



Research

Comparison of Hazardous Medical Waste Management in Public and Private Hospitals in Takalar Regency

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ABSTRACT

Proper management of B3 (Hazardous and Toxic Materials) medical waste in hospitals is essential to prevent adverse impacts on patients, visitors, and healthcare personnel. This study aims to compare the B3 medical waste management practices between public and private hospitals in Takalar Regency. This research employed a quantitative observational method with a cross-sectional approach. The population comprised all medical waste management officers and cleaning service personnel at the selected hospitals. Sampling was conducted using a non-probability total sampling technique, whereby all members of the population were included as research subjects. Data analysis was performed using the Mann-Whitney U test. The results revealed significant differences in waste segregation ($p = 0.013$), containment ($p = 0.001$), temporary storage ($p = 0.015$), and transportation ($p = 0.004$) practices between public and private hospitals. Both types of hospitals were found not to conduct training on B3 medical waste management for relevant personnel and failed to provide complete personal protective equipment (PPE), such as boots, aprons, gloves, masks, and goggles, during handling activities. It is recommended that both public and private hospitals ensure the availability of adequate and complete PPE, enforce proper usage among medical waste handlers and cleaning staff, and enhance management practices in accordance with established regulations.

1. Introduction

Hospitals are complex health service facilities that produce various types of waste, including hazardous and toxic (B3) medical waste, as a result of diagnostic, therapeutic, and operational activities (Muse et al., 2023; Oktariana & Kiswanto, 2021). B3 medical waste is particularly dangerous because it poses immediate and long-term threats to environmental and human health (Himayati et al., 2018 in Rochmawati et al., 2022). According to WHO (2018), although only 15% of healthcare

waste is categorized as hazardous, its improper management can lead to serious consequences, including infections and chronic illnesses. The global healthcare workforce is at elevated risk, with over 35 million workers potentially exposed to health hazards due to inadequate waste management systems (Rangkuti et al., 2023). Infections such as hepatitis, HIV, skin diseases, and cancers are among the health outcomes caused by poor B3 medical waste management (Purwanti, 2018; Gizalew et al., 2021).

Despite the critical importance of proper medical waste handling, many healthcare facilities in Indonesia are still not in compliance with national standards. Data from the Indonesian Ministry of Health (2020) revealed that in 2019 only 42.64% of hospitals met the standard requirements for waste management. Concurrently, the increase in healthcare facilities—from 2,852 hospitals and 9,909 Puskesmas in 2018—has led to a significant rise in B3 waste generation, amounting to approximately 296.86 tons/day, far exceeding the treatment capacity of licensed third-party processors (151.6 tons/day) (Kristanti et al., 2021). The Ministry of Environment and Forestry identified multiple challenges such as excessive infectious waste accumulation, non-standard temporary storage, and improper use of incinerators (Kurniawan et al., 2022). In South Sulawesi, although most hospitals possess incinerators, only a few have operational permits, indicating regulatory and operational challenges at the regional level (Muntazarah et al., 2020).

While several studies have assessed B3 medical waste management practices in various national and international settings, limited research has specifically addressed comparative analysis between different types of hospitals, particularly in the same geographic region. This study aims to analyze and compare the B3 medical waste management systems implemented by public and private hospitals in Takalar Regency, identifying differences in practice and compliance, and proposing improvements aligned with regulatory standards.

2. Method

The research method is discussed clearly and in detail consisting of 400-800 words, namely: The type of research and the approach used, Place and time of research, Consideration of subject selection and research situation, Sources of literacy and information, Population and sample and sampling method, Research procedures, including informed consent, Instrument used, Data processing/analysis, Processing, analysis, and presentation of data, Statement of having obtained a health code of ethics permit through the research ethics commission (optional).

This study employed a quantitative observational approach with a cross-sectional design. The cross-sectional method involves the collection of data at a single point in time, without continuous follow-up, to analyze the conditions and relationships between variables as they exist during the study period. In this research, both dependent and independent variables were measured simultaneously to determine differences in B3 medical waste management practices between the selected hospitals.

The research was conducted in Takalar Regency, specifically at two hospitals: Rumah Sakit Umum Daerah Haji Padjonga Daeng Ngalle, representing a public hospital, and Rumah Sakit Maryam Citra Medika, representing a private general hospital. Data collection was carried out over the course of one month, from April 29 to May 29, 2024.

