Challenges of Covid-19 Medical Waste Management in Indonesia: A Multi-stakeholder Perspective

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Abstract

The increase in the number of positive Covid-19 patients in Indonesia shows that the Indonesian government has not been fully prepared to face this outbreak. Recently, most of patients have been treated in several hospitals and emergency hospitals designated for Covid-19 patients. As a consequence, there has been an increase in Covid-19 medical waste. This study aims to explain how the management of Covid-19 medical waste is carried out by several stakeholders who are responsible for managing this hazardous waste.

This study used qualitative research methods. The process of collecting primary data is carried out by interviewing stakeholders such as the Director of the Hospital, the Ministry of Environment, the Ministry of Health, environmental NGOs, and private parties managing hazardous and toxic waste (B3). Meanwhile, secondary data sources are processed from legislation, literature, and data related to Covid-19 waste management, such as the capacity for treating B3 waste, Increasing Medical Waste, Managing Hazardous Waste Elimination, etc.

The results of this study indicate that the government has planned the development of medical waste treatment. However, it is hampered because the policy will only be implemented in 2020 – 2024. Meanwhile, from the private sector, the main problem faced is that not all private waste management companies still do not have an incinerator permit. Moreover, in the perspective of hospital managers, apart from having limited incinerators, some of the challenges faced in managing covid-19 waste are low supervision in waste management so that many parties recycle the waste.

Keywords: *Covid-19, Waste Management, Indonesia, Multi-stakeholders*

Introduction

The covid-19 pandemic is currently developing rapidly around the world. One of the environmental impacts caused by this pandemic is an increase in the demand for and use of health-protective products to protect the general public, patients, health workers, and other workers. The increasing trend towards the use of health products is expected to be in line with the global pandemic curve for various plastic products as personal protective equipment (PPE) such as gloves and masks for health workers, disposable plastic components for life support equipment, respirators, and general plastic supplies including syringes[1]. This condition has resulted in an increase in the amount of medical waste, especially Covid-19[2]. For example, the amount of medical waste in Wuhan has quadrupled to more than 200 tons of waste on February 24, while this amount exceeds the capacity of medical waste management in Wuhan, which is only able to manage 50 tons of medical waste per day[3].

Medical waste has become an important problem because it has the potential to cause health problems and environmental damage[4,5]. The issue of medical waste has become a crucial issue in

various countries. In developing countries, medical waste is placed together with non-medical waste, which can pose a risk of unavoidable health problems[67]. For example, the problem of medical waste in the form of sharp objects that are not handled properly has the potential to be contaminated with twenty pathogens, which resulted in the emergence of the hepatitis B virus (HBV), hepatitis C virus (HCV), and HIV virus in 2010[8]. The explanation above shows that medical waste management is a serious problem that can cause serious health problems.

Many health facility services in Indonesia ignore medical waste management by not implementing proper waste management[9]. According to data from the Ministry of Health, 2,820 hospitals and 9,884 community health centers produce 290 tons of medical waste every day. Meanwhile, there are only ten licensed waste processing plants in Indonesia with a combined capacity of 170 tons per day, and only 87 hospitals have incinerators to treat waste on-site with a combined capacity of up to 60 tons[10]. In addition, transportation and waste treatment processes are already problematic. Among them, PT Putra Restu Ibu Abadi (PRIA) was accused of hoarding or dumping B3 waste, including medical waste near residential areas in Mojokerto, which resulted in a decrease in the quality of residents' well water and cases of medical waste scattered in mangrove forest areas in Karawang in 2018 and banks of the Ciherang river, West Java[11]. These conditions indicate that medical waste treatment in Indonesia has not been resolved optimally.

