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Research

Analysis of Hospital Solid Waste Management in West Sumatra Province

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A B S T R A K

Background: The current situation in West Sumatra is that there are 1,899.15 tons of solid medical waste per year, including hazardous and toxic materials (B3), originating from 2,839 health facilities in West Sumatra, and hospitals or other health facilities are not allowed to dispose of medical waste carelessly, so it costs quite a lot. The poor management of this waste can be seen starting from the lack of efforts to prevent or at least reduce the amount of waste, the absence of a system for segregation, containerization, transportation, temporary storage, placement, or collection of waste that is not by regulations, and the inconsistent system for processing/final processing of waste and its disposal

Methods: This qualitative research project will help us learn more about how hospitals in West Sumatra handle solid medical waste by looking at how they do it**.** The researcher is the crucial instrument; sampling data sources is done purposefully or snowballed, collection techniques are triangulation (combined), data analysis is inductive or qualitative, and the results of qualitative research emphasize meaning rather than generalization.

Results: By researching 12 hospitals in West Sumatra, using interviews, researchers obtained information that there were other variables as hidden influences/other factors in this study, namely training in medical waste management and low levels of education for cleaning service personnel.

INTRODUCTION

The Law of the Republic of Indonesia Number 32 of 2009 concerning the Protection and Management of the Environment (PPLH) in Chapter I, Article 1, Paragraphs 1 and 2) states that the living environment is a unitary space with all objects, forces, conditions, and living things, including humans and their behavior, which affect nature itself, the continuity of life, and the welfare of humans and other living things, and that protection and management of the environment are systematic and integrated efforts made to preserve environmental functions and prevent environmental pollution and damage to life, which include planning, utilization, control, maintenance, supervision, and law enforcement (UU No. 32/2009). Furthermore, it is stated in Chapter VII, Article 59, Paragraph 1, that everyone who produces B3 waste is responsible for its management. Paragraph (3) states that if everyone cannot manage B3 waste independently, the management is delegated to another party. He is obliged to carry out B3 waste management for the produced waste (UU No. 32/2009).

Government Regulation of the Republic of Indonesia Number 101 of 2014 concerning Hazardous and Toxic Waste Management in Chapter I Article 1 Paragraph (1), states that Hazardous and Toxic Materials, from now on abbreviated as B3,

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are substances, energy, and/or other components that, due to their nature, concentration, and/or amount, either directly or indirectly, can pollute and/or damage the environment and/or endanger the environment, health, and the survival of humans and other living things (PP No.101/2014).

The hospital is an essential public building because it is where people get checked out, get care, get treated, and get better. Some hospitals even function as places of education, training, and research. A good, clean, and healthy environment and sanitation are undoubtedly needed so that the various functions of the hospital can continue to run as they should. The challenge is that every activity with a different function in every part of the hospital generates waste of different types and amounts. However, waste can be divided into solid, liquid, and gaseous forms, including radioactive, non-medical, and solid and liquid medical waste (Ministry of Environment, 2014). The last group, medical waste, is categorized as hazardous and toxic waste (B3), based on PP 101 of 2014 concerning B3 Waste Management.

Medical waste management—solid, liquid, and non-medical—must be done appropriately and in accordance with the legislation to avoid damaging a hospital's reputation and hindering its operations. Poor waste management begins with a lack of attempts to prevent or decrease trash, a non-regulated system for sorting, containerized transportation, temporary storage, placement, or collection, and an inconsistent system for processing/final processing and disposal. Hospital trash can vary in shape, composition, and amount, necessitating a competent and consistent strategy and management (Ministry of Environment, 2014). Minimize, sort, containerize, transport, temporarily store, and process solid medical waste (Ministry of Environment, 2014). Hospital cleaners rarely receive medical waste training. Government involvement in infrastructure improvement has to be improved. Hospital solid medical waste is collected internally without analysis. (Askar Ilyas, Anwar Daud, 2015).

Medical waste is toxic and must be properly disposed of. Hospital, waste disposal company, and 200 patients were thoroughly inspected. Field visits and questionnaire surveys were used to acquire information on medical waste generation, sorting, collecting, containers, temporary storage, transport, training and education, trash disposal/final processing, and public awareness (Young , 2009). This study found that medical waste generation varies from 0.5 to 0.8 kilogram/day of sleep, averaging 0.68 kg. 73% of hospitals have separated medical waste, 20% employ unqualified medical waste collectors, and 93.3% have temporary storage rooms. 93.3% of hospitals have trained staff/medical waste managers, however only 20% have ongoing training. Medical waste disposal costs $580 per ton in a centralized sewage system with incineration technology.

77% of respondents said medical waste management was crucial when choosing hospital services, and the community needed to understand more about it. The hospital becomes a repository for all community diseases due to its activities or services. Because disease-vulnerable people live, utilize, and visit there, it can spread disease. In these settings, cross-infection or vector-borne infection from contaminated objects or insects can endanger public health. Hospitals, which are frequently in heavily populated regions (normally in the centre of cities), pollute the communities surrounding them by disposing both solid and liquid waste in public channels. Hospitals must dispose of and manage solid and liquid waste. However, with the rising cost of land, community demands for more supporting facilities for good health facilities, and stricter government regulations on environmental preservation, hospitals generally place waste processing facilities on a low priority scale because they require significant investment.

