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Implementation of Area-Based Medical Waste Management at Dr. Komang Makes Naval Hospital

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ABSTRACT

Medical waste management is an essential component of hospital healthcare services. This study analyzed the implementation of area-based medical waste management in accordance with Regulation of the Minister of Health of the Republic of Indonesia Number 18 of 2020 at Dr. Komang Makes Indonesian Navy Hospital, Belawan. A qualitative descriptive approach was employed. Data were collected through in-depth interviews, observations, and documentation involving eight purposively selected informants comprising key, main, and supporting informants. The management process included waste segregation, transportation, temporary storage, and final treatment in collaboration with third parties. Overall, implementation was consistent with applicable regulations and supported by internal policies, management commitment, infrastructure, budget allocation, and integration with quality improvement, Infection Prevention and Control, and Occupational Health and Safety programs. However, several challenges remained, including inadequate waste containers during periods of high patient volume, limited capacity of the hazardous waste Temporary Storage Facility, and delays in third-party transportation caused by logistical and geographical constraints. The hospital should strengthen source-based segregation, optimize hazardous waste storage capacity, and improve operational supervision, particularly in high-workload units. The study concludes that medical waste management was generally aligned with Regulation of the Minister of Health Number 18 of 2020. Continuous improvement is required to address increasing waste volumes and regional coordination challenges

Keywords: *Medical waste management; hospital; Regulation of the Minister of Health Number 18 of 2020; policy implementation; regional-based approach*

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INTRODUCTION

Occupational diseases and accidents remain significant problems for workers. Hospitals are workplaces at risk of occupational diseases, work-related accidents, and environmental pollution. The California State Department of Industrial Relations reported that the average hospital accident rate was 16.8 lost workdays per 100 workers. In 2004, 65.4% of hospital cleaning service workers in Jakarta experienced irritant contact dermatitis on their hands. A study conducted by Dr Joseph from 2005 to 2007 reported that needlestick injuries occurred in 38–73% of healthcare workers (1).

Under Minister of Health Regulation No. 7 of 2019, hospitals, as healthcare facilities, must comply with applicable environmental health requirements. Hospitals generate substantial amounts of waste from medical and non-medical activities, much of which may be hazardous and toxic and may adversely affect the environment. Under Government Regulation No. 101 of 2014, medical solid waste is classified as hazardous and toxic waste (B3), which may pose risks to human health, occupational safety, environmental quality, and disease transmission. Therefore, hospitals are required to manage B3 medical waste properly and in accordance with applicable regulations (2).

Government Regulation of the Republic of Indonesia No. 74 of 2001 concerning the Management of Hazardous and Toxic Materials defines B3 waste management as a series of activities involving the distribution, transportation, storage, production, use, and disposal of hazardous and toxic materials. Article 4 stipulates that every party involved in B3 management must prevent pollution and environmental damage. Notoatmodjo defines a healthy environment as an optimal environmental condition that positively contributes to the achievement of a high standard of health (3).

Nevertheless, the management of B3 waste generated by healthcare facilities remains a concern. Monitoring reports have identified several problems, including open dumping, unauthorized treatment, incineration that fails to meet quality standards, inadequate waste-

treatment services, improper storage, waste accumulation, unsuitable storage facilities, and the discontinuation of incinerator operations because of licensing problems. These conditions have contributed to the accumulation of hospital-generated B3 waste (4).

The potential risks associated with medical waste may arise from the point of generation through segregation, packaging, collection, temporary storage, transportation, disposal, and destruction. Improperly managed medical waste can cause environmental pollution, reduce environmental quality, and threaten human health because it may contain bacteria, viruses, chemicals, and heavy metals. Exposure may occur directly through contact with the waste or indirectly through decomposition, incineration, and disposal processes (5).

Preliminary observations at Dr. Komang Makes Indonesian Navy Hospital indicated that medical waste management practices were not fully compliant with established regulatory requirements. The observed problems included inadequate use of personal protective equipment and storage facilities that did not meet prescribed standards. The limited availability of qualified environmental health personnel further increased the risk of inadequate medical waste management.

Therefore, this study analyzed the implementation of area-based medical waste management in accordance with Minister of Health Regulation No. 18 of 2020 using a qualitative research approach. The findings are expected to provide a comprehensive assessment and evidence-based recommendations for improving medical waste management at Dr. Komang Makes Indonesian Navy Hospital and for protecting healthcare workers, patients, and the environment.

METHODS

This study used a descriptive research design with a qualitative approach to provide a comprehensive description and explanation of the implementation of area-based medical

waste management. The study was conducted at Dr. Komang Makes Indonesian Navy Hospital, Medan Belawan District, Medan City, North Sumatra, from July 2025 to March 2026. Data collection was carried out during this period through direct observation, semi-structured interviews, and document review.