The increase in the number of Covid-19 patients in Indonesia shows that the Indonesian government has not been fully prepared to face this outbreak. As a consequence, there has been an increase in Covid-19 medical waste. Based on a case study in China, the average patient infected with Covid-19 contributed 14.3 kilograms of medical waste per day[12]. If this is multiplied by the number of positive patients in Indonesia to date, the resulting waste reaches 243,457.5 kilograms of medical waste. This amount cannot be estimated because it does not include the amount of medical waste mixed with domestic waste produced by the patient under surveillance or people under surveillance, which carries out self-quarantine. Therefore, this condition worsened the management of medical waste management in Indonesia before the pandemic was still not optimally resolved.

The occurrence of the Covid-19 pandemic gave birth to a governance crisis and policies for handling pandemics in various countries. Indonesia also faces similar challenges, even exacerbated by the nuances of the politicization of the pandemic, ignorance of science at the beginning of the crisis, limited economic capacity, and a minimal health service system[13]. This study aims to explain how the management of Covid-19 medical waste from various multi-stakeholder perspectives. Through this perspective, researchers will get comprehensive results on the complexity[14,15] of the Covid-19 medical waste problem. As a study model, this article will aim to enrich the discussion and debate on the management of Covid-19 medical waste in Indonesia.

Methods

This research was conducted in June - October 2020 in Indonesia. This research uses qualitative methods. The data collection process was carried out in several stages. First, the research team conducted semi-structure interviewed to participants/informants who have an interest in managing B3 and Medical Covid-19 waste, such as the Ministry of Health, Ministry of Environment and Forestry (KLHK), Private B3 Waste Management Companies, Hospitals, Indonesian Hospital Association, and environmental NGOs. Several points were asked in the interview process including laws or regulations that govern waste management, breakthrough rules, regulations, and policies to regulate Covid-19 medical waste, implementation of Covid-19 waste management policies, obstacles faced in managing Covid-19 medical waste and so on.

In addition, the data collection process was also carried out through the participation of the research team in a webinar that discussed the issue of medical or other B3 waste in Indonesia. Furthermore, this research is also complemented with secondary data such as data on hazardous waste processing capacity, data on increased medical waste, and related laws and regulations about waste management.

The data analysis in this study used thematic analysis. This analysis was carried out in several stages [16]. First, reviewing the interview transcripts. Then, coding the results of the interview transcript from

several quotes and classifying the results of the interview based on the topics discussed. And the last one is interpreting the findings from predetermined ideas, namely the multi-stakeholder challenges in managing covid-19 medical waste.

Results and discussion

Government Efforts in Handling Covid-19 Medical Waste

Based on *Worldometer* data as of November 21, 2020, Indonesia is in the 21st position with the total COVID-19 cases in the world with a case record of 488,310[17]. As a consequence, there has been an increase in the amount of B3 infectious COVID-19 waste. According to the Minister of Environment and Forestry Siti Nurbaya Bakar, the volume of infectious medical waste throughout Indonesia as of June 8, 2020, reached more than 1.100 tons[18]. The piles of B3 COVID-19 waste have an impact on the environmental conditions of the community. This indicates the need for action in proper waste management. Meanwhile, based on a study conducted by the government, the capacity for B3 medical waste management in 6 regions in Indonesia is only able to manage a total of 314.29 tons/day[19].

Table 1: The Number of B3 (Hazardous and Toxic) Waste Management Services in Indonesia[19]

REGION	SUMATERA	JAWA	BALI NUSRA	KALIMANTAN	SULAWESI	MALUKU PAPUA	TOTAL
Health Service Facility Capability	8.58	41.72	2.40	8.00	9.51	0.00	70.21
Ability of B3 waste management services	5.40	225.48	0.00	10.80	2.40	0.00	242.08
TOTAL	**13.58**	**267.20**	**2.40**	**18.80**	**11.91**	**0.00**	**314.29**

The low capacity for managing B3 medical waste in 6 regions in Indonesia is a new problem in the management of B3 medical waste management. Based on the results of the capacity gap analysis carried out by the Ministry of Environment and Forestry on April 28, 2020, it shows that the ability to manage medical, hazardous limbs in 6 regions in Indonesia during the pandemic has increased to 877.26 tons/day[19]. From the six regions, the Java region is the largest contributor to the largest amount of Covid-19 medical waste in Indonesia because almost a third of the population in Indonesia is in the Java region.