Hence, an easy-to-use hospital solid medical waste treatment facility is needed. So, hospital solid medical waste processing methods and their pros and cons must be shared. With accurate information, the waste manager can choose a waste management approach that suits the trash to be processed, is technically viable, inexpensive, and environmentally friendly. Outpatients generate less infectious medical waste daily. Intensive care, surgery, and emergency departments produce ten times more infectious medical waste than wards. Hospitals remove 60% of infectious medical waste from treatment, surgeries, emergency, and clinical inspection rooms (Ikeda, 2020). Jogjakarta Hospital's environmental health installation directed waste management officers' solid medical waste management. Waste Management Officers are self-funded hospital contractors. Several partners (private hospitals, private practising doctors, private maternity clinics, and private midwives who do not have

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incinerators) handle waste—their medical treatment—with the Jogjakarta Hospital incinerator, which provides ease and profitability for hospitals. The Jogjakarta Center for Environmental Health Engineering and Infectious Disease Management helps monitor air, exhaust pollutants, and incinerator ash (BBTKL-PPM). Jogjakarta Hospital WWTP receives burned ash (Maulana et al., 2015).

Debere et al. found that medical waste generation averaged 0.361-0.669 kg/patient/day, with 58.69% non-hazardous and 41.31% hazardous waste. Patient flows also increase waste. Public hospitals waste 59.22% more healthcare than private hospitals (40.48). The Kruskal-Wallis test showed that hospitals had different waste generation rates ($X2 = 30.65$, $p < 0.0001$). Patient waste increased with waste ($p < 0.05$). (Debere, Gelaye, Alamdo, & Trifa, 2013). Kumar said poor health staff management in developing countries necessitates healthcare waste management in hospitals and health centers. After training in healthcare waste management (HCWM), nurses and paramedics outperformed doctors (Kumar et al., 2016). Moreira and Gunther (2013) found that Brazilian officers mingled medical and non-medical garbage since they didn't know the laws. They disobeyed (Moreira & Günther, 2013). After this, Omar uncovered flaws in medical waste sorting and storage (Omar, Nazli, & Karuppannan, 2012). A survey of 14 primary health facilities in Libya found that almost all hospitals had poor medical waste management, no regulations for handling medical waste, and low-educated medical waste officers (Sawalem, Selic, & Herbell, 2009a). According to Zheng (2016a), China's medical waste processing might be improved by sorting, storing, and having regulations and facilities for sorting.

Medical waste management can be effective if several conditions are met, including clarity of the definition of medical waste and the scope of the regulations, the basic principles of promotion, reduction of clinical waste from the source, equality in waste grouping, and environmentally friendly waste treatment (Imsa, Zamorano, & López, 2010a). Caniato stated networks of groups handled Gaza's medical waste. Health, Local Government, and Waste Management were key stakeholders. Networks for medical waste management are difficult due to different beliefs, little knowledge, limited money, and difficulty sharing information. Medical waste management suffers from lawlessness (Caniato, Tudor, & Vaccari, 2015). The Ministry of Environment and Forestry reported that 2,813 Indonesian hospitals generate 242 metric tons of solid medical waste daily. The daily garbage pile averages 87 kilos. (Ministry of Environment and Forestry Director of Hazardous and Non-B3 Waste Management Performance Assessment) Hence, substantial trash remains. Taiwanese research showed 3.97 kg/bed/day or 0.075 kg/patient/day solid medical waste. Blood centres (3.14 kg/bed/day), private clinics (1.91 kg/bed/day), clinical laboratories (1.07 kg/bed/day), and government clinics (0.053 kg/bed/day) produce the greatest medical waste (Cheng, Li, & Sung, 2010). Greek dental clinics generate 92% medical waste. Istanbul generated 22,755 tons of medical waste in 2017, up from 5,307 tons in 2000. Hospital medical waste has increased from 0.43 kg/bed in 2000 to 1.68 kg/bed in 2017. (Korkut, 2018). 30 Greek hospitals and 1,427 healthcare centers generate 3,350 tons of medical waste annually (Mantzaras & Voudrias, 2017). According to the Directorate General of Public Health, Ministry of Health (2019), Indonesian hospitals and health centers generate 296.86 t/day of solid medical waste. Solid and liquid medical waste requires careful control. These hospitals manage liquid medical waste using the Wastewater Management system (WWTP). B3 waste management needs particular handling and processing of solid medical waste.

In addition to health facilities with waste treatment facilities, third parties handle most of the solid medical waste in Indonesia. Based on the Ministry of Environment and Forestry data for April 2020, Indonesia's total solid medical waste processing capacity is 314.29 t/day. The details are that as many as 21 provinces have health facilities capable of processing medical waste with a capacity of 70.21 metric tons per day. There are 7 B3 waste treatment services with a capacity of 244,08 t/day in seven provinces.

The governor of West Sumatra stated through Tribun Padang (2020) that there are 1,899.15 tons of medical hazardous and toxic waste (B3) from 2,839 health facilities in West Sumatra annually. B3 medical waste originating from service facilities It is also said that hospitals and other health facilities cannot just throw away medical waste without thinking about it.

