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# Health Workers' Medical Waste Management at the Public Health Center

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ABSTRACT

*Medical waste (MW) has the potential to be hazardous due to the presence of dangerous microbes. During the COVID-19 pandemic, MW had exploded, particularly in healthcare facilities. The lack of knowledge, attitudes, and practices related to medical waste management (MWM) among health workers will have a substantial influence on public health and environmental health concerns. The objective of this research is to evaluate health workers' knowledge, attitudes, and practices encompassing MWM at the health center during the COVID-10 pandemic. This cross-sectional study was done from April to May 2023, involving direct interviews with healthcare workers at the Manggis I Karangasem Health Center. A total of 36 participants responded (100% response rate). The results demonstrate that the respondent's knowledge (n=34 [68.0%]) and attitude (n=44 [88.0%]) were considered good. Pearson correlation test showed a weak relationship between knowledge and attitude (Sig.2 tailed= 0.045; correlation=0.336). Solid MWM practices in the emergency room (ER) were suitable (64.0%); liquid MWM in the ER were suitable (66.5%); solid MWM in polyclinic were suitable (64.0%); liquid MWM in polyclinic were suitable (83.0%); solid MWM in pharmacy were suitable (67.5%); liquid MWM in pharmacy were suitable (50.0%). In general, health workers' knowledge, attitudes, and practices in MWM were beneficial. Statutory requirements require periodic examinations of the necessity of handling medical waste in health facilities.*

## 1. Introduction

The World Health Organization (WHO) defines medical waste (MW), also known as healthcare waste, as wastage or by-products from hospitals and healthcare facilities for both humans and animals that are used for diagnosis, treatment, or immunization (WHO, 2015). A few examples are soiled syringes, hypodermic needles, sharp items, metal, bandages, body parts, drugs, chemicals, radioactive materials, and devices (Singh, Ogunseitan and Tang, 2021).

Medical waste is potentially hazardous, and it can include infectious agents. Potentially dangerous germs that might infect medical personnel, hospital patients, and the general public are present in MW. Drug-resistant germs that escape from healthcare facilities and enter the environment could be another source of danger. Medical waste has a major impact on the environment and public health and has proven very detrimental. In addition, the generation and disposal of MW causes increased levels of emissions and pollution (Attrah *et al.*, 2022).

Medical waste disposal is a new issue worsening due to a lack of training, knowledge, and financial resources. The most frequent issues are low emphasis given to the subject, insufficient financial and human resources, poor training in proper medical waste management (MWM), lack of MWM and disposal systems, and ignorance of the health risks faced by healthcare professionals. Connected to subpar procedures for managing MW. Several factors, including staff dedication and experience, knowledge and training, the presence of an MWM utility, MWM commitment, the management team, and the national regulatory framework, affect a health facility's ability to manage health workers effectively (Mannocci *et al.*, 2020).

WHO reported that high-income countries generate up to 0.5 kilograms of hazardous waste per hospital bed every day, while low-income countries generate only 0.2 kg. However, in low-income countries, MW is not always separated into hazardous and non-hazardous wastes, resulting in a much higher overall volume of hazardous waste. There is still a lack of proper MWM worldwide, particularly in low-income countries. Across the globe, one in every three healthcare facilities fails to handle medical workers appropriately.

Health worker management has emerged as one of the key concerns. because inappropriate MWM has detrimental effects on the environment, public health, workplace safety, water quality, and the likelihood of disease outbreaks, particularly in developing nations (Jazieh, 2020). Medical waste management is frequently quite low in low-income nations, which raises questions regarding the suitability of the techniques employed there. Healthcare facilities generate MW, which has the potential to contaminate the environment and provide a risk of disease transmission and other health problems, necessitating the need for MWM (Menteri Kesehatan RI, 2020).