The study population consisted of all personnel involved in the management of B3 medical waste, including both cleaning service staff and medical waste handlers. A total sampling technique was employed, which means that the entire population was used as the sample, considering its size was under 100 individuals. This method ensures comprehensive representation. The inclusion criteria for sample selection were personnel from both hospitals who were responsible for supervising and managing B3 medical waste on a quarterly basis.

Primary data were collected through structured observation forms and questionnaires administered directly to respondents, focusing on B3 medical waste management practices within the two hospitals. Secondary data were obtained from a variety of supporting sources including scientific articles, textbooks, and relevant literature that provided contextual and theoretical support for the study.

The data collected underwent several processing stages, starting with editing to ensure accuracy and completeness of the questionnaire responses. This was followed by coding, where textual responses were converted into numerical values. Subsequently, the data were entered into the SPSS version 21 software for further analysis. Cleaning was then conducted to identify and correct any errors in data entry or incomplete data. For analysis, univariate analysis was used to describe the characteristics of the study variables through frequency and percentage distributions presented in tables. Bivariate analysis was performed using the Mann-Whitney U test, which is appropriate for ordinal data and non-normally distributed variables. The test determined whether there were statistically significant differences between the two hospital groups, with decision rules based on a significance value of 0.05. A p-value below 0.05 indicated a significant difference, while a p-value above 0.05 indicated no significant difference.

3. Results & Discussion

Based on Table 1, most respondents in both hospitals were male, with 73.6% in the public hospital and 100% in the private hospital. The dominant age group was 21–30 years in both settings, comprising 32.1% in the public and 75% in the private hospital. In terms of education, the majority had completed senior high school: 71.7% in the public and 100% in the private hospital. Most respondents worked as cleaning service staff – 94.3% in the public and 95.0% in the private hospital. Regarding work experience, the highest proportion in the public hospital had worked for 5–10 years (45.3%), while in the private hospital it was 1–5 years (40.0%). Lastly, most respondents in both hospitals had never received training in B3 waste management – 67.9% in the public and 70.0% in the private hospital.

Table 1. Characteristics of Respondents

Characteristic	General		Private	
	n	%	n	%
Sex				
Men	39	73,6	20	100
Women	14	26,4	0	0
Age				
<20 year	10	18,9	3	15
21 - 30 year	17	32,1	15	75
31 - 40 year	9	17,0	1	5
41 - 50 year	13	24,5	1	5
51 - 60 year	4	7,5	0	0
Last Education				
Elementary School	3	5,7	0	0
Junior High Scholl	12	22,6	0	0
Senior High Scholl	38	71,7	20	100
Work Unit				
Management Officer	3	5,7	1	5,0
Cleaning Service	50	94,3	19	95,0
Length of Service				
< 1 year	13	24,5	7	35,0
1 -5 year	2	3,8	8	40,0
5 - 10 year	24	45,3	5	25,0
10 - 20 year	12	24,5	0	0
>20 year	1	1,9	0	0
Training				
Yes	17	32,1	6	30,0
No	36	67,9	14	70,0
Total	53	100%	20	100%

Table 2. Comparison of medical waste management practices

Action	Category	Public Hospital (n=53)	Private Hospital (n=20)
Segregation	Good	32 (60.4%)	7 (35.0%)
	Poor	21 (39.6%)	13 (65.0%)
Containment	Good	33 (62.3%)	6 (30.0%)
	Poor	20 (37.7%)	14 (70.0%)
Temporary Storage	Good	33 (62.3%)	3 (15.0%)
	Poor	20 (37.7%)	17 (85.0%)
Transportation	Good	15 (41.5%)	11 (55.0%)
	Poor	38 (58.5%)	9 (45.0%)

Table 2 shows the comparison between the public and private hospitals in four aspects of B3 medical waste management—segregation, containment, temporary storage, and transportation—shows notable differences. The public hospital consistently performed better in segregation (60.4% vs. 35.0%), containment (62.3% vs. 30.0%), and temporary storage (62.3% vs. 15.0%). However, in transportation, the private hospital performed slightly better (55.0% vs. 41.5%). Overall, the public hospital demonstrated stronger compliance with waste management standards, likely due to better training, facilities, supervision, and institutional support.

