

Evaluation of the waste management system of disposable masks in the Faculty of Medicine, Public Health and Nursing in the context of public health

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Abstract. The COVID-19 has introduced new habits such as the daily use of masks, which extends to campus environments. This habit poses health risks as masks are considered infectious waste and can facilitate disease transmission, thus requiring attention in terms of management. As a proponent of the Health Promoting University, FK-KMK UGM is expected to lead by example in managing mask waste. The aim of this study is to evaluate the implementation of mask waste management at FK-KMK UGM. This study used descriptive cross-sectional design with a mixed-method approach. Quantitative data were collected by distributing questionnaires to 141 respondents, while the qualitative method was carried out by evaluating using logic model framework to know the input, process, and output from the implementation. About 81.6% of respondents continued to wear masks on campus, with 65.2% citing health reasons. Furthermore, 85.8% reported the absence of proper mask disposal facilities, and 92.9% indicated a need for such facilities. Regarding input, process, and output components, it was found that lacks designated disposal bins and does not separate mask waste from other waste at FK-KMK UGM. The management of disposable mask waste at FK-KMK UGM has not been implemented properly. The campus should provide specialized bins for mask waste and collaborate with the Center for Agricultural Technology Innovation (PIAT) UGM to integrate mask waste treatment.

1 Introduction

The COVID-19 pandemic that occurred a few years ago brought new habits to society, one of which is the use of masks. Even though the pandemic status has now ended, many people still wear masks. During the pandemic, the world produced an estimated 3.4 billion disposable masks daily. This resulted in 150,000 to 390,000 tons of mask waste entering oceans annually. Current waste management practices are largely inadequate, with 25% of plastic waste being incinerated and 40% sent to unsanitary landfills. These disposal methods create dangerous

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byproducts like microplastics, heavy metals, and toxic compounds (PCDDs and PCDFs), posing significant environmental risks [1].

The Ministry of Health of the Republic of Indonesia recommends individual management of used masks by collecting the used masks, disinfecting them by soaking in disinfectants such as chlorine, altering the shape of the masks, and damaging the straps to prevent misuse, and then disposing of them in domestic trash bins [2]. This waste should be managed properly by recycling or incinerating it according to procedures [3]. According to Mulasari in Lindawati, there has been a 20% increase in household mask waste, and 85% of people do not know how to manage medical waste, including infectious masks. Waste management is still carried out by mixing it with other waste, so proper management of mask waste is necessary [4].

Faculty of Medicine, Public Health and Nursing (FK-KMK) UGM is an educational institution that has a potential risk of disease transmission due to the numerous activities of students and clinical practitioners in hospitals and other health services within the campus environment. As part of a Health Promoting University, where the majority of individuals are knowledgeable about health aspects, FK-KMK UGM is expected to be a role model in managing waste, starting with the behavior of its students. This paper aims to provide an overview of the management of disposable masks and evaluate the management of disposable mask waste at FK-KMK UGM.

2 Methods

This research uses a descriptive cross-sectional design with a mixed-method approach. In the quantitative study, the research was conducted using primary data based on a survey using Google Forms to the community of FK-KMK UGM from October 29, 2023, to November 9, 2023. The qualitative study was conducted through in-depth interviews with managers of the Center for Agricultural Technology Innovation (PIAT) UGM, canteen managers, campus waste managers, and the asset management directorate of FK-KMK UGM. The management of mask waste was evaluated using the Logic Model conceptual framework, examining the components of input, process, and output. The research instruments used included interview guidelines and observation sheets.

3 Results and Discussion

The following are the results of the survey conducted through Google Form. Based on Table 1, postgraduate students constitute the largest proportion of respondents, accounting for 62.41%. The distribution of respondents across various categories and levels is uneven. This disparity arises from the participatory nature of respondent selection, which did not involve prior stratification.

Table 1. Distribution of respondents by occupation

Characteristics of respondents	Number	%
Sex		
Male	23	16.3
Female	118	83.7
Occupation		
Postgraduate Students	88	62.41
Undergraduate Students	39	27.65
Professional Students	8	5.67
Staff	5	3.54
Lectures	1	0.7

Table 2. Distribution of questionnaire responses

Components	Number	%
The habit of wearing masks on campus		
Yes	115	81.6
No	26	18.4
Reasons for wearing masks		
Health reasons (preventing disease transmission)	90	63.8
Social reasons (Privacy/Feel Comfortable)	28	19.8
Others	23	16.4
Disposal Locations for single-use masks		
Take it home	95	67.4
Inorganic waste bin	25	17.7
Others	16	11.3
Paper waste bin	5	3.6
Organic waste bin	0	0
Availability of disposal locations for single-use masks at FK-KMK		
Not Available	121	85.8
Available	20	14.2
Need for special facilities for disposal of single-use masks at FK-KMK		
Necessary	131	92.9
Not necessary	10	7.1

According to Table 2, it was found that 81.6% of respondents still wear masks in the FK-KMK area. The primary reason cited by the majority of respondents (65.2%) is health-related, specifically the prevention of disease transmission. This result was consistent with Gandhi and Marr [5], who explain that masks are effective in blocking or filtering viruses carried in aerosols. Despite 81.6% of respondents at FK-KMK still wearing masks, a significant portion of respondents (85.8%) indicated that there are no adequate disposal facilities for single-use masks, and 92.9% expressed a demand for such amenities. The widespread use of masks underscores the critical need for effective mask waste management at FK-KMK.



