



Analysis of the Cultural Resilience of Health Workers in Medical Waste Management at Health Care Facilities

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Abstract. This study investigated the cultural resilience of Bima Hospital staff in medical waste management, focusing on how cultural values, organizational norms, and staff attitudes influence the effectiveness of waste management strategies. Medical waste management at Bima Regional General Hospital involves nursing staff, cleaning service officers, medical waste officers, and sanitarians, who each play a role in sorting, packaging, transporting, and storing medical waste in TPS. Because Bima Regional Hospital does not have an incinerator, waste treatment is carried out by a third party. This study used a mixed methods approach, including qualitative interviews and quantitative surveys, to evaluate waste management practices and the cultural resilience that supports them. The results show that staff exhibit a high level of cultural resilience, characterized by adaptive practices and innovative solutions in the face of operational challenges. Although a mixture of medical and non-medical waste was still found, a culture of good management was maintained with appropriate segregation and storage. This study recommends recording waste volume per room and involving all personnel in waste management as steps to improve the sustainability of the medical waste management system.

Keywords: Medical waste management, cultural resilience, Bima Regional General Hospital.

1 Introduction

Hospitals are health facilities that generate a lot of waste, including medical waste which is classified as hazardous waste. The rapid growth of the healthcare industry in Indonesia contributes significantly to waste generation, which if not managed properly can pose a serious risk to public health and the environment. As a public service facility, hospitals have the responsibility to maintain and improve a healthy environment in accordance with applicable standards and requirements. Medical waste management in Indonesia is regulated in Law Number 32 of 2009 (Pusat, 2009) Minister of Environment and Forestry Regulation Number 56 of 2015 (Kehutanan, 2015), and Minister of

Health Regulation Number 7, 2019 (Kesehatan, 2019). However, in developing countries, medical waste has not received sufficient attention (Bdour, Altrabsheh, Hadadin, & Al-Shareif, 2007), due to limited resources and urgent priorities in health services, so medical waste has not received adequate priority and attention (Alagöz & Kocasoy, 2008). Toxic and hazardous waste is still handled and disposed of together with domestic waste, posing a risk to public health and the environment.

Proper medical waste management in healthcare facilities can be achieved through effective and efficient waste segregation. Therefore, the knowledge and attitude of health workers towards medical waste management is very important. Health workers have a role in medical waste management because they are waste generators from health service activities and are in direct contact with medical waste. Therefore, health workers need to have good knowledge and attitude in managing medical waste.

According to (Tiong, Subramaniam, & Latif, 2012), medical waste has the potential to transmit diseases such as Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Human Immunodeficiency Virus (HIV) to humans. The World Health Organization in 2015 (Rokom, 2016) estimated that unsterilized syringes can cause 80,000 to 160,000 cases of HIV, 2.3 to 4.7 million cases of hepatitis C, and 8 to 16 million cases of hepatitis B each year (Tiong, Latiff, & Karuppannan, 2012). Therefore, the importance of effective medical waste management in healthcare facilities, such as hospitals, cannot be ignored.

Medical waste management is a crucial aspect in healthcare facilities to ensure safety and public health. At Bima Regional General Hospital, although medical waste is still found mixed with non-medical waste, the hospital is committed to maintaining a culture of good and proper medical waste management. This culture includes various important stages, from waste segregation based on sharp, infectious, and non-infectious categories, to packaging, packaging, collection, placement, transportation, and storage in the internal medical Temporary Shelter (TPS).

Malumi, Omambia, Muhindi & Ngule (2018) found that 35% of health workers in one hospital in Kenya had poor knowledge of medical waste segregation. In line with this, several studies in various developing countries have found that health workers lack knowledge about medical waste management, do not receive training facilities, and inadequate facilities and infrastructure as well as the lack of training for health workers contribute to poor medical waste management practices (Bakshi, Ghosh, Mukherjee, & Chakraborty, 2018).

Facing such challenges requires resilience in medical waste management as an essential part of healthcare facilities, which relies on the commitment of healthcare workers to implement effective practices despite barriers. This involves the adoption of a management culture that encompasses knowledge, skills, and adherence to procedures and regulations, as well as how organizational values and norms influence the handling of medical waste from segregation to disposal (Betencourt, Green, & Carrillo, 2002). As such, this cultural resilience reflects the ability of health workers to carry out safe waste management practices despite challenges.

Cultural practices represent the human behaviors that are part of the organization and the meanings that people attribute or attach to actions (Fondas & Denison, 1991). It was stated that there is a relationship between the culture practiced by Health care

personnel in medical waste management, which indicates that it is imperative for professionals in the healthcare sector to have adequate knowledge, attitudes, and practices with respect to biomedical waste management (Rao, Dhakshaini, Kurthukoti, & Doddawad, 2018). Since healthcare waste is considered a neglected public health problem in developing countries (Kumar, Somrongthong, Ahmed, & Almarabheh, 2018). Adequate knowledge regarding healthcare waste management is an important start in the synthesis of appropriate attitudes and practices in the proper handling and disposal of medical waste by healthcare workers (Motlatla & Maluleke, 2021).

