



SOLID MEDICAL WASTE MANAGEMENT COSTS BETWEEN OUTSOURCING AND SELF-MANAGED SYSTEM AT HOSPITAL DURING THE COVID-19 PANDEMIC

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Abstract

Health service programs aim to improve the level of society's health. On one side, it will give benefit public health, and on the other side, it will have a bad impact if the process is not managed appropriately. Health service activities produces wastes, one of which is solid waste. It is important to know the problem related to the process and cost of the solid medical waste management, which is part of the B3 wastes (hazardous and toxic wastes). The B3 waste management is under the supervision of public health facilities which have the security and cost responsibilities. The costs include investment cost, maintenance cost, cooperation cost or cost of the third-hand management, and consumable cost. This study compares solid medical waste cost between outsourcing systems and self-management systems in the X hospital during the Covid-19 pandemic. This study uses descriptive research in a qualitative approach through observation, document review, and cost calculation for data collection. The study results show that the process of solid medical waste management has been running well. In addition, self-managed solid medical waste management is cheaper than outsourcing management.

Keywords: Hazardous and toxic wastes; COVID-19; Pandemic era

1. Introduction

Hospital is a health service institution that is engaged in complete individual health services including outpatient, inpatient, and emergency services (Law No. 44, 2009). In addition, hospital provide plenary services including promotive, preventive, curative, and rehabilitative services aiming to provide satisfaction, patient safety, and a healthy environment in hospitals (Rusli, 2017).

A healthy environment in a hospital aims to create a healthy environmental quality in terms of physics, chemistry, biology, and social environment. Besides, it also provides comfort to visitors and avoids environmental pollution and nosocomial infections. The implementation of waste security is one of the requirements for

environmental health in hospitals (PERMENKES, 2019).

Waste is the residue from a business and or activity (PERMENLHK, 2015). Hazardous waste, according to the Government Regulation No. 101/2014, includes energy, substances, funds, or other components which due to concentration either directly or indirectly can endanger the environment and people's health survive (PP, 2014).

As per October 31st, 2020, the Covid-19 cases in the world reached 45. 4 million people with a death rate of 1.2 million. Meanwhile in Indonesia, there were 407,000 cases of the Covid-19 with a death rate of 13.7 thousand (WHO, 2020).

The Covid-19 pandemic in Indonesia has required massive efforts to prevent the transmission of infectious diseases in various ways, one of which is managing solid medical waste appropriately. The increased cases of Covid-19 patients have led to an increase in the

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use of medical equipment such as masks, hazmat, gloves, and other medical equipment. As a result, it increased the production of solid medical waste. To handle this situation, an increase in a management capacity in terms of quantity and quality is needed.

B3 waste management has been regulated in the Regulation of the Minister of Environment and Forestry No. 56/2015 on the Procedures and Technical Requirements for the Management of Hazardous and Toxic Waste from Health Service Facilities (PERMENLHK, 2015). B3 waste management related to Covid-19 waster is different from other B3 waste management. B3 waste from Covid-19 is separated from other B3 waste and wrapped in leak-proof and airtight yellow plastic. Personal Protective Equipment that has gone through the process of disinfection and sterilization can be reused (MENLHK, 2021).

Solid medical waste production in Indonesia is estimated at 376,089 tons/day. This amount of waste can potentially pollute the environment and may cause work accidents and disease transmission. Hospital medical and non-medical waste management is needed for the comfort and cleanliness of hospitals, since it can break the chain of the spread of infectious diseases, especially nosocomial infections. Medical waste, which is categorized as B3 waste, needs to be managed appropriately. Otherwise, solid medical waste in hospitals may have negative impacts, including causing injury, environmental pollution, and causing nosocomial diseases. Good B3 waste management in hospitals is expected to minimize these impacts and reduce costs (Purwanti, 2015).

Solid medical waste produced by hospitals can be destructed in 2 ways, namely using incinerators owned by the hospital or outsourcing with third parties (Badi et al., 2016). Hospital x has an incinerator and has carried out waste destruction with a self-managed system. In this case, the hospital has made an in-depth calculation whether managing waste through their own infrastructure is more profitable than the outsourcing system from the third parties.

2. Method

This study uses descriptive research with a qualitative approach through observation, documentation review, and cost calculation for data collection.

Primary data were obtained from the first sources, i.e., respondents of interviews and questionnaires about the costs incurred from medical solid waste management. Secondary data were obtained from documents related to solid medical waste management. This research was conducted during the Covid-19 pandemic from January – December 2020.

3. Result and Discussion

To know the cost of solid waste management, it needs to know the flow of waste management processes such as sorting, collecting, distributing, and storing the wastes. This is in line with a study by Pertiwi (2017) entitled “Evaluation of Hazardous Waste Management at Roemani Muhammadiyah Hospital Semarang.”.