Fig. 1. Dumask project on mask waste processing at the Center for Agricultural Technology Innovation (PIAT) facilities, UGM.

Figure 1 provides a detailed view of the waste management facilities at PIAT, UGM PIAT UGM, centered at the Recycling Innovation House (RInDU). For the management of disposable medical mask waste, PIAT UGM has a project called Dumask (Dropbox-Used Mask), specifically aims to provide a safe and environmentally friendly disposal route for used masks and gloves from the public. To process mask waste, in addition to the pyrolysis method, Dumask also processes waste by sorting, cleaning, grinding, and processing it into useful and economically valuable items such as coasters, mini pots, tables, and chairs.

3.1 Input

In the management of mask waste on campus, there are several input components such as waste management regulations, waste management facilities and infrastructure at the Integrated Agrotechnology Innovation Center (PIAT), the availability of human resources for waste management both on campus and at the final stage of waste management, and the availability of supporting facilities such as incinerators. The research conducted has found several aspects that need to be evaluated in the input components. The Standard Operating Procedures (SOP), which should serve as a reference and guide for implementation, have not been definitively established or are still in the process [3, 6, 7]. Based on an interview with the asset department, it was mentioned, "For waste management, SOP will be created, but it is still in process. There are already 2 trained waste sorters, and the collection is carried out by the cleaning service. Waste that is still in good condition and can be utilized will be collected for sale, while waste that needs to be processed will be managed independently by the campus. Masks are not yet specifically differentiated".

After the COVID-19 pandemic, the United Nations Environment Programme (UNEP) urged global governments to pay attention to waste management, including medical, household, and other hazardous waste, as an essential public service to minimize health and environmental impacts [8]. Additionally, studies in several countries indicate the need for policy and management interventions in waste management [9, 10, 11]. At FK-KMK UGM, regulations and SOPs for waste management are not yet in place. Training for cleaning staff on health risks and universal precautions has not been conducted for a long time, and the discipline in the use of PPE by staff is still lacking. Regulations are urgently needed to produce appropriate output in the management of disposable mask waste [9]. The input components at FK-KMK UGM are already comprehensive, but regulations and training still need to be improved.

3.2 Process

In the process component based on observations and interviews, waste sorting at FK-KMK is not yet optimal. Waste, including masks, is still found being disposed of improperly. Masks being discarded carelessly is evidence of poor management and a lack of environmental awareness [12]. The sorting process should ideally be done from the beginning at the trash bins. Waste from the canteen is collected in the afternoon, while other waste is collected daily by cleaning staff and stored at the waste processing site next to the Research and Development building at FK-KMK UGM. At this site, waste is re-sorted, with economically valuable waste sold to third parties, while masks and waste deemed worthless are disposed of at the PIAT UGM disposal site in Sleman. Waste is routinely transported by truck to PIAT UGM, where mask waste is processed separately by a third party, DUMASK (Dropbox-Used Mask), which then transforms mask waste into valuable items such as flowerpots, tables, and so on. The transportation and processing of mask waste by DUMASK are running smoothly. The incineration of mask waste, hazardous waste, and used laboratory items at FK-KMK is carried out in the incinerator 3-4 times a week. Staff use complete PPE, including masks, gloves, boots, and aprons.

3.3 Output

In the Output component, it is known that suboptimal recycling processes can lead to pollution. Medical waste should be disposed of in double-layered plastic bags and sprayed with chlorine-containing disinfectant before being placed in temporary storage containers [13]. Improperly decomposed mask waste can contaminate soil, water, and air [14]. To address this issue, better waste management is needed, such as using designated trash bins or independently processing mask waste. Further handling of infectious waste must follow hazardous waste (B3) procedures [15]. The recycling process is a solution to reduce environmental impact, but it is still not optimal, especially for waste without high economic value. Due to restrictions on sending waste to the Piyungan landfill, waste from UGM is stockpiled at PIAT Kalitirto, Berbah, Sleman. A study in Bangkok showed that improper disposal of masks contaminates the environment with hazardous waste [10, 16].

4 Conclusion

The management of disposable mask waste at FK-KMK UGM needs to be properly implemented, and instances of improper waste disposal are still occurring. No designated trash bins are specifically for mask waste, and waste collection must be properly sorted into organic and inorganic categories. Additionally, mask waste is still mixed with other types of waste, indicating a need for dedicated facilities for disposable masks within the FK-KMK UGM campus. Furthermore, there is a need to integrate the mask waste process with PIAT UGM and to establish regulations regarding the management and disposal of disposable mask waste. It is also recommended that awareness campaigns be conducted among the academic community of FK-KMK UGM regarding proper waste management practices.

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