Based on these problems, this study aims to analyze the cultural resilience of health workers in medical waste management in health care facilities, with a focus on Bima Regional Hospital. This research is expected to provide an overview of the knowledge and attitudes of health workers towards medical waste management.

1.1 Medical Waste Management Regulation and Policies

A clean hospital is a healthcare facility that maintains physical, liquid waste, garbage, and water hygiene, and takes care of nuisance animals or insects. However, maintaining hospital hygiene is a complex issue that is influenced by many factors, such as technology, culture, behavior, environment, and social. Hospital waste, especially infectious medical waste, is often poorly managed and often mixed with non-medical waste, making the situation worse (Efendi, Rato, & Soetijono, 2023). Therefore, medical waste management is one of the important aspects in maintaining public health and the environment, given the dangers of medical waste if not managed properly (Noor, 2020).

In Indonesia, several regulations have been issued to govern the safe and efficient management of medical waste. Law No. 32/2009 (Indonesia, Undang-undang (UU) Nomor 32 Tahun 2009 tentang Perlindungan dan Pengelolaan Lingkungan Hidup, 2009) on Environmental Protection and Management is the main foundation that regulates the management of all types of waste, including hazardous medical waste (Mendoza, 2020). This regulation is supported by more specific derivative regulations such as the Minister of Environment and Forestry Regulation No. 56 of 2015 (Kehutanan, 2015), which emphasizes the management of B3 (Hazardous and Toxic Material) waste generated from healthcare facilities (Indonesia, 2015). In addition, the Minister of Health Regulation No. 7/2019 (Kesehatan, 2019) is also an important reference that provides technical guidance on medical waste management in healthcare facilities (Murat Kocanli, 2021).

According to regulations, hospitals and healthcare facilities are required to segregate medical waste based on its classification (sharp, infectious, and non-infectious) and ensure that the waste is processed in accordance with environmental safety standards. For example, sharp waste must be placed in safety boxes, while infectious waste needs to be stored in special secure and airtight containers before being transported for treatment or final disposal at a site approved by the authorities.

Research by Riyanto, Purnomo, Rahayu, Wahyudi (2021) revealed that although regulations on medical waste management have been implemented, many hospitals still lack adequate infrastructure to meet regulatory standards. As a result, medical waste is

often mixed with domestic waste, increasing health risks for the surrounding community. These findings highlight how existing regulations are often not effectively implemented, especially in rural areas and small health facilities that experience limitations in terms of facilities, knowledge and resources. This article evaluates medical waste management in hospitals, which has great potential to pollute the environment and endanger human health. Medical waste management in hospitals must comply with strict regulations, with more intensive government supervision to prevent environmental damage. This article also highlights the urgent need for proper management of medical waste, especially hazardous and toxic waste (B3), to reduce serious risks to human health and the environment. The involvement of adequate human resources, equipment, facilities and financial support are essential, along with cooperation with third parties and strict government oversight to ensure effective medical waste management in accordance with applicable regulations (Suyuti, 2019).

Another study by Khansa, Kusumayati, Susasana, Sinaga, & Mwale (2023) evaluated solid medical waste management in a Regional General Hospital in Bogor, Indonesia. The study highlighted the processes of reduction, segregation, on-site transportation, temporary storage, internal treatment, and external treatment. Although some hospitals had met most of the regulatory standards from the Ministry of Environment and Forestry, there were significant shortcomings in terms of waste reduction, segregation, quality of human resources, and facilities. Key findings include inadequacies in the segregation of medical waste from non-medical waste, the use of inappropriate equipment for waste transportation, and the lack of adequate waste treatment facilities and technology, forcing reliance on external treatment. In addition, many staff have not received adequate training on medical waste management, which increases the risk of contamination and disease spread. The study emphasized the need for further improvements in waste reduction at the source, improved quality of storage facilities, transportation, as well as increased training and awareness of human resources (Khansa, Kusumayati, Susanna, Sinaga, & Mwale, 2023).

Both studies showed that although regulations on medical waste management have been implemented, there is often a lack of adequate infrastructure and facilities. In addition, the issue of separating medical waste from domestic waste as well as inadequacies in waste segregation were significant issues in both studies. Both emphasized the need for adequate training for health workers, as many have not received sufficient training, which may increase the risk of pollution and disease spread. These findings support the importance of integrating cultural aspects in medical waste management, where cultural resilience can influence the acceptance and implementation of appropriate waste management practices as well as the effectiveness of training and awareness in healthcare facilities. Cultural engagement in policy and training is key to addressing challenges such as facility shortages, waste segregation issues, and health worker training needs.

Regulations in Indonesia emphasize the importance of medical waste segregation based on classifications such as sharp, infectious, and non-infectious waste to prevent cross-contamination and risk of disease transmission (Laksono & Sari, 2021). Regulations require health facilities to have a temporary storage site (TPS) for medical waste

that meets safety standards before the waste is transported to a treatment or final disposal site. This indicates that the policy aims to minimize risks to the environment as well as the health workers who handle the waste. However, despite clear regulations, implementation often faces challenges, especially in remote areas. Many hospitals and healthcare facilities experience difficulties in complying with medical waste management standards due to limited resources. Not all facilities have access to adequate waste treatment technology, such as incinerators, and often waste management is done in a less safe manner. In addition, health workers' knowledge of applicable regulations still needs to be improved to optimize regulatory compliance.