If Hospital X uses an outsourcing party in the management of solid medical waste at the hospital, the costs will be as follows:

Tabel 1. Cost of Waste Management Without Incineration with Outsourcing Party

Month	Year	The amount of waste generated (kg)	Waste cost/kg	Waste Cost (IDR)
Jan- Mar	2020	20,808	13,500	280.908.000
Apr- Jun	2020	31,346		423.171.000
Jul- Sep	2020	47,990		647.865.000
Oct- Dec	2020	61,798		834.273.000
Total		161,942		2.186.217.000

The amount of waste generated from January to December 2020 was 161,942 kg with a total cost of 2.186.217.000 IDR. In addition, there was the cost of collecting medical waste from each room to be transported to the B3 Waste station by employees of the WWTP unit. The total cost is obtained by converting the salaries of the WWTP unit employees. In this case, the employees collect waste in each room for approximately 2 hours. Hospital X has 7 waste collector employees. Thus, the total cost of waste collector employees is 5.901.056 IDR.

Table 2. Total Cost of Outsourcing Management

Type of Costs	Total Cost (IDR)
Cost of Waste Management Without Incineration	2.186.217.000
Cost of Waste Collector Employees	5.901.056
Total Cost	2.192.118.056

Table 2 shows that the total cost of outsourcing for solid waste management is 2.192.118.056 IDR. If Hospital X manage solid medical waste by themselves, the total cost can be calculated in detailed as follows:

Tabel 3. Total Cost of Waste Self-Management

Type of Costs	Total Cost (IDR)
Incinerator Ash Management Cooperation Fee	502.870.410
Incinerator Maintenance Cost	84.313.476
Investment Cost	170.647.284
General Cost	703.790.265
Total Cost	1.461.621.435

The table above shows that the total costs incurred by the hospital if they manage their waste themselves is 1.461.621.435 IDR. Sorting activities include assigning the medical waste bins with yellow plastic bags and non-medical waste with black plastic bags. In addition, safety box is intended for syringe waste or sharp objects. This is in line with Himayati (2018) who did a study entitled "Evaluation of Hazardous Medical Waste Management at Hospital II 04.05.01 dr. Soedjono Magelang.

The storage activity is carried out by the WWTP (Waste Water Treatment Plant) unit under the occupational health and safety committee. They take medical and non-medical waste collected by officers in the rooms of each ward or according to the waste collection schedule. Solid medical waste is taken directly to toxic and hazardous temporary shelter. In this activity, all solid medical waste that has been brought to the B3 waste station (hazardous and toxic waste temporary shelter) is collected and weighed. All wastes are transported in the wheeled bin or trolley to reduce contamination. The data of waste is then recorded in a logbook before burning. This is in line with Arindita et al. (2016) who conducted a study entitled "Quality Management of Hazardous Waste Management on the Proper Index at RAA Soewondo Pati Hospital."

The waste at the hospital x was collected 2 times every day, at 07.30 am and 03.00 pm. However, if the wheeled bin is almost full, it will be immediately taken to avoid waste accumulation which disturb the environment. This is in line with Hanako and Trihadiningrum (2020) who conducted a study at X Hospital, Surabaya where waste collection is carried out more than once in 1 day.

Solid medical waste storage is close to the WWTP building, which is located on the right back of the hospital. At the temporary storage area for medical waste, there are coordinate points that determine the location of the hazardous B3 waste. Hazardous wastes include TL lamps, incinerator ash, medical waste, WWTP sludge, pharmaceutical product packaging, expired pharmaceutical products, B3 contaminated laboratory equipment, used rags, and flue gas processing residue.

All solid medical waste is burned in the incinerator. Meanwhile, non-medical B3 waste is handed over to a third party. The results from the combustion of incinerators or incinerator ashes are also handed over to third parties.

The incinerator ash is put into yellow plastic and placed at the B3 Medical Waste while waiting for transportation by a third party (maximum storage for 3 months or 90 days). The third parties as the transporters, i.e., PT. Triata and PT Artama, will only transport when the waste has reached a minimum weight of 4 tons in one transportation with FIFO system (First In, First Out). In this case, they will transport first the waste which was stored earlier. The minimum limit becomes the detriment of third parties in the operational process of transporting incinerator ash. This is in line with Ari Purwohandoyo (2018) stating that that earlier storage of B3 waste will be transported first.

After the transportation of waste was completed by a third party, waste manifest is filled out and signed by both parties. The manifest contains the name of the officer, the weight of the waste transported, the code of the waste, the number of the transport vehicle, and the type of waste.

