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Research Article

# Training on Solid Medical Waste Management at Private Hospitals in Medan City

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***Abstract***

*Inadequate management of solid medical waste poses potential risks of infection transmission, exposure to hazardous materials, and environmental damage. This study aims to evaluate the impact of training programs on enhancing nurses' knowledge, attitudes, and practices related to solid medical waste management. The research employed a quasi-experimental design with a pre-test and post-test approach, without a control group. A total of 38 inpatient nurses served as the research respondents. The results demonstrated significant improvements in the mean scores: knowledge increased by 3.342 points ($t = 6.374$; $p = 0.000$), attitude by 13.026 points ($t = 8.525$; $p = 0.005$), and practice by 2.079 points ($t = 5.370$; $p = 0.001$). All outcomes showed statistical significance ($p < 0.05$), and the 95% confidence interval indicated substantial and consistent improvements. Structured training programs have proven effective in developing nurses' competencies, especially when supported by adequate environmental literacy and strong management commitment. These findings underscore the importance of ongoing training as a strategic approach to improve the quality of solid medical waste management in hospitals.*

*Keywords: Attitude, Knowledge, Medical waste management, Practice, Training*

## Pendahuluan

Every human activity generates waste, whether within households, industrial sectors, or service industries such as hospitals. Household solid waste can lead to infectious diseases (Omang et al., 2021); (Endris et al., 2022). Hospitals are recognized as the primary sources of hazardous waste generation (Olaifa et al., 2018), (Normawati et al., 2022), (Afesi-Dei et al., 2023). Research indicates that tertiary care hospitals produce approximately 300 kilograms of waste per day. To ensure waste disposal processes are efficient and effective, it is essential that the number of knowledgeable staff exceeds that of untrained personnel. This approach can reduce errors and mistakes, thereby ensuring that hospitals do not have to contend with potential side effects or adverse outcomes (Rakshanda et al., 2024). Additionally, the production of hospital waste in both private and public institutions has increased significantly during the pandemic, reaching up to 102.2% in Iran (Kalantary et al., 2021).

Hospital waste poses significant health and environmental risks (Lattanzio et al., 2022); (Citraningtyas et al., 2024). Effective and efficient waste management is essential to ensure the sustainability of environmental health (Shekoohiyan et al., 2022). The challenges in managing medical waste from healthcare facilities include the diverse nature of the waste, which encompasses solid, liquid, chemical, radioactive, infectious, and non-infectious waste (IEC, 2024).

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Addressing these challenges requires collaboration among all sectors, including hospital leadership, management, administration, nursing staff, and cleaning personnel.

Medical waste includes contaminated materials such as blood, bodily fluids, hazardous chemicals, and sharps, which possess significant potential for transmitting infections and spreading pathogens (Permenkes, 2019); (Adu et al., 2020); (Sujon et al., 2022). Nurses are responsible for ensuring that each type of waste is placed in appropriate containers, clearly labeled, and coded with standard color codes, in accordance with applicable regulations and guidelines (Permenkes, 2020). Nurses are required to have comprehensive knowledge of the classification of medical waste based on its hazardous characteristics (e.g., infectious, pathological, pharmaceutical, genotoxic, chemical, and radioactive), as well as strict separation protocols at the point of waste generation. Effective waste management planning should ideally begin with an understanding of the waste characteristics produced (Ugwu et al., 2020).

Healthcare services play a crucial role in implementing effective and safe medical waste management to protect patient safety, staff, and the surrounding environment (Arizona & Margata, 2021). Nurses, as one of the human resources in hospitals providing patient care, hold a central role in the medical waste management cycle, from identification and separation to initial disposal (Marselinus et al., 2024). A practical approach to waste management involves identifying medical waste and assessing the potential risks associated with the waste generated (Istiqomah et al., 2023). The involvement of nurses goes beyond mere compliance with protocols; it also requires a deep understanding of the scientific and public health implications of improper waste handling.

The main issue in medical waste management is that waste management personnel are often untrained (Ciawi et al., 2024). Another study identified obstacles such as the absence of Standard Operating Procedures (SOPs) and work instructions related to waste management (Jannah, 2024). Additionally, other problems include limited funding, inadequate training, and a lack of knowledge regarding regulations and policies for medical waste handling. Many hospitals and healthcare facilities do not manage medical waste properly, which also impacts the processes of transportation and storage of the waste (Chisholm et al., 2021).

