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Medical Waste Management on Covid-19 Pandemic at Primary Health Centers in Bandung City Indonesia

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Abstract— To prevent the increase in the spread of new cases of Covid-19 requires the use of more medical equipment quantity such as Personal Protective Equipment (PPE), rapid and swab test than in normal conditions. In consequence,this Pandemic situation produces more medical waste inPrimary Health Centers (Puskesmas), which must be managed according to the required health protocol. This study aims to describe the medical waste generation during the Covid-19 pandemic and its management inpuskesmas.The research design used was a cross-sectional survey. This research was conducted at 60 health centers in Bandung City, and the results showed there was no difference in the methods of managing medical waste under normal conditions with the Covid-19 pandemic. 93.3% out of 60 puskesmas experienced an increase in the amount of medical waste of 43.19% average. Most of them have sorted medical waste from domestic waste. Medical waste packaging in temporary storage has not been labeled and stored for more than two days at temperatures above 0^0C without using cold storage. Based on the result, it is recommended that integrated waste storage is needed per region for the temporary storage of medical waste, which is equipped with cold storage. The person in charge of the Environmental Health program in Puskesmas, 78.3% were Sanitarian/Environmental Health Workers.

Keywords: Medical Waste Generation, Medical Waste Management, Primary Health Center (Puskesmas), Covid-19 Pandemic

Introduction

World Health Organization states that 10 - 25% of solid waste produced by health facilities is a medical waste[1].In Indonesia, the generation of medical waste in healthcare facilities, especially hospitals and puskesmas is 296.86 tons/day[2].Medical waste can cause environmental pollution and health problems [1,3,4]. The health impacts caused by medical waste include being infected by microorganisms in medical waste, wounds generated by sharp objects, and chemical poisoning. Also, exposure to radioactive substances can cause headaches, dizziness, nausea, and other complaints[5].Medical waste can be a risk factor for transmitting HIV, hepatitis B, and hepatitis C[6]. In 1999 WHO reported that in France, there were 8 cases of health workers infected with HIV through wounds. Two of them were infected through needles while handling medical waste. The toxic nature of medical waste, with improper handling, can damage the environment and disturb the balance of the ecosystem[7].

The Covid-19 pandemic has led to the use of more medical equipment and has the potential to produce medical waste. Medical waste is solid waste resulting from diagnosis and treatment activities in health service facilities, such as hospitals, clinics, blood banks, dentist practices, and animal hospitals/clinics, medical research facilities, and laboratories as well as immunization activities [8,9].Medical waste in health facilities consists of infectious characteristics, sharp characteristics, expired chemicals, packaging waste, pathological, radioactive, pharmaceutical, cytotoxic, and medical equipment that has high heavy

metal content[10,11,12,13]. The most common medical waste produced during the Covid 19 pandemic is Personal Protective Equipment (PPE), such as protective clothing, masks, gloves, bandages, tissues, plastics used for drinks and food, food and beverage paper for patients, and syringe infusion sets.Also,other objects may be contaminated by infectious substances [14].

Medical waste produced by health facilities needs to manage adequately. The three main activities in managing medical waste are sorting and collection on the source, transport from health facilities, and disposal [15]. Sorting consists of sorting medical waste with domestic waste, and sorting medical waste by type, which uses different packaging colors [1,11]. The collection is carried out by collecting medical waste from the producing room to temporary storage, then transported and disposed of [16,10]. Studies related to medical waste management include in China and Malaysia not carried out sorting, and lack of facilities for medical waste [17,18]. 88.2% of public health centers in Myanmar were not supported by medical waste management facilities [19].It was also found in Kupang Indonesia that medical waste is not sorted and stacked without safe packaging and inadequate disposal of the waste [20].

Puskesmas,primary health center is one of an integrated primary health care facility in Indonesia that protecting and improving the health of people and their communities by providing health service largely preventive and promotive activities in its working area [21].Total puskesmas in Indonesia up to 2019 was 9.993 [22]. Covid-19 Pandemic situation produces more medical waste in Puskesmas, which must be managed according to the required health protocol management waste.

