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Management of Solid Medical Waste at Regional Public Hospital of West Papua Province

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Abstract: This study aims to characterize, identify and evaluate the management of solid medical waste in the West Papua Province Regional Public Hospital. This research is descriptive qualitative research conducted in December 2023 -January 2024 at the emergency room, obstetrics ward, pediatric ward, perinatology ward, surgical room, internal disease department and laboratory. The results research are the average amount of solid medical waste in West Papua Province Regional Public Hospital is 282.3 kg/month, consisting of infectious solid medical waste of 229 kg/month and the amount of infectious sharps medical waste of 53.3 kg/month. The process of solid medical waste management of hospitals in West Papua Province Regional Public Hospital has referred to the Government Regulation of the Republic of Indonesia Number 7 of 2019, although the results are not all appropriate.

Keywords: Infectious; Sharps medical waste; Solid medical waste; Waste management

Introduction

The West Papua Province Regional Public Hospital is an institution owned by the West Papua Provincial Government which provides and organizes health service, prevention, maintenance and rehabilitation activities in Manokwari Regency. These activities are carried out comprehensively, with high quality, and are expected to be affordable to all levels of society in the Manokwari Regency area in particular and in general for West Papua Province. This hospital is classified as a type B hospital with existing facilities and has 12 (twelve) buildings or rooms.

According to data from the Ministry of Health of the Republic of Indonesia in 2019, around 57% of hospitals do not of hospitals do not complied with the regulations guiding the proper management of medical waste (Khansa et al., 2023; Mutiara et al., 2021). West Papua Province Regional Public Hospital as a health service center will produce various solid medical waste in wards and health service units. Besides, the lack of public and patient awareness regarding hygiene also adds to the difficulty of managing medical waste in hospitals (Jumriah et al., 2021; Sinaga et al., *2023)*. Referring to Attachment X of Government Regulatio n Number 22 of 2021, infectious solid medical waste including Hazardous and Toxic Waste (B3 waste in Indonesian abbreviation), namely solid medical waste contaminated with pathogenic organisms that are not routinely present in the environment, and these organisms are in sufficient quantity and virulence to transmit disease to susceptible humans (Hossain et al., 2011). Medical waste produced by hospitals includes radioactive waste, infectious waste, pathological and anatomical waste, cytotoxin waste, chemical and

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pharmaceutical waste (Peraturan Menteri Kesehatan Republik Indonesia, 2019).

Medical waste has a greater potential to generate risk of work accidents and disease transmission for doctors, nurses and all those related to hospital management and patient's care and hospital visitors (Ciawi et al., 2024; Massrouje, 2001). Waste control is an important part of public health where waste that is not managed properly can create conditions which can have adverse impacts on public health and the environment. Considering the negative impact of hospital medical waste, it is necessary to have a well treatment in order to reduce the risk of disease transmission (Dewi et al., 2022; Mihai, 2020).

This study aims to characterize solid medical waste in the West Papua Province Regional Public Hospital, also identify and evaluate the management of solid medical waste in the West Papua Province Regional Public Hospital.

Method

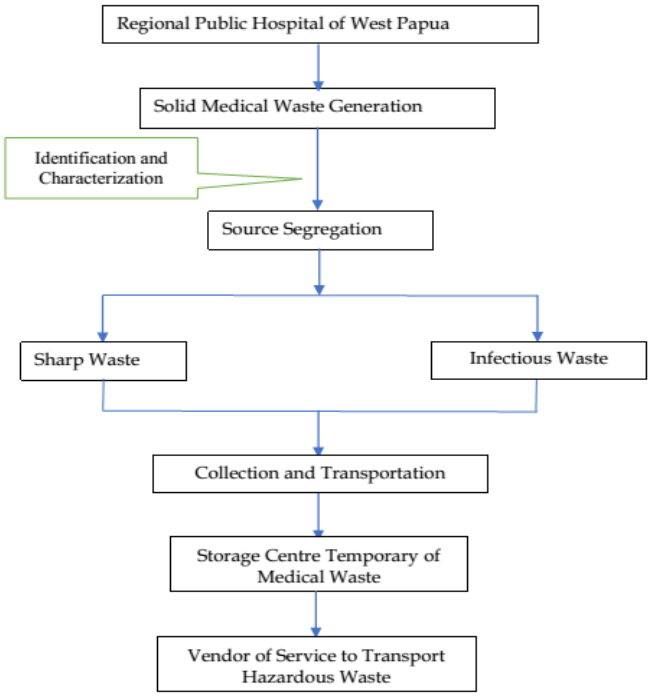


Figure 1. Flowchart of the medical waste management system and data collection on solid medical waste generation

The study was carried out on December 2023 to January 2024. The study data was obtained through observations and interviews arranged every week for 2 (two) months. The observations were carried out in the Emergency Room, Obstetrics ward, Pediatric ward, Perinatology ward, Surgical Room, Internal Disease Department and Laboratory. The interviews were conducted with supervisors who are responsible for managing solid medical waste at the West Papua Province Regional Public Hospital and several relatives of patients who are taking treatment at the West Papua Province Regional Public Hospital. Data collection on solid medical waste generation is carried out by referring to SNI 19-3964-1994 (Figure 1).