Proper and standards-compliant medical waste management can prevent the spread of infections, exposure to hazardous materials, and reduce negative impacts on the ecosystem (WHO, 2021). Previous research indicates that regulations regarding medical waste management are relatively new for healthcare personnel (Singh et al., 2022). Through comprehensive training, healthcare workers and hospital staff can understand the correct procedures for collecting, sorting, storing, and disposing of medical waste in accordance with regulations such as the Indonesian Ministry of Health Regulation No. 18 of 2020 concerning Medical Waste Management in Healthcare Facilities Based on Regional Regulations (Permenkes, 2020). Therefore, investing in such training is crucial to enhance human resource competencies, minimize contamination risks, and support environmental sustainability within healthcare facilities.

Previous studies have highlighted the importance of medical waste management in hospitals; however, most of these focus on public hospitals or policy aspects. Training has been shown to improve the skills of staff in the segregation of medical waste. Training programs on medical waste management have a significant impact on healthcare professionals' knowledge and practices (Singh et al., 2022). Meanwhile, research by Sari et al. (2022) in public hospitals demonstrated a notable increase in waste management practices following training.

Nevertheless, there is limited research specifically examining the impact of training on private hospitals and nurses as the primary subjects. The training provided; solid waste sorting, waste symbols, identification,

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transportation and disposal. Waste management training with the themes solid waste Sorting, Waste Symbols, Identification, Transportation, and Disposal is very important because it can increase participants' awareness and competence in managing waste effectively and environmentally friendly. By understanding the sorting process, waste symbols, waste type identification, and proper transportation and disposal methods, they can reduce the negative impact of waste on human health and the environment. This training also supports the implementation of sustainable and regulatory waste management practices, thereby helping to create a clean, healthy, and sustainable environment.

The effectiveness of training as an intervention to enhance nurses' competencies in private hospitals remains underexplored. Nurses are healthcare workers who are directly involved in the daily production and handling of dense medical waste. Therefore, training on dense medical waste management is a crucial strategy to improve healthcare workers' understanding and skills in performing procedures that are safe and compliant with regulations. The research problem formulated is: Does training in dense medical waste management influence nurses' knowledge, attitudes, and practices in managing medical waste in private hospitals in Medan City?

The lack of skills in waste management has been identified as a significant barrier to proper waste handling in Malaysia (Soomro et al., 2023). Inadequate waste management in hospitals can be addressed through proper training, which is essential for effective waste handling (Ibáñez-Cruz et al., 2025). This study is important to determine the impact of training on improving nurses' knowledge, attitudes, and skills in dense medical waste management. The findings are expected to serve as a basis for recommending sustainable interventions aimed at enhancing the quality of waste management in private hospitals.

## Methods

### Research Design

This study employed a quasi-experimental design with a pre-test and post-test approach, without a control group. This design was selected to evaluate changes in nurses' knowledge before and after the implementation of a training intervention on dense medical waste management.

### Time and Location of the Study

The research was conducted at one private hospital in Medan City from December 2024 to February 2025. The study was carried out following approval from the hospital authorities.

### Population and Sample

The population in this study consisted of nurses working in the inpatient wards of a private hospital in Medan City. The selection of this population was based on scientific considerations and practical relevance to the research objectives. Inpatient nurses are a group of healthcare providers with frequent interactions with patients and dense medical waste, particularly during daily nursing activities such as medication administration, invasive nursing procedures, and handling of single-use medical devices. The total population comprised 62 nurses. A sample of 38 nurses, meeting the inclusion criteria—having worked for at least 6 months, willing to participate in the training, not currently on leave or sick leave during the study period, and serving as implementing nurses—was selected.

### Instruments and Procedures

The primary instrument used was a validated questionnaire assessing knowledge of dense medical waste management, referencing prior research indicating that successful waste management is determined by nurses' behaviors (Cahyawati et al., 2024). The training was conducted over two days, incorporating theoretical content delivered through lectures, videos, and practical exercises on waste management based on Indonesian Ministry of Health Regulation No. 7 of 2019 (Permenkes, 2019). The pre-test was administered before the training, and the post-test was conducted after the completion of the training. The training provided;

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solid waste sorting, waste symbols, identification, transportation and disposal.

The training was divided into two groups: 19 nurses participated in the first session, and another 19 in the second session. This division was necessary because conducting training simultaneously for all 38 nurses was impractical due to potential interference with their work schedules.

