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ANALYSIS OF SOLID MEDICAL WASTE MANAGEMENT AT COMMUNITY HEALTH CENTERS (PUSKESMAS) IN BENGKALIS SUBDISTRICT, BENGKALIS REGENCY

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ABSTRACT

Analysis of Solid Medical Waste Management at Health Centers in Bengkalis District, Bengkalis Regency. *Solid medical waste management at Bengkalis District Health Centers still faces various obstacles, including limited facilities, lack of compliance with standard operating procedures, and minimal trained human resources. This study aims to analyze the condition of solid medical waste management at Bengkalis District Health Centers and formulate effective strategies in its management. The research method used was a qualitative approach with data collection through in-depth interviews and observations at Health Centers in the area. The results of the study indicate that solid medical waste management has not been running well, although the health centers have collaborated with third parties in waste management, there are still various problems such as delays in waste transportation, inappropriate storage, non-compliance with standard operating procedures (SOP), limitations in facilities and infrastructure, and health workers' awareness of the importance of waste management was also still low. The recommended strategies include increasing the capacity of health workers through training, optimizing waste management facilities, and strengthening regulations and supervision so that medical waste management can run according to established standards. The implementation of this strategy was expected to make the management of solid medical waste in health centers more efficient, safe and environmentally friendly, so that the risk of pollution can be minimized.*

INTRODUCTION

Environmental health efforts play a crucial role in supporting the success of public health development. A conducive environment with adequate health facilities can help realize a healthy environment. A healthy environment also encompasses the management of waste originating from healthcare facilities [1]. Community Health Centers (Puskesmas), as healthcare facilities that generate waste, bear the responsibility of maintaining environmental and public health by managing the waste they produce to achieve a sound environment [2]. Puskesmas generate hazardous medical waste that poses health risks. A pressing issue is the handling of infectious or hazardous medical waste, particularly waste classified as Hazardous and Toxic Materials (B3). Improper management of medical waste can increase the risk of environmental contamination and disease transmission such as cholera, typhoid, malaria, and dermatological diseases such as itching [3]. Contact with sharp

objects from medical waste can lead to infections like Hepatitis B, Hepatitis C, HIV, and may also cause occupational accidents [1].

In 2022, the estimated volume of medical waste in Riau Province was approximately 24 tons per month, including solid medical waste and B3 hazardous waste, produced by around 700 hospitals and Puskesmas. Currently, Riau Province lacks its own medical waste treatment facility (UPT), causing medical waste to be managed by third parties. In 2020, type B hospitals in Riau generated 71,616 kg of medical waste, and from January to August 2021, they generated 73,747 kg, followed by 7,194 kg of sharps waste [4]. Although most detailed data come from hospitals, medical waste management remains a significant challenge for Puskesmas as primary healthcare providers. The volume of solid medical waste at Puskesmas in Riau is expected to continue increasing, in line with the growing number of healthcare facilities, increasing patient visits, and intensified medical activities. Therefore, proper management of solid medical waste at Puskesmas is vital to prevent environmental pollution and public health risks.

Bengkalis Regency has 20 Puskesmas, consisting of 10 inpatient and 10 non-inpatient facilities. Bengkalis District has three main Puskesmas: two non-inpatient (UPT Puskesmas Bengkalis and UPT Puskesmas Meskom) and one inpatient (UPT Puskesmas Pematang Duku). Preliminary observations revealed that solid medical waste management at the three Puskesmas in Bengkalis District has not been properly implemented due to the lack of standardized waste management facilities, resulting in accumulated waste waiting to be collected by third parties. Despite existing collaborations with waste transporters, waste management remains suboptimal.

Waste generated from healthcare services, including all byproducts from health service activities at Puskesmas, must be managed properly in accordance with regulations and procedures throughout the stages of containment, temporary storage, transportation, final disposal, and destruction [5]. The output of these stages is expected to fulfill the health requirements for solid medical waste management as mandated by the Ministry of Health Regulation No. 18 of 2020. However, many shortcomings remain.

Based on the background above, the solid medical waste management at Puskesmas in Bengkalis District has not been optimally addressed. If poorly managed, Puskesmas solid medical waste can have direct implications for public health and environmental pollution, especially considering the increasing daily waste production. This situation is exacerbated by a new policy in Bengkalis Regency mandating 24-hour Emergency Unit (UGD) services at all outpatient and inpatient Puskesmas, which is expected to significantly increase medical waste volume. Nevertheless, scientific studies on solid medical waste management at the Puskesmas level, particularly in Bengkalis District, remain limited. In fact, Puskesmas as primary healthcare providers play a pivotal role in the public health system and generate hazardous medical waste that, if not managed according to standards, can pose serious risks. The absence of a proper waste management system not only constitutes an operational issue but also an urgent ecological and public health threat. Therefore, this study aims to analyze the existing conditions of solid medical waste management at Puskesmas and formulate appropriate and applicable management strategies for Puskesmas in Bengkalis District, Bengkalis Regency.

