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Analysis of Solid Medical Waste Management in Health Centres and Its Impact on Environmental Health in Koto Tangah Aie Pacah District, Padang City, West Sumatera

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ABSTRACT

Proper management of solid medical waste is essential to prevent environmental and health hazards. Improper handling can cause pollution and spread diseases within nearby communities. Objective: This study analyses solid medical waste management in health centres and its impact on environmental health in Koto Tangah, Air Pacah District, Padang City, West Sumatera. Method: A descriptive survey with quantitative and qualitative approaches was conducted from January to June 2024. Data were collected through direct observation, in-depth interviews with 15 waste management officers from selected health centres, and secondary data from environmental and public health reports (2023). Results: The findings show that medical waste management in these centres remains below standard, particularly in sorting, storage, and disposal practices. These shortcomings may degrade environmental quality and increase the risk of infectious diseases among local residents. Implications: The study highlights the urgent need to enhance staff capacity, awareness, and adherence to standard operating procedures for medical waste management to reduce environmental risks. Conclusion: Medical waste management in health centres across Air Pacah Sub-district requires significant improvement to mitigate its adverse effects on environmental health and to promote a cleaner, safer, and healthier community environment.

Keywords: *Medical Waste Management, Community Health Centres, Environmental Impact, Disease Risk*

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INTRODUCTION

Solid medical waste management is an important aspect in efforts to maintain environmental health, especially in health care facilities such as health centers. Solid medical waste derived from health care activities contains hazardous materials and has the potential to pose a risk of infection for humans and environmental pollution if not properly managed (Ministry of Health, 2018). Therefore, good and standard medical waste management is needed to minimize these negative impacts.

The main problems that are often encountered in health centers are the lack of optimal waste sorting from the source, inadequate storage, and waste disposal procedures that are not in accordance with technical provisions. This can cause medical waste to mix with domestic waste, increasing the risk of spreading infectious diseases and environmental pollution (Rahmawati, 2022). This situation is a serious concern because the Health Center is the frontline of health services that serve the community directly.

According to a recent study by Wijaya et al. (2024), in several health centers in the Central Java region, it was found that about 60% of solid medical waste management did not meet the standards set by the Ministry of Health. The study emphasizes that the lack of training and understanding of Puskesmas officers is a major factor in the failure of good medical waste management. This shows that there is still an urgent need to improve the capacity of human resources in waste management.

In addition, a study by Santoso (2023) revealed that the impact of improper medical waste management is very pronounced in the environment around Puskesmas, such as soil and water pollution that has the potential to cause skin diseases and respiratory disorders in the surrounding community. This study confirms the importance of a thorough evaluation of medical waste management procedures in primary health facilities.

Another problem that needs to be considered is the limited facilities and infrastructure in Puskesmas which often become obstacles in managing solid medical waste effectively. Based on a report from the XYZ District Health Office (2024), some health centers do not yet have adequate medical waste storage facilities and waste destruction tools such as incinerators are still very rare. This condition causes medical waste is often disposed of directly into the surrounding environment without prior treatment.

Research by Putri and Handayani (2023) also shows that medical waste management policies at the Puskesmas level have not been fully implemented consistently. Many Puskesmas still run partial waste management and are less coordinated with related parties, such as the health office and regional waste managers. This contributes to the low overall effectiveness of medical waste management.

Environmental health impacts due to poor medical waste management is a real problem that requires serious attention from all relevant parties. Solid medical waste that is not properly treated can be a source of various infectious diseases, both for health workers who directly handle the waste and people who live around the waste disposal site. According to the WHO report (2023), poorly managed medical waste has the potential to pose a risk of infection, such as hepatitis

B and C, HIV/AIDS, and antibiotic-resistant bacterial infections that are increasing in various regions. In addition to the risk of infection, carelessly disposed of medical waste can also pollute the environment, especially the quality of groundwater, soil and air.