Result and Discussion

Characteristics of Solid Medical Waste

The solid medical waste produced by the West Papua Province Regional Public Hospital is infectious solid medical waste, sharp objects, expired medicines and chemicals. Infectious solid medical waste consists of infusion bottles, infusion hose, aboceth, medical gloves, wet cotton, gauze, ampoule bottles, syringes (needles), splint, alcohol cotton, vacutainer blood collection tubes, and sputum collection bottles. Referring to Attachment IX of Government Regulation Number 22 of 2021, the characteristics of solid medical waste generation at West Papua Province Regional Public Hospital are dominated by: (1) Clinical waste that has infectious characteristics with waste code A337-1, hazard category 1, (2) Expired pharmaceutical product with waste code A337-2, hazard category 1.

In general, types of waste from hospitals and health care facilities include infectious clinical waste (code A337-1), expired pharmaceutical products (A337-2), expired chemicals (A337-3), laboratory equipment contaminated with B3 (A337-4), health equipment containing heavy metals (A337-5), used pharmaceutical product packaging (B337-1), WWTP sludge (B337-2), incinerator fly ash (A347-1), slag or incinerator bottom ash (A347-2), emissions processing residue (B347-1), used filters and absorbents (B347-2), and WWTP sludge (B347-3) (Purwanti, 2018).

Sources and Amount of Solid Medical Waste at Regional Public Hospital of West Papua Province

The source of solid medical waste at the West Papua Province Regional Public Hospital mostly comes from the Emergency Room, Obstetrics ward, Pediatric ward, Perinatology ward, Surgical Room, Internal Disease Department and Laboratory. The amount and type of solid medical waste produced from each source is presented in Table 1.

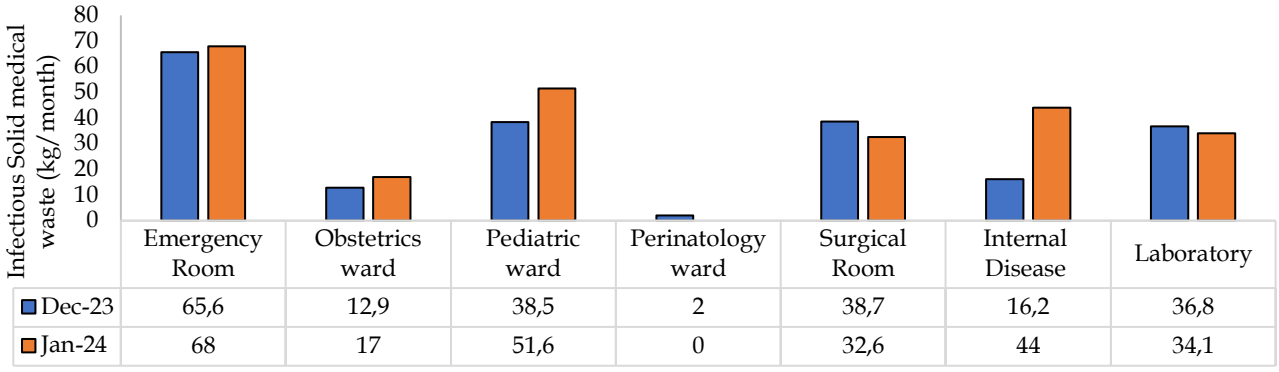
The amount of infectious solid medical waste produced by the West Papua Province Regional Public Hospital in December 2023 and January 2024 was 210.7 kg and 247.3 kg, respectively. Based on the results of observations for 2 (two) months, the Emergency Room (IGD) is the room that produces the largest solid medical waste compared to other sources/rooms, namely 66.8 kg/month or an average of 16.7 kg/week. Similarly to emergency room, the surgical room, pediatric ward, laboratory and internal disease department also produce

quite large amounts of solid medical waste, approximately 45.05 kg/month from the pediatric ward, 35.65 kg/month from the surgical room, 35.45 kg/month from the laboratory, and 30.1 Kg/month from the internal disease department (Figure 2).