**Data Analysis**

Data were analyzed using a paired t-test to measure differences in knowledge scores before and after the training. Prior to conducting the parametric t-test, data normality was assessed. If the data followed a normal distribution, the paired t-test was deemed appropriate. The paired t-test was chosen because the data were paired and numerical, enabling the evaluation of the effectiveness of the intervention.

**Results**

Table 1 below presents the characteristics of the research respondents, displayed in the form of a frequency distribution table. These characteristics include age, gender, highest educational attainment, and length of service at the hospital.

**Table 1. Characteristics of Research Respondents (n=38)**

| Characteristics | Frequency | Persentage |
|---|---|---|
| **Age (year)** | | |
| 25 – 35 | 7 | 18.4 |
| 36 – 46 | 18 | 47.4 |
| 57 - 57 | 13 | 34.2 |
| **Sex** | | |
| Man | 9 | 23.7 |
| Woman | 29 | 76.3 |
| **Education** | | |
| Diploma III in Nursing | 30 | 78.9 |
| Bachelor of Nursing | 8 | 21.1 |
| **Work period (year)** | | |
| 1 – 10 | 16 | 42.1 |
| 11 – 20 | 16 | 42.1 |
| 21 – 30 | 6 | 15.8 |

*Source: primary data, 2024*

The descriptive analysis of the respondents' characteristics in this study is as follows: Based on age distribution, the majority of respondents fall within the 36–46 years age range, totaling 18 individuals (47.4%). This is followed by respondents aged 57 years, numbering 13 individuals (34.2%), and the 25–35 years age group, comprising 7 individuals (18.4%). Regarding gender, out of the total 38 respondents, the majority are female, totaling 29 individuals (76.3%), while 9 respondents (23.7%) are male. Based on educational level, 30 respondents (78.9%) hold a Diploma Three (D3) in Nursing, and 8 respondents (21.1%) are Bachelor's degree graduates (S1).

Regarding years of service, the distribution indicates that 16 respondents (42.1%) have worked for 1–10 years, and an equal number of respondents (16 individuals, 42.1%) have a tenure of 11–20 years. Additionally, 6 respondents (15.8%) have been employed for 21–30 years.

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**Table 2. Univariate analysis of knowledge, attitude and practice scores**

| Variable | Mean | N | Std.Deviation | Std. Error Medan |
|---|---|---|---|---|
| Knowledge before training | 17.63 | 38 | 1.822 | 0.296 |
| Knowledge after training | 20.97 | 38 | 4.070 | 0.660 |
| Attitude before training | 62.68 | 38 | 6.448 | 1.046 |
| Attitude after training | 75.71 | 38 | 10.363 | 1.681 |
| Practice before training | 21.95 | 38 | 1.845 | 0.299 |
| Praactice after training | 24.03 | 38 | 2.736 | 0.44 |

*Source: primary data, 2024*

Table 2 shows that the mean knowledge score of respondents prior to training was 17.63, which increased to 20.97 following the training. This increase reflects a positive change in the respondents' conceptual understanding of medical waste management. Although the standard deviation increased from 1.822 to 4.070, indicating a wider dispersion of scores after the training, this suggests that there was greater variability in the rate of understanding among participants.

The average attitude scores of the respondents also demonstrated a significant increase, rising from 62.68 before the training to 75.71 after the training. This indicates that the training successfully enhanced respondents' awareness and fostered a more positive perception of the importance of proper sorting and management of medical waste. The increase in standard deviation from 6.448 to 10.363 suggests greater variability in emotional responses or perceptions post-training, which may be influenced by individual backgrounds or work experiences of the respondents.

The practice aspect showed an increase in the mean score from 21.95 to 24.03. This indicates that the training not only provided theoretical understanding but also encouraged behavioral changes in the sorting and handling of solid medical waste. Although the standard deviation increased from 1.845 to 2.736, reflecting variability in the ability to implement the practices, the relatively small standard error of 0.440 suggests that the estimated mean is accurate and stable.