Methodology

This study was using a crossectional survey design. Samples of the study were 60 Puskesmas in Bandung City and selected by simple random sampling according to the sample size. Interviews with officers in charge of the environmental health programs and observations of Puskesmas medical waste management facilities and infrastructure were conducted from June until July 2020. They were using a questionnaire and checklist sheets instruments based on the literature on medical waste and research. The validity and reliability of the questionnaire were conducted at an early stage.

Finding and Discussion

Puskesmas Characteristics

Most of the Puskesmas had been accreditated with score Madya (43.3%). Proportion Health services provided in Puskesmas, 100% general and outpatient health services and also dental, pharmaceutical, simple laboratory tests, and Maternal and Child health services around 91%-95%. In the meantime,Basic Emergency Obstetric Neonatal Care (PONED) service was only 4%.The person in charge of the Environmental Health program in Puskesmas, 78.3% were Sanitarian/Environmental Health Workers. 93.3% out of 60. Puskesmas experienced an increase in the amount of medical waste of 43.19% average during the Covid-19 Pandemic; on the other hand, the number of visits decreased.

The average amount of puskesmas waste under normal conditions before the Covid-19 pandemic was 17.26 kg/ month. This amount was less compared to the amount of medical waste produced by hospitals. The amount of medical waste in puskesmas was related to the number of patient visits and the type of health service provided. The average puskesmas visit under normal conditions is 106 people per day. The type of health service provided was basic without any specialist services. Diseases treated were minor diseases. Patients who required medical treatment or experience symptoms of severe illness will be referred to the hospital. 4.0% of Puskesmas maintained Basic Essential Neonatal Obstetric Services

(PONED), which is a 24-hour inpatient service for pregnant women and maternity, and 40 days after childbirth services as well as newborns with complications [23].

Table 1. Characteristics of puskesmas Bandung City

Characteristic of puskesmas	n	%
Accreditation of puskesmas		
- Excelent (paripurna)	2	3,3
- Primary (utama)	4	6,7
- Medium (madya)	26	43,3
- Basic (Dasar)	18	30,0
- Unregistration/ non akreditation	10	16,6
Puskesmas Service		
- Outpatient	60	100,0
- PONED	4	6,7
- General Treatment	60	100
- Dental Service	56	93,3
- Farmation	55	91,7
- Simple Laboratorium	55	91,7
- Maternal and Child Health Services	57	95,5
- Emergency Service	9	15,0
Medical waste on Covid-19 pandemic		
- Increasing	56	93,3
- Unchanged	4	6,7
A person in charge environmental health program		
• Education Level		
- D3	26	43,3
- S1	34	56,7
• Background of Education		
- Environment Worker	47	78,3
- Midwives	2	3,3
- Nutritionist	2	3,4
- Public Health	8	13,3
- Others	1	1,7

