in the Waste Management Division at the Dental and Oral Hospital of North Sumatra University

Based on the findings of this study, the human resources working in the waste management unit at the Dental and Oral Hospital of North Sumatera University, consist of non-medical personnel. This includes one Head of Medical and Non-Medical Services, Medical Support, and Nursing at Dental and Oral Hospital of North Sumatera University, two environmental health staff members, and four operational workers, all of whom have received prior training. These results are in line with the study conducted by Andri et al. (2021), which reported that the number of personnel in the waste management unit at Rafflesia Hospital, Bengkulu, was still insufficient. The researchers assume that the limited number of personnel has contributed to the incomplete implementation of infectious waste management

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procedures, posing a significant challenge. A lack of trained personnel can lead to greater resistance to change. In fact, medical waste comprises only about 10–50% of the total waste generated by hospitals (Ciawi et al., 2024).

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