Table 1. The Amount and Type of Solid Medical Waste from Each Source/Room at West Papua Province Regional Public Hospital

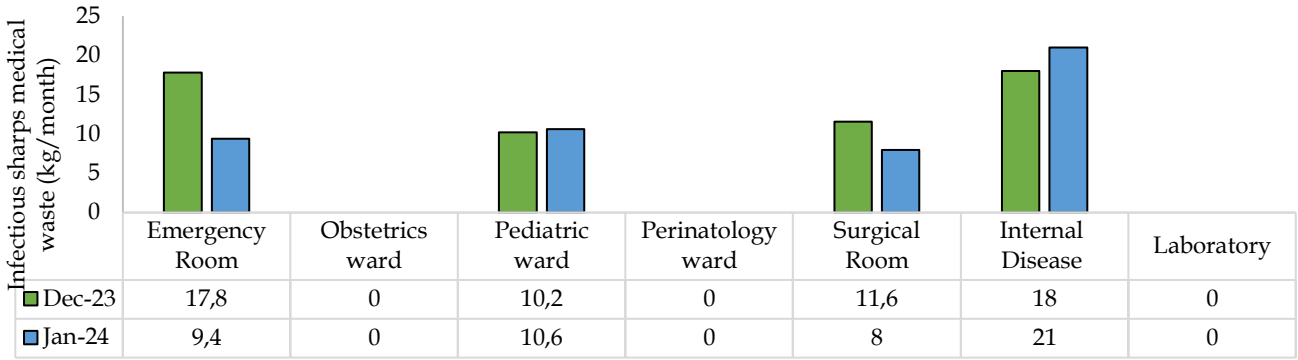
Waste Sources	Type of Waste	Infectious solid medical waste				Infectious sharps medical waste			
		December 2023		January 2024		December 2023		January 2024	
		Total (kg)	Everage (kg/week)	Total (kg)	Everage (kg/week)	Total (kg)	Everage (kg/week)	Total (kg)	Everage (kg/week)
Emergency Room	Infusion bottles, infusion hose, aboceth, medical gloves, wet cotton, gauze, ampoule bottles, syringes (needles), splint, alcohol cotton, vacutainer blood collection tubes, and sputum collection bottles	65.6	16.4	68	17	17.8	4.45	9.4	2.35
Obstetrics ward	Infusion bottles, infusion hose, aboceth, medical gloves, wet cotton, gauze, ampoule bottles, syringes (needles), splint, alcohol cotton, vacutainer blood collection tubes, and sputum collection bottles	12.9	3.225	17	4.25	0	0	0	0
Pediatric ward	Infusion bottles, infusion hose, aboceth, medical gloves, wet cotton, gauze, ampoule bottles, syringes (needles), splint, alcohol cotton, vacutainer blood collection tubes, and sputum collection bottles	38.5	9.625	51.6	12.9	10.2	2.55	10.6	2.65
Perinatology ward	Infusion bottles, infusion hose, aboceth, medical gloves, wet cotton, gauze, ampoule bottles, syringes (needles), splint, alcohol cotton, vacutainer blood collection tubes, and sputum collection bottles	2	0.5	0	0	0	0	0	0
Surgical Room	Infusion bottles, infusion hose, aboceth, medical gloves, wet cotton, gauze, ampoule bottles, syringes (needles), splint, alcohol cotton, vacutainer blood collection tubes, and sputum collection bottles	38.7	9.675	32.6	8.15	11.6	2.9	8	2
Internal Disease	Infusion bottles, infusion hose, aboceth, medical gloves, wet cotton, gauze, ampoule bottles, syringes (needles), splint, alcohol cotton, vacutainer blood collection tubes, and sputum collection bottles	16.2	4.05	44	11	18	4.5	21	5.25
Laboratory	Medical gloves, wet cotton, gauze, ampoule bottles, syringes (needles), splint, alcohol cotton, vacutainer blood collection tubes, and sputum collection bottles	36.8	9.2	34.1	8.525	0	0	0	0
Total (kg/month)		210.7		247.3		57.6		49	

The high level of infectious medical waste in the emergency room is due to the large number of actions or physical contact with patients when medical staffs is taking care of the patients, so standard personal protective equipment (PPE) such as gloves and masks is needed. The lowest amount of infectious medical waste was in the Perinatology room, with only 2 kg on the entire December, while in January 2024 there was no infectious medical waste from that room. The lack of infectious medical waste in the Perinatology room shows that there is no special health service for newborn babies or we can conclude that babies born during the observation month are healthy.