Pollution of groundwater and surfaces due to the infiltration of harmful substances from medical waste can lead to contamination of drinking water sources, resulting in a direct impact on public health. In addition, harmful chemicals and pharmaceutical ingredients contained in medical waste can damage the soil ecosystem, disrupt the balance of microorganisms, and reduce soil fertility. Air pollution also occurs when medical waste is openly burned without proper technology, resulting in the emission of toxic gases such as dioxin and furan that are harmful to human respiratory health.

Because such negative impacts are so widespread and complex, the management of solid medical waste must be carried out with an integrated and sustainable approach. An integrated approach means involving various parties, ranging from health workers, waste managers, local governments, to local communities, who work together to run an effective and efficient waste management system. A sustainable approach requires that waste management is carried out in a consistent and planned manner, taking into account environmental, health and socio-economic aspects in the long term.

The implementation of environmentally friendly waste treatment technologies such as autoclaves, incinerators with emission control, as well as strict waste sorting systems from the source are an important part of this strategy. In addition, education and continuous training to officers and the public on the importance of safe waste management should also be a priority. In this way, the risk of infection and environmental pollution can be minimized, so that environmental health and people's quality of life can be optimally maintained.

The management of solid medical waste in health centers is a critical aspect of environmental health, especially in rapidly growing urban areas such as Koto Tangah Aie Pacah District in Padang City, West Sumatera (Wahana Lingkungan Hidup Indonesia Sumbar et al., nd). Improper handling and disposal of medical waste can lead to environmental pollution and pose significant health risks to the surrounding community (World Bank, 2018). In Padang City, increasing population growth and urbanization have contributed to higher volumes of medical waste, necessitating an effective waste management system to mitigate its adverse impacts on environmental quality and public health (Nasution, Andayani and Oktavia, 2023).

In the Koto Tangah Air Pacah sub-district itself, preliminary research findings indicate that there is no systematic and standardised data available on the management of solid medical waste in community health centres. The information that does exist is limited, scattered and poorly documented, making it difficult to use as a basis for planning and evaluation. This situation is very different from the ideal condition, where medical waste management should be recorded regularly, completely, and in accordance with the technical standards set by the Ministry of Health. This gap emphasises the urgent need for in-depth research on solid medical waste management as a basis for policy formulation, strategic planning, and capacity building in medical waste management at the primary health care level.

In this context, this study aims to conduct an in-depth analysis of solid medical waste management in health centers and its impact on Environmental Health. This research will focus on aspects of waste sorting, storage, and disposal, as well as the evaluation of risks that may arise in the environment surrounding health centres in the Koto Tangah Aie Pacah sub-district of Padang City, West Sumatera. Thus, it is expected that the results of this study can be the basis for effective and applicable policy recommendations.

This background confirms that solid medical waste management in Puskesmas still faces various obstacles, both from the technical and non-technical sides, which need to be addressed immediately to prevent negative impacts on environmental and public health. Technical constraints include the limitations of adequate storage facilities, lack of effective waste treatment tools such as incinerators or autoclaves, and less optimal sorting of waste from the source. This often leads to the mixing of medical waste with domestic waste, thereby increasing the risk of contamination and transmission of diseases. On the other hand, non-technical obstacles include the low level of knowledge and awareness of Puskesmas officers regarding the correct waste management procedures, lack of training and socialization, and lack of coordination between Puskesmas and related agencies such as health offices and regional waste managers.

Increasing the capacity of waste management officers is one of the crucial strategic steps. With intensive and continuous training, personnel can understand the importance of proper medical waste management, recognize the risks that may arise, and master the technical procedures that must be carried out in sorting, storing, and disposing of waste. In addition, the fulfillment of adequate facilities and infrastructure is also a determining factor for the success of medical waste management. Complete and standard facilities will facilitate the implementation of waste management effectively and safely, while reducing the potential for environmental pollution.