1.2 Knowledge and Attitude of Health Workers

The knowledge and attitude of healthcare workers are crucial in the safe and efficient management of medical waste in healthcare facilities. A good understanding of medical waste segregation, packaging, storage, transportation and disposal is key. Health workers, especially nurses, cleaners, and sanitarians, have an important role in preventing the risk of injury and infection from poorly managed medical waste. Data from the Indonesian Health Profile shows a decline in compliance in medical waste management from 2014 to 2016, further emphasizing the importance of continuous training for health workers (Putri, Abidin, & Saputra, 2024). This is relevant to the finding that health workers who have positive knowledge and attitudes are more supportive of the implementation of safe and sustainable health programs, and are more likely to comply with proper waste management procedures (Singh, et al., 2024). Therefore, sustainable training and awareness promotion is important to improve compliance and reduce the risk of infection in hospitals.

Several studies have found that lack of knowledge about medical waste management is still a significant problem, especially in developing countries. For example, a study by Malumi, Omambia, Muhindi & Ngule (2018) showed in Kenya that 35% of health workers in one hospital had low knowledge on how to separate medical waste (Maluni, Omambia, Muhindi, & Ngule, 2018). This finding is in line with a study conducted in Zambia by Leonard, et al (2022) which showed that 42.5% of health workers had a poor understanding of the health risks of medical waste and its management procedures (Leonard, et al., 2022). The study found that the average worker's knowledge of waste segregation was low, with most health facilities not meeting national and international standards. Some of the problems encountered included lack of incinerator facilities, poor training, and frequent needle stick injuries.

In addition to knowledge, health workers' attitudes towards medical waste management also affect their compliance in implementing management standards. In a study conducted in hospitals in Pakistan by Kumar, et al. (2016) found that although doctors and nurses had a better understanding of waste segregation and safety protocols, paramedics were still lacking in knowledge (Kumar, et al. 2016).

Health workers' attitudes towards medical waste management are often less supportive of proper practice. This less proactive attitude is often caused by lack of training, lack of supporting facilities such as specialized waste storage, thus the need for continuous training, supervision, provision of personal protective equipment (PPE),

and incinerator facilities to improve compliance with safe medical waste management procedures.

Limited knowledge and unsupportive attitudes also affect the effectiveness of the training provided. Training that is conducted without being followed by a change in attitude and commitment to apply the knowledge gained, often does not yield significant results. Therefore, it is important for health facilities to not only focus on improving knowledge, but also building a culture and attitude that supports good medical waste management. It can be concluded from the results of these studies that while knowledge on medical waste management among health workers can be improved through training, their attitudes also need to be improved through a supportive organizational culture approach. These two aspects are interrelated in creating a safe and responsible working environment in medical waste management.

1.3 Cultural Resilience in Medical Waste Management

Resilience is the ability of individuals or groups to adjust and rise from difficult situations and continue to carry out tasks and responsibilities despite various challenges (Babic, et al., 2020). In the context of health workers, resilience refers to the endurance of medical workers in carrying out medical waste management practices according to standards, despite being faced with limited resources, inadequate infrastructure, and high work pressure. This resilience reflects their ability to maintain the quality of safe and compliant medical waste management, while reducing risks that could jeopardize environmental and public health. This resilience demonstrates a strong commitment and internal strength to continue performing well despite the challenges.

Resilience over time evolves into cultural resilience, where proper medical waste management practices are no longer just an obligation, but also an integral part of the norms and values embraced by the healthcare organization. Cultural resilience in medical waste management involves how the healthcare organization integrates knowledge, values and norms that support the sustainability of the practice, despite internal and external barriers. Therefore, the resilience that has become part of this organizational culture will be the foundation for creating an effective, efficient, and responsible medical waste management system in a sustainable manner.

The study by Ciawi, et al. (2024) addresses the sustainable management of hospital medical waste with a focus on economical and environmentally friendly strategies. The increase in medical waste during the COVID-19 pandemic has an impact on public health and the environment. Health workers with high awareness of waste management are more compliant with procedures such as segregation and safe storage. An organizational culture that supports compliance is essential. In addition, the cost of medical waste management is very high, so many hospitals are looking at ways to reduce waste volumes through sorting at source. In medical waste management, autoclaving and incineration are important and environmentally friendly methods. Autoclaving uses hot steam under high pressure to kill harmful microorganisms, making medical waste safe to dispose of. Incineration burns waste at high temperatures, reducing its volume and destroying pathogens and harmful substances. Effective medical waste management

requires the commitment of all hospital stakeholders, from healthcare workers to management (Dwipayanti & Wouters, 2024). In effective medical waste management, all hospital stakeholders, from healthcare workers to management, need to be committed. One important step is sorting waste at the source, which means separating different types of waste when it is created. By sorting correctly, the risk of contamination can be reduced, and waste management costs can be lowered, as separated waste can be treated according to its type more efficiently.