**Table 3. Analysis of Differences in Knowledge, Attitudes, and Practices Before and After Training**

| Variable | Mean | Std. Deviation | t | Sig. | 95% Confidence Interval of the Difference | |
|---|---|---|---|---|---|---|
| | | | | | lower | Upper |
| Knowledge before and after training | 3.342 | 3.232 | 6.374 | 0.000 | 2.280 | 4.405 |
| Attitude before and after training | 13.026 | 9.420 | 8.525 | 0.005 | 9.930 | 16.122 |
| Practice before and after training | 2.079 | 2.387 | 5.370 | 0.001 | 1.294 | 2.863 |

*Source: primary data, 2024*

The mean knowledge score increased by 3.342 points following the training. The t-test results showed a t-value of 6.374 with a p-value of 0.000 ($p < 0.05$), indicating that this difference is statistically highly significant. The 95% confidence interval (CI) ranged from 2.280 to 4.405. It was also observed that the mean attitude score increased by 13.026 points post-training,

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with a t-value of 8.525 and a p-value of 0.005 ($p < 0.05$), demonstrating a significant impact of the training on fostering positive attitudes toward medical waste management. The 95% confidence interval (CI) spanned from 9.930 to 16.122. Additionally, the mean practice score improved by 2.079 points, with a t-value of 5.370 and a p-value of 0.001 ($p < 0.05$), indicating a significant effect of the training on behavioral changes among participants. The confidence interval (1.294–2.863) suggests that this improvement occurred consistently.

**Discussion**

The research findings indicate that the majority of respondents are employed workers within the productive age range and possess relevant experience. The predominance of female nursing personnel in hospitals aligns with the general trend in Indonesia, where the nursing profession is predominantly occupied by women. Furthermore, students pursuing nursing education at higher education institutions are predominantly female compared to their male counterparts (Rohmah et al., 2023), (Baduge et al., 2024).

The research results indicate that the majority of respondents have extensive work experience, which is expected to support the application of new knowledge gained from training. An increase in knowledge and experience positively influences work performance (Saraswati & Praptiestrini, 2021), (Rasinta et al., 2023). Furthermore, long tenure provides workers with valuable experience and has a significant impact on their work capabilities (Puspita, 2018).

The same study examining attitudes and work experience explains that, despite having a negative attitude towards medical waste management, respondents demonstrated work behaviors that complied with established procedures. One of the contributing factors to this phenomenon is the influence of work experience and the social environment in the workplace, particularly peer colleagues. The exemplary behavior of colleagues who consistently perform their duties in accordance with standard operational procedures can encourage others to adopt similar behaviors, even if their attitudes have not yet become fully positive (Ikhlasiah, 2022).

Based on the results of the paired t-test, it can be concluded that the medical waste management training provided has a significant impact on enhancing knowledge, fostering positive attitudes, and improving respondents' work practices. All variables demonstrated statistically significant differences ($p < 0.05$) with consistent increases in scores. The three variables showed an increase in mean values following the training intervention, supported by low standard error estimates, indicating the statistical reliability of the results.

After the waste separation practice training, participants correctly applied knowledge related to waste container symbols, safety procedures, and waste categorization. This finding is consistent with previous research. Waste separation is a critical step in determining the success of medical waste management (Miamiliotis & Talias, 2024). The effectiveness of the training program is measured by the participants' ability to classify medical waste, properly containerize it, and adhere to waste disposal regulations (Suhermi, 2020). Approximately 61.3% of each department correctly performed waste separation following the training (Letho et al., 2021).

Consistent with other research, regular training, environmental literacy enhancement, and strong management support are key factors in improving nurses' competence in medical waste management. Therefore, healthcare institutions should provide periodic training and integrate waste management practices into hospital accreditation standards (Huda et al., 2022). Poor training quality and low awareness are primary factors that trigger inadequate medical waste handling (Tolera et al., 2024).

Based on the findings of the study conducted by Temesgen et al. (2022), work experience and safety training have demonstrated a significant influence on the prevalence of work-related injuries among waste collectors in hospitals

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(Temesgen et al., 2022). Workers with less experience and those who have not received adequate safety training exhibit higher injury rates compared to their colleagues with more extensive experience and who have undergone safety training. Experience and skill development through training play a crucial role in enhancing awareness and the implementation of safe work practices, thereby reducing the risk of accidents and occupational injuries within healthcare facility environments.

Based on the Regulation of the Minister of Health of the Republic of Indonesia Number 18 of 2020 concerning Medical Waste Management in Healthcare Facilities, nurses have the obligation to document the quantity and types of waste generated, ensure the proper use of personal protective equipment (PPE), and report any high-risk incidents such as spills or direct exposure to infectious waste (Permenkes, 2020). The involvement of nurses extends beyond technical aspects, encompassing educational and preventive dimensions aimed at colleagues and patients.