	Emergency Room	Obstetrics ward	Pediatric ward	Perinatology ward	Surgical Room	Internal Disease	Laboratory
Dec-23	65,6	12,9	38,5	2	38,7	16,2	36,8
Jan-24	68	17	51,6	0	32,6	44	34,1

Figure 2. The amount of infectious solid medical waste at West Papua Province Regional Public Hospital



	Emergency Room	Obstetrics ward	Pediatric ward	Perinatology ward	Surgical Room	Internal Disease	Laboratory
Dec-23	17,8	0	10,2	0	11,6	18	0
Jan-24	9,4	0	10,6	0	8	21	0

Figure 3. The amount of infectious sharps medical waste at West Papua Province Regional Public Hospital

Sharps media waste includes discarded syringes, broken ampoules contaminated with cytotoxic and cytostatic drugs, and other contaminated disposable sharps or instruments (Griffith & Tengnah, 2006). Waste from sharp objects can cause injury. Injuries caused by sharp objects will have a psychological impact (Blenkharn, 2009). Sharps medical waste also has a large potential risk of transmitting infectious diseases and contagious diseases to both nurses or hospital workers and visitors (Ningrum & Tualeka, 2019; Veilla & Samwel, 2016). The amount of infectious sharps medical waste produced by the West Papua Province Regional Public Hospital in December 2023 and January 2024 was 57.6 kg and 49 kg, respectively. Based on the results of observations for 2 (two) months, the internal disease department is the room that produces the largest infectious sharps medical waste compared to other sources/rooms, namely 19.5 kg/month or 4.88 kg/week. Apart from the internal disease department, the emergency room, surgical room and pediatric ward also produce quite a large amount of infectious sharps medical waste, namely 13.6 kg/month from the emergency room; 10.4 Kg/month from the pediatric ward, and 9.8 Kg/month from the surgical room. The medical procedures carried out by health workers in internal disease department leave behind sharp medical waste in the form of syringes and ampoule bottle waste. During the two months observation, no infectious sharps medical waste was found from the Perinatology ward, Obstetrics ward and laboratory room. This is because there is no medical officers in the room who need medical sharp objects (Figure 3). When compared to solid medical waste observation data from the Manokwari Regional Public Hospital from February to March 2021, the amount of solid medical waste produced was 224.1 kg/month (Come et al., 2022) or this amount is smaller than the amount of medical waste produced by the West Papua Province Regional Public Hospital. According to Politon et al. (2023), the average weight of medical waste produced at Madani Palu

Regional Public Hospital is 27.5 kg/day. The difference in the rate value of solid medical waste generation is influenced by the number of patient visits, type of hospital/health center as well as medical waste sorting activities and type of medical services provided (Jang et al., 2006).

Efforts to Manage Solid Medical Waste at West Papua Province Regional Public Hospital

The management of solid medical waste is crucial because medical waste that is not managed properly can pose health risks to hospital workers, patients and the general public (Pant, 2012). Overall, the environmental management system in hospitals aims to plan, implement, achieve, assess and align environmental policies with the hospital's vision. It involves various components, such as management support, planning, implementation, inspection, action, human resources, funding, equipment, and methods. Policies and commitment to manage solid medical waste by implementing an effective environmental management system, hospitals can fulfill their environmental responsibilities, comply with regulations, and protect the environment and public health (Fiqra & Antomi, 2023; Ruoyan et al., 2010; Sawalem et al., 2009). The main obstacles found in medical waste management includes limited land, procedural weaknesses, and internalization of other costs (Debora et al., 2023).

Referring to the Ministry of Environment and Forestry Regulation of Republic of Indonesia Number P56 of 2015 concerning Procedures and Technical Requirements for Management of Hazardous and Toxic Waste from Health Facilities and Regulation of the Minister of Health of the Republic of Indonesia Number 7 of 2019 concerning Hospital Environmental Health, management of Hazardous and Toxic Waste arising from health service facilities includes the stages of reducing and sorting Hazardous and Toxic Waste; storage of Hazardous and Toxic Waste; transportation of Hazardous and Toxic Waste; Hazardous and Toxic Waste processing; burial of Hazardous and Toxic Waste; and/or landfill of Hazardous and Toxic Waste. Based on the results of observations, it was found that the form of management of infectious solid medical waste that has been carried out at the West Papua Province Regional Public Hospital as follows:

Sorting

The sorting of infectious solid medical waste from its source is carried out by waste officers at the West Papua Province Regional Public Hospital. The separation of infectious solid medical waste from non-medical waste is carried out every day and the average generation of solid medical waste produced is <10 kg/day. In the stage of sorting infectious solid medical waste, the West Papua Province Regional Public Hospital provides yellow containers labeled/symbols for infectious waste and lined with plastic bags matched to the type of waste, equipped with a lid, watertight, and opened by stepping on it. The non-medical waste container is a green container, equipped with a lid, watertight, and opened by stepping on it (Figure 4).