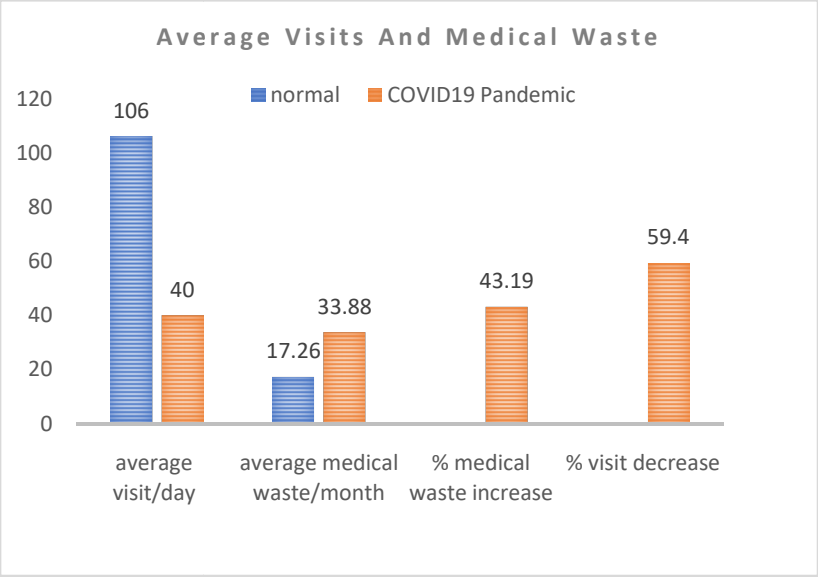

Figure 1. **Average visits and medical waste in PuskesmasBandung City**

A declining number of patients visits due to efforts to keep a distance for transmission virus the COVID-19 [24]. It is very important because puskesmas is one of the health facilities that many patients had visited. The increased amount of medical waste relates to health services, which conducted rapid test sampling and swab tests to find COVID-19 cases. Officers must be equipped with personal protective equipment, medical masks, eye protection, gloves, headgear, which is plastic and disposable used [25,26]. Medical waste derived from patients includes cotton swabs, syringes, materials contaminated with blood or bodily fluids,etc. [27]. In Wuhan, China, there was also increased medical waste from 0.68 kg/bed/day to 2.5 kg/bed/day [28,25]. In Indonesia, the cumulative amount of medical waste during the Covid-19 pandemic is accumulated 77 days ranging from 1,250 tons to 6,250 tons [29]. Medical waste to the Covid-19 pandemic in various cities such as Manila 280 tons/day, Jakarta 212 tons/day, Kuala Lumpur 154 tons/day, Bangkok 210 tons/day, and Hanoi 160 tons/day [30].

Medical Waste Management Facilities and Infrastructure at Puskesmas

Puskesmas that already have medical waste sorting containers with different colors were 68.3%. Medical waste sorting facilities are based on sufficient type, and good condition was 70.0%. 48.3% Puskesmas has temporary locked storage medical waste and not access for the public. None of them comes with cold storage. Third parties carried out transport and disposal of medical waste.

Table 2. Medical waste management facilities and infrastructure

Medical Waste Management Facilities	n	%
Facilities in normal condition vs. COVID-19 pandemic		
- No change Facilities	60	100,0
- Different Facilities	0	0,0
Medical and domestic waste sorting facilities		

Medical Waste Management Facilities	n	%
Facilities in normal condition vs. COVID-19 pandemic		
- No change Facilities	60	100,0
- Different Facilities	0	0,0
- Same colour	7	11.7
- Different colours and insufficient quantity	12	20.0
- Different colours and sufficient quantity	41	68.3
Medical waste sorting facilities		
- Does not meet the amount and quality	6	10.0
- Insufficient amount	12	20.0
- Enough amount and good conditions	42	70.0
Medical waste collection facilities		
- Don't have the facilities	58	96.7
- Have the facilities	2	3.3
The temporary storage of medical waste facilities		
• Storage room		
- Don't have	19	31.7
- Have, open and near public spaces	8	13.3
- Have, closed and near public spaces	4	6.7
- Have, locked and difficult to access public	29	48.3
• Cold Storage		
- Don't have	60	100,0
- Have	0	0,0
Transportation Vehicles		
- Have	0	100.0
- Cooperation with third parties	60	0.0
Means for disposal		
- Have	0	100.0
- Cooperation with third parties	60	0.0

There was no difference in the facilities of medical waste management between normal conditions and the COVID-19 pandemic. The completeness and condition of facilities and infrastructure determine the ability of institutions to manage medical waste. It was found there are still medical waste packaging sorting with the same color with domestic waste (11.7%). Medical waste packaging has to have a different color with domestic waste. Black plastic bags are used for domestic waste and yellow plastic bags for medical waste [10]. Only 3.3% of Puskesmas have the means to collect medical waste from medical waste-producing rooms to temporary storage. The medical waste plastic packaging that has been tied by binding is put in a container for transport [14]. The required storage space is a separate building or a special locked room that can only be accessed by assigned personal [14,10]. Puskesmas did not have cold storage (100%). Cool storage is required if medical waste is stored for more than two days [11].

Medical Waste Management Process

85% Puskesmas routinely sorted medical waste with domestic waste. All Puskesmas has sorted out infectious medical waste with sharp object waste. 88.3% of Puskesmas collected medical waste without trolley with complete PPE officers. 45.0% of Puskesmas collected infectious medical waste from sources every day. 63.3% ofPuskesmas collected sharp medical waste if the container is almost full. There were still 15.0% Puskesmas that do not close medical waste packaging tightly in the storage process, and 95.0% of packaging is not labeled. Third parties carried out carriage and disposal.