Inpatient wards also constitute one of the service units that significantly contribute to the volume of solid medical waste. Consequently, nurses' understanding, attitudes, and practices in waste management are critical determinants of the overall effectiveness of hospital waste management systems. A study conducted in 2021 demonstrated satisfactory results, with waste management training in hospitals increasing from 44.7% prior to training to 68.9% afterward, particularly in the aspect of proper waste segregation (Bannour et al., 2024). Effective training in waste management plays a vital role in enhancing compliance, awareness, and the responsible implementation of work practices within hospital environments. To sustain these achievements, consistent attention and ongoing training for all healthcare personnel involved are essential (Chelly et al., 2024), (Jannah, 2024).

One study conducted in primary healthcare facilities indicated that policies and standard operating procedures (SOPs) regarding medical waste management have been established; however, their implementation continues to face challenges, including operational gaps and policy discrepancies (Omoleke et al., 2021). Waste management failure has been attributed to inadequate training among healthcare personnel (Thirunavukkarasu et al., 2022). The selection of nurses in inpatient wards as the research population is considered appropriate for evaluating the impact of solid medical waste management training, particularly in the context of waste segregation, understanding of medical waste symbols, and the implementation of work procedures aligned with environmental health and safety standards. Furthermore, as frontline providers in patient care, inpatient nurses are at a higher potential risk of exposure to medical waste, making the enhancement of their competencies in waste management a critical aspect of efforts to prevent nosocomial infections and protect the work environment.

## Conclusion

Training in solid medical waste management provided to nurses in private hospitals in Medan City has been proven to produce significant positive impacts. The study's findings indicate that the training effectively enhanced nurses' knowledge regarding medical waste procedures and symbols, fostered more responsible attitudes toward waste management, and improved work practices in accordance with safety and environmental health standards. The increase in scores across all variables—knowledge, attitude, and practice—after the training demonstrates that this intervention was successful both statistically and practically. These findings suggest that the training not only serves an informative purpose but also effectively shapes safer and standards-compliant work behaviors.

Training induces changes in nurses' knowledge, attitudes, and practices by delivering structured, relevant, and up-to-date information based on current guidelines for medical waste management. The training material not only enhances conceptual understanding (knowledge) but also fosters awareness of the importance of

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occupational safety and environmental responsibility (attitude). Additionally, training sessions are typically complemented by simulations or hands-on practice, which encourage participants to apply their skills in real-world settings (practice). Through a combination of educational and practical approaches, the training facilitates behavioral changes that are more consistent with standard operating procedures for the safe and effective management of medical waste.

The real impact of the benefits of training for nurses includes improved patient care, increased efficiency, enhanced safety, and greater confidence in their skills. For example, training can lead to better infection control practices, more accurate medication administration, and effective communication with patients and colleagues. This ultimately results in better health outcomes and a safer healthcare environment. To apply these benefits in daily lives, nurses can: Incorporate new protocols and best practices learned during training into their routine tasks. Educate patients and their families about health management, promoting preventative care. Continuously stay updated with ongoing training to adapt to evolving healthcare standards. Collaborate with colleagues to share knowledge and improve team performance. Use training insights to advocate for patient safety and quality improvement initiatives within their workplace.

Solid medical waste management training is critically important to be conducted periodically, particularly for nursing staff who serve as the frontline providers of direct patient care. This training can serve as an effective strategy to prevent the spread of infections, reduce exposure to hazardous materials, and support the creation of a clean and safe hospital environment for healthcare workers, patients, and the surrounding community. Hospital management must provide systematic support, including the provision of adequate facilities, regular monitoring, and the consistent implementation of standard operating procedures (SOPs). Furthermore, enhancing environmental literacy and fostering a safety-oriented work culture, along with environmentally friendly waste management practices, should be integral components of the hospital's quality policy for healthcare services.

**References**

Adu, R. O., Gyasi, S. F., Essumang, D. K., & Otabil, K. B. (2020). Medical Waste-Sorting and Management Practices in Five Hospitals in Ghana. *Journal of Environment and Public Health*, 1–14. https://doi.org/https://doi.org/10.1155/2020/2934296

Afesi-Dei, C., Appiah-Brempong, M., & Awuah, E. (2023). Health-care waste management practices: The case of Ho Teaching Hospital in Ghana. *Heliyon*, *9*(4), e15514. https://doi.org/10.1016/j.heliyon.2023.e15514

Arizona, M., & Margata, L. (2021). Pelatihan tentang Modifikasi Penanganan Limbah RS di RSU Sembiring. *Journal of Industrial and Engineering Chemistry*, *1*(2), 6–10.

