

Medical Waste Generation of Community Health Centers (PUSKESMAS) In Magelang Regency, Indonesia

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Abstract: The majority of Magelang Regency's society is registered as participants and actively uses the Indonesian National Health Insurance (JKN). This makes the active role of Community Health Centers as first level service that takes care of health problems. This has an impact on the amount of hazardous waste by the Community Health Centers activities and how to manage it. The study was carried out to identify and calculate hazardous waste generation in Community Health Centers. The study was conducted using a purposive sampling method by examining the Community Health Centers services (e.g., hospitalization and out-patient care) and analyzing medical waste generation based on SNI 19-3964-1994 standard. The study results indicate that the type of Community Health Centers has an impact on the daily generation and composition of hazardous waste. The composition of non-sharp infectious waste produced was as much as 82%, and that sharp infectious waste was 18% average from hospitalization and out-patient care. The potential for waste generated from Community Health Centers in Magelang Regency is as much as 33.66 kg per day. This needs to be reconciled with the increasing knowledge of health workers and sanitarians in handling this. The generation and composition of hazardous waste in Community Health Centers are influenced by several factors, including the type of Community Health Centers service, the number of patients and treatments provided, and the extent of laboratory services.

Keywords: Medical waste; Hazardous waste; Generation waste.

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INTRODUCTION

Magelang is one of the regency with the highest population growth in the Central Java province, where the population growth is 0.92% per year with a total population of 1,268,396 people based on data from Statistics Indonesia (BPS) in 2018. Furthermore, as much as 59.04% of the population of Magelang Regency has health insurance and is an active participant registered in the health insurance of the Healthcare and Social Security Agency called Badan Penyelenggara Jaminan Sosial (BPJS). Then, 59.04% of the population has a morbidity rate of as much as 16.97% (BPJS, 2019). BPJS is an independent legal institution established by the government to administer social insurance programs for the community consisting of health insurance. This program has two classifications; the first is BPJS Ketenagakerjaan for employment and given by the company. The second is BPJS Kesehatan, which Indonesian people use; usually, it pays personally to each person or in a group of family. BPJS helps to organize health insurance for the community, which is directly supported by Community Health Centers (Pusat Kesehatan Masyarakat or PUSKESMAS) in each sub-district throughout Indonesia as First Level Health Facilities/ FLHF (Fasilitas Kesehatan Tingkat Pertama (BPJS, 2019). FLHF is also a place for BPJS patients to handle at first stop health diagnosis, then it can receive referrals to second and higher-level health facilities such as hospitals if necessary. BPJS ketenagakerjaan usually has a private doctor as FLHF for the whole company, but BPJS Kesehatan members use Community Health Centers as their FLHF. Due to the increases services in Community Health Centers, patient visits to Community Health Centers in Magelang Regency also increased by 9.39% from 2018-2019 (BPJS, 2019). The increasing the visitor to Community Health Centers will lead to an increase in the rate of generation and composition of hazardous waste. Due to this problem needs to be balanced with a good management system for hazardous waste not to pollute the environment. The generated waste from medical centers such as hospitals and clinics is highly hazardous and puts people at risk of fatal disease (Shareefdeen, 2012, Egwu *et al.*, 2021).

Separation of medical waste from all other waste in waste producing sites is one of the keys to good waste management. Health workers highly influence this as they are the first people to separate medical waste. Based on the final report on the survey of health facilities in 2011, it was found that nationwide, the number of Community Health Centers who had separated medical and non-medical waste was 64.6% of Community Health Centers in Indonesia. (Ministry of Health, 2012). The results of research in several areas, including the hospital environment, are still not committed to complying with current regulations regarding the management of solid medical waste generated every day (Astuti & Purnama, 2014), and there is still a need to provide training and protection for health workers (Kusumayanti, 2017). Improper management can endanger the health of the environment and society. The management officer is the first element that has the potential to be exposed to nosocomial infections as these infections can be transmitted from patients to health workers (Kusumayanti, 2017). Because of this, there is a need to conduct research to identify and analyze the generation and composition of hazardous waste from Community Health Centers activities. It is expected that the results of this study will provide data on the existing condition of

Community Health Centers waste generation for further planning and proper management of hazardous waste.