The COVID-19 pandemic has led to medical treatments for people all around the world. The increase in healthcare services caused by the pandemic has resulted in a large increase in the amount of MW generated, which includes single-use personal protective equipment (PPE), testing materials, and other related items (Hantoko *et al.*, 2021). Despite improvements in health worker management in the previous decade since the WHO disseminated recommendations on national plans, managing health workers and avoiding possible hazards remains a key concern for healthcare facilities. It is important to handle this MW properly to avoid environmental contamination and reduce the possibility of disease transmission to patients, healthcare workers, and the general public.

Several studies have shown that the Covid-19 outbreak contributed to a 102.2% increase in waste generation in both private and public institutions. Furthermore, the ratio of infectious waste in the surveyed institutions increased by an average of 9% in the composition of MW and 121% compared to before the COVID-19 pandemic (Kalantary *et al.*, 2021)(Hantoko *et al.*, 2021).

According to data from the Asian Development Bank, the volume in five Southeast Asian nations is as follows: the Philippines (280 kg/day), Indonesia (212 kg/day), Malaysia (154 kg/day), Thailand (210 kg/day), and Vietnam (160 kg/day). According to Ministry of Health data, Indonesia has 3.042 hospitals, 10.177 health centers, and 7.614 clinics (Kementerian Kesehatan Republik Indonesia, 2021). Medical waste

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generated by healthcare facilities across Indonesia might amount to 296.86 tonnes each day. In the meantime, the current processing capacity is only 115.68 tonnes per day.

By 2021, 26.7% of Indonesian hospitals and healthcare facilities will have implemented standardized MWM practices. This is an increase of 18.9% over the previous year (Kementerian Kesehatan Republik Indonesia, 2021).

Every day, Community Health Centers generate a significant amount of MW, much of which is harmful, particularly solid waste. A survey of 100 Indonesian health clinics found that the average waste production was 3.2kg/bed/day. Further investigation revealed that the waste generated was 76.8% residential waste and 23.2% infectious waste. The garbage generated by health centers is projected to be 376,089 tonnes per day on a country-wide scale (Kementerian Kesehatan RI, 2019). This definition implies that healthcare facilities can damage the environment and transmit sickness to their employees.

Medical waste disposal must be done properly and effectively and fulfill sanitation requirements. Medical waste management is a systematic, comprehensive, and continuous activity, starting from containerization, collection, sorting, and landfilling to destruction. Guidelines for MWM in referral hospitals, emergency hospitals, and community health centers treating COVID-19 patients have been issued by the Minister of Health of the Republik of Indonesia (Kementerian Kesehatan RI, 2020).

Strict rules and procedures must be followed to manage MW during the epidemic. Health workers who work on the front lines endure a heavy schedule. Knowledge, attitudes, and practices (KAP) on *MWM* are critical to ensuring the efficacy and safety of MW disposal procedures. Understanding these components of KAP is critical for identifying gaps, improving training education programs, and developing policies to improve MWM practices (Jazieh, 2020; Attrah *et al.*, 2022).

Manggis I Health Center is located in Karangasem Regency's Manggis Sub-district. The Manggis I Health Center has an operational area of 109.70 square kilometers, which includes 39 villages. Health personnel at the Health Center are involved in and play an important role in MWM. This health center's research on MWM has not been extensively disseminated. The researchers aimed to present an overview of MWM knowledge, attitudes, and practices in primary care, particularly during the COVID-19 outbreak. This work is expected to offer a scientific contribution to MWM.

## 2. Materials and Methods

### Sampling method

An observational study employing a cross-sectional design and direct interviews with health professionals at the Manggis I Karangasem Community Health Center was carried out from April to May of 2023. A total sampling approach was employed on 36 health personnel, including doctors, pharmacy staff, nurses, and midwives. Because the population was less than 100, the entire research sample was collected.