Baduge, M. S. D. S. P., Garth, B., Boyd, L., Ward, K., Joseph, K., Proimos, J., & Teede, H. J. (2024). Barriers to advancing women nurses in healthcare leadership: a systematic review and meta-synthesis. *EClinicalMedicine*, *67*, 102354. https://doi.org/10.1016/j.eclinm.2023.102354

Bannour, R., Cheikh, A. Ben, Bhiri, S., Ghali, H., Khefacha, S., Rejeb, M. Ben, & Laatiri, H. S. (2024). Impact of an educational training about healthcare waste management on practices skills of healthcare workers: a prexperimental study in a tertiary Tunisian hospital. *Antimicrobial Resistance and Infection Control*, *13*(1), 122. https://doi.org/10.1186/s13756-024-01446-w

Cahyawati, A. I., Fanny, N., & Sari, D. P. (2024). *Administrasi Rumah Sakit, Fakultas Ilmu Kesehatan, Universitas Duta Bangsa Surakarta S1 Administrasi Rumah Sakit, Fakultas Ilmu Kesehatan, Universitas Duta*

https://jurnal.uinsu.ac.id/index.php/kesmas/index
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*Bangsa Surakarta 3) S1 Administrasi Rumah Sakit, Fakultas Ilmu Kesehatan, Universitas Duta Bangsa S*. *4*(2), 46–51.

Chelly, S., Saffar, S., Mabrouk, R., Ltaif, I., Ammar, A., Ezzi, O., Njah, M., & Mahjoub, M. (2024). Evaluation of a training programme on the management of infectious and sharp healthcare waste in Tunisia. *BMJ Open Quality*, *13*(3), 1–8. https://doi.org/10.1136/bmjoq-2024-002793

Chisholm, J. M., Zamani, R., Negm, A. M., Said, N., Abdel daiem, M. M., Dibaj, M., & Akrami, M. (2021). Sustainable Waste Management of Medical Waste in African Developing Countries: A Narrative Review. *Waste Management and Research*, *39*(9), 1149–1163. https://doi.org/10.1177/0734242X211029175

Ciawi, Y., Dwipayanti, N. M. U., & Wouters, A. T. (2024). Pengelolaan Limbah Medis Rumah Sakit yang Berkelanjutan: Eksplorasi Strategi Ekonomis dan Ramah Lingkungan. *Jurnal Ilmu Lingkungan*, *22*(2), 365–374. https://doi.org/10.14710/jil.22.2.365-374

Citraningtyas, G., Simbala, H., & Rundengan, G. (2024). Pelatihan Pengelolaan Limbah Medis Rumah sakit di kelurahan Girian Weru Dua Kecamatan Girian Kota Bitung. *The Studies of Social Science*, *06*(02), 15–20. https://doi.org/https://doi.org/10.35801/tsss.v6i2.57154

Endris, S., Tamir, Z., & Sisay, A. (2022). Medical laboratory waste generation rate, management practices and associated factors in Addis Ababa, Ethiopia. *PLoS ONE*, *17*(4 April), 1–14. https://doi.org/10.1371/journal.pone.0266888

Huda, M. N., Hailemariam, T. G., Hossain, S. Z., Malo, J. S., Khan, S., Hadisuyatmana, S., Ferdous, A., Akombi-Inyang, B., Islam, R. M., & Renzaho, A. M. N. (2022). Medical waste management-related factors affecting health and experiences of health risks among medical waste handlers in low and middle-income countries: A systematic review protocol of qualitative studies. *BMJ Open*, *12*(3), 1–6. https://doi.org/10.1136/bmjopen-2021-056037

Ibáñez-Cruz, A. J. A., Vergara-Florián, A. M. E., & Algoner, W. C. (2025). Hospital solid waste management strategies to prevent healthcare-associated infections from occupational exposure to bloodborne pathogens and improve occupational safety. *Frontiers in Public Health*, *13*(January). https://doi.org/10.3389/fpubh.2025.1499463

IEC. (2024). *Strategi Pengelolaan Limbah Medis*.