So, it takes quite a lot of money to send it to Java, with a transportation fee of IDR 20,000–40,000 per kilogram. The capacity to process medical waste carried out by all private parties and all hospitals with licensed incinerators is still different from the waste generated by health facilities. This results in much medical waste that is not treated according to standards. Healthcare (fasyankes) is a problem that has been around for a long time. Failure to separate medical waste from non-medical waste, solid and liquid, causes expired/addictive drugs to be found around landfills which can cause epidemiological problems. There is an illegal sale of medical waste and illegal recycling of medical waste into raw materials for children's toys which can cause health problems (Ali, Wang, Chaudhry, & Geng, 2017).

A study of 14 primary health services in Lybia found that almost all hospitals handle medical waste poorly, there are no proper regulations for handling medical waste, and the staff generally need higher education (Sawalem, Selic, & Herbell, 2009b). He, Li, and Fang (2016) say there are problems with how medical waste is handled in China, such as the lack of segregation and the lack of rules and facilities for sorting medical waste.Problems related to the handling of solid medical waste in Indonesia are generally caused by incomplete cooperation with third parties, namely between producers and processors. Due to quota limitations, collaboration with third parties is carried out, namely, when the amount of solid medical waste > 100 kg, and healthcare facilities that produce medical waste depend on third parties—the need for more funds while medical waste generation is increasing. Human resources are involved in handling medical waste. Segregation, storage, transportation, temporary storage, and final processing of solid medical waste are not maximized (Banten Province Environment and Forestry Service, 2018).

Inputs in handling medical waste are policy elements, implementing staff, financing, facilities, and infrastructure. The process is a series of activities in handling medical waste: sorting, collecting, transporting, processing, and monitoring. The output is related to the management objectives of medical waste handling. The outcome of handling medical waste is the opportunity for health and environmental problems related to waste handling. Solid medical waste management can be effective by fulfilling several conditions, namely the clarity of the definition of medical waste and the scope of focus of the regulations, the basic principles of promoting the reduction of clinical waste at the source, the similarity in waste grouping and the implementation of environmentally friendly waste treatment (Imsa et al., 2010b)). (World Health Organization et al., 2014) says that good management of medical waste depends on the team's commitment, good management, careful planning, good organization, laws and regulations that help, enough money, and full participation by trained employees.

METHOD

This qualitative research will get more in-depth information about how hospitals in West Sumatra handle solid medical waste management. The researcher is the critical instrument; sampling data sources is done purposefully or snowball; collection techniques are triangulation (combined), data analysis is inductive or qualitative, and the results of qualitative research emphasize meaning rather than generalization. Sources of informants in this study consisted of the Head of the West Sumatra Provincial Environmental Service and the Head of the West Sumatra Provincial Health Service, 12 hospital directors throughout West Sumatra, 12 officials related to hospital medical waste, 12 heads of rooms, and 12 implementing staff or cleaning services for handling hospital medical waste. This research was conducted at 12 (twelve) hospitals in West Sumatra Province, with details of 1 type A hospital, namely Dr M. Jamil Padang, and 5 type B hospitals, namely RSAM Bukittinggi, Brain Hospital Bukittinggi, Regional General Hospital Solok, Regional General Hospital Dr Adnaan WD Payakumbuh, and Bukittinggi Regional General Hospital. Three type C hospitals: Ibnu Sina Hospital Bukittinggi, Batusangkar Regional General Hospital, and Dr Sadikin Kota Pariaman; three type D hospitals: Madina Bukittinggi General Hospital, Suliki Regional General Hospital, and Ibnu Sina Padang Panjang Hospital.

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RESULT DAN DISCUSSION

Handling of Type A Hospital Solid Medical Waste

The in-depth interview revealed that Dr. M. Jamil Padang, RSUD's exceptional solid medical waste management staff, is a D3 Kesling who follows Permenkes No.7 of 2019 concerning Hospital Kesling, on pages 50–51, part b concerning the Implementation of Safeguarding Hazardous and Toxic Material Waste (B3), states the Principles of Hospital B3 Waste Management, structured and continuous. Permenkes No. 7 of 2019 did not implement or find various items after observing and documenting. a) The room source must always have a spill kit or other B3 waste cleanup method with a method of use and material safety data. b) B3 waste in the source room that is handed over or taken by the hospital's B3 waste officer to be taken to the B3 waste TPS must be accompanied by an official report of delivery that at least contains the day and date of delivery, the waste's origin (source location), type, form, volume, and containerization or packaging method. b) Packages and waste containers utilize colors that don't match hazardous waste. Along with the Permenkes above and the Minister of Environment and Forestry letter no. 56 of 2015 concerning Procedures for Technical Requirements for B3 Waste Management from Health Facilities article 7, paragraphs 3 and 4, B3 waste packaging and containers should be red for radioactive waste and brown for expired chemical waste, spills, leftover packaging, and ph. d) According to Permenkes No.7 of 2019 (Ministry of Environment and Forestry, 2015) in article 8 paragraph 2 page 8, infectious B3 waste can be stored for 90 days at -2 to -50C or 7 days at 3–80C. Medical waste management involves several laws and rules. In the International Publication "World Journal of Health Science," Singh et al. claimed that medical waste management had gotten more attention due to new legislation. Medical waste management can harm health professionals, patients, communities, and the environment (Singh, 2017). Let's also examine the relationship between CS officer injuries, mixing medical and non-medical trash, and RSUP Dr. M. Jamil Padang's medical waste management training. CS staff training does not ensure mixing medical and non-medical waste or injury. Nurses mislabel their garbage as infectious or non-infectious, mixing medical and non-medical waste (in a hurry). In Moreira and Gunther's study of medical waste processing in Brazil, officers' lack of understanding of waste handling regulations led to a mix-up of medical and non-medical waste and incompatibility between handling practices and regulations (Moreira & Günther, 2013). Omar et alinvestigation .'s showed medical waste sorting weaknesses (Omar et al., 2012). Zheng et al. concluded that China's medical waste management was lacking in segregation, rules, and infrastructure (He et al., 2016a).