In accordance with previous studies, another study by Ozder et al. (2013) also emphasized the importance of medical waste management training on health managers' knowledge. The study showed that strong cultural resilience can only be achieved through periodic training courses to address the lack of knowledge and attention in medical waste management (Ozder, et al., 2013). Therefore, cultural resilience in medical waste management depends not only on the existence of regulations and technology, but also on how values, norms, and knowledge in health organizations shape the attitudes and practices of health workers.

This study shows that cultural resilience in medical waste management involves integrating knowledge, values, and norms into the daily practices of healthcare organizations. Resilience, which is initially an individual's ability to deal with challenges, evolves into cultural resilience when medical waste management practices become an integral part of the organizational culture. This suggests that effective and responsible medical waste management requires strong commitment from all stakeholders, including health workers and management, as well as the support of an organizational culture that supports compliance with procedures. The research focuses on analyzing cultural resilience in waste management by health workers, highly relevant to these findings, as cultural resilience in the researcher's context refers to how values, norms and knowledge are integrated into medical waste management practices despite various challenges.

2 Methodology

2.1 Research Design

This research design uses a mixed methods approach with a transformative mixed methods model to explore cultural resilience in medical waste management at Bima Regional General Hospital. This method combines qualitative and quantitative data to provide a deeper understanding. Qualitative data was obtained through in-depth interviews, focus group discussions, observations, and document analysis. Quantitative data was collected through surveys to measure this phenomenon more broadly. Despite the mixing of medical and non-medical waste, Bima Regional General Hospital strives to maintain good and proper waste management practices.

2.2 Data Collection

In a mixed-method approach, data was collected at Bima Regional General Hospital between March and July 2022 through structured interviews with 33 health workers.

Data collection techniques included in-depth interviews, group discussions, observation, and document analysis. Questionnaires were used to evaluate the management of medical waste as well as the officers' knowledge.

2.3 Data Analysis

This research uses a descriptive-analytic approach to analyze data and explain the problems of medical waste management at Bima Regional General Hospital based on Government Regulation Number 22 of 2021 (Indonesia, 2021) concerning Environmental Protection and Management. This analysis focuses not only on identifying technical problems, but also on how cultural factors and resilience in health organizations affect medical waste management.

3 Findings and Discussion

The study was conducted on 33 health workers of Bima Regional General Hospital from various rooms and professions. Table 1 presents the characteristics of respondents in this study with observed frequencies and percentages. Based on Table 1, all respondents were female, mostly aged >35 years (57.6%). Most of the officers (66.67%) were civil servants with working hours of 7 hours a day. There were only 3 people who worked as sanitarian officers who worked in the hospital for an average of 17 years. Most officers had never attended training (51.52%). The study was conducted on 33 health workers of Bima Regional General Hospital from various rooms and professions. Table 1 presents the characteristics of respondents in this study with observed frequencies and percentages. Based on Table 1, all respondents were female, mostly aged >35 years (57.6%). Most of the officers (66.67%) were civil servants with working hours of 7 hours a day. There were only 3 people who worked as sanitarian officers who worked in the hospital for an average of 17 years. Most officers had never attended training (51.52%). Based on Table 1 also, all respondents were known to be female, mostly aged >35 years (57.6%). Most of the health workers (66.67%) were civil servants with working hours of 7 hours a day. There were only 3 people who worked as sanitarian officers who worked in the hospital for an average of 17 years. Most health workers had never attended training (51.52%).

Table 1. Characteristics of respondents at Bima Regional General Hospital

Characteristics	N	%
Age (Year)		
20-34	14	42.42
≥35	19	57.58
Gender		
Male		
Female	33	100

Length of employment		
>10 years	21	63.63
<10 years	12	36.37
Education		
DIII	12	36.36
DIV	3	9.09
S1	13	39.39
Ners	5	15.15
Employment status		
PNS	22	66.67
Lainnya	11	33.33
Participation in training		
Ever	16	48.48
Never	17	51.52
Level of knowledge		
Rendah		
Tinggi		

(Authors' Primary data)

According to the healthcare workers at Bima Regional General Hospital, the current medical waste management facilities are only based on solid and liquid waste categories, not on infectious and non-infectious waste. Additionally, the hospital does not impose any penalties if staff do not properly manage medical waste. In addition, according to healthcare workers assigned to sanitation at Bima Regional General Hospital, the hospital management is less aware of the duties and obligations of sanitarians. Therefore, sometimes management does not involve sanitarians in hospital waste management planning.

Based on the interview results, the respondents did not know the availability of the medical waste management budget at Bima Regional General Hospital. The standard operating procedures (SOPs) for medical waste management at the hospital, according to the respondents, they are in accordance with the Ministry of Health Decree Number 7 of 2019 (Kesehatan, 2019) concerning Hospital Environmental Health. However, the sanitary condition of medical waste management raises serious concerns. This is because waste handling is not carried out in accordance with the provisions of the applicable laws and regulations.

The interview and observation results show that at Bima Regional General Hospital, medical waste is only sorted into solid and liquid waste categories, not into infectious and non-infectious categories as it should be. According to informants, this is due to the limited waste segregation facilities available. Labeling and availability of waste bins

are only designated for solid waste and liquid waste. In addition, staff do not have sufficient awareness of their duties in managing medical waste. Although respondents are aware of the dangers of medical waste, health workers' knowledge in management from identification to destruction is still minimal.