### Research instrument

The use of statistically validated questionnaires can eliminate bias, errors, and inconsistencies in data collecting, enabling the reliability and validity of research findings to be examined (Sürücü and Ahmet Maslaci, 2020). The questionnaire was modified from the WHO Health Care Waste Management Guidelines, the Ministry of Health's waste management recommendations for healthcare facilities, and previous research with a similar approach (Menteri Kesehatan RI, 2020; Wassie *et al.*, 2022; Tilahun, Donacho and Zewdie, 2023). The questionnaire included inquiries about demographic characteristics, knowledge, and attitude assessments, including a list of observations to assess MWM practices. The contents of the questionnaire were validated by experts.

Validated questions can successfully assess research objectives, reducing misinterpretations of health workers' knowledge, attitudes, and behavior toward medical waste management. Validating a questionnaire needs a thorough procedure that includes pilot testing, reliability, and validity checks, and the use of statistical methods to ensure that the questions are clear, relevant, and consistently accepted by respondents (Mannocci *et al.*, 2020).

The questionnaire was divided into 3 (three) parts. The first part collected information about respondents' age, gender, education, profession, and period of work. The second part was a questionnaire about MWM's knowledge, attitude, and practice. The knowledge questionnaire featured 9 (nine) questions/statements, whereas the attitude questionnaire featured 7 (seven) dichotomous questions/statements with a Guttman Scale, Yes/True, and No/False answers. Each correct answer received a score of one (one), whilst incorrect answers received a score of zero. Knowledge was classified as good (score ≥7), fair (score 5-6), or poor (score ≤4), while attitude was rated as positive (score >5) or negative (score ≤5). The third part was a practice questionnaire that utilized a checklist method derived from the MWM Guidelines (Kementerian Kesehatan RI, 2020). The study utilized 22 solid waste indicators and 6 liquid waste indicators. If the proportion of assessments was 50%, the practice category was considered good.

### Data analysis

The data was analyzed with SPSS 24.0. The Pearson Correlation Test was used to examine the correlation between knowledge and attitude by fitting the requirements of a numeric data scale (ratio interval) and normally distributed data. The data presentation was descriptive, describing the proportion of research results.

### Ethical consideration

This study was granted ethical approval from the Bali International University Ethics Committee number 02.0364/UNBI/EC/III/2023 on March 30th, 2023.

## 3. Result and Discussion

### Respondents' characteristics

Thirty-six respondents participated in this study, achieving a 100% response rate. Table 1 presents the demographic characteristics of the respondents, indicating that the majority were aged 40-49 years (n = 13; 36.1%). The sample comprised predominantly female participants (n = 28; 77.8%) and individuals with a diploma-level education (n = 21; 58.3%). In terms of professional background, nurses constituted the largest group (n = 15; 41.7%), and half of the respondents reported having 4-6 years of work experience (n = 18; 50%).

### Knowledge

According to Table 2, almost all of respondents (91.7%) understood the concept of MW, and 88.9% acknowledged that MW is generated by health-related activities. Thus, 91.7% of respondents stated that medical trash should not be combined with ordinary waste and should be separated quickly and that sharp MW should be separated (94.4%). For MW marking, 69.4% of respondents knew the color code for MW is yellow, 77.8% of respondents knew the black color code for general waste, and 77.8% of respondents knew biomedical waste containers should be marked with the biohazard symbol. Specifically for liquid medical waste, 66.7% of respondents knew that containers should not be filled more than three-quarters full, however, 88.9% of respondents thought that liquid MW could be

flushed down the toilet. In general, health workers' knowledge of MWM was good (Table 4). This is consistent with studies conducted in other nations where knowledge tends to be high (Akkajit, Romin and Assawadithalerd, 2020). Local governments should adopt well-planned MW collection and transportation procedures to decrease the risk of environmental pollution and infection to healthcare workers and the general public.