The main things that make people good at managing medical waste are their education and training. Many training programs have been implemented to improve competency in medical waste management. Yong's research clearly shows the importance of implementing this training (Yong et al., 2009). It was stated that 93.3% of hospitals had provided training for medical waste management staff/personnel, but only 20% of hospitals had done so—and continuing education. The subsequent finding is that the education and training at RSUP Dr. M. Jamil Padang, has yet to follow a follow-up program.

As key informants, the head of the West Sumatra Province Environmental Service and the head of the West Sumatra Provincial Health Service provided policy statements that could help manage hospital medical waste in West Sumatra. The DLH of West Sumatra Province uses the legal basis for Permen LHK No. 56/2015 concerning Procedures and Technical Requirements for Hazardous Waste Management in Health Facilities. Due to the long distance to the extermination center due to the COVID-19 pandemic, the government gives discretion to hospitals throughout Indonesia for those who have incinerators with a combustion degree of more than 800 degrees Celsius and are allowed to operate even though they do not have a permit (this is not yet known to the hospital located in West Sumatra, including the director of health care of West Sumatra Province).

The Ministry of Environment and Forestry established the West Sumatra LHK Service, which has yet to be operationalized and is still being tested. It is located in Cold Water and has a 300 kg/hour capacity. The Provincial DLH Supervision Policy manages B3 Medical Waste for Type B Hospitals, District/City DLH for Type C and D Hospitals, and Type A Hospitals by the Ministry of Environment and Forestry (central). The responsibility of the Provincial DLH in handling medical Waste in hospitals is to collaborate with PT Semen Padang, which has an incinerator with a burning temperature of

1,400 degrees Celsius. With the Decree of the Governor of West Sumatra, PT. Semen Padang acts as a quarantine and B3 medical waste processor for hospitals and health facilities that do not have an MOU with a third party, and this quarantine activity is free. DLH of West Sumatra Province in the process of handling medical Waste in hospitals and health facilities in the form of reporting B3 Waste in the Si Raja Limbah system, and using the Minister of Environment and Forestry Regulation Number P.4/MenLHK/Setjen/Kum.1/1/2020 concerning the transportation of Hazardous and Toxic Waste and implementation of the Integration of the B3 Waste Festronic application with B3 Waste Reporting, with a system of 3 accounts consisting of a producer account, a transporter account, and a management account.

Handling of Type B Hospital Solid Medical Waste

Hospital solid medical waste management for type B (Bukittinggi Hospital, M. Natsir Solok Hospital, Adnaan WD Payakumbuh Hospital, and Bukittinggi City Hospital). Data in the field shows that, during the in-depth interview, it was stated that the medical waste management specialist at the five hospitals was D3 Environmental Health, who carried out his duties under Permenkes No.7 of 2019 concerning Hospital Environmental Health, where on pages 50–51, section b concerning the Implementation of Safeguarding Hazardous and Toxic Waste (B3), it is stated that the Principles of Hospital B3 Waste Management are carried out in a structured and sustainable manner. After observing and documenting, it turned out that several things had not been implemented and were not found to be following Permenkes No.7 of 2019 (Ministry of Environment and Forestry, 2015). These include: a) the availability of a spill kit or other cleaning methods for B3 waste must always be prepared in the source room and accompanied by instructions for use and material safety data. b) B3 waste in the source room that is handed over or taken by the hospital's B3 waste officer to be taken to the B3 waste TPS must be accompanied by an official report of delivery, which at least contains the day and date of delivery, the origin of the waste (source location), type of B3 waste, a form of B3 waste, the volume of B3 waste, and the method of containerization or packaging of B3 waste. c) There is a use of color on each packaging and/or waste container that does not match the characteristics of the hazardous waste. Along with the Permenkes above with the Minister of Environment and Forestry No. 56 of 2015 concerning Procedures for Technical Requirements for Hazardous Waste Management from Health Facilities. In Article 7, paragraphs 3 and 4 (Ministry of Environment and Forestry, 2015), it is stated that the colour of the packaging and/or container for the B3 waste is red for unused radioactive waste at RSAM Bukittinggi; while the purple-colored plastic used for chemotherapy/cytotoxic medical waste is not used in RSUD Dr. Adnaan WD Payakumbuh, and two essential plastic packages, namely purple and red, were not used in RSOMH/RSUP Bukittinggi, RSUD Dr. M. Natsir Solok and the Bukittinggi.