Ikhlasiah, M. (2022). Pelatihan Tenaga Medis Dalam Pengolahan Limbah B3 Di Fasilitas Kesehatan Kesehatan Klinik Azzahra. *KREATIF: Jurnal Pengabdian Masyarakat Nusantara*, *2*(2), 139–146. https://doi.org/10.55606/kreatif.v2i2.2971

Istiqomah, A. N., Prasetyo, E., & Suwandi, J. F. (2023). Perilaku Tenaga Kesehatan dalam Pemilahan Limbah Medis Padat. *Jurnal Penelitian Perawat Profesional*, *5*(3), 1031–1038. https://doi.org/10.37287/jppp.v5i3.1702

Jannah, R. (2024). Tugas dan Kewenangan Puskesmas dalam Pengelolaan Limbah Medis sebagai Perlindungan Kesehatan Lingkungan. *Jurnal Hukum, Politik Dan Kekuasaan*, *5*(1), 73–99. https://doi.org/10.24167/jhpk.v5i1.10026

Kalantary, R. R., Jamshidi, A., Mofrad, M. M. G., Jafari, A. J., Heidari, N., Fallahizadeh, S., Arani, M. H., & Torkashvand, J. (2021). Impact of COVID-19 pandemic on medical waste management in Lebanon. *Journal of Environmental Health Science and Engineering*, *19*(1_suppl), 831–836. https://doi.org/10.1177/0734242X211003970

Lattanzio, S., Stefanizzi, P., D'ambrosio, M., Cuscianna, E., Riformato, G., Migliore, G.,

DOI: 10.30829/jumantik.v10i2.24444
p-ISSN: 2548-2173; E-ISSN: 2580-281X

Tafuri, S., & Bianchi, F. P. (2022). Waste Management and the Perspective of a Green Hospital—A Systematic Narrative Review. *International Journal of Environmental Research and Public Health*, *19*(23). https://doi.org/10.3390/ijerph192315812

Letho, Z., Yangdon, T., Lhamo, C., Limbu, C. B., Yoezer, S., Jamtsho, T., Chhetri, P., & Tshering, D. (2021). Awareness and practice of medical waste management among healthcare providers in National Referral Hospital. *PLoS ONE*, *16*(1 January), 1–10. https://doi.org/10.1371/journal.pone.0243817

Marselinus, K., Salim, C. H., Dewi, A. K., & Parulian, A. A. (2024). *Manajemen Administrasi Rumah Sakit* (Issue November).

Miamiliotis, A. S., & Talias, M. A. (2024). Healthcare Workers' Knowledge about the Segregation Process of Infectious Medical Waste Management in a Hospital. *Healthcare (Switzerland)*, *12*(1). https://doi.org/10.3390/healthcare12010094

Normawati, Miswan, & Andri, M. (2022). Analisis Sistem Pengelolaan Limbah Padat Bahan Berbahaya dan Beracun di Rumah Sakit Umum Tadulako An Analysis of Hazardous and Toxic Solid Waste Management System at Tadulako Hospital. *Jurnal Kolaborasi Sains*, *04*, 676–680.

Olaifa, A., Govender, R. D., & Ross, A. J. (2018). Knowledge, attitudes and practices of healthcare workers about healthcare waste management at a district hospital in KwaZulu-Natal. *South African Family Practice*, *60*(5), 137–145. https://doi.org/10.1080/20786190.2018.1432137

Omang, D. I., John, G. E., Inah, S. A., & Bisong, J. O. (2021). Public health implication of solid waste generated by households in bekwarra local government area. *African Health Sciences*, *21*(3), 1467–1473. https://doi.org/10.4314/ahs.v21i3.58

Omoleke, S. A., Usman, N., Kanmodi, K. K., & Ashiru, M. M. (2021). Medical waste management at the primary healthcare centres in a north western Nigerian State: Findings from a low-resource setting. *Public Health in Practice*, *2*(January), 100092. https://doi.org/10.1016/j.puhip.2021.100092

Permenkes. (2019). Peraturan Menteri Kesehatan Republik Indonesia Nomor 7 Tahun 2019 tentang Kesehatan Lingkungan Rumah Sakit. In *Menteri Kesehatan RI* (pp. 1–14). https://peraturan.bpk.go.id/Details/111721/permenkes-no-7-tahun-2019

Permenkes. (2020). *Pengelolaan Limbah Medis Fasilitas Pelayanan Kesehatan Berbasis Wilayah.*

Puspita, R. (2018). Pengaruh pengetahuan kerja, kemampuan kerja dan pengalaman kerja terhadap kinerja karyawan PT. Muslimat Nusantara Utama Kabupaten Malang. *Management and Business Review*, *2*(1), 62–70. https://doi.org/10.21067/mbr.v2i1.4732

Rakshanda, A., Vahid, & Binazhar, S. (2024). A study on Biomedical waste management in the Healthcare sector. A pathway towards Sustainability. *Social Medicine*, *17*(2), 66–77. https://www.socialmedicine.info/index.php/socialmedicine/article/view/1603