This waste management capacity is supported by the destruction of cement kilns or other required destruction installations. Optimization of hazardous waste treatment capacity Health service facilities and licensed B3 waste management services are also carried out by allocating the entire capacity to manage infectious B3 waste.

As a guide in dealing with the impact of a pandemic, there are several efforts made by the government in dealing with B3 COVID-19 waste management. First, savings and reallocation of the K/L APBN 2020 budget to be converted into funds for handling COVID-19. Second, forming the COVID-19 Task Force Unit within the scope of the Ministry of BAPPENAS (National Development Planning Agency) to formulate national development planning policies in the context of handling COVID-19, one of which is compiling a study of hazardous waste management in Indonesia. The B3 and B3 Waste Management Policy have become a priority agenda in the 2020-2024 RPJMN (National Medium-Term Development Plan), namely the construction of an integrated hazardous medical and hazardous waste treatment facility. The construction of B3 medical waste processing facilities in 32 provinces and integrated B3 waste processing facilities in 4 regions (Sumatra, Sulawesi, East Java, and Kalimantan) are detailed in the following table.

Table 2: KLHK Project Support[20]

List of Ministry/Institution Project	TARGET	Ministry/Institution
Construction of Integrated Hazardous Waste Treatment Centers in Sumatra and Papua	2 unit	Cooperation between government and business entities
Construction of Integrated Hazardous Waste Treatment Centers in Kalimantan	1 unit	Cooperation between government and business entities
Construction of Integrated Hazardous Waste Treatment Centers in East Java	1 unit	Private Sector
B3 waste treatment facilities from Health Service Facilities	32 province	Ministry of Environment and Forestry (KLHK)
Management of medical waste in health care facilities according to standards	8.800 Health Service Facility Capability	Ministry of Health

The construction of B3 medical waste processing facilities, and integrated B3 waste processing facilities is one of the strategic priority projects (major projects) in building the environment, increasing disaster resilience and climate change. B3 medical waste processing facilities in 32 provinces and integrated B3 waste processing facilities will be built in 4 regions (Sumatra, Sulawesi, East Java, and Kalimantan) with the aim of increasing the capacity of B3 medical waste management in Indonesia. In addition, the benefits of the construction of B3 waste processing facilities are an increase in the capacity of the amount of B3 waste treated to 26,880 tons/year and reduce transportation costs for B3 waste management[3]. Simultaneously an Early Warning System (EWS) was also built for priority non-natural disasters, especially for epidemics and disease outbreaks in the 2021 Government Work Plan (RKP), including those related to B3 medical waste management.

Management of B3 medical waste from Health Service Facilities before the pandemic is regulated in the Minister of Environment and Forestry Regulation 56/2015 Procedures and Technical Requirements for Management of Hazardous and Toxic Waste from Health Service Facilities (Data from the Ministry of National Development Planning/ and IATL ITB, 2020). The regulation describes the stages of waste management, starting from reduction and sorting, container and storage, transportation, processing, burial, and landfilling. In 2018 the Directorate of Performance Assessment of Hazardous and Non-B3 Waste Management of the Ministry of Environment and Forestry also issued a roadmap related to waste management from Health Service Facilities from 2019 to 2028. This is also regulated in the Ministry of Health Regulation Number 7/2019 concerning the Health Hospital Environment. The following is an overview of the flow of medical waste management for Health Service Facilities.

Referring to the Circular of the Minister of Environment for 2020 SE.2 / MENLHK / PLB.3 / 3/2020, the tools used for handling B3 / Medical waste are Incinerators and Autoclaves. However, it is not necessarily when the Incinerator and Autoclave tools listed in the Ministerial Regulation can be used just like that, but there are strict regulations in the use of these tools. Management of B3 COVID-19 waste in the scope of the hospital, personal protective equipment waste, test equipment, and laboratory equipment are classified as dangerous infectious B3 medical waste so that the processing is carried out using an autoclave equipped with a counter. Meanwhile, waste originating from the homes of Patients under Monitoring (PDP) and People under Monitoring (ODP) such as masks, tissues, medicine bottles, and other household waste is processed using an incinerator. Broadly speaking, crisis management in facing a pandemic includes at least the aspects of risk, impact, and mitigation[21].