METHOD

This study applies descriptive research that analyzes quantitative data and is taken from April to May 2019. Quantitative data are presented in the form of numbers to see the amount of generation and composition of hazardous waste produced at Community Health Centers in Magelang Regency. It is carried out based on SNI 19-3964-1994 protocol about collection and measurement of municipal solid waste generation and composition (Badan Standarisasi Nasional, 1994). It takes 8 days continuously in Community Health Centers, which is classified into two types of services, hospitalization and out-patient care. The amount of Community Health Centers as the sample, taken by the same regulation that determined by at least 10% of the population for public facilities. The amount of Community Health Centers in the Magelang Regency is 29, so the minimum sample is equivalent to 3. According to the research method that this study used purposive sampling to compare the types of Community Health Centers services, primary sampling taken at 4 Community Health Centers, 2 samples on hospitalization Community Health Centers (Borobudur and Salaman I subdistrict), and 2 more in out-patient care Community Health Centers services (Salam and Ngluwar subdistrict). According to SNI 1903964-1994, the average data of hazardous waste generation that obtained from the primary sampling was used to estimate potential waste generation from Community Health Centers activities.

RESULTS AND DISCUSSION

They are handling the management of hazardous waste in Community Health Centers in Magelang Regency in good condition. They separate two kinds of hazardous waste. The type of hazardous waste arising in Community Health Centers is a non-sharp and sharp infectious waste. This is in accordance with Minister of Environment and Forestry Regulation Number 56 of 2015 on Procedures and Technical Requirements for the Disposal of Hazardous Wastes from Health Care Facilities (Kementerian Lingkungan Hidup dan Kehutanan, 2015). The kind of non-sharp infectious waste includes gauze, gloves, cotton, masks, bandages, used bandages, and wipes. Besides, Sharp infectious waste consists of lancet needles and syringes contaminated with patient blood and body fluids, broken vial bottles, and broken glass utensils. Another condition shows that there is plastic packaging of the syringe on the sharp infectious waste box (Figure 1), it was contamination, and it should be explained to the health workers about the kind of differentiation between sharp infectious waste and non-sharp infectious waste and its handling on the separated containers.

Based on the results of the analysis of the existing conditions conducted by Community Health Centers in Magelang Regency in the disposal of hazardous waste, Community Health Centers separated solid hazardous waste into 2 (two) containers, i.e., infectious waste and sharp waste (Figure 2). The determination of generation and composition is done by measuring the weight and volume of hazardous waste generated by Community Health Centers and sorting the solid hazardous waste into two types

according to the existing management conditions, i.e., infectious waste and sharp object waste.



Figure 1. Medical waste at Community Health Centers that mixed on sharp infectious box



(a)



(b)

Figure 2. Hazardous waste handling in all of Community Health Centers that separated by two kind of container : (a) non-sharp infectious waste; and (b) sharp infectious waste

The sources and types of hazardous and toxic waste generated in Community Health Centers in Magelang Regency can be seen in Table 1. The service facilities in Community Health Centers all generate hazardous waste on both non-sharp infectious and sharp infectious waste. The form of this waste is solid, but Community Health Centers also generate liquid waste, including hazardous waste; there was human blood usually from the laboratory and washing laboratory equipment.

Table 1. Sources and Types of Hazardous Waste at Community Health Centers in Magelang Regency

No	Waste Type	Emergency Room	Dental Clinic	Mother and Child clinic	Laboratory	Delivery Room	Ward
1	Infectious non sharp objects	All units produce solid hazardous waste					
2	Infectious sharp objects						

No	Waste Type	Emergency Room	Dental Clinic	Mother and Child clinic	Laboratory	Delivery Room	Ward
3	Human blood/body fluids				Liquid		
4	Washing laboratory equipment				Liquid		

Community Health Centers are the first level of the health facility for the community in carrying out treatment, both daily out-patient and hospitalization care. Some Community Health Centers have hospitalization service facilities for patients with moderate to severe health diagnoses. The acceptability of the number and application of patient measures per day also differs between the two types of health centers. Table 2 shows the number of patients treated in a day in the two types of Community Health Centers with hospitalization and out-patient care. The number of patients treated in hospitalization at Community Health Centers tends to be higher because they have the capacity to provide intensive care services to patients. The average number of patients treated per day in Community Health Centers with hospitalization ranges 107-128 person per day, while in out-patient care, around 54 – 87 person treated per day. The details can be seen in Table 2. This amount depends on the facilities offered at each Community Health Centers; besides, it is already serviced by the residence area.