Figure 4. Solid medical waste container

The waste containers for sharp objects and needles in the form of yellow disposable puncture-resistant safety boxes with a biohazard symbol are placed in each medical treatment room and then collected at the temporary storage area before being destroyed (Figure 5). Effective sharps waste segregation at the generating area and use of proper waste containers provides a most effective safeguard against the hazardous effects of sharps waste (Veilla & Samwel, 2016).

Figure 5. Safety boxes, containers for sharps and needles waste

Collection

The collection activities of solid medical waste at the West Papua Province Regional Public Hospital has been carried out based on the type of medical waste available. The collection of solid medical and non-medical waste has been carried out at different times using different conveyance equipment, but the type of conveyance used has the same characteristics, which are in the form of containers made of strong plastic material,

leak-proof, large size, easy to carry, tightly closed and labeled according to the type of waste. The 240 L solid medical waste transporter has wheels to make transportation easier, tightly closed and labeled as infectious waste on the transport trolley.

The waste in each room/unit is collected, put into a trolly and then transported to a temporary storage area by waste collector officers. The officers who collect waste use complete personal protective equipment, which are head coverings, masks, aprons, boots and thick rubber gloves (Figure 6).

Figure 6. The collection activity of solid medical waste

Transportation

The transportation of solid medical waste at the West Papua Province Regional Public Hospital for all rooms uses silo trolleys with a capacity of 240 liters equipped with a cover and has a special transportation route which is separate from the road used by hospital visitors, patients and staff. The solid medical and non-medical/domestic waste are transported on separate trolleys. The waste is transported in plastic packaging that has been tied to prevent the risk of it being spilled. The transportation schedule for solid medical waste at the West Papua Province Regional Public Hospital is carried out in two shifts every day, which at 06.00 WIT to 07.00 WIT and 16.00 WIT to 17.00 WIT. If it had passed the transportation schedule and medical waste is still available, the waste will be transported in the next shift.

Temporary Storage Area (TSA)

After the solid medical waste is collected in the waste conveyance, namely three-wheel Viar vehicle, then the waste is taken by officers to the TSA owned by the West Papua Province Regional Public Hospital for temporary storage before being transported by a third-party company in solid medical waste disposal sector (Figure 7). The storage time for solid medical waste before handing it over to a third party is approximately two months. The TSA building of West Papua Province Regional Public Hospital is separate from the main building. At TSA, medical waste is placed separately from B3 waste and non-medical waste. The three types of waste are stored separately in one building which is divided into three rooms for temporary storage, namely the medical, non-medical and B3 waste rooms with separate doors.

Figure 7. Temporary storage area (TSA)

Destruction

The best method for infectious waste disposal is disinfection at the point of generation including use of autoclave and controlled proper disposal or use of incinerator (Dehghani et al., 2019). The West Papua Province Regional Public Hospital has an incinerator but it cannot be operated because it does not have an operational permit, so the Regional Hospital is collaborating with an infectious/B3 waste disposal company that has a permit. The handover of solid medical waste from West Papua Province Regional Public Hospital to third-party company is carried out every two months (Figure 8). For non-infectious medical waste, the hospital staff immediately destroy it by burning it every day.

Figure 8. The transportation activity by third-party company

Conclusion

The characteristics of solid medical waste in West Papua Province Regional Public Hospital are dominated

by clinical waste which has infectious characteristics with waste code A337-1, hazard category 1 and expired pharmaceutical products with waste code A337-2, hazard category 1. The average amount of solid medical waste in West Papua Province Regional Public Hospital is 282.3 kg/month, consisting of infectious solid medical waste of 229 kg/month and the amount of infectious sharps medical waste of 53.3 kg/month. The forms of management of infectious solid medical waste that have been carried out at the West Papua Province Regional Public Hospital are sorting, collection, transportation and storage.

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Author Contributions
ST: methodology, writing—original draft preparation, formal analysis, investigation, and visualization. BM: writing—review and editing, formal analysis, investigation, and visualization, EAM: review and editing.

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Conflicts of Interest
The authors declare no conflict of interest.

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