Rasinta, R., Jhon Rinaldo, & Delvianti, D. (2023). Pengaruh Pengetahuan, Kemampuan dan Pengalaman Kerja Terhadap Kinerja Karyawan PT. Batang Hari Barisan Padang. *Ekasakti Matua Jurnal Manajemen*, *1*(4), 358–369. https://doi.org/10.31933/emjm.v1i4.976

Rohmah, N., Damayanti, E., Salsabila, Y., Arifin, Y. A. D. R., Agustina, R., Mangkuluhur, A., & Yosiawan, O. (2023). Motivasi Mahasiswa Keperawatan Dalam Perspektif Gender Berbasis Teori Attention, Relevance, Confidence, and Satisfaction Attributes. *Jurnal Ilmiah Keperawatan (Scientific Journal of Nursing)*, *9*(2), 344–352.

DOI: 10.30829/jumantik.v10i2.24444
p-ISSN: 2548-2173; E-ISSN: 2580-281X

https://doi.org/10.33023/jikep.v9i2.1564

Saraswati, M. D., & Praptiestrini. (2021). Pengaruh Pengetahuan, Pengalaman Dan Kemampuan Terhadap Kinerja Karyawan Pt. Cahaya Sakti Karanganyar. *Jurnal Penelitian Dan Kajian Ilmiah*, *19*(4), 302–308. http://ejournal.unsa.ac.id/index.php/smooting/article/view/800

Shekoohiyan, S., Parsaee, F., & Ghayour, S. (2022). *Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID- 19 . The COVID-19 resource centre is hosted on Elsevier Connect , the company ' s public news and information . January*.

Singh, S., Vashisht, M., Malik, I., Dahiya, P., & Bhattacharya, S. (2022). Health research in the state of Odisha, India: A decadal bibliometric analysis (2011-2020). *Journal of Family Medicine and Primary Care*, *6*(2), 169–170. https://doi.org/10.4103/jfmpc.jfmpc

Soomro, M. A., Ali, M. H., Zailani, S., Tseng, M. L., & Makhbul, Z. M. (2023). Understanding barriers and motivations in solid waste management from Malaysian industries: a comparative analysis. *Environmental Science and Pollution Research*, *30*(3), 5717–5729. https://doi.org/10.1007/s11356-022-22558-z

Suhermi, S. (2020). Pelatihan Pengelolaan Limbah Medis Padat. *Jurnal Pemberdayaan Komunitas MH Thamrin*, *2*(1), 18–23. https://doi.org/10.37012/jpkmht.v2i1.201

Sujon, H., Biswas, T. K., Chowdhury, A., & Chowdhury, M. E. (2022). Medical Waste Management: An Assessment of District-Level Public Health Facilities in Bangladesh. *Cureus*, *14*(5). https://doi.org/10.7759/cureus.24830

Temesgen, L. M., Mengistu, D. A., Mulat, S., Mulatu, G., Tolera, S. T., Berhanu, A., Baraki, N., & Gobena, T. (2022). Occupational Injuries and Associated Factors Among Municipal Solid Waste Collectors in Harar Town, Eastern Ethiopia: A Cross Sectional Study. *Environmental Health Insights*, *16*. https://doi.org/10.1177/11786302221104025

Thirunavukkarasu, A., Al-Hazmi, A. H., Dar, U. F., Alruwaili, A. M., Alsharari, S. D., Alazmi, F. A., Alruwaili, S. F., & Alarjan, A. M. (2022). Knowledge, attitude and practice towards bio-medical waste management among healthcare workers: a northern Saudi study. *PeerJ*, *10*, 1–19. https://doi.org/10.7717/peerj.13773

Tolera, S. T., Kebede, K., Muzeyin, M., & Aschalew, A. (2024). Medical waste generation rate and management practices among government hospitals in Eastern Ethiopia. A descriptive survey. *SAGE Open Medicine*, *12*. https://doi.org/10.1177/20503121241257145

Ugwu, C. O., Ozoegwu, C. G., & Ozor, P. A. (2020). Solid waste quantification and characterization in university of Nigeria, Nsukka campus, and recommendations for sustainable management. *Heliyon*, *6*(6), e04255. https://doi.org/10.1016/j.heliyon.2020.e04255

WHO. (2021). *Safe management of wastes from health-care activities*. https://www.who.int/publications/i/item/9789240024199