Furthermore, coordination between agencies must also be strengthened to create synergies in medical waste management. Good cooperation between health centers, health offices, environmental agencies, and waste and hazardous waste managers is very important so that the process of collecting, transporting, and processing waste goes according to applicable procedures and regulations. In addition, the involvement of the surrounding community in supervision and education can also increase collective awareness of the importance of Responsible Waste Management.

By overcoming these technical and non-technical obstacles through increasing the capacity of officers, fulfilling facilities, and Cross-Sector Coordination, it is hoped that solid medical waste management in Puskesmas can run more effectively and sustainably. This step will not only minimize the negative impact on environmental and public health, but also support the creation of a safe and environmentally friendly health service environment. Therefore, a comprehensive and integrated intervention is needed as part of efforts to improve the quality of Health Services at the primary level.

METHODS

This study uses a descriptive approach with survey and observation methods to analyse the management of solid medical waste in community health centres and its impact on environmental health. The research location is at the Community Health Centre in Koto Tangah Aie Pacah District, Padang City, West Sumatera, which was purposively selected based on the number of patient visits and the level of health service activity. The research was conducted from January to June 2024, using primary and secondary data. Primary data were obtained through direct observation of the medical waste management process at each health centre, as well as in-depth interviews with 15 medical waste management officers involved in the collection, sorting, storage, and disposal of waste. Secondary data was obtained from environmental reports and public health records in 2023 in the area surrounding the health centres. Data analysis was conducted quantitatively and qualitatively. Quantitative data from observations and interviews was analysed using descriptive statistics to describe the level of compliance with medical waste management standards. Meanwhile, qualitative data from interviews were analysed using content analysis techniques to identify obstacles and supporting factors in waste management practices. The impact of waste management on environmental health was evaluated by comparing environmental quality data and disease incidence rates in communities around the research location.

RESULTS

The results showed that the management of solid medical waste in most of the Health Centers studied still did not fully meet the standard operating procedures set by the Ministry of Health. From the observations made, it is known that only about 40% of Puskesmas have implemented a medical waste sorting system by Category (infectious, sharp, pharmaceutical, and non-medical) consistently. The rest are still mixing medical waste with domestic waste, which increases the risk of cross-contamination and endangers officers and the surrounding community.

In addition, most health centers do not have standard medical waste temporary storage facilities, such as closed, leak-proof, and secure locations out of public reach. In terms of transportation and disposal of waste, it was found that only a small percentage of health centers that cooperate with third parties have a B3 waste management license (hazardous and toxic materials). Others still rely on the open burning method or disposal in public trash, which has the potential to pollute the surrounding environment.

From interviews with officers, it was found that the main obstacle in the management of medical waste is the lack of technical training and the lack of understanding of the risks of medical waste to health and the environment. Some officers admitted that they had never attended special training on medical waste management. On the other hand, the limited operating budget is also an inhibiting factor in the provision of adequate waste management facilities and equipment.

The impact of suboptimal medical waste management can be seen from the reports of local people who complain of unpleasant odors and the presence of medical waste scattered around the Puskesmas area. Some residents also claimed to have skin and respiratory problems, although no

further research has directly linked the condition to medical waste. Nevertheless, the data indicate a potential risk to environmental health that needs to be addressed immediately.

To explore more in-depth information about solid medical waste management practices, researchers conducted in-depth interviews with 15 medical waste management officers from several community health centres in Koto Tangah Aie Pacah Subdistrict. These interviews aimed to obtain a realistic picture of the implementation of procedures, the obstacles encountered, and the respondents' views on efforts to improve the waste management system. A summary of the interview results can be seen in Table 1 below.