Of the twelve hospitals that were the study's subjects, only two hospitals had autoclaves, namely RSUP Dr. M. Jamil Padang and RSOMH/RSUP Bukittinggi, as a tool that can process the destruction of medical waste. However, the two hospitals that have autoclaves need operational permits. Using steam or other wet thermal methods, autoclaving is a way to eliminate medical waste. Medical waste that has been shredded is exposed to high temperatures and high-pressure steam so that no longer dangerous residues will be produced. The mixing of medical and non-medical waste and the incident of injury to CS officers is inseparable from the compliance of the said staff with regulations regarding the management of hospital medical waste and the training they received. We can see this in Singh's research. G, published in the international journal "Global Journal of Health Science", stated that biomedical waste management had received greater attention because of the latest biomedical waste regulations. Inadequate management of biomedical waste can be associated with risks to health workers, patients, communities, and the environment (Singh, 2017). Also supported by Moreira and Gunther's research, the results of an evaluation of how medical waste is handled in Brazil found that officers' lack of knowledge about regulations for handling waste led to a mix-up of medical and non-medical waste and a difference between how waste is handled and what the rules should be made (Moreira & Günther, 2013).

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Handling of Type C Hospital Solid Medical Waste

Hospital solid medical waste management for type C hospitals (Yarsi Ibnu Sina Hospital Bukittinggi, Regional General Hospital Dr Hanafiah Batusangkar, and Regional General Hospital Dr Sadikin Kota Pariaman) showed findings that were almost the same as type B hospitals. During the in-depth interview, it was stated that the special personnel for solid medical waste management at the three hospitals were D3 Environmental Health, who carried out their duties following Permenkes No.7 of 2019 concerning hospital environmental health, which on pages 50–51, part b concerning the implementation of waste security hazardous and toxic materials (B3), states that the principles of hospital B3 waste management are carried out in a structured and sustainable manner. After observing and documenting it, it turned out that several things still needed to be implemented and were not found (following Permenkes No.7 of 2019). These include: a) The availability of a spill kit or other cleaning methods for B3 waste must always be prepared in the source room and accompanied by instructions for use and material safety data. b) B3 waste in the source room that is handed over or taken by the hospital's B3 waste officer to be taken to the B3 waste TPS must be accompanied by an official report of delivery that at least contains the day and date of delivery, the origin of the waste (source location), type of B3 waste, a form of B3 waste, the volume of B3 waste, and the method of container/packaging of B3 waste. c) There is a use of colour on each packaging and/or waste container that does not match the characteristics of the hazardous waste. Along with the Permenkes above and the Minister of Environment and Forestry's No. 56 of 2015 concerning the Procedures for Technical Requirements for B3 Waste Management from Health Facilities, Article 7 Paragraphs 3 and 4 (Ministry of Environment and Forestry, 2015), it states that the colour of the packaging and/or container for the B3 waste is: Red for radioactive waste and purple for chemotherapy medical waste (cytotoxic) are not used in these 3 Type C hospitals because these two packages are essential and must be used, so between radioactive and chemotherapy waste. Cytotoxicity is mixed into the yellow waste container, and d) The duration of storage for infectious B3 waste is not explained. In contrast, according to Permenkes No.7 of 2019 (Ministry of Environment and Forestry, 2015), in Article 8, paragraph 2, page 8, it is divided into two groups, namely: stored at temperatures below O0C to O0C for a maximum of 90 days, and stored at temperatures of 3 – 80C for a maximum of 7 days.

The mixing of medical and non-medical waste and the incident of injury to CS officers are inseparable from the compliance of the said staff with regulations regarding the management of hospital medical waste and the training they received. We can see this in Singh's research, published in the international journal "Global Journal of Health Science", stated that biomedical waste management had received greater attention because of the latest biomedical waste regulations. Inadequate management of biomedical waste can be associated with risks to health workers, patients, communities, and the environment (Singh, 2017). Also supported by Moreira and Gunther's research, the results of an evaluation of medical waste handling in Brazil found that the lack of knowledge of officers about waste handling regulations led to a mix-up of medical and non-medical waste and a discrepancy between handling practices and established regulations (Moreira & Günther, 2013). The existence of Permenkes Number 7 of 2019 concerning Environmental Health for Hospitals and Minister of Environment and Forestry Regulation Number 56 of 2015 concerning Procedures and Technical Requirements for the Management of B3 Waste from Health Service Facilities shows its function. Of the 3 type C hospitals that were the subject of the study, it turned out that none of the hospitals used them as references.