The obstacle faced by Hospitals

The incidence of B3 medical COVID-19 health facilities has increased by up to 30%, which is 328 tons per day (KLHK, 2020). Based on data from the Ministry of Health, as of March 2020, as many as 4,500 B3 medical COVID-19 waste has been processed using hospital incinerators. Of the 132 referral hospitals, 110 of them already have licensed incinerators[22].The data on the generation of medical waste from Health Service Facilities does not include the development of the number of COVID-19 referral

hospitals, which has reached 506 hospitals throughout Indonesia[23]. This is a gap when all hospitals can produce waste, which is increasing in quantity during the COVID-19 pandemic. However, the amount of utilization of medical waste processing equipment is still insufficient or even inadequate.

The low capacity for managing B3 medical COVID-19 waste in hospitals creates new problems. This arises as a result of the unpreparedness of hospitals and related agencies in dealing with the COVID-19 pandemic. In addition, this problem is caused by the structuring of B3 medical COVID-19 waste handling procedures that have not been right on target, a low level of supervision at the container, transportation and storage stages by the hospital, and illegal use of waste by hospital staff[23]. There is a need for cross-sector coordination on the ease of managing hospital medical waste in the era of the COVID-19 pandemic, considering that hospitals and medical personnel currently need high concentration in patient care.

Supervision in the management of B3 and Medical Covid-19 waste in Indonesia, which is mostly generated by the use of masks for the community, creates a risk of recycling activities carried out illegally against used disposable masks. The risk that arises is the possibility of transmission of the virus caused by a recycling process that is wrong or does not follow the correct procedure and is carried out without official permission from the relevant agency. This also creates an increased risk of infected patients, which in turn can result in increased medical waste for hospitals or health agencies. However, if the PPE waste is recycled with an appropriate method such as the recrystallization method. This method includes cutting plastics, dissolving plastics, mixing with anti-solvents, depositing on anti-solvents, and separating solvents and anti-solvents, so that a pure plastic without degradation will be obtained which has benefits and functions as a plastic with similar quality[24].

Outside Java Island, the number of licensed transporters is difficult; on-site facilities are very few, the number of licensed managers is felt to be very insufficient so that the handling of Covid-19 is more focused on handling infected patients. On the other hand, there is a problem of medical waste processing which is no less important to take seriously. Transporter and Managers who understand the dangers of Covid-19 medical waste are deemed minimal so that implementation in the field is in accordance with predetermined regulations (Timely waste collection & avoiding illegal use) In addition, it is equally important to have the compliance and vigilance of all medical personnel regarding the precautionary protocol against the risk of infection through the use of PPE (Personal Protective Equipment). Increased medical waste management costs have increased, in difficult times such as now hospital cash-flow is disrupted, thus adding to the hassle of hospital management, so it is necessary to have a standardized price / special price for hospitals for the medical waste management process in the Covid-19 era. The handling of medical waste by the hospital, of course, needs to apply a special price so that waste management can be carried out properly according to existing procedures and can be carried out optimally.

The Private Sector Roles

The dangers contained in medical waste must be considered, given the risk of poison and can infect someone if misused. Covid-19 medical waste comes from PPE (Personal Protective Equipment) and masks produced by hospitals, health centers, clinics, laboratories, and households that are aware of PHBS (Clean and Healthy Living Behavior) in the midst of a pandemic. The risk posed by B3 Covid waste is caused by medical waste that is not sterilized due to a lack of qualified knowledge. There is a need for further medical waste treatment so that the risks can be overcome. If the processing is not correct, it can spread the disease to other patients, the public, and health workers because it contains microorganisms or germs. Moreover, the agency to sort or double-check medical waste that has not been cut by residents so that later it is not misused by the community so that the dangers arising from covid-19 medical waste can be overcome[2].