MATERIALS AND RESEARCH METHODS

This study was conducted at Puskesmas in Bengkalis District, Bengkalis Regency. The selected sites include three Puskesmas: UPT Puskesmas Bengkalis, UPT Puskesmas Meskom, and UPT Puskesmas Pematang Duku. These locations were chosen based on the criterion that they represent new Puskesmas that have not previously been studied. This research employs a descriptive qualitative approach using in-depth interviews and observations. This method was chosen to directly observe field conditions and explore secondary data. Data collection for supporting variables was conducted simultaneously at a single point in time.

This study utilizes primary data collected through in-depth interviews with informants and direct observation using observation sheets. Secondary data were obtained from relevant institutions, including data on personnel, infrastructure, geographic and demographic information, and the volume of solid medical waste generated.
Informants were selected based on the principles of appropriateness and adequacy, where appropriateness in qualitative research implies that samples are chosen based on their knowledge related to the research topic. Informants consisted of 3 heads of Puskesmas (main informants), 6 environmental health officers and 15 nurses (key informants), and 6 cleaning staff and 15 patients or community members living near the Puskesmas (supporting informants), totaling 45 informants.
Data processing utilized triangulation, which involves combining various data collection techniques and sources. The triangulation methods used in this study include interviews, observations, and document analysis. Data were analyzed descriptively to describe or explain the main characteristics of the data without drawing broader conclusions or predictions.

RESEARCH RESULTS AND DISCUSSION

General Conditions of Puskesmas in Bengkalis District

Bengkalis District, covering an area of 514 km^2, has three main Puskesmas: UPT Puskesmas Bengkalis (non-inpatient, Jl. Panglima Minal, Sungai Alam Village), UPT Puskesmas Meskom (non-inpatient, Jl. Utama, Meskom Village), and UPT Puskesmas Pematang Duku (inpatient, Jl. Banjar, Pematang Duku Village). UPT Puskesmas Bengkalis serves 3 urban villages and 11 rural villages, UPT Puskesmas Meskom serves 8 villages, and UPT Puskesmas Pematang Duku serves 9 villages.
The region has a tropical climate with rainy and dry seasons. The topography is lowland, about 2 meters above sea level, with an average daily temperature of 31°C, humidity of 34%, and an average monthly rainfall of 231 mm. Geographically, Bengkalis District borders Bantan District and the Malacca Strait to the north, Bukit Batu District to the west, Meranti Islands Regency to the south, and the Malacca Strait to the east. The population in 2024 is 93,313, consisting of 47,560 males and 45,753 females.

Solid Medical Waste Management

Human resources involved in managing solid medical waste at Puskesmas in Bengkalis District are adequate and meet the relevant criteria. Observations and in-depth interviews revealed that two sanitarian officers are responsible for waste management, supported by four cleaning staff and all medical personnel in service areas. However, in-depth interviews indicated insufficient knowledge among staff regarding proper solid medical waste management, particularly in waste segregation.
According to the Ministry of Health Regulation No. 18 of 2020, human resources in medical waste management must have experience and competence in the field [6]. The researchers' analysis indicates that while personnel numbers are adequate, there is a lack of comprehensive training and seminars on waste management, resulting in errors in waste segregation and incomplete use of Personal Protective Equipment (PPE). Health workers should not only provide care but also act as initial drivers of safe and standardized waste management practices. Capacity building through training, mentoring, and active participation in waste audits is essential.

Facilities and Infrastructure

Solid medical waste management facilities at Puskesmas in Bengkalis District are available in each service room, including separate containers for medical and non-medical waste, and safety boxes for syringes. PPE is provided, including gloves, masks, boots, goggles, and hazmat suits. However, observations revealed that cleaning staff rarely use complete PPE,

usually wearing only masks and gloves. There is no incinerator, and waste management relies on third-party services, coordinated by the Health Office.
According to SNI 19-2454-2002 and Ministry of Health Regulation No. 46 of 2016 concerning accreditation of primary health facilities, Puskesmas must support public health development by prioritizing promotive and preventive efforts [7].
The researchers concluded that facilities and infrastructure are essential for effective solid medical waste management. Adequate infrastructure can ease the duties of responsible personnel. However, facilities at Puskesmas in Bengkalis are still lacking. It is necessary for Puskesmas to propose incinerator procurement to the Health Office, ensure PPE is available, and require its consistent use. Inadequate infrastructure hampers effective waste management and exposes staff to infectious waste. It also influences compliance with procedures, as complete facilities enhance both adherence and efficiency.