Handling of Type D Hospital Solid Medical Waste

Hospital medical waste management for Type D hospitals (Madina Bukittinggi Hospital, Dr. Ahmad Darwis Suliki Hospital, and Yarsi Ibnu Sina Padang Panjang Hospital) showed findings almost identical to Type B and C hospitals. During in-depth interviews, it was stated that the exceptional staff responsible for medical waste management at the three hospitals is D3 Kesling, which carries out its duties following Permenkes No.7 of 2019 concerning Hospital Kesling, which on pages 50-51 part b concerning the Implementation of Safeguarding Hazardous and Toxic Material Waste (B3) states that the Principles

of Waste Management at B3 Hospital, carried out in a structured and continuous manner. After observing and documenting, several things still need to be implemented and are not found in Permenkes No.7 of 2019. These include: a) the availability of a spill kit or other cleaning methods for B3 waste must always be prepared in the room source and equipped with a method of use and material safety data. b) B3 waste in the source room that is handed over or taken by the hospital's B3 waste officer to be taken to the B3 waste TPS, must be accompanied by an official report of delivery that at least contains the day and date of delivery, the origin of the waste (source location), type of B3 waste, form B3 waste, the volume of B3 waste, and method of containerization or packaging of B3 waste. c) There is a use of color on each package and/or waste container that does not match the characteristics of the hazardous waste. Along with Permenkes and Minister of Environment and Forestry No. 56 of 2015 concerning Procedures for Technical Requirements for B3 Waste Management from Health Facilities, article 7, Paragraphs 3 and 4, states that the color of the packaging and/or container for the B3 waste is red for radioactive waste and purple for chemotherapy medical waste or cytotoxic waste and is not used in these three Type D hospitals because these two packages are significant and must be used. The hospital is a health service institution with a core of preventive, curative, rehabilitative and promotive service activities. These activities will generate positive and negative impacts. The positive impact is increased public health, while the negative impact includes medical and non-medical waste that can cause disease and environmental pollution that need special attention.

A hospital is a place that requires high standards of hygiene. Because hospital medical waste is B3 waste (hazardous and toxic materials), hospital solid medical waste, if not handled properly, will impact humans, living things, and the environment around the hospital. These impacts can be in the form of water, land, and air pollution (Hanako & Trihadiningrum, 2020). All medical waste produced by hospital operations and other supporting activities. Compared with other agencies' activities, the type of hospital medical waste can be categorized as complex waste. Medical waste originates from medical, nursing, dental, veterinary, pharmaceutical, or similar services, treatment, care, research, or education that uses toxic, infectious, or dangerous materials unless certain safeguards are carried out. If hospitals and other healthcare facilities do not care for their medical waste properly, it can pollute the environment (Hanako & Trihadiningrum, 2020). Various essential efforts have been made so that the management of hospital medical waste can be carried out optimally and that the community can be protected from the dangers of environmental pollution and infectious diseases originating from hospital waste. The main characteristic of hospital waste is the presence of medical waste. Medical waste is waste originating from medical service activities. Various types of medical waste generated from hospitals and other medical service units can be dangerous and cause health problems, especially during collection, storage, handling, transportation, disposal, and destruction. According to WHO (2014), several types of hospital medical waste can carry a greater risk to health, namely infectious waste (15%–25% of the total hospital waste). Among these wastes are sharps, body parts, medicinal and chemical waste, radioactive waste, poisons, and broken thermometers.

Therefore, it is necessary to improve the hospital environment, which aims to protect the public and employees from the dangers of environmental pollution from hospital medical waste. Hospital medical waste is dangerous because it can be toxic, infectious, and radioactive. The effect of hospital medical waste on environmental quality and health can cause various problems, such as those listed in Medical & Health (2018), (a) comfort and aesthetic disturbances in the form of colors originating from sediment, solution, phenol odor, eutrophication, and organic chemicals, so that the appearance of the hospital can have a psychological effect on service users, as a result of an unfavourable impression caused by improper waste disposal. (b) property damage due to dissolved salts (corrosive, rust), murky water, and other factors that can lower the quality of buildings near the hospital; hospital waste disturbs or harms plants and animals. This is mainly due to nitric compounds (acids, bases, and vital salts), chemicals, disinfectants, certain nutrient metals, and phosphorus. (c) disturbance/damage to plants and animals caused by viruses, nitrate compounds, chemicals, pesticides, certain metal nutrients, and phosphorus, (d) disturbances to human health caused by various types of bacteria, viruses, chemical compounds, pesticides, as well as metals such as Hg,

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Pb, and Cd originating from the dentistry department, health problems can be grouped into direct disturbances, namely the effects caused by direct contact with these wastes, for example toxic clinical waste, waste that can injure the body, and waste containing germs and pathogens that can cause disease, and indirect disturbances that can be felt by the community, both those living around hospitals and those living in the community who often pass medical waste sources due to the processes of decomposition, burning, and disposal of these waste, and (e) genetic and reproductive disorders, although the mechanism of the disturbance is not fully known with certainty, but several s Compounds can cause genetic disorders or damage to the human reproductive system, for example, pesticides or radioactive materials.

Hospital medical waste can also cause cross-infection. Medical waste can spread disease-carrying microorganisms through cross-infection from patient to patient, from patient to work, or from officer to patient. In the environment, waste is possible to be released into groundwater, surface water, and the air, causing environmental pollution due to hospital waste. Some of the above losses lead to economic losses in the long run, such as higher operational and maintenance costs, less patient coverage, and the need to pay compensation for polluting the environment. People whose health is disrupted due to environmental pollution, let alone being disabled or dead, require medical expenses and health workers, which means a socio-economic burden on the sufferer, his family, and the community.

CONCLUSION

According to the research findings, there is a favorable association between input performance, process performance, and output performance. On performance indicators, variables affecting the amount of medical waste managed are legal aspects, aspects, and storage, while variables affecting the amount of medical waste managed include Puskesmas with Basic Emergency Obstetrics and Neonatal Services.