Table 2. Number of Patients at Community Health Centers in Magelang Regency

Sampling Period (day)	Out-Patient Care 1 (person/day)	Out-Patient Care 2 (person/day)	Hospitalization 1 (person/day)	Hospitalization 2 (person/day)
1	126	81	154	191
2	130	89	137	157
3	0	0	12	19
4	134	86	216	175
5	91	56	93	113
6	130	76	126	160
7	0	0	10	27
8	84	44	106	180
Average (person/day)	87	54	107	128

Community Health Centers' medical services generate various types of medical waste, which are categorized as hazardous waste according to Government Regulation No. 22 of 2021 (Presiden Republik Indonesia, 2021). The amount and type of waste vary and are uncertain every day. This is due to the varying number of patients treated per day and the service capacity of each Community Health Centers. Waste generation can be determined by collecting primary data at Community Health Centers using the method of collecting and measuring samples of Municipal Solid Waste (MSW) generation and composition in SNI 19-3964-1994. This is because Community Health

Centers are among the urban public facilities that produce waste on a daily basis, both household-type waste and specific waste, such as hazardous waste.

Measurement of hazardous waste generation is carried out to identify and collect actual and accurate information on the generation rate and composition of hazardous waste generated. Information on the amount and composition of hazardous waste generation is needed to determine the average amount produced per day to help in determining the appropriate waste management method (Korkut *et al.*, 2018). Due to the large number of treatment operations that are carried out using equipment that can become hazardous waste, the generation of hazardous waste is greater in hospitalization at Community Health Centers. This is because the treatment is given when the administration can no longer cure the patient of drugs alone. The amount of waste generated by Community Health Centers is greatly influenced by the service facilities, the type of Community Health Centers, and the number of patients served in service day units. Komilis *et al.*, (2012) found that the rate of hazardous waste generation is influenced by the size and type of public health service facilities. The rate of hazardous waste generation can be influenced and identified by the size of the medical care event and the proportion of disposable items used in treatment activities and medical care of patients (Utami, 2017). Besides, it also depends on the activity that Community Health Centers hold, such as regional meetings, citizen education, or vaccination for baby and child.

The comparison of average hazardous waste generation between hospitalization and out-patient care at Community Health Centers can also be seen in Figure 1, showing that out-patient care at Community Health Centers generates less hazardous waste than the hospitalization one. This is due to the limited availability of service facilities and a lesser number of patient visits compared to Hospitalization care at Community Health Centers. Hospitalization at Community Health Centers provides more health care facilities than the services offered by out-patient care. Hazardous waste generated mainly from activities in hospitalization at Community Health Centers are from laboratory tests, delivery actions, and actions of doctors in out-patient care and hospitalization, while in out-patient care at Community Health Centers, the number of patient visits per day does not affect the hazardous waste generated. This is because doctors generally only perform actions such as counseling and administering generic medications, so less hazardous waste is generated each day.

Table 3 is the result of determining the amount of waste generated for each unit in Community Health Centers. From the graph, it can be seen that the unit that produces the most waste during the sampling period is the laboratory. Each Community Health Centers has a laboratory to assist in providing services to the surrounding community. The laboratory in Community Health Centers is capable of conducting blood type examinations, complete blood tests, sediment, plano tests, blood sugar analysis, cholesterol, triglycerides, serum creatinine, uric acid, urine, and sputum testing. Possessing laboratory services makes it easier for Community Health Centers medical staff to make accurate diagnoses of patients based on the disease they are suffering from, thereby increasing the accuracy of diagnosing diseases felt by the community.