The role of medical waste management companies in handling the Covid-19 outbreak was conveyed by Dr. Eng. Candra Nugraha[25] as the President Commissioner of PT. Jasa Medivest said that there are several stages in integrated waste management, namely:

1. Training
We are providing training to producers of medical waste in both hospitals, laboratories, and households in handling medical waste.

2. Fetching Loading
Carry out the collection and loading of medical waste from waste generators. Before taking the load, it is necessary to spray disinfectant against the wrapped waste.

3. Transport
Transport the evacuated waste to the disposal site

4. Extermination
Exterminate medical waste by burning it using an incinerator. Before carrying out the combustion process, it must go through a disinfection process first.

5. Residue Handling
Handling bottom ash and fly ash to PPLI

To carry out the handling process of Covid-19 medical waste, it is also necessary to have a security system for workers in the form of wearing PPE (Personal Protective Equipment) and collaborating with other parties who handle waste, environmental control, or related agencies. In this case, PT. Jasa Medivest collaborated with the Center for Environmental Health and Disease Control Engineering to transport 594 kilograms of medical waste in the activity of returning the Diamond Princess crew from the Kertajati Class II Port Health Office to the *Dawuan* plant. In a period of four months, starting from January to April 2020, there was an increase in the amount of medical waste generated by several hospitals such as Dr. Hasan Sadikin Bandung, RS. Dr. Lung HA. Rotinsulu Bandung, Al-Ihsan Regional Hospital Bandung, Syamsudin Sukabumi Regional Hospital, PPSDM Prov. West Java Cimahi, etc. The following is a diagram of the rate of increase in medical waste, which is quoted from PT. Java Medivest:

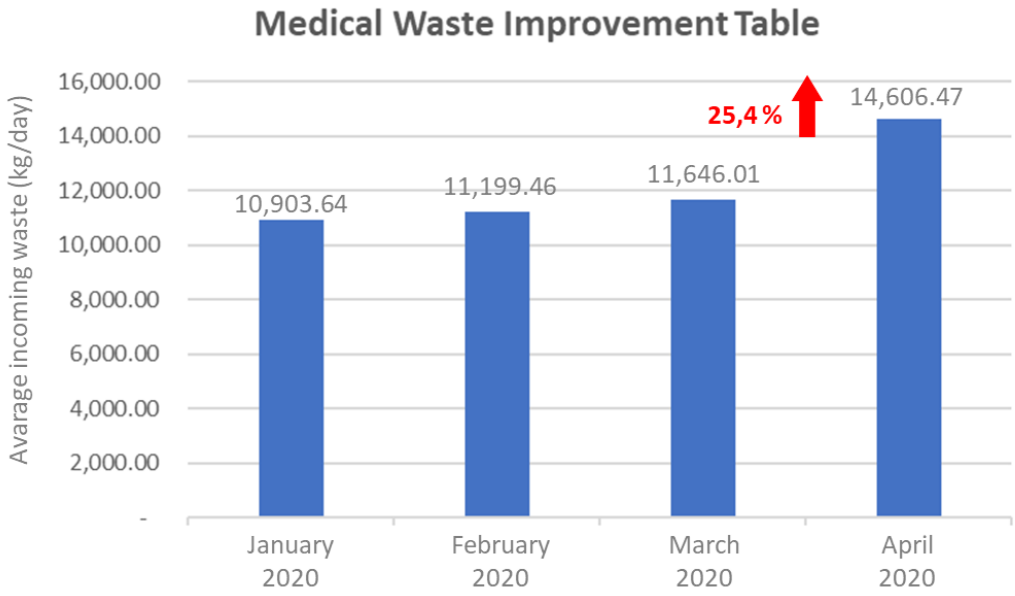

Figure 1: Medical Waste Improvement Table[25]

From the Figure 1, it can be clearly seen that from January to April, there was an increase in the amount of medical waste from 10,903.64 kg to 11,199.46 kg in February and increased again in March with a total of 11,646.01 kg. From March to April, to be precise, on April 21, there was a significant increase in the amount of waste by 25.4%, with a total of 14,606.47 kg. The type of medical waste Covid-19 consists of disposable PPE (Personal Protective Equipment) waste made from plastic, which is not easy to get wet, is not easily destroyed, and is not completely flammable. The increase in the amount of Covid-19 Medical waste has also emerged due to the use of disposable masks by the public, which is still frequently used.