Standard Operating Procedures (SOP)
Puskesmas in Bengkalis District have SOPs for solid medical waste management, and all personnel are aware of them. However, interviews and observations revealed that these SOPs exist only as digital files and are not physically accessible in workspaces. SOPs are vital for ensuring safe handling and disposal practices and minimizing health and environmental risks [8].
According to the Ministry of Health Regulation No. 18 of 2020, healthcare facilities must have SOPs or policies regulating waste management, and if the waste is managed in cooperation with the private sector, local governments must prepare the necessary support mechanisms[8].
Researchers observed that while SOPs exist, they should be visibly posted in relevant rooms to ensure staff compliance. Hazardous waste (B3) SOPs must be displayed at the site of waste management activities [9]. Ownership and internalization of SOPs are linked to accident prevention [10]. Without proper internalization, SOP implementation tends to be inconsistent. Health workers must act not only as SOP implementers but also as reminders and enforcers.

Segregation
The segregation of solid medical waste is carried out by all healthcare workers following medical procedures, supported by cleaning staff. Waste is sorted using yellow bags for medical waste and black bags for non-medical waste. However, observations indicated some instances where medical waste was mixed with non-medical waste and disposed of in black bags. Inconsistency in the use of yellow bags was also observed due to a lack of materials and awareness among staff.

Source: Researcher
Figure 1. Waste bin without plastic bag as per regulations

Ministerial Regulation of the Ministry of Environment and Forestry (Permen LHK) No. 56 of 2015 stipulates that hazardous and toxic waste (B3 waste) must be segregated according to its type or characteristic, and contained based on its properties [11]. Segregation helps reduce the volume of waste categorized as B3 or medical waste by isolating infectious waste. The

segregation process must be conducted as close as possible to the waste generation site and must continue during storage, collection, and transportation [12].

Proper knowledge, a positive attitude, and safe practices among healthcare workers regarding waste segregation are essential, as they are at high risk of exposure to medical waste generated during their work [13]. According to the researcher's analysis, while waste segregation practices have been implemented, they are not yet optimal. Infectious waste and sharps are generally separated; however, instances of mixed medical and non-medical waste remain. More accurate segregation between medical and non-medical waste is needed, which can be achieved by improving the knowledge and awareness of human resources through regular supervision, socialization, and reward systems for rooms that successfully implement segregation. Segregation is the primary responsibility of healthcare personnel. Mistakes at this stage can affect all subsequent stages. Therefore, it is crucial to strengthen staff awareness and accountability through training and performance-based incentives.

Collection and Transportation

Waste collection is based on the segregation of solid medical waste at the source, which includes infectious waste, pathological waste, sharps, pressurized containers, and waste with high heavy metal content [14]. Based on field observations, the collection of solid medical waste at Puskesmas in Bengkalis District is conducted manually, without using dedicated trolleys. The transportation of waste also lacks a designated route and is only carried out once daily when the containers are full.

Permen LHK No. 56 of 2015 states that B3 waste must be collected and transported to a temporary storage area at least once daily or as needed [11]. Transportation must follow a specific route to avoid areas frequently used by the general public. Medical waste should be transported using trolleys or wheeled containers designated for such use.

According to the researcher's analysis, the current collection and transportation process does not meet the required standards, as manual handling increases the risk of waste spillage. Ideally, waste should be transported every shift change or at least twice daily. The involvement of healthcare workers in ensuring that waste is correctly placed in appropriate containers before collection is crucial. Puskesmas should establish SOPs for transport routes and provide specialized trolleys. Additionally, waste transport must follow dedicated paths that are not used by patients or the public to minimize the risk of exposure [15]. However, currently, no Puskesmas in the study area has designated medical waste transport routes.

Temporary Storage Facility (TPS)

Solid medical waste that has been collected is stored at a Temporary Storage Facility (TPS). Puskesmas in Bengkalis District have designated TPS for solid medical waste; however, these facilities do not fully comply with regulations. Solid and liquid medical waste is separated, but there is still visible accumulation of solid medical waste due to delays in collection by third-party contractors. Based on observations, storage practices are suboptimal, as waste is stored for more than one week without the use of freezers. Moreover, TPS buildings are not physically separated from the main healthcare facility.