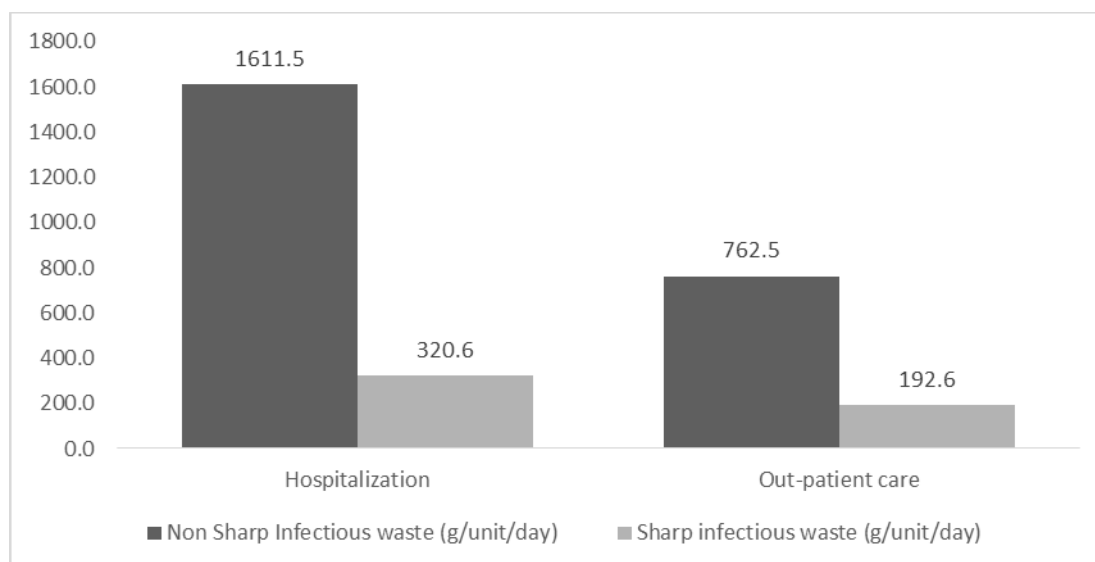


Figure 1. Hazardous Waste Generation from Community Health Centers

Table 3. Average daily weight each unit in Community Health Centers

Unit services	Hospitalization		Out-patient care	
	Non-Sharp infectious waste	Sharp Infectious waste	Non-Sharp infectious waste	Sharp Infectious waste
Dental Clinic	238.5	25.8	171.3	40.0
Mother and child clinic	114.2	44.0	100.8	44.7
Laboratory	423.9	94.9	325.0	76.1
Emergency room	383.1	75.1	75.6	20.3
Delivery Room	207.4	19.8	89.4	11.5
Ward	244.4	60.5	0.0	0.0
Total Generation (gram/unit/day)	1611.5	320.1	762.1	192.6

The services offered are tests of blood, urine, and other parts of the human body. Not all laboratory test results can be obtained on the day the test is performed on the patient. Some data can be generated in a period of more than a day, so the hazardous waste generated by the working process in the laboratory is also directly proportional to the duration of the testing time of the samples from the patient, so the testing period continues to generate hazardous waste. In addition, the waste generated by the laboratory is not directly proportional to the number of tests performed on patients, since laboratory testing services are not always provided to patients who come to Community Health Centers but to patients with advanced indications in relation to their health status, which tend to stagnate for several days. The types of hazardous waste generated in the laboratory are disposable masks, disposable gloves, syringes, body tissues, body fluids, blood, specimen cups, chemical tubes, hematology tubes, napkins, wipes, contaminated paper/tissue, pipettes, and chemical reagents (Himayati *et al.*,

2018). According to *Rahno et al., (2015)*, one of the services from hospitalization Community Health Centers that produces a lot of medical waste is the delivery room of Community Health Centers, which produces a lot of used gauze, soaked clothes, disposable pads, and sanitary napkins from mothers who delivered their babies.

In addition to the different types of waste and the process of sorting waste at the health center, the results of the as-is analysis still include a proportion of household waste in the form of food waste and wrapper and paper in non-sharp infectious waste containers. By nature, paper waste, plastic waste, and other household waste are not hazardous and toxic waste, but because they have been contaminated with hazardous waste, the characteristics of such household waste have changed to hazardous waste.

This happens because officials' level of knowledge and awareness on how to deal with hazardous waste management tends to be low. *Leonita et al., (2014)* noted that the stages of sorting are basically done by the medical staff of the health center, but there is still medical staff who mix medical waste with non-medical waste. These attitudes and actions are the cause of the mixing of wastes and contamination of non-hazardous wastes. In addition, it is also caused by too many health workers serving patients, which results in health workers not paying more attention to the waste generated.

Routinely bringing awareness to the issue and monitoring hazardous and toxic waste management in Community Health Centers is very important and should be done. The target is not only the sanitation staff but also the team of health workers. They should be enabled to perform their respective duties in the best possible way and implement good and proper management of hazardous waste in Community Health Centers. In addition to the methods and techniques of handling hazardous waste, there is also a need to bring more awareness regarding the negative effects that can be caused by hazardous waste so that no more household waste is mixed with hazardous waste. Another procedure that should also be implemented is the use of the full Personal Protective Equipment for Community Health Centers employees.