**Table 1.** Respondents' characterictics (n=36)

| Characteristics | n | % |
|---|---|---|
| *Age (years)* | | |
| 20 – 29 | 4 | 11.1 |
| 30 – 39 | 8 | 22.2 |
| 40 – 49 | 13 | 36.1 |
| > 50 | 11 | 30.6 |
| *Gender* | | |
| Male | 8 | 22.2 |
| Female | 28 | 77.8 |
| *Education* | | |
| Diploma | 21 | 58.3 |
| Bachelor | 15 | 41.7 |
| *Profession* | | |
| Pharmacy staff | 3 | 8.3 |
| Doctor | 7 | 19.4 |
| Nurse | 15 | 41.7 |
| Midwife | 11 | 30.6 |
| *Work period (years)* | | |
| 1 -3 | 14 | 38.9 |
| 4 – 6 | 28 | 50.0 |
| 7 – 9 | 3 | 8.3 |
| >10 | 1 | 2.8 |

**Table 2.** Respondents' knowledge (n=36)

| Statements | Yes/True n (%) | No/False n (%) |
|---|---|---|
| 1. MW includes expired drugs, materials contaminated with body fluids, and vaccine containers | 33 (91.7) | 3 (8,3) |
| 2. MW was generated from health activities | 32 (88,9) | 4 (11.1) |
| 3. MW must be separated immediately | 33 (91.7) | 3 (8.3) |
| 4. Sharp MW must be separated | 34 (94.4) | 2 (5.6) |
| 5. The color code for MW is yellow | 25 (69.4) | 11 (30.6) |
| 6. The color code for general waste is black | 28 (77.8) | 8 (22.2) |
| 7. Biomedical waste containers must be labeled with the biohazard symbol | 28 (77,8) | 8 (22,2) |
| 8. Liquid MW containers should be filled no more than three-quarters full | 24 (66.7) | 12 (33.3) |
| 9. Liquid MW may be flushed down the toilet | 32 (88.9) | 4 (11.1) |

**Table 3.** Respondents' attitude (n=36)

| Statements | Yes/True n (%) | No/False n (%) |
|---|---|---|
| 1. MW should not be mixed with general waste | 35 (97.2) | 1 (2.8) |
| 2. MW was collected more carefully | 28 (77.8) | 8 (22.2) |
| 3. MW containers should be sealed daily | 30 (83.3) | 6 (16.7) |
| 4. Gloves should always be used during medical services to prevent exposure | 29 (80.6) | 7 (19.4) |
| 5. MWM at this health center was by regulations | 30 (83.3) | 6 (16.7) |
| 6. MWM should be more closely monitored by local government | 33 (91.7) | 3 (8.3) |
| 7. There are sanctions for violations of MWM | 32 (88.9) | 4 (11.1) |

**Table 4.** Knowledge and attitude (n=36)

| | n | % |
|---|---|---|
| *Knowledge* | | |
| Good | 23 | 63.9 |
| Fair | 10 | 27.8 |
| Poor | 3 | 8.3 |
| *Attitude* | | |
| Positive | 24 | 66.7 |
| Negative | 12 | 33.3 |

| | *Knowledge* | |
|---|---|---|
| | Sig. 2-tailed | Correlation |
| *Attitude* | 0.450 | 0.336 |

**Table 5.** Practice of medical waste management

| Location | Type | Indicators | Suitable | | Unsuitable | |
|---|---|---|---|---|---|---|
| | | | n | % | n | % |
| Emergency | Solid | 22 | 14 | 64.0 | 8 | 36.0 |
| | Liquid | 6 | 4 | 66.7 | 2 | 33.5 |
| Clinic | Solid | 22 | 14 | 64.0 | 8 | 36.0 |
| | Liquid | 6 | 5 | 83.0 | 1 | 17.0 |
| Pharmacy | Solid | 22 | 15 | 67.5 | 7 | 32.5 |
| | Liquid | 6 | 3 | 50.0 | 3 | 50.0 |

## Attitude

Table 3 shows that 97.2% of respondents thought MW should not be mixed with general waste and should be collected more carefully (77.8%). A total of 83.3% of respondents agreed that MW containers should be sealed daily, and 80.6% of respondents stated that strict use of gloves during healthcare to prevent exposure. Although 83.3% of respondents said that MWM in their work unit was governed by regulations, 91.7% believed that MWM should be more strictly supervised by the local government. A total of 88.9% of respondents believed that there are penalties for MWM violations.