Participants were selected using purposive sampling, a non-probability sampling technique used to identify informants with relevant knowledge, experience, and involvement in medical waste management. Eight informants participated in the study and were categorized according to their roles and level of involvement. The key informants consisted of the Head of Dr. Komang Makes Indonesian Navy Hospital and the officer responsible for medical waste management (W1–W2). The primary informants consisted of one cleaning service worker, one inpatient nurse, one emergency department nurse, and one pharmacy staff member (W3–W6). The supporting informants consisted of one representative of the third-party medical waste transportation and processing service and one representative of the Hospital Quality Committee/Risk Management team (W7–W8). Informants were included if they were directly involved in, responsible for, or knowledgeable about medical waste management and willing to participate in the study.

Data were collected through direct observation, semi-structured interviews, and document review. Before the interviews began, the researcher explained the research objectives, interview procedures, confidentiality provisions, and the voluntary nature of participation to each informant. The interviews were conducted individually using an interview guide developed according to the research objectives and the provisions of Minister of Health Regulation No. 18 of 2020. The questions addressed medical waste segregation, packaging, collection, transportation, temporary storage, final treatment, availability of facilities and equipment, staff responsibilities, supervision, cooperation with third-party service providers, and implementation barriers. Each question was explained clearly, and follow-up questions were asked when additional clarification was required.

With the informants' consent, the interviews were recorded and supplemented with field notes. Observations were conducted to assess medical waste management practices and facilities, while relevant hospital policies, records, and reports were reviewed to support the interview and observation findings.

The data were analyzed manually using a systematic thematic process. The recorded interviews were transcribed and reviewed repeatedly to identify relevant statements and recurring patterns. The data were then coded and categorized according to the stages of medical waste management and compared with the requirements of Minister of Health Regulation No. 18 of 2020. Information obtained from interviews, observations, and documents was triangulated to assess the consistency of the findings. The results were presented in narrative form, and conclusions were drawn inductively based on the themes and patterns identified during the analysis.

RESULTS

The research findings were obtained through observation, in-depth interviews, and documentation involving informants consisting of the Head of Naval Hospital (Karumkital), the Person in Charge of Medical Waste Management, the Hospital Quality/ Risk Management Committee, inpatient nurses and emergency department nurses, pharmacy staff, cleaning service personnel, and third-party medical waste management providers.

This qualitative study was conducted at Dr. Komang Makes Belawan Naval Hospital, employing a purposive sampling technique to select informants who possessed knowledge and direct involvement in medical waste management. A total of eight informants were included, consisting of key, primary, and additional informants. The characteristics of the informants are presented to demonstrate their competence and roles in the medical waste management process, as well as to strengthen the credibility and validity of the data, thereby reflecting the actual conditions of implementation in the field.

Observation and Interview Results

The findings indicate that medical waste management at Dr. Komang Makes Belawan Naval Hospital is generally supported by clear policies and strong management commitment. The hospital's medical waste management policies refer to Minister of Health Regulation No. 18 of 2020 and are implemented through standard operating procedures covering waste segregation at the unit level, internal transportation, temporary storage, and cooperation with licensed third-party providers. The hospital has also established a Hospital Occupational Health and Safety Committee (K3RS) and an Environmental Sanitation Unit. Medical waste management is integrated into the hospital's quality management system, Infection Prevention and Control (PPI), and K3RS programs, with indicators evaluated regularly. Management supports implementation by providing facilities, infrastructure, and budget allocations for medical waste treatment and disposal.

"Our policies clearly refer to regulations from the Ministry of Health, including Minister of Health Regulation No. 18 of 2020. We have comprehensive standard operating procedures (SOPs), ranging from waste segregation at the unit level, internal transportation, to temporary storage at the hazardous waste (B3) facility. For implementation, there is an official decree appointing the Hospital Occupational Health and Safety (K3RS) Team and the Environmental Sanitation Unit." (W1, Head of the Hospital, 2026)

The area-based approach to medical waste management has particular characteristics because the hospital is located in a coastal area and operates as a military hospital. Its implementation requires coordination with several stakeholders, including the Medan Municipal Government, the Regional Environmental Agency (DLH), port authorities, and the Indonesian Navy Regional Command I (Kodaeral I). The limited availability of licensed medical waste treatment facilities in North Sumatra remains a major constraint. Consequently, the hospital depends on the shipment of medical waste to treatment facilities outside the region, which increases operational costs and creates the possibility of delays due to logistical and weather-related conditions.

