Descriptive Monthly Trend Analysis of Hazardous Medical Waste Generation at Dr. H. Jusuf SK Regional Hospital in 2025

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Abstract
Hospitals generate hazardous medical waste that can threaten human health and the environment when segregation, storage, transportation, and treatment are not properly managed. In Indonesia, healthcare facilities are required to manage hazardous and toxic waste from healthcare activities according to national environmental and health regulations; therefore, local hospital-based monitoring is essential for operational planning. This study aimed to describe the amount and monthly trend of hazardous medical waste generated at Dr. H. Jusuf SK Regional Hospital from January to December 2025. This study focused on waste generation patterns and did not test causal factors affecting monthly fluctuations. A descriptive quantitative design with monthly trend observation was used. Secondary data were obtained from hospital sanitation installation records, including hazardous waste weighing recapitulation, temporary hazardous waste storage records, and waste handover or transportation documentation. The analyzed variables were medical waste, glass waste, sharps waste, and total hazardous waste. Incineration ash was excluded because complete monthly data were not available. Data were analyzed using mean, standard deviation, minimum, maximum, percentage contribution, month-to-month percentage change, and graphical visualization. Results of this study was the average total hazardous waste generation was 263.10 kg/month (SD = 16.13). The lowest total waste generation occurred in July (227.42 kg), while the highest occurred in September (284.70 kg). Medical waste was the dominant component, contributing 95.55% of the total hazardous waste, followed by glass waste (2.37%) and sharps waste (2.09%). The sharpest monthly decline occurred from June to July (-9.98%), while the largest increase occurred from July to August (17.70%). Conclusion of this study was hazardous medical waste generation at Dr. H. Jusuf SK Regional Hospital fluctuated throughout 2025. These findings highlight the importance of continuous monthly monitoring, adaptive storage capacity, proper waste segregation, and data-driven coordination with waste treatment and transportation systems.

Introduction

Hazardous medical waste generation is an important environmental health issue in hospitals because the waste may contain infectious agents, toxic substances, sharps, pharmaceutical residues, chemical materials, and other hazardous components. If waste is not properly segregated and handled from the source, it can increase the risk of occupational injuries, disease transmission, environmental contamination, and regulatory non-compliance.

Globally, the World Health Organization reports that approximately 85% of waste generated by healthcare activities is general non-hazardous waste, while the remaining 15% is hazardous material that may be infectious, toxic, carcinogenic, flammable, corrosive, reactive, explosive, or radioactive (World Health Organization, 2024). Poor waste management can expose healthcare workers, patients, waste handlers, and surrounding communities to preventable health and environmental risks.

In Indonesia, hazardous waste from healthcare facilities is regulated through environmental and health sector policies, including the Regulation of the Minister of

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Environment and Forestry Number P.56/MENLHK-SETJEN/2015, the Regulation of the Minister of Health Number 18 of 2020, and Government Regulation Number 22 of 2021. These regulations emphasize waste reduction, segregation, storage, transportation, treatment, and final management according to waste characteristics and safety requirements.

Hospital waste generation is influenced by service intensity, occupancy, type of clinical service, disposable medical equipment use, waste segregation practices, and treatment capacity. Previous studies have shown that medical waste management in hospitals is affected by institutional policy, facility availability, human resource behavior, and treatment methods (Hutajulu et al., 2022).

Most studies on medical waste management emphasize average waste generation or general compliance with waste management procedures. However, hospital waste generation is dynamic and may fluctuate monthly. A monthly descriptive trend is useful for planning temporary storage capacity, scheduling waste transportation, estimating treatment needs, evaluating segregation performance, and anticipating periods with higher waste loads.

Dr. H. Jusuf SK Regional Hospital is a regional healthcare facility in North Kalimantan that provides inpatient, outpatient, emergency, laboratory, surgical, and supporting services. These activities continuously generate hazardous medical waste that must be monitored as part of hospital environmental health management.

Therefore, this study analyzed monthly hazardous medical waste generation at Dr. H. Jusuf SK Regional Hospital during January to December 2025. The study was limited to describing waste quantities and monthly trends; it did not determine causal relationships because patient volume, bed occupancy rate, procedure volume, and disease pattern data were not included. The results are expected to support more adaptive, data-driven, and regulation-compliant hazardous waste management planning in the hospital.

Methods

This study used a descriptive quantitative design with monthly trend observation. The term monthly trend observation refers to descriptive analysis of consecutive monthly waste records and does not indicate formal statistical time-series modeling, forecasting, or autocorrelation analysis. The research was conducted at Dr. H. Jusuf SK Regional Hospital using secondary data from January to December 2025.