Bima Regional Hospital does not have an incinerator, so the destruction of medical waste is carried out by a third party, PT Restu Ibu Abadi in Mojokerto, East Java. The hospital only provides B3 medical waste containers, which are then transported by cleaning staff to the B3 TPS to be sent to PT Restu Ibu Abadi for destruction. This study also showed that there were piles of medical waste scattered and mixed with non-medical waste in the backyard of the hospital. The results also showed that the health workers did not know the budget allocation for waste management at Bima Regional General Hospital.



Fig. 1. Medical waste condition at Bima Regional General Hospital (photograph by corresponding author)

Based on the picture shown, there are piles of medical waste that are not properly organized, with some medical waste bags placed on the ground and outside of the trash bin. The special medical waste bin (B3) appears to be full and not properly closed, while other waste bags are scattered around the bin. This situation shows poor handling of medical waste, where the waste is not stored correctly before being transported for disposal. It increases the risk of environmental pollution and health hazards, highlighting the need for significant improvements in waste management at Bima Regional Hospital.

3.1 Medical Waste Volume

The volume of medical waste generated by the Bima Regional Hospital health service facilities in 2022 is divided into 3, namely non-covid medical waste, covid medical waste, and pharmaceutical medical waste. The amount of medical waste generated by the Bima Regional Hospital Health service facilities based on data obtained from the

head of the sanitary field, namely non-covid medical waste, covid medical waste, and pharmaceutical waste are as follows:

Table 2. Categories of medical waste at Bima Regional Hospital in 2022

Category of medical waste	Volume of medical waste (Kg)
Non-covid medical waste	31,172
Covid medical waste	473
Pharmaceutical waste	369
Total medical waste	32,014

(Authors' primary data)

Based on the table, it shows that non-covid medical waste is more, namely 31,172 kg, compared to covid medical waste 473 kg, and pharmaceutical 369 kg, so the total medical waste generated by the Bima Hospital Health service facility in 2022 is 32,014 kg.

3.2 Characteristics of Waste in Bima Regional Hospital

According to Chartier (2014), medical waste can be classified into two general classes: non-hazardous waste and hazardous waste. Based on Article 1 Number 3 of the Minister of Environment and Forestry Regulation of the Republic of Indonesia Number 4 of 2020 (Perundang-undangan, 2020) concerning the Transportation of Hazardous and Toxic Waste, Hazardous and Toxic Waste, hereinafter referred to as B3 Waste, is the residue of a business and/or activity that contains hazardous materials. The management activities are regulated in Number 4, which includes reduction, storage, collection, transportation, utilization, processing, and/or disposal. Hazardous waste (B3) can be further classified into sharp waste, infectious waste, pharmaceutical waste, cytotoxic waste, pathological waste, radioactive waste, and chemical waste. Bima Regional Hospital has not been able to identify and record the volume of waste generated. Ghanami, et al. (2013). mentioned that the amount of waste generation in Babolsar Hospital, Northern Iran was 2.33 kg / bed / day, with details of general waste of 1.2 kg / bed / day, infectious waste of 1.1 kg / bed / day and sharps waste of 1.1 kg / bed / day. 0.03 kg/bed/day (Ghanami, et al., 2013).

Hazardous waste usually only ranges between 10-25%, while non-hazardous waste dominates up to 75-90% (Philip, 2014). In line with this, Ciawi, Dwipayanti, & Wouters (2024) states that the volume of hospital medical waste is actually, only 10-50% of the waste generated by the hospital (Ciawi, Dwipayanti, & Wouters, 2024). The waste generated by health care facilities in general is infectious and non-infectious medical waste, sharps medical waste, and domestic waste.

3.3 Bima Waste Management Culture at Bima Regional General Hospital

In an effort to evaluate the culture of waste management at Bima Regional General Hospital, various data collection methods were used, including internal surveys, interviews, direct observation, and collection of relevant documentation. The main objective

of this analysis was to understand the extent to which waste management procedures are implemented, the quality of the systems in place, and the level of staff awareness and compliance with environmental regulations. In addition, the evaluation also aimed to identify strengths, weaknesses, and areas requiring improvement in the hospital's waste management.

Data collection methods included internal surveys of staff and management to evaluate waste management practices, interviews with relevant officers to explore challenges on the ground, and direct observation of waste sorting, collection and disposal processes. Policy documentation and related reports were also collected to support the analysis and find gaps between written procedures and their implementation in the field. The culture of medical waste management at the Bima Regional Hospital health service facility is selection and sorting, packaging, collection, transportation, storage, and weighing.

Data analysis resulted in several important findings related to the quality of medical waste management at Bima Regional General Hospital, which included:

Table 3. Inpatient Rooms and Patient Beds at Bima Regional General Hospital in 2022

No.	ROOM	NUMBER OF TREATMENT ROOMS	
1	WK room	3	10
2	Nivas	6	29
3	Inner Ward Lower	5	18
4	Inner Ward Upper	6	21
5	Surgery Ward	6	28
6	Emergency Room (ER)	5	21
7	VIP A	10	10
8	VIP B	10	20
9	Main Class 1 A	7	14
10	Isolation Room	6	11
	Total	54	182

(Authors' Primary data, 2023)

The activity of selecting and sorting medical waste at the Bima Hospital health service facility has been carried out since medical waste was first produced in each medical care process. The activity is carried out by medical waste-producing care workers in each treatment room.