The waste manifest contains 7 copies, one of which is a copy for hospital x and a copy is for the Semarang city environmental service. The waste manifest is also useful for the hospital report to the environmental service.

When the waste handover is completed, the hospital *x* or in this case the admin from sanitation inputs the waste data into the "Si Raja Limbah," which is connected to the *festronik* (electronic manifest). The difference between waste management process through outsourcing system and by hospital themselves is only in the processing activities.

If solid medical waste is managed by outsourcing system, the waste is only placed in the B3 waste station without being burning in the incinerator. Thus, the cost for employees who take the waste from each room cannot be calculated. This is because the waste collection from each room is done by the Water Treatment Plant (WTP) unit. Likewise, when the hospital manage the waste by themselves, the cost for employees who burner the waste cannot be calculated. This is because waste management, both outsourcing and self-management, is carried out by the WWTP unit in terms of waste collection and waste incineration.

Medical waste management requires competent human resources based on the recognition of the WWTP coordinator. Waste collection in hospital *x* is not carried out by the cleaning service because they do not yet know how to collect and burn the medical waste. Therefore, taking and burning the waste are carried out simultaneously by staffs in the WWTP unit.

In calculating the cost of managing solid medical waste, the price of diesel is taken from the procurement department at hospital *X*. The data of solid medical waste is obtained from manifests and reports that are carried out every 3 months by hospital *X* in the Environmental Service unit. The manifest contains the amount of incinerator ash and solid medical waste generated. This is in accordance with the Regulation of the Minister of the Environment No. 4/2020 on the Transportation of B3 Waste which explains the hospital rules for reporting to the Environmental Service every 3 months and inputting data into the electronic manifest of the waste processed (PERMENLHK, 2020).

The cost of the incinerator maintenance is also obtained through the procurement department at hospital *X*. General costs, such as environmental testing around the incinerator, are

obtained from the sanitation officers; the testing was once carried out in October 2020. The process of sorting, storing, and collecting wastes requires infrastructure such as wheeled bins for transporting waste, digital scales for measuring the waste, yellow plastic for wrapping waste and a safety box for disposing sharp objects. These infrastructure facilities must still be fulfilled independently by hospital *x* both when either the third party or in-house waste management is employed. This is because the cooperation contracts with third parties, namely PT. Triata and PT. Artama, do not state a wheeled bin loan or free plastic and safety boxes. This is in line with a study by Ismayanti et al. (2020) entitled "Management of Solid Medical Waste at the Mamuju Regional General Hospital, West Sulawesi." The results show that the B3 waste was stored in the temporary storage before further being transported.

For outsourcing system, the cost that can be calculated is only limited to the cost of managing waste without incineration. Meanwhile, if solid medical waste is managed by the hospital, the cost that can be calculated includes incinerator processing, incinerator maintenance, investment costs, and general costs.

In the cost analysis for the outsourcing system, the only item that is calculated is the cost of waste per kg submitted by Hospital *X* to a third party. Meanwhile, the cost analysis of the self-managed system, it includes the cost of incinerator management cooperation, incinerator maintenance, investment costs, and general costs. The self-management system still uses a third party because the ash from the combustion must be further processed by a third party. Whereas in outsourcing management, the waste generated is managed directly by a third party without incineration. The calculation results show that the cost of managing solid medical waste with self-management system is 1.461.621.435 IDR. Meanwhile, the cost of managing solid medical waste through outsourcing system is 2.192.118.056 IDR.

The ratio of the cost comparison between self-managed waste management is 1.49 times cheaper than outsourcing waste management. Thus, the choice of Hospital *X* to manage its solid medical waste independently is the right choice.

Table 4. Comparison of Solid Medical Waste Management Costs between Self-Managed and Outsourcing Systems

Type of cost	Total Cost Based on Cost Analysis Method	
	Outsourcing System (IDR)	Self-managed System (IDR)
Cost of Waste Management Without Incineration	2.186.217.000	
Cost of Waste Collecting	5.901.056	
Employee Salary		502.870.410
Cost of Waste Management by Incineration		84.313.476
Cost of Incinerator Maintenance		170.647.284
Cost of Investment		703.790.265
General Cost		
Total	2.192.118.056	1.461.621.435

4. Conclusion and Suggestion

The process of solid medical waste management at hospital X includes storage, transportation, reduction, sorting, and processing. After calculating the entire waste management process from storage to processing, the cost of incineration show a difference of 730.496.621 IDR.

Hospital X, as a hospital that manages solid medical waste independently, still requires a third party to dispose of the ashes from the incinerator combustion. The decision taken by hospital X's management to carry out self-managed waste management is the right choice.

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