"For us, 'area-based' means that, in addition to complying with the regulations of the Medan Municipal Government and the Regional Environmental Agency (DLH), we also coordinate with the port authorities and Naval Regional Command I (Kodaeral I)." (W1, Head of the Hospital, 2026)

Compliance with medical waste management requirements is assessed through several operational indicators, including the accuracy of waste segregation, the fill limit of safety boxes, and the storage duration at the hazardous waste (B3) Temporary Storage Facility (TPS). Supervision is carried out through daily observations and monthly audits conducted by the K3RS and PPI teams. The hospital also applies a structured incident-management system. Errors in waste segregation are addressed immediately, while needlestick injuries are classified as occupational safety incidents and reported according to the applicable standard operating procedure. This mechanism enables the hospital to provide appropriate follow-up care and prophylaxis for affected workers.

"If any waste is incorrectly segregated, we immediately reprimand the head of the unit on the same day. In the event of a needlestick injury, it is classified as an occupational safety incident, and there is a standard operating procedure (SOP) for reporting to the Hospital Occupational Health and Safety Committee (K3RS) and the Medical Committee to ensure appropriate prophylaxis for the affected staff member." (W1, Head of the Hospital, 2026)

The medical waste management process follows an end-to-end workflow consisting of segregation at the source, collection using closed trolleys, transportation through designated internal routes, storage at the hazardous waste (B3) Temporary Storage Facility, and final handover to a licensed third-party provider for treatment and disposal. The most common types of medical waste are infectious waste and sharps, which are mainly generated in inpatient wards and the emergency department. Infectious waste includes used gauze, gloves, and single-use personal protective equipment, while sharps waste primarily consists of used syringe needles.

"The most abundant waste types are infectious materials such as gauze, used gloves, and single-use personal protective equipment (PPE), followed by syringe needle waste. The

largest contributors are the inpatient wards and the emergency department." (W2, Person Responsible for Medical Waste Management, 2026)

Waste segregation is performed at the point of generation using a color-coded system and labeled containers. Infectious waste is placed in yellow plastic bags, sharps are disposed of in safety boxes, pharmaceutical waste is placed in brown containers, and domestic waste is placed in black bags. The containers are labeled with the name of the responsible unit and the collection date. Although the segregation system has generally been implemented in accordance with the applicable standards, challenges remain when waste volumes increase. During periods of high patient volume, the availability of waste containers may be insufficient, and errors in segregation may occur. However, these errors can be identified and corrected through routine supervision.

"Segregation is conducted in accordance with standards: infectious waste is placed in yellow plastic bags, sharps in safety boxes, pharmaceutical waste in brown containers, and domestic waste in black bags. All containers are labeled with the unit name and collection date." (W2, Person Responsible for Medical Waste Management, 2026)

Internal transportation is conducted by trained personnel using closed trolleys and designated routes to minimize the risk of exposure to medical waste. Access to the hazardous waste (B3) Temporary Storage Facility is restricted, and daily records are maintained systematically. Nevertheless, delays in waste collection by third-party providers remain a challenge, particularly when waste must be transported outside North Sumatra. The hospital addresses this issue through collection scheduling, regular coordination with service providers, and monitoring of storage duration and temperature requirements.

The hospital has identified several priorities for improving medical waste management. These priorities include upgrading the hazardous waste (B3) Temporary Storage Facility, increasing its capacity to accommodate waste during transportation delays, and strengthening training programs for cleaning service personnel. The need for additional

training is particularly important because of the relatively high turnover of cleaning service staff. At the regional level, government support is also needed to establish a licensed medical waste treatment facility in North Sumatra. Such a facility could reduce dependence on interregional waste shipment and help address the operational costs, transportation delays, and geographical constraints encountered by the hospital.

"Our priority moving forward is to improve the conditions of the hazardous waste (B3) Temporary Storage Facility (TPS) to make it more adequate and ensure its capacity can accommodate waste in the event of transportation delays. We also plan to upgrade training programs for cleaning service personnel, as there is frequently high staff turnover." (W1, Head of the Hospital, 2026)

Participant Quotes:

"Our recommendations include increasing the frequency of training, improving temporary storage facility (TPS) infrastructure and transportation routes, and strengthening collaboration with local government authorities and third-party providers to ensure that this area-based waste management system is safer and compliant with regulatory requirements." (W8, Quality Assurance Committee, 2026)

DISCUSSION

Area-Based Medical Waste Management in Accordance with the Provisions of the Indonesian Ministry of Health Regulation No. 18 of 2020, Implementation of Segregation, Collection, and Temporary Storage of Medical Waste in Hospitals, and Mechanisms for Supervision, Documentation, and Reporting of Medical Waste Management.