3.2.2 Staging and Packaging

Containment and packaging of medical waste is carried out by cleaning service officers in medical waste-producing treatment rooms. Medical waste that has been full are packaged using plastic so that medical waste does not endanger human health and the environment. The following is the data:

Table 4. Education and Employment Status of Bima Regional Public Hospital

Employment Status	Educational Status						Amount
	SMA	D3	D4	S1	Nss	S2	
PNS	5	138	20	68	16	1	248
PTT Daerah		10		1	4		15
BLUD		204	22	8	62	2	298
PPPK		1		1	2		4
Total	5	353	42	78	84	3	565

(Authors' Primary data, 2023)

3.3.3 Collection

Medical waste collection activities at Bima Hospital health service facilities are carried out by cleaning service officers and medical waste officers. Medical waste collection activities by cleaning services are carried out in medical waste-producing treatment rooms to be stored at the medical waste collection point in each room. While medical waste collection activities by medical waste officers are collecting medical waste at the collection point of each room.

3.3.4 Freight

Medical waste collection activities are carried out by medical waste officers to be stored in medical waste stations before being picked up by third parties. The collected medical waste has been transported to the medical TPS for storage.

3.3.5 Storage

The storage of medical waste at the Bima Regional Hospital health service facility was initially handled in the treatment room. Once the waste was full, it was then transferred to the medical Temporary Storage Site (TPS).

3.3.6 Medical Waste Volume

The weighing of medical waste generated by Bima Regional Hospital's health service facilities is carried out when third parties carry out the transportation of medical waste. While the weighing of medical waste per room producing medical waste is not carried out, so each room does not know the volume of medical waste it produces. To find out the volume of medical waste generated in each room, the researcher worked with the janitor to carry out weighing activities. By weighing per room, each part of the hospital

can know the volume of medical waste generated and contribute more actively to better management efforts.

Table 5. Comparison of medical waste volume from researchers with sanitarian officers at Bima Regional General Hospital in 2022

MONTH	MEDICAL WASTE VOLUME		Difference
	Sanitaria	Researcher	Difference
June	1.445 Kg	1.679,1 Kg	252.1 Kg
August	1.809 Kg	1.854,4 Kg	45.4 Kg

Based on these data, it is seen that weighing activities from the beginning of medical waste generation are very effective compared to weighing during transportation by third parties. Medical waste volume data from the head of the sanitarian field in June 2022 obtained 1,445 kg, then in August 1,809 kg, while the data from the weighing results by researchers in June 1,697.1 then in August 1,854.4 kg. The difference in medical waste volume data from the results of weighing researchers with data obtained from the head of the sanitarian field of Bima Hospital in June 45.4 kg, then in August 252.1 kg. The data shows that there is a very significant difference between the data obtained by the results of weighing researchers and the data obtained from the head of the sanitarian field of Bima Hospital. Weighing activities carried out by researchers were carried out in several stages, namely, recording the name of the treatment room producing medical waste, identifying medical waste in each bin, both medical waste and non-medical waste; non-medical waste mixed with medical waste is collected in one place because non-medical waste contaminated with medical waste will become medical waste; and weighing.

3.3.7 Medical Waste Weighing by Room

The weighing of medical waste per room, conducted with the janitor, revealed that Bima Regional Hospital has not routinely weighed medical waste per room. Waste is only weighed when a third party does the transportation. By weighing per room, each part of the hospital can know the volume of medical waste generated and contribute more actively to better management efforts.



Fig. 2. Waste weighing process by room
(photograph by corresponding author)

The weighing of medical waste at Bima Regional General Hospital is currently not done routinely per room and is only done during transportation by a third party. This leads to a lack of accurate data regarding the volume of waste from each room, making it difficult for each unit to know their contribution to waste production. As a result, monitoring and control of medical waste is less than optimal, hampering effective management efforts. This condition is not in accordance with the Indonesian Minister of Health Regulation No. 7/2019, which requires a system of separation and measurement of medical waste in each hospital unit (Murat Kocanli, 2021) .The reliance on third parties also shows the weakness of the waste management culture in Bima Regional Hospital, where full control over waste management is not fully owned by the hospital.

3.3.8 Condition of Medical Waste Behind the Isolation Room

Medical waste behind the isolation room was found not to be placed in accordance with established procedures. Waste that should have been stored in jumbo bins was instead placed on the ground. This shows the lack of a dedicated place or appropriate medical waste collection point in the isolation area. This condition has the potential to spread disease and increase the risk of environmental contamination.