The unit of analysis was the monthly hazardous waste record; therefore, all 12 monthly records in 2025 were included. The use of 12 consecutive months was intended to capture annual variation and provide a complete year-based description for waste management planning. The data were obtained from the hospital sanitation installation, including monthly hazardous waste weighing recapitulation, temporary hazardous waste storage records, and waste handover or transportation documentation.

The analyzed variables consisted of medical waste, glass waste, sharps waste, and total hazardous waste. Incineration ash was not analyzed because the monthly data column was incomplete in the available records. Data were analyzed using descriptive statistics consisting of mean, standard deviation, minimum, and maximum values. The contribution of each waste type was calculated by dividing the annual total of each waste category by the annual total hazardous waste. Month-to-month changes were calculated as the percentage difference between the total waste in one month and the previous month. Graphical visualization was used to display the monthly trend.

This study used aggregated institutional secondary data and did not involve human respondents or individual patient records. Institutional permission was obtained from the hospital, and data confidentiality was maintained throughout the research process.

Results and Discussion

The results indicate that hazardous medical waste generation fluctuated throughout 2025. The total hazardous waste generated during the year was 3,157.16 kg, with an average of 263.10 kg/month and a standard deviation of 16.13 kg. The lowest monthly total occurred in July (227.42 kg), while the highest occurred in September (284.70 kg). Medical waste was the dominant component, contributing 95.55% of total hazardous waste, followed by glass waste (2.37%) and sharps waste (2.09%).

The monthly trend shows a decline toward the middle of the year followed by an increase in the third quarter. The sharpest decline occurred from June to July (-9.98%), while the largest increase occurred from July to August (17.70%). Because this study did not include patient volume, bed occupancy rate, or procedure volume, these changes should be interpreted as descriptive fluctuations rather than evidence of causal changes in healthcare service demand.

Unlike previous studies that focus only on average values, this study highlights the importance of time-based variability for hospital waste management planning. Monthly monitoring can help estimate temporary storage capacity, arrange timely transportation with licensed third-party providers, ensure that temporary storage does not exceed regulatory requirements, and evaluate waste segregation practices in service units.

Table 1. Monthly Generation of Hazardous Medical Waste in 2025

Month	Glass(kg)	Sharps(kg)	Ash (kg)	Total (kg)
January	255.77	7.58	9.29	272.65
February	248.36	5.45	4.98	258.79
March	252.16	5.32	3.94	261.42
April	258.13	5.17	3.60	266.90
May	233.23	5.29	4.03	242.55
June	244.03	4.53	4.07	252.63
July	215.23	7.08	5.11	227.42
August	253.87	7.81	6.00	267.68
September	270.93	7.17	6.60	284.70
October	268.71	6.19	6.03	280.94
November	260.00	6.70	6.13	272.83
December	256.10	6.45	6.10	268.65

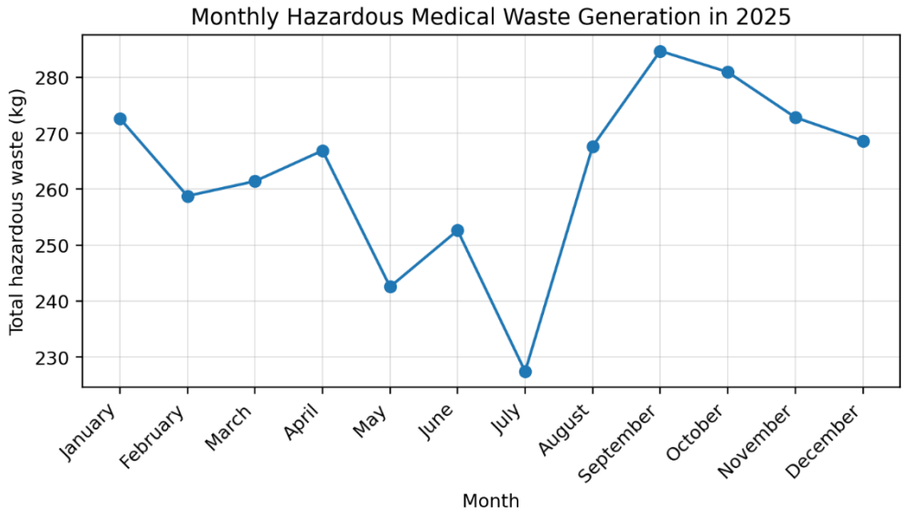

Figure 1. Monthly trend of total hazardous medical waste generation in 2025

Table 2. Descriptive statistics and annual contribution of hazardous medical waste in 2025

Waste category	Mean (kg/month)	SD	Minimum (kg)	Maximum (kg)	Contribution (%)
Glass	251.38	15.23	215.23	270.93	95.55
Sharps	6.23	1.07	4.53	7.81	2.37
Ash	5.49	1.58	3.60	9.29	2.09
Total	263.10	16.13	227.42	284.70	100.00

Note: The monthly fluctuations are interpreted descriptively because patient volume, bed occupancy rate, number of medical procedures, and disease pattern data were not included in the dataset.