The Covid-19 Medical waste management system in Indonesia, in principle, avoids misuse of society, undertakes efforts to reduce medical waste through recycling or reuse, recovering, and processing it first before landfilling or destroying waste. The challenge in waste management arises when there is a significant increase in medical waste, given the increase in infected patients and the use of disposable medical devices by hospitals in handling Covid-19 cases in Indonesia.

The accumulation of Covid-19 medical waste in the waste disposal site at Health Service Facilities is an impact caused by the limited final processing of B3 waste. In addition, an increase in the number of patients infected with Covid-19 also produces infectious waste that needs to be sterilized before processing waste before it is destroyed. A good management process in treating Covid-19 medical waste in accordance with procedures ranging from reducing the amount of waste, sterilizing to culling waste through incineration using an incinerator by a company that already has a license can certainly be an alternative to facing challenges in managing Covid-19 medical waste in Indonesia.

Conclusions

The covid-19 pandemic has become an outbreak that cannot be avoided by the global community. All governments in the world are not prepared for this pandemic—no exception to developed countries. In Indonesia, the trend of patients infected with Covid-19 shows a sufficient number of increases every day. One of the most significant consequences of the rise in the number of Covid-19 patients is the increase in Covid-19 medical waste in Indonesia.

As one of the countries that are not ready to face this pandemic, the Indonesian government is very overwhelmed in handling this waste because of its unpreparedness with legal rules to manage this hazardous waste. However, with all its limitations, the Indonesian government is making responsive efforts in dealing with the waste problem, including by increasing the number of B3 waste management centers in almost all parts of Indonesia. In addition to government efforts, various sectors support and provide roles in covid-19 medical waste management, namely the private sector and hospitals.

However, this sector is also experiencing several problems in overcoming this Covid-19 medical waste, including the limited incinerator and weak waste control from the government, especially the involvement of individuals who want to recycle the hazardous waste. Therefore, it is necessary to have synergy from stakeholders who have the authority and interest in managing the covid-19 medical waste.

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Výzvy nakládání s lékařským odpadem Covid-19 v Indonésii: Perspektiva mnoha zúčastněných stran

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Souhrn

Nárůst počtu pozitivních pacientů s Covid-19 v Indonésii, kteří byli léčeni v nemocnicích a pohotovostních nemocnicích, způsobil, že došlo ke zvýšení produkce zdravotnického odpadu. Studie si kladla za cíl vysvětlit, jak správně nakládat se zdravotnickým odpadem při zapojení několika zúčastněných stran, které jsou odpovědné za nakládání s tímto nebezpečným odpadem.

V práci byly využity kvalitativní výzkumné metody. Proces sběru primárních údajů byl proveden na základě rozhovorů se zúčastněnými stranami, jako jsou ředitelé nemocnic, ministerstvo životního prostředí, ministerstvo zdravotnictví, nevládní organizace v oblasti životního prostředí a soukromé subjekty, které nakládají s nebezpečným odpadem (B3).

Také byla zpracována data a údaje související s nakládáním s odpady v souvislosti s onemocněním Covid-19, jako je např. potřebná kapacita pro zpracování odpadu, zvyšování množství odpadu ze zdravotnictví, minimalizace nebezpečného odpadu atd. Údaje byly převzaty z legislativních a literárních zdrojů.

Klíčová slova: *Covid-19, odpadové hospodářství, Indonésie, zdravotnický odpad, nebezpečný odpad*