According to Permen LHK No. 56 of 2015, infectious, sharp, and pathological waste should not be stored for more than two [2] days to prevent bacterial growth and odor [11]. If storage for more than two days is unavoidable, the waste must be chemically disinfected or kept in a refrigerator or freezer at 0°C or lower [16]. B3 waste generated by healthcare facilities should be stored in a building separate from the main healthcare facility. [17]

Source: Researcher
Figure 2. Temporary Storage Facility (TPS) at one of the Puskesmas

The Ministry of Health Regulation No. 18 of 2020 on medical waste management stipulates that solid medical waste must be temporarily stored in licensed hazardous and toxic waste (B3) storage facilities that comply with relevant legislation [6]. A TPS for B3 waste must be equipped with drainage channels connected to catchment tanks, lighting, ventilation, and a roof to protect waste from sunlight and rain. The floor must be impermeable, uncracked, level, and marked with hazard symbols in accordance with the waste characteristics, and must be equipped with a fire extinguisher (APAR) [18].

According to the researcher's analysis, temporary storage facilities at Puskesmas in Bengkalis District are neither optimal nor compliant with regulations. Solid medical waste storage should be separated from other rooms. Puskesmas should also establish cooperation with third parties for waste collection at least every two days or procure freezers or cold storage units. Prolonged storage can result in disorganized and unsafe conditions, increasing the risk of infection [19]. Healthcare workers must monitor waste volumes and report immediately when the TPS nears full capacity. Temporary storage must be carefully managed to avoid the accumulation of solid medical waste. The availability of infrastructure such as proper temporary storage facilities significantly influences staff behavior; in this context, adequate disposal facilities can positively impact sanitation workers' waste disposal practices [20].

Final Disposal Management

All entities generating B3 waste are required to obtain waste management permits [21]. Incineration using incinerator technology is the most common method for the treatment or destruction of waste generated by healthcare facilities [22]. The main advantages of using an incinerator are its ability to reduce waste volume and destroy various types of waste, including both toxic and non-toxic B3 waste, converting infectious into non-infectious waste [23].

Field observations revealed that none of the Puskesmas in Bengkalis District conduct their own final disposal or destruction of solid medical waste. Instead, they rely on third-party contractors, as none of the facilities possess an incinerator. Solid medical waste handed over to third parties ranges from 200 kg to 900 kg per year. However, due to delayed pick-up schedules and waste accumulation, cleaning staff at several Puskesmas have resorted to open burning of solid medical waste on-site, which may lead to environmental contamination, including soil and air pollution [24].

According to Permen LHK No. 56 of 2015, the destruction of solid medical B3 waste without freezer storage must be conducted within 2 days, using incineration at a minimum combustion temperature of 1000°C–1500°C to ensure the complete breakdown of materials like syringes. Ash resulting from incineration should be buried in the ground at a depth of 2 meters by trained personnel [25].

According to the researcher's analysis, final waste management remains inefficient. The scheduling of waste pick-up should be reviewed based on the volume of patient visits to each Puskesmas—especially with the new district policy mandating 24-hour Emergency Unit (UGD) services at all outpatient and inpatient Puskesmas. This policy increases patient visits and consequently the volume of generated solid medical waste. Delays in waste collection lead to stockpiling at TPS. Final disposal should be conducted more frequently, and waste should not be stored for extended periods. On-site burning should be strictly prohibited; destruction must be conducted in cooperation with authorized third-party services. Furthermore, the implementation of strict regulations and regular monitoring by the relevant authorities is crucial. Healthcare personnel must monitor compliance, prevent illegal burning, and report delays to the District Health Office. Therefore, collaboration with third parties and the Bengkalis District Health Office is essential.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings, it can be concluded that the solid medical waste management at Puskesmas in Bengkalis District has not been properly implemented. Although the Puskesmas have partnered with third parties for waste disposal, several issues remain, such as delays in waste collection. The recent policy requiring 24-hour emergency services at Puskesmas has increased patient numbers, leading to higher waste generation and accumulation at temporary storage facilities. Moreover, current storage practices do not comply with regulations, infrastructure is inadequate, and healthcare workers' awareness of the importance of medical waste management remains low.

It is recommended that Puskesmas in Bengkalis District enhance the capacity of healthcare workers through training and mentoring, optimize infrastructure, and strengthen regulatory frameworks and supervision. These steps are necessary to ensure that solid medical waste management is conducted in accordance with the standards outlined in the Ministry of Health Regulation No. 18 of 2020. The implementation of these strategies is expected to improve the efficiency, safety, and environmental sustainability of solid medical waste management in Puskesmas, thereby minimizing environmental pollution risks.

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