Conclusion and Suggestion

This study demonstrated that hazardous medical waste generation at Dr. H. Jusuf SK Regional Hospital fluctuated throughout 2025, with an average total generation of 263.10 kg/month. The lowest total occurred in July (227.42 kg), while the highest occurred in September (284.70 kg). Medical waste was the dominant component, contributing 95.55% of the annual total, followed by glass waste (2.37%) and sharps waste (2.09%).

The monthly trend indicates that hazardous waste management should be planned dynamically rather than relying only on annual average values. The observed fluctuations were described as monthly variation and should not be interpreted causally because patient volume, bed occupancy rate, procedure volume, and disease pattern data were not included.

Hospitals are recommended to strengthen continuous monthly monitoring, maintain complete weighing and handover records, ensure proper source segregation, provide adequate temporary storage capacity, and coordinate regularly with licensed waste treatment and transportation providers. Future studies should include patient volume, bed occupancy rate, number and type of medical procedures, service unit contribution, active bed capacity, disease pattern, and incineration ash data. These additional variables would allow analysis of kg/bed/day generation rates and a more comprehensive assessment of factors influencing hazardous medical waste trends.

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References

Government of Indonesia. (2021). Government Regulation Number 22 of 2021 concerning the implementation of environmental protection and management. https://peraturan.go.id/id/pp-no-22-tahun-2021

Hanedar, A., Çifçi, D. İ., Zafer, N., & Görgün, E. (2022). The impact of COVID-19 pandemic in medical waste amounts: A case study from a high-populated city of Turkey. Journal of Material Cycles and Waste Management, 24, 1760–1767. https://doi.org/10.1007/s10163-022-01428-3

Hutajulu, S. M., Marsaulina, I., Siregar, F. A., & Indirawati, S. M. (2022). Solid medical waste management strategy in hospitals, Indonesia. The Open Public Health Journal, 15, e187494452212231. https://doi.org/10.2174/18749445-v15-e221223-2022-152

Ministry of Environment and Forestry of the Republic of Indonesia. (2015). Regulation of the Minister of Environment and Forestry Number P.56/MENLHK-SETJEN/2015 concerning technical procedures and requirements for hazardous and toxic waste management from healthcare facilities. https://peraturan.bpk.go.id/Details/322441/permen-lhk-no-p56menlhk-setjen2015-tahun-2015

Ministry of Health of the Republic of Indonesia. (2020). Regulation of the Minister of Health Number 18 of 2020 concerning regional-based medical waste management in healthcare facilities.https://peraturan.bpk.go.id/Details/152561/permenkes-no-18-tahun-2020

Nugraha, A., & Putri, D. S. (2022). Analisis timbulan limbah medis padat di rumah sakit daerah. Jurnal Kesehatan Lingkungan Indonesia, 21(2), 101–108.

Palita, F. B., Purnaweni, H., & Luqman, Y. (2024). Evaluation of solid medical waste management system in Undata Regional General Hospital, Palu City, Central Sulawesi Province, Indonesia. Journal of Bioresources and Environmental Sciences, 3(2), 70–77. https://doi.org/10.61435/jbes.2024.19923

Pratiwi, R., & Handayani, S. (2021). Pengelolaan limbah medis padat di rumah sakit selama masa pandemi COVID-19. Jurnal Kesehatan Masyarakat Indonesia, 16(3), 145–152.

Sari, D. P., & Nugroho, A. (2023). Analisis timbulan limbah medis pada rumah sakit regional di Indonesia. Jurnal Penelitian Kesehatan, 15(1), 55–63.

Setyowati, E., & Rahmawati, N. (2020). Evaluasi sistem pengelolaan limbah bahan berbahaya dan beracun (B3) rumah sakit. Jurnal Sanitasi Lingkungan, 12(1), 44–51.

World Health Organization. (2024). Health-care waste. https://www.who.int/news-room/fact-sheets/detail/health-care-waste

Yuliana, F., & Saputra, H. (2021). Hubungan jumlah pasien dengan timbulan limbah medis padat rumah sakit. Jurnal Ilmu Kesehatan Masyarakat, 10(2), 87–94.