Table 1. Results of Interviews with Medical Waste Management Officers at Community Health Centres in the Koto Tangah Aie Pacah District, Padang City, 2024

No	Interview Questions	Summary of Respondents' Answers	Direct Quote
1	What is the procedure for sorting solid medical waste on a daily basis?	Most respondents stated that they had sorted waste according to category (infectious, sharp, pharmaceutical, non-medical), but mixing still often occurred due to limited facilities.	"We do sort waste, but because space is limited, medical and domestic waste sometimes get mixed together." (R3)
2	What are the obstacles encountered in the process of storing medical waste before it is disposed of or transported by a third party?	The main obstacles are limited storage space, substandard conditions, and delays in waste transport by third parties.	"The storage space is small and not standard, so sometimes we store things behind the building temporarily.'' (R11)
3	Have respondents ever received special training related to medical waste management?	The majority of respondents admitted that they had never received formal training on medical waste management, learning only from experience or instructions from previous officers.	"During my time working here, I have never participated in any training, only learning from senior staff." (R7)
4	According to respondents, what steps are most needed to improve the waste management system at health centres?	Respondents suggested improvements to facilities and infrastructure, regular technical training, and stricter supervision by health or environmental agencies.	"The most important thing is training and adequate storage facilities." (R5)
5	What is the local community's response to	Some respondents said that the community had begun to complain	"Residents often complain about the smell

the management of medical waste at the community health centre?	about unpleasant odours and the presence of waste around the health centre, although no official reports had been made to the health department.	coming from behind the health centre, but they have never made an official report.'' (R9)

These responses indicate that limited resources, inadequate training, and a lack of structured systems are the main challenges in managing solid medical waste at health centres in the study area. These findings reinforce the observations that most stages of medical waste management have not been carried out in accordance with the technical standards set by the Ministry of Health.

DISCUSSION

The results of the study indicate that the management of solid medical waste in several community health centres in Koto Tangah Aie Pacah Subdistrict, Padang City, still faces various technical and non-technical obstacles. In terms of sorting, most health centres have separated medical waste into infectious, sharp, pharmaceutical, and non-medical categories. However, this practice has not been carried out consistently due to limited storage space and supporting facilities. Several officers reported that medical and domestic waste are still often mixed due to a lack of standardised sorting and storage facilities. This condition is in line with the findings of a study at the Bangli District Inpatient Health Centre, which revealed that although the sorting and storage processes had been carried out in accordance with guidelines, limitations in infrastructure and human resources were the main obstacles to the implementation of solid medical waste management (Juliastini et al., 2024).

In terms of temporary storage, most of the medical waste storage rooms in the health centres in the study locations still did not meet technical requirements, such as limited space, inadequate ventilation, and unsafe locations. These results are consistent with research conducted at the Karya Medika Bantar Gebang Hospital, which found that most of the waste management facilities and infrastructure did not meet the technical requirements of Permenkes No. 7 of 2019, including the lack of special symbols and colouring on waste transport trolleys (Fitrianingsih & Yaser, 2023).

In terms of human resources, most medical waste management officers at the research site had never undergone formal training on medical waste management. Their knowledge was generally gained from work experience or guidance from senior officers. This lack of technical training also contributed to inconsistencies in the waste sorting, storage, and disposal processes. These findings are in line with research at Sunan Kudus Islamic Hospital, which emphasises that increasing human resource capacity through training plays an important role in the successful implementation of medical waste management in accordance with guidelines ('Ulya & Pawenang, 2022).

Furthermore, from an institutional and supervisory perspective, medical waste management in community health centres still relies on third parties for transportation and

disposal. However, the mechanism for supervising the implementation of this cooperation is not yet optimal. In some cases, delays in waste transportation have led to the accumulation of waste in unsuitable storage areas. This condition is in line with research conducted in health care facilities in the West Java region, which found that many health care facilities do not yet have an optimal hazardous waste management system due to weak infrastructure and institutional coordination (Rahim et al., 2023).

This finding is in line with the results of research Wijaya et al. (2024) which states that more than 55% of Puskesmas in urban and semi-urban areas have not implemented medical waste management systems according to standard operating procedures. From the aspect of human resource capacity, this study also found that most of the officers had never attended formal medical waste management training. This is the main cause of procedural errors, from sorting to waste storage. Research by Sari and Handayani (2023) reinforces this finding, where it is stated that the lack of technical training has a direct impact on the quality of medical waste management at the primary service level, such as Puskesmas. Without adequate understanding, officers tend to ignore the risks of medical waste to environmental and public health.