Table 3. *Comparison of medical waste management practices*

Action	Mann-Whitney U	Z Score	P-value
Segregation	336.5	-2.482	0.013
Containment	280.5	-3.317	0.001
Temporary Storage (TPS)	363.5	-2.437	0.015
Transportation	318.5	-2.889	0.004

Table 3 illustrates the Mann-Whitney U test results indicate statistically significant differences between the public and private hospitals in all four aspects of B3 medical waste management: segregation ($p = 0.013$), containment ($p = 0.001$), temporary storage ($p = 0.015$), and transportation ($p = 0.004$). Since all p -values are below 0.05, it can be concluded that there are significant differences in waste management practices between the two hospital types, with the public hospital generally demonstrating better adherence to established procedures.

The study reveals significant differences between public and private hospitals in all four aspects of B3 medical waste management. For segregation, the public hospital showed better practice, with waste separated based on type using appropriately colored bags and safety boxes, and most staff used basic PPE. In contrast, the private hospital showed poor implementation, with improper segregation from source and incomplete use of PPE. In containment, the public hospital used sealed, labeled, and leak-proof containers aligned with regulatory standards, while the private hospital often used inappropriate containers lacking proper closure and water resistance. For temporary storage, the public hospital had a designated, equipped area with medical waste symbols and handwashing facilities. The private hospital's TPS lacked basic requirements such as ventilation and access to clean water. Regarding transportation, the private hospital performed relatively better with a dedicated route and consistent PPE usage, whereas the public hospital lacked a designated transport route and had incomplete PPE use among staff.

The findings are consistent with several prior studies. Agpina (2023), Salim et al. (2022), and Siddik & Wardhani (2019) highlight the importance of segregation at the source and proper labeling, as applied in the public hospital. Conversely, the issues identified in the private hospital align with research by Diyanah (2022) and Lestari & Upa (2020), where inadequate segregation and PPE usage led to mixed and improperly handled waste. Similar deficiencies in containment and temporary storage facilities were reported by Yurindani et al. (2021) and Amelia et al. (2020), confirming the necessity of structural and procedural compliance. The transportation practices in the private

hospital, which adhered to safer handling and route protocols, reflect findings from Tenriawi (2023), suggesting that even without incinerators, efficient third-party coordination can be effective. This study adds value by directly comparing public and private hospitals within the same regional context, emphasizing institutional differences and their implications for regulatory compliance.

These findings are critical for public health and environmental safety, highlighting that public hospitals, despite resource limitations, often achieve higher compliance due to better structure and training. However, private hospitals, while sometimes better at operational efficiency (e.g., transport), often lack foundational support for proper waste segregation and containment. The implications suggest a need for policy reinforcement, mandatory training, and regular audits across all hospital types. Furthermore, integrating faith-based ethical perspectives, as referenced in Islamic teachings, reinforces the moral obligation of healthcare institutions to maintain cleanliness and avoid harm. This underscores that medical waste management is not only a technical and administrative issue but also a social and ethical responsibility.

4. Conclusion

This study concludes that there are significant differences in the B3 medical waste management practices between public and private hospitals in Takalar Regency. Public hospitals demonstrated better performance in segregation, containment, and temporary storage, aligning more closely with regulatory standards. However, private hospitals showed slightly better practices in the transportation of waste. These findings indicate that while public hospitals benefit from stronger structural procedures and adherence to health regulations, private hospitals may require enhanced oversight and institutional support to improve their compliance, particularly in the early stages of waste handling.

The implications of these findings are twofold: first, healthcare institutions must strengthen their commitment to proper waste management by ensuring the availability and use of adequate personal protective equipment (PPE), implementing consistent staff training, and establishing safe infrastructure; second, the government and health authorities should provide more stringent monitoring and capacity-building initiatives for both public and private facilities. This research contributes to the existing body of knowledge by offering a localized comparative analysis that reflects operational disparities between hospital types. Limitations of this study include its limited geographical scope and sample size, suggesting future research should expand to broader regions and incorporate longitudinal designs to assess long-term compliance.

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