ANNOUNCEMENT

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REFERENCE

[1] Adisasmito, W. (2009). *Sistem Manajemen Lingkungan Rumah Sakit*. Jakarta: PT Raja Grafindo Persada.

[2] Al-Khatib, I. A., Eleyan, D., & Garfield, J. (2016). A system dynamics approach for hospital waste management in a city in a developing country: the case of Nablus, Palestine. *Environmental Monitoring and Assessment*, *188*(9). https://doi.org/10.1007/s10661-016-5487-9.

[3] Ali, M., Wang, W., Chaudhry, N., & Geng, Y. (2017). Hospital waste management in developing countries: A mini review. *Waste Management and Research*, *35*(6), 581– 592. https://doi.org/10.1177/0734242X17691344.

[4] Andarnita, A. (2012). Faktor-Faktor yang Mempengaruhi Penholahan Sampah Medis di Badan Layanan Umum Daerah Rumah Sakit Umum Daerah dr . Zainoel Abidin. *Jurnal Kesehatan Lingkungan Rumah Sakit*, *16*.

[5] Askar Ilyas, Anwar Daud, M. (2015). Model Pengelolaan Limbah Medis Rumah Sakit Berbasis Wilayah di Provinsi Sulawesi Selatan *FKM Universitas Hasanuddin, Makassar*.

[6] Aung, T. S., Luan, S., & Xu, Q. (2019). Application of multi-criteria-decision approach for the analysis of medical waste management systems in Myanmar. *Journal of Cleaner Production*, *222*(March), 733–745. https://doi.org/10.1016/j.jclepro.2019.03.049

[7] Bokhoree, C., Beeharry, Y., Makoondlall-Chadee, T., Doobah, T., & Soomary, N. (2014). Assessment of Environmental and Health Risks Associated with the Management of Medical Waste in Mauritius. *APCBEE Procedia*, *9*, 36–41. https://doi.org/10.1016/j.apcbee.2014.01.007

[8] Caniato, M., Tudor, T., & Vaccari, M. (2015). Understanding the perceptions, roles and interactions of stakeholder networks managing health-care waste: A case study of the Gaza Strip. *Waste Management*, *35*, 255–264.https://doi.org/10.1016/j.wasman.2014.09.018

[9] Chen, Y., Liu, L., Feng, Q., & Chen, G. (2012). Key Issues Study on the Operation Management of Medical Waste Incineration Disposal Facilities. *Procedia Environmental Sciences*, *16*, 208–213. https://doi.org/10.1016/j.proenv.2012.10.029

[10] Debere, M. K., Gelaye, K. A., Alamdo, A. G., & Trifa, Z. M. (2013). Assessment of the health care waste generation rates and its management system in hospitals of Addis Ababa, Ethiopia, 2011. *BMC Public Health*, *13*(1), 1–9. https://doi.org/10.1186/1471- 2458-13-28

[11] Dinas Lingkungan Hidup dan Kehutanan Provinsi Banten. (2018). Limbah B3 dari Fasilitas Pelayanan Kesehatan, (6). Retrieved from https://dlhk.bantenprov.go.id/upload/article-pdf/LIMBAH B3 DARI FASILITAS PELAYANAN KESEHATAN.pdf

[12] Emilia, A. U., Julius, N. F., & Gabriel, G. (2015). Solid medical waste management in Africa. *African Journal of Environmental Science and Technology*, *9*(3), 244–254. https://doi.org/10.5897/ajest2014.1851

[13] He, Z., Li, Q., & Fang, J. (2016). The Solutions and Recommendations for Logistics Problems in the Collection of Medical Waste in China. *Procedia Environmental Sciences*, *31*, 447–456. https://doi.org/10.1016/j.proenv.2016.02.099

[14] Ikeda, Y. (2020). Estimation of Infectious Medical Waste Quantities on a Per-patient Basis: An Observational Study at a Hospital. *The Open Waste Management Journal*, *12*(1), 1–5. https://doi.org/10.2174/1874347101912010001

[15] Indonesia, P. R. (2009). Undang-Undang Republik Indonesia Nomor 32 tahun 2009 tentang PPLH. In *UU RI No.32/2009* (Vol. 2009, pp. 31–47).

[16] Kementerian Lingkungan Hidup. (2014). Pedoman Kriteria Teknologi Pengelolaan Limbah Medis Ramah Lingkungan. *Kesehatan*, 1–122.

[17] Kesehatan, K. (2019). Permenkes No.7 tahun 2019 tentang Kesehatan Lingkungan Rumah Sakit. *Αγαη*. Indonesia. https://doi.org/10.22201/fq.18708404e.2004.3.66178

[18] Kesehatan, M. (2019). Peraturan Menteri Kesehatan Nomor 7 Tahun 2019 Tentang Kesehatan Lingkungan Rumah Sakit. *Kementerian Kesehatan*, *8*(5), 55

[19] Kesehatan, P. M. (2017). Permenkes No. 34 tahun 2017 tentang Akreditasi Rumah Sakit. Korkut, E. N. (2018). Estimations and analysis of medical waste amounts in the city

[20] Istanbul and proposing a new approach for the estimation of future medical waste amounts. *Waste Management*, *81*, 168–176.https://doi.org/10.1016/j.wasman.2018.10.004

[21] Kuchibanda, K., & Mayo, A. W. (2015). Public health risks from mismanagement of healthcare wastes in Shinyanga municipality health facilities, Tanzania. *Scientific World Journal*, *2015*. https://doi.org/10.1155/2015/981756

[22] Kumar, R., Somrongthong, R., & Ahmed, J. (2016). Effect Of Medical Waste Management Trainings On Behavior Change Among Doctors Versus Nurses And Paramedical Staff In Pakistan. *Journal of Ayub Medical College, Abbottabad : JAMC*, *28*(3), 493–496.