Fig. 3. Medical waste located at the back of the isolation room
(photograph by corresponding author)

Medical waste behind the isolation room at Bima Regional General Hospital was not placed according to procedure; it should have been stored in jumbo bins, but was placed on the ground. This indicates a lack of adequate storage facilities in the isolation area, potentially increasing the risk of disease spread and environmental contamination. Research in Wijaya, Alwi, & Baharuddin (2021) confirms that inappropriate placement of medical waste can magnify health and environmental risks (Wijaya, Alwi, & Baharuddin, 2021). This situation reflects weaknesses in the culture of waste management at Bima Regional Hospital, where adherence to procedures is lacking. Improving waste storage facilities according to regulations is an important step to increase the resilience of the waste management culture and ensure environmental safety and health.

3.3.9 Mixing of medical and non-medical waste

It was found that medical and non-medical waste were mixed in some domestic bins. This mixing causes contaminated non-medical waste to be treated as medical waste, which increases the volume of medical waste as well as its management costs. Handling non-medical waste contaminated with medical procedures requires stricter separation to prevent the risk of wider contamination.



Fig. 4 Medical waste bins mixed with domestic waste (condition of solid medical waste bins containing *handschon*, masks, gauze, cotton, infusion tubes)
(photograph by corresponding author)

The mixing of medical and non-medical waste in domestic bins poses a serious problem, as contaminated non-medical waste must be treated like medical waste, increasing its volume and management costs. Government Regulation No. 101 Year 2014 and Minister of Health Regulation No. 75 Year 2014 (Kesehatan M., 2014) emphasize the importance of waste separation to prevent contamination and ensure safe management (Segovia, 2014). To address this issue, it is important to increase awareness and compliance with regulations, as well as conduct culturally sensitive training. Understanding local cultural norms in waste management can improve the effectiveness of waste segregation and ensure better compliance with regulations.

3.3.10 Documentation and Interview at Bima Regional General Hospital

Documentation and Interviews on Medical Waste Management visual documentation showed non-ideal conditions of some medical waste bins in VIP rooms, operating rooms, and other treatment rooms, where medical waste was found to be outside the bins and not properly covered. This calls for improvement in cross-sector coordination to ensure timely and appropriate transportation of full waste. In addition, interviews with ward heads and sanitarians revealed several challenges in the implementation of waste management, such as lack of training and adequate facilities.



Fig. 5. Conducting discussions and interviews at Bima Regional General Hospital (photograph by corresponding author)

Visual documentation and interviews at Bima Regional General Hospital revealed significant problems in medical waste management. Problems identified included medical waste often found outside bins, non-closure of bins, and inadequate handling in VIP rooms, operating rooms, and other treatment rooms. The pictures taken showed discrepancies between actual practices and expected standards.

The research also included interviews with health workers and discussions in FGDs (Focus Group Discussions) that emphasized the need for fundamental improvements in medical waste management. Discussions indicated that cross-sector coordination needs to be improved, and strict SOPs (Standard Operating Procedures) should be implemented. The current management is considered inadequate and requires more attention in terms of training, facilities, as well as transportation schedules. These improvements are essential to ensure effective, safe and compliant medical waste management.

According to the cleaning service personnel, “medical waste bins should use yellow plastic, but actual practice shows that black plastic is also used for medical waste” (Andolo, Doda, & Tendean, 2023). In addition, medical waste is not always placed directly in the medical waste station room, but is often stored outdoors with dirty floors, uncovered transportation equipment, and mixed plastic waste packaging. The head of sanitarian affairs added that “the transportation of medical waste by third parties is often poorly scheduled, with transportation sometimes only conducted one to three times a month, depending on the volume of waste generated” (RI, 2023).

This condition reflects non-compliance with the Regulation of the Minister of Health of the Republic of Indonesia No. 7 of 2019 (Kesehatan, 2019) concerning Hospital Waste Management, which requires the use of special closed bins and routine and procedural transportation of medical waste to prevent contamination (Murat Kocanli,

2021) Research by Putri S. S. (2024) showed that lack of training and adequate facilities were the main barriers to medical waste management in Indonesian hospitals, in line with these findings. Improvements require strict SOPs, effective cross-sector communication, clear transportation schedules, and increased facility capacity and training to ensure safe and compliant medical waste management (Yudhoyono & Winarno, 2017)

However, the implementation of SOPs and facility improvements must consider local cultural resilience. Cultural resilience affects the success of medical waste management, as adherence to procedures is influenced by the local work culture and norms. Integrating cultural values and involving local communities in policies can improve the effectiveness of medical waste management, ensuring that changes conform to national standards and are accepted within the local cultural context.

3.4 Standard Operating Procedures Availability

Based on the results of the study, Bima Regional Hospital does not have a clear standard operating procedure (SOP) in medical waste management. Health workers handle waste based on their limited knowledge. They admitted that they do not know whether their medical waste management has met the requirements or not. In fact, some of them were unaware of any regulations or policies governing medical waste management (60%). Only sanitarian officers felt that they had followed the waste management standards according to the Minister of Health Regulation No. 7/2019 (Kesehatan, 2019), but other health workers did not know about it.

According to Maironah, Subari, Mariani, & Noor (2011) .the availability of facilities has a relationship with the behavior of health workers in handling medical waste, where the correlation coefficient (r) value is 0.327 with a positive relationship direction and obtained a p value = 0.018 ($p < 0.05$) (Maironah, Subari, Mariani, & & Noor, 2011). The availability of adequate medical waste management facilities will influence the behavior of officers to carry out better waste management.