Table 3. Medical waste management at puskesmas

Medical waste management	n	%
Management in normal condition and COVID-19 pandemic		
- No change Facilities		
- Different Facilities	60	100,0
	0	0,0
Sorting waste between medical waste and domestic waste		
- There is no sorting between them	3	5.0
- Have done, but it's not routine.	6	10.0
- Have done and routine	51	85.0
Sorting of infectious medical waste and sharp objects		
- Have	60	100,0
- Don't have	0	0,0
Medical waste collection		
- Without Trolley and PPE	5	8.3
- With PPE but without trolly	53	88.3
- With Trolley dan PPE	2	3.4
Schedule of Collection of infectious medical waste		
- Nothing/not clear	27	45.0
- Only when to be transported to the disposal	2	3.3
- If the container is almost full	4	6.7
- Everyday	27	45.0
The sharp medical waste collection schedule		
- Nothing/not clear	18	30.0
- Only when to be transported to the disposal	2	3.3
- If the container is almost full	38	63.3
- Everyday	2	3.3
Medical Waste Storage		
• Temporary Medical Waste Storage		
- There's no Temporary Medical Waste Storage	6	10.0
- On wheeled bin		
- On Temporary Medical Waste Storage but not sealed	12	20.0
	9	15.0
- On Temporary Medical Waste Storage and sealed		
• Packaging label		
- Don't have	33	55.0
- Have		
	57	95.0
	3	5.0
Length of medical waste storage		
- No fixed length	21	35.0
- Storage length is not up to standard	39	63.3
Transport and disposal		
- - Third-party cooperation	60	100.0

There was no difference in medical waste management between normal conditions and the COVID-19 pandemic. The stages of medical waste management consist of a process of sorting, collecting, transporting, and disposal.When compared between normal conditions and during the Covid-19 pandemic, there is no difference in the medical waste management system carried out at puskesmas. There were still 5% of Puskesmas that did not do medical waste sorting with domestic waste. 6% of them have done sorting but have not been routine. The sorting of medical waste and domestic waste is carried out to facilitate the next process and prevent health problems. Medical waste should be adequately, and protocol treated because the risk of infection and accidents is high. Medical waste sorting lowers the 80.0% risk of needle puncture wounds [31]. There were still officers who collect medical waste without using PPE (8.3%). Officers collecting medical waste must be equipped with personal protective equipment such as masks and gloves. During the Covid-19 pandemic, collecting officers had to use comprehensive PPE, including hazmat, protective goggles, and boots [14,27]. Collecting officers are particularly at risk of being infected by infectious medical waste or injured by sharp objects [31,32]. Infectious medical waste and sharp objects should be collected daily (24 hours) or if the container is already 3/4 full of the storage [14].

Of the 60 Puskesmas, only 48.3% have a temporary storage area for medical waste. This condition is because some of the puskesmas have narrow land and limited building areas. There are even health centers that do not have their buildings (rent a building).All storages were not equipped with cold storage and more than two days stored. Infectious waste, sharp objects, and pathologies should not be stored for more than 2 (two) days to avoid bacterial growth, putrefaction, and odor. If stored for more than 2 (two) days, waste must be chemically disinfected or stored in a refrigerator or cooler at a temperature of 0^{o}C (zero degrees Celsius) or lower [10]. Transportation by a third party cannot be carried out every two days because it is related to the amount of medical waste generation and costs required for transportation. The amount of medical waste generated in puskesmas is less than in hospitals. So that if the transportation is carried out every two days, it will be more costly and ineffective.

For this reason, it is necessary to think about providing an integrated temporary storage area for medical waste per region. The integrated temporary storage area will support several puskesmas in the same area. The benefits that can be obtained are reduced transportation costs and solutions for health centers that do not have temporary storage places for waste due to limited land and building conditions.

Conclusion

The pandemic of Covid-19 increased the onset of medical waste in Puskesmas Bandung City. On the other hand,a decrease in the number of patients visits. The increase in the onset of medical waste is related to the increase in medical equipment used. 50% of Puskesmas did not have medical waste storage facilities and are not equipped with cold storage. It is necessary to design integrated medical storageequipped with cold storage per region working area of puskesmas.

Competing Interest

The author states that there is no conflict of interest in this study

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