Table 4 shows that health workers' attitudes toward MWM were reported to be positive (66.7%). Pearson correlation test showed there was a relationship between knowledge and attitude (Sig.2 tailed= 0.045; correlation=0.336). This was also reported in other country studies where high knowledge was associated with positive attitudes and good practices. The length of work experience of health workers was the most significant factor influencing the practice of MWM (Akkajit, Romin and Assawadithalerd, 2020). Previous research reported that the behavior or practice of health workers in MWM has a significant relationship with knowledge. Trustworthiness, work ethic, responsibility, and accountability influence the practice (Faghfirlia *et al.*, 2022).

Previous studies have reported that awareness of MWM among healthcare workers is often limited, resulting from inadequate sensitization and a lack of implementation of appropriate guidelines (Letho *et al.*, 2021). Several countries including Indonesia have developed national guidelines on MWM during the COVID-19 pandemic, although there are inconsistencies between these and international guidelines (Barua and Hossain, 2021; Saxena, Pradhan and Kumar, 2022). Policymakers can identify gaps that hinder the implementation of MWM policy guidelines by taking appropriate corrective actions and improving preparedness and capacity to deal with possible future situations post-pandemic.

## Practice

Table 5 displays the findings from the checklist-based observation. In the ED, 14 of 22 (64.0%) solid waste indicators and 4 of 6 (66.7%) liquid waste indicators were suitable. At the Polyclinic, 14 of 22 (64.0%) solid waste indicators and 5 of 6 (83.0%) liquid waste indicators were suitable. At the pharmacy, 15 of 22 (67.5%) solid waste indicators and 3

of 6 (50%) liquid waste indicators were suitable. In the practice of MWM, several things are not by the standard such as the transportation of MW more than 2x24 by a third party. Changes in management plans and actions such as increasing the frequency of waste collection per week may lead to a decrease in the risk of transmission of infection from MW (Kalantary *et al.*, 2021). This is also recommended by previous studies, where investment is needed in providing safer disposal facilities to accommodate all MW generated from healthcare facilities to ensure public safety and prevent environmental pollution (Akkajit, Romin and Assawadithalerd, 2020).

The use of plastic bags as containers contributes the most to medical waste. This is in line with previous research, even as countries around the world are struggling to develop strategies and infrastructure for the proper disposal of the increased MW generated by the COVID-19 pandemic. Plastic materials make up approximately 35% of medical waste, presenting an opportunity for sustainable resource recovery and recycling. The COVID-19 pandemic's sudden increase in the amount and composition of plastic waste highlights the critical need to strengthen plastic reduction policies (and put them into action as soon as possible), increase innovation for environmentally friendly and sustainable plastic solutions, and urgently develop dynamic and responsive waste management systems (Patrício *et al.*, 2020). All countries must adopt environmentally sound MWM to prevent the build-up of infectious waste during and after the pandemic (Singh, Ogunseitan and Tang, 2021; Saxena, Pradhan and Kumar, 2022). For this reason, policy guidelines and regulations concerning MWM are strictly enforced to improve MWM practices, particularly in the collection and transportation of MW (Akkajit, Romin and Assawadithalerd, 2020).

## 4. Conclusions

In general, the medical waste management (MWM) at the Manggis I Karangasem Community Health Center are proficient. However, the study's limited scope, small sample size, and dependence on self-reported data may have an impact on the findings' validity and generalizability. To increase knowledge, attitudes, and practices linked to MWM, all healthcare staff must participate in regular and comprehensive training sessions. In addition, waste management techniques must be routinely evaluated and monitored to ensure that enough infrastructure and resources are available. Furthermore, waste reduction initiatives, policy development and implementation, fostering cross-disciplinary collaboration, increasing public awareness, and utilizing technology can significantly increase the effectiveness and safety of medical waste management in community health centers.

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## Conflict of Interest

The authors declared that there is no conflict of interest in this study.

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