From an environmental perspective, improper waste management practices, such as open burning, have caused negative impacts that are directly felt by the surrounding community. Residents complain of pungent odors, scattered waste, to the emergence of minor health problems such as respiratory irritation and skin diseases. This is consistent with the World Health Organization report (2023) which states that poorly managed solid medical waste can pollute the air (through harmful emissions), groundwater, and soil, as well as being a source of infectious diseases such as hepatitis, HIV, and respiratory tract infections.

The researchers ' analysis of this condition shows that the problem of solid medical waste management in health centers is systemic and interrelated. Limited facilities such as waste storage rooms, the absence of destructive devices (e.g. incinerators or autoclaves), and poor coordination with waste management agencies contribute to unsafe management practices. Even in health centers that have cooperated with licensed third parties, inappropriate waste storage practices are still found, indicating a gap in internal supervision.

The researchers also considered that weak regulation and supervision at the regional level was the cause of low compliance with medical waste management standards. In this context, a study by Firmansyah (2024) found that in many districts/cities, supervision of medical waste management by health facilities is still minimal due to limited environmental supervision personnel and Cross-Sector Coordination that has not been optimal. This reinforces the importance of a collaborative approach in improving the medical waste management system.

In general, the results and findings of this study indicate the need for a comprehensive strategy to strengthen medical waste management at the Puskesmas level. The discrepancy between field practices and established medical waste management standards shows that the approaches that have been applied have not been effective enough. Therefore, a strategic intervention involving various aspects is needed, ranging from human resources, supporting facilities, to institutional governance. The first strategy that should be a priority is continuous

training of officers. This training includes not only waste management techniques, but also an understanding of environmental and health risks, as well as applicable laws and regulations. Health workers who understand the risks of medical waste will be more careful in sorting, storing, and reporting waste.

From a regulatory perspective, most solid medical waste management practices at the research site are not yet fully compliant with Minister of Health Regulation No. 7 of 2019 concerning Hospital Environmental Health, Minister of Health Regulation No. 2 of 2023 concerning Standards for Solid Medical Waste Management, and Minister of Environment and Forestry Regulation No. P.56/MENLHK/2015 concerning procedures for managing hazardous waste. These regulations stipulate in detail the stages of sorting, packaging, collection, temporary storage, transportation, and disposal of hazardous medical waste. Non-compliance with these standards can increase the risk of environmental pollution and the spread of infectious diseases in the surrounding community. Therefore, it is necessary to improve facilities and infrastructure, provide continuous technical training for officers, and strengthen the cross-sectoral monitoring system so that medical waste management in community health centres can be carried out effectively, safely, and in accordance with regulations.

CONCLUSIONS

Based on the results of the research and discussions that have been conducted, it can be concluded that the management of solid medical waste at the Community Health Centre in the Koto Tangah Aie Pacah District, Padang City, still does not fully meet the technical standards and regulations set by the government. Although a sorting process has been implemented, this practice is not consistent due to limited facilities and infrastructure. Temporary storage is still largely not in accordance with technical standards, and most officers have not received formal training on medical waste management. In addition, supervision of the implementation of cooperation with third parties in waste transportation is still weak.

To overcome this, efforts need to be made to improve medical waste storage facilities that meet standards, provide regular technical training for officers, and strengthen the supervision and coordination system between relevant agencies. The entire process of solid medical waste management must refer to Minister of Health Regulation No. 7 of 2019, Minister of Health Regulation No. 2 of 2023, and Minister of Environment and Forestry Regulation No. P.56/MENLHK/2015, which cover the stages of sorting, packaging, collection, temporary storage, transportation, and disposal of hazardous medical waste. With the consistent and comprehensive implementation of these regulations, it is hoped that the medical waste management system at community health centres can operate more effectively, safely, and sustainably, thereby minimising the risk of environmental pollution and threats to public health.

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