Sanitation officers must be high-level officials in applying waste management, especially hazardous waste, as the knowledge of the problem of waste generated is considered very capable (*Ramírez & Gonzalez, 2019*). These conditions can meet the requirements to serve as leaders and carry out the proper implementation of waste management in the Community Health Centers environment. Training activities and practices in waste management for the waste officers must be planned by the sanitarians so that waste management is done according to the standards and so the quality of environmental control can be improved.

Based on the results of the analysis of hazardous waste generation from Community Health Centers sample sites, both hospitalization and out-patient care services generally tend to have a greater composition of non-sharp infectious waste. The average composition of hazardous waste for infectious types of sharps is 82% and for non-sharps is 18%. According to the explanation in the analysis of the results in Figure 2, this condition is influenced by the type of service, since the treatment of each patient is different and not all require treatment with a syringe or lancet, as well as the presence of waste from laboratory activities and delivery rooms, which are also quite large.

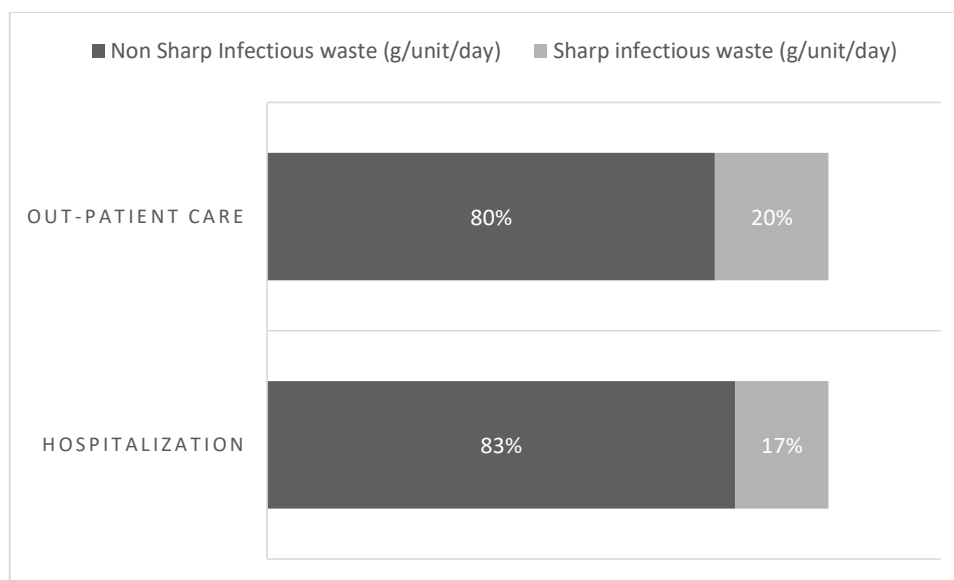


Figure 2. Composition of Hazardous Waste from Community Health Centers Activities in Magelang Regency

Based on Table 4, Magelang Regency has the potential to produce hazardous waste from service activities of Community Health Centers, 33.66 kg per day from operational activities of 29 active Community Health Centers based on SNI 19-3964-1994. This becomes problematic when a transport service is delayed or a handling error occurs, resulting in the contamination of household-type waste. The management system is also not interrupted at Community Health Centers, but also in relation to the transport of hazardous waste to reprocessors or other parties. Waste from this medical activity can be stored for a maximum of 2x24 hours at a storage temperature of 0⁰ Celcius (Kementerian Lingkungan Hidup dan Kehutanan, 2015) Therefore, if transportation system for hazardous and toxic waste still does not comply with the rules of the regulation, ideally at least a temporary storage place for hazardous waste from Community Health Centers activities can be provided to minimize the negative impact of the distribution of hazardous waste to the environment.

Table 4. Hazardous Waste Generation from Community Health Centers in Magelang Regency

Types of Community Health Centers Services	Number of Community Health Centers (units)	Hazardous waste generation per unit (kg/day)	Total generation in all Community Health Centers (kg/day)
Hospitalization	6	1.93	11.58
Out-patient care	23	0.96	22.08
Total	29	2.89	33.66

CONCLUSION

Community Health Centers, as the first level health facility for the community, are the starting point for community health care, which produces a large amount of hazardous waste. This needs to be reconciled with the increasing knowledge of health workers and

sanitarians in handling this. The generation and composition of hazardous waste in Community Health Centers are influenced by several factors, including the type of Community Health Centers service, the number of patients and treatments provided, and the extent of laboratory services. Magelang Regency has the potential to produce 33.66 kg of hazardous waste per day, with a composition of 82% non-sharp infectious waste and 18% sharp infectious waste

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