[23] Mantzaras, G., & Voudrias, E. A. (2017). An optimization model for collection, haul, transfer, treatment and disposal of infectious medical waste: Application to a Greek region. *Waste Management*, *69*, 518–534. https://doi.org/10.1016/j.wasman.2017.08.037

[24] Maulana, M., Kusnanto, H., Suwarni, A., Faculty, P. H., Epidemiology, F., Program, T., … Ministries, H. (2015). Sistem kontrak pengolahan limbah padat rumah sakit pemerintah. *Jurnal Kesehatan Masyarakat*, *9*(1), 69–76.

[19] Medis, L., & Kesehatan, P. (2018). *Pengelolaan Limbah Medis Pelayanan Kesehatan*. (S. Devy Halim, Ed.) (Februari 2). Banjarmasin: Lambung Mangkurat Univ.Press.

[20] Moore, L., Lavoie, A., Bourgeois, G., & Lapointe, J. (2015). Donabedian's structure- process-outcome quality of care model: Validation in an integrated trauma system. *Journal of Trauma and Acute Care Surgery*, *78*(6), 1168–1175. https://doi.org/10.1097/TA.0000000000000663

[21] Muduli, K., & Barve, A. (2012). Barriers to Green Practices in Health Care Waste Sector: An Indian Perspective. *International Journal of Environmental Science and Development*, (January 2012), 393–399. https://doi.org/10.7763/ijesd.2012.v3.25

[22] Mursyidto, M. I. (2014). Permenkes RI No.56 tahun 2014. *Implementation Science*. Indonesia. https://doi.org/10.4324/9781315853178

[23] Nguyen, D. L., & The Hung Nguyen, X. T. B. (2014). Estimation of Current and Future Generation of Medical Solid Wastes In Hanoi City, Vietnam. *International Journal of Waste Resources*, *04*(02). https://doi.org/10.4172/2252-5211.1000139

[24] Omar, D., Nazli, S. N., & Karuppannan, S. A. (2012). Clinical Waste Management in District Hospitals of Tumpat, Batu Pahat and Taiping. *Procedia - Social and Behavioral Sciences*, *68*, 134–145. https://doi.org/10.1016/j.sbspro.2012.12.213 . PendekatanSistem Mubasyisyir.pdf. (n.d.).

[25] Sawalem, M., Selic, E., & Herbell, J. D. (2009a). Hospital waste management in Libya: A case study. *Waste Management*, *29*(4), 1370–1375.https://doi.org/10.1016/j.wasman.2008.08.028.

[26] Siswanto, Susila, S. (n.d.). *Metode Penelitian Kombinasi (Kuantitatif dan Kualitatif)*. Klaten Selatan, 2017: BOSSCRIPT.

[27] Sitharam, T. G. (n.d.). *Springer Briefs in environtmental Science Preparing for Earthquakes : Lessons for India*.

[28] Taru, P., & Kuvarega, A. (2005). Solid medical waste management. The case of Parirenyatwa Hospital, Zimbabwe. *Rev Biomed*, *16*(3), 153–158. Retrieved from http://www.medigraphic.com/pdfs/revbio/bio-2005/bio053a.pdf

[29] WHO. (1999). https://www.who.int/news-room/fact-sheets/detail/health-care-waste.

[30] Windfeld, E. S., & Brooks, M. S. L. (2015). Medical waste management - A review. *Journal of Environmental Management*.https://doi.org/10.1016/j.jenvman.2015.08.013

[31] World Health Organisation, Emmanuel, J., Pieper, U., Rushbrook, P., Stringer, R., Townend, W., … Zghondi, R. (2014). Safe management of wastes from health-care activities, 329. Retrieved from http://apps.who.int/iris/bitstream/10665/85349/1/9789241548564_eng.pdf

[32] Yong, Z., Gang, X., Guanxing, W., Tao, Z., & Dawei, J. (2016). Medical waste management in China: A case study of Nanjing. *Waste Management*, *29*(4), 1376– 1382. https://doi.org/10.1016/j.wasman.2008.10.023

[33] Zakianis. (2019). Pengembangan Indikator Kinerja Pengelolaan Sampah di TP3SR dan Bank Sampah pada Skala Pemukiman (Studi Kasus Dua Kota di Propinsi Jawa Barat dan Satu Kota di Propinsi Banten.

[34] Zurbrügg, C., Caniato, M., & Vaccari, M. (2014). How assessment methods can support solid waste management in developing countries-a critical review. *Sustainability (Switzerland)*, *6*(2), 545–570. https://doi.org/10.3390/su6020545.