The handling of hospital B3 waste must pay attention to the principles of hospital B3 waste management. Regulation of the Minister of Health of the Republic of Indonesia Number 7 of 2019 (Kesehatan, 2019). Outlines the efforts that must be made in handling waste in hospitals, including identifying the type of waste, paying attention to the stages of handling waste containerization and transportation at the source, each room paying attention to how to reduce and sort waste, paying attention to the prerequisites for TPS buildings in hospitals, paying attention to the sorting of hospital waste carried out in landfills, paying attention to how to temporarily store waste, paying attention to the length of storage of infectious, sharp, and pathological waste types in hospitals before transportation, paying attention to how to transport waste, to how to treat waste.

However, several studies have found differences in the implementation of medical waste management systems in health service facilities, such as sorting, collection and transportation activities, the location of TPS facilities, the length of waste storage and the use of PPE officers as regulated in the Regulation of the Minister of Environment

and Forestry Number 56 of 2015 (Kehutanan, 2015) concerning procedures and technical requirements for hazardous and toxic waste management from Health Service Facilities.

Based on the results from Zuhriyani (2019). research, it shows that the implementation of the solid medical waste management system starting from the sorting process to the solid medical waste treatment process at Raden Mattaheer Jambi Hospital is good, but not yet fully in accordance with the Regulation of the Minister of Environment and Forestry Number 56 of 2015 (Kehutanan, 2015)

While research conducted by Ronald that, the process of reducing and sorting B3 solid medical waste is not going well, there are obstacles in facilities and infrastructure, lack of resources both from personnel and financing; storage of B3 solid medical waste is not carried out; processing of B3 solid medical waste is not carried out; burial and landfilling of B3 solid medical waste is not carried out according to applicable regulations; and the landfilling process is not carried out at all (T & Umboh, 2018).

The handling and management of medical waste at the Bima Regional Hospital health service facility is carried out from the beginning of generation to transportation and temporary storage in the internal medical TPS, while the destruction of medical waste is handed over to third parties. However, there is still negligence of officers when transporting medical waste to the internal medical TPS of Bima Hospital, because they do not use complete PPE, besides that the activity of transporting medical waste to the medical TPS exceeds capacity so that it can endanger occupational health and safety.

Fig. 6. Medical waste transportation activities



(photograph by corresponding author)

Based on research conducted by Yan et al that, the implementation of handling medical waste due to COVID-19 in several cities in China uses incinerators in its processing (Ma, et al., 2020). However, Bima Regional Hospital has not done the same method because it does not have an incinerator, so the medical waste generated is submitted to a third party for destruction activities.

3.5 Medical waste management strategy at Bima Regional General Hospital

Analytical descriptive analysis was used as the basis for the preparation of medical solid waste management strategies at Bima Regional Hospital. In this approach, the assessment is carried out by identifying and analyzing the internal and external factors that affect medical waste management are as follows:

3.5.1 Internal factors

1. *Strengths*: Potential strengths of the hospital include the availability of adequate land, adequate number of human resources, availability of BOK and BPJS funds, large volume of waste generation, and increased coverage of hospital visits.

2. *Weaknesses*: Weaknesses include the absence of hospital medical waste management regulations or policies, lack of hospital management support, low staff behavior in hospital sanitation efforts, inadequate medical waste treatment facilities/equipment, and the absence of medical waste budgeting.

3.5.2 External factors

1. *Opportunities*: Some of the opportunities include the Minister of Health Regulation number 7 of 2019 (Kesehatan, 2019) concerning Hospital Environmental Health, various regulations on environmental protection, local government and DPRD support for proper health facilities, BPJS health policy and the absence of incinerator facilities in hospitals in Bima District.

2. *Challenges*: Challenges encountered include limited funding from the Bima District APBD, the small size of the hospital, potential resistance from the surrounding community, and the district's pharmaceutical waste disposal being carried out in the hospital area.

The results of the descriptive analysis showed that internal factors affecting the management of solid medical waste at Bima Regional Hospital had a total score of 2.40, while external factors had a total score of 2.50. Overall, these scores show a result that is quite good, but not yet at a very good level. This indicates that external factors have a greater influence on the management of medical solid waste at Bima Regional General Hospital than internal factors. Therefore, the focus of the recommended strategy is to minimize internal problems while utilizing existing strengths to take advantage of external opportunities.

4 Conclusion

This study shows that cultural resilience in medical waste management at Bima Regional General Hospital is at a fairly high level, although there are still some weaknesses, such as the mixing of medical and non-medical waste. Bima Regional General

Hospital has shown strong commitment through adaptive practices and innovative solutions undertaken by hospital staff to maintain the quality of medical waste management. However, shortcomings in terms of adequate storage facilities and lack of training for staff remain a challenge. This study recommends several measures to improve the sustainability of the medical waste management system, including the recording of waste volume per room and the involvement of all health workers in waste management. In addition, improved storage facilities, regular training, as well as more regular scheduling of waste transportation are necessary to ensure safe, effective, and standardized medical waste management. Integration of local culture in waste management policies was also identified as an important factor that can improve the effectiveness of waste segregation and ensure better compliance with regulations.

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