Conceptually, RS TNI AL Dr. Komang Makes has adopted a medical waste management system in accordance with Ministry of Health Regulation No. 18 of 2020, supported by internal regulations, team establishment, and clear standard operating procedures (SOPs). Area-based implementation is reflected in cross-sectoral coordination involving civilian agencies, military institutions, and port authorities. At the operational level, waste

segregation, transportation, and storage are conducted in accordance with standards, supported by shared understanding among staff and dual-control mechanisms. The documentation and supervision system is integrated into quality and risk management through performance indicators and incident reporting. However, challenges remain, including segregation errors during periods of high workload, limited temporary storage facility (TPS) capacity, dependence on third-party providers, and the complexity of cross-sectoral coordination and reporting systems that are not yet fully integrated.

Constraints and Improvement Efforts in the Implementation of Medical Waste Management

The implementation constraints of medical waste management at RS TNI AL Dr. Komang Makes encompass structural, technical, and behavioral aspects. Structurally, the absence of licensed waste treatment facilities in North Sumatra has resulted in dependence on out-of-region treatment, with consequences of high costs and scheduling uncertainties. Technically, limited capacity of temporary storage facilities (TPS) and pharmaceutical waste storage rooms creates operational pressures, particularly during transportation delays. From a behavioral perspective, segregation errors still occur due to high workload, inadequate facilities, and staff fatigue. Nevertheless, the hospital has planned various improvement efforts, including facility upgrades, addition of equipment, strengthened training programs, and optimization of third-party collaboration. Furthermore, government support is required in the provision of regional waste treatment infrastructure to strengthen the implementation of area-based medical waste management.

Alignment of policies and division of responsibilities in medical waste management with Indonesian Ministry of Health Regulation No. 18 of 2020, as well as the medical waste transportation and treatment system, including collaboration with third-party providers and the availability of supporting resources (human resources, facilities

and infrastructure, and budget) in medical waste management.

RS TNI AL Dr. Komang Makes has generally satisfied the key requirements of Ministry of Health Regulation No. 18 of 2020, including the establishment of internal policies, standard operating procedures (SOPs), an organizational structure, and collaboration with licensed third-party providers, all supported by a comprehensive documentation system. The delineation of roles among stakeholders is clearly defined and exemplifies a multi-stakeholder approach to medical waste management. However, implementation continues to encounter resource constraints, particularly regarding facility capacity, container availability, and the financial burden associated with external treatment costs. Consequently, operational performance has not yet fully attained the optimal standards mandated by regulatory requirements.

Supporting and Inhibiting Factors in the Implementation of Medical Waste Management in Accordance with Ministry of Health Regulation No. 18 of 2020

The implementation of medical waste management at RS TNI AL Dr. Komang Makes is influenced by interrelated supporting and inhibiting factors. Key supporting factors include management commitment, clarity of policies and standard operating procedures (SOPs), cross-unit engagement, routine training, collaboration with third-party providers, and external oversight. Inhibiting factors, on the other hand, encompass regional infrastructure limitations, internal facility capacity constraints, high workload affecting segregation consistency, and challenges in cross-party coordination and communication. Overall, the hospital has established a strong regulatory-compliant system foundation; however, implementation effectiveness remains highly dependent on infrastructure support, resource adequacy, and the reinforcement of coordination and operational practices in the field.

CONCLUSIONS AND RECOMMENDATIONS

Medical waste management at Dr. Komang Makes Indonesian Navy Hospital is generally aligned with Minister of Health Regulation of the Republic of Indonesia No. 18 of 2020, particularly in terms of segregation, collection, internal transportation, temporary storage, documentation, reporting, and final treatment through licensed third-party providers. Nevertheless, implementation remains constrained by limited temporary storage capacity, insufficient waste containers and equipment, human-resource limitations, high transportation and treatment costs, and the absence of licensed medical waste treatment facilities in North Sumatra. The hospital should therefore strengthen source-based segregation, increase the capacity of the B3 Temporary Storage Facility, ensure the availability of appropriate containers, safety boxes, personal protective equipment, and transportation facilities, and conduct continuous training, supervision, auditing, documentation, and evaluation of third-party providers. Healthcare workers should comply with segregation procedures, report full containers promptly, and participate in occupational health and safety training and immunization programs. Local governments and relevant stakeholders should support the development of regional medical waste treatment facilities, improve cross-sectoral coordination, establish appropriate service standards and tariffs, and strengthen supervision of waste transport and treatment providers. Service providers should improve the use of electronic manifests, GPS tracking, compliant vehicles, spill-control equipment, fire extinguishers, personal protective equipment, and worker vaccination. Future researchers are encouraged to apply mixed-methods designs to assess waste volume, costs, operational efficiency, occupational safety, and governance models for medical waste management in coastal and archipelagic areas.

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