Knowledge, Attitudes, and Practice Health Care Workers on Disposable Mask Waste Management in the Post-COVID-19 Pandemic

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Abstract: Biomedical waste including disposable masks requires proper waste handling so it doesn't pollute the environment and cause re-transmission of COVID-19 disease. The purpose of this study was to look at the relationship between the knowledge, attitudes and practices of the Public Health Centre in Pangandaran Regency. Methodology: Cross-sectional study approach to study assessed KAP. 91 participants were from 15 different public health centres in Pangandaran. Data analysis used chi-square statistical test. Presented with frequency distribution and the form of a tabulation. Result indicated knowledge of respondents was only 41.40% with high scores and practices with high scores were only 44.40% but attitudes towards disposable mask waste management with high scores reached 98.6%. There is a relationship between age and practice with a p-value of 0.009 and a relationship between knowledge and practice with a p-value below 0.05. Conclusion the participants had insufficient knowledge and practice scores but have good attitude scores. Our results conclude that the HCWs good attitude does not affect good practice but knowledge may lead to a proper practice. Findings of this study suggest that a regular training program for the HCWs on BMW specially on disposable mask management may lead to better practice.

Keywords: Disposable Mask; KAP; Pangandaran

Introduction

Covid-19 masks fall into the category especially medical Waste (BW) referring to waste generated by medical and laboratory activities during diagnosis, treatment or immunization of humans or animals. Hazardous waste is considered a major threat to health and the environment (Pieper et al., 2017). Improper management and exposure to infectious waste resulting from positive patients can easily infect health staff such as; doctors, nurses, waste collectors and visitors (Das et al., 2021).

The largest composition of Biomedical Waste from the manufacture of personal protective equipment (PPE), one of which is a mask, is a type of plastic. This composition was more or less the same before the pandemic and during the pandemic but due to very high demand, production increased significantly (Singh et al., 2020). In Indian hospitals, the number of Biomedical Waste increased from 25 tons pre-pandemic to 349 tons/day during May–July and is expected to double during August–October (Chand et al., 2021). The local government in Sydney reported a 35% increase in biomedical waste due to the COVID-19 pandemic (Scott et al., 2021). In Indonesia, in just one year (from March 2020 to February 2021) the amount of medical waste generated by healthcare facilities was 6,418 tons, this figure does not include medical waste from the Covid-19 vaccination process which began in January 2021 and

is targeted to target 180 million Indonesian residents (Suryani, 2021). The massive production of Biomedical Waste during a pandemic is a new threat to public health and the environment (Haji et al., 2020). Managing Biomedical Waste during a pandemic needs special attention because this waste acts as a vector for COVID-19 and can increase the spread of the virus. The COVID-19 virus can survive for 72 hours outside the host organism on the surface of the mask used (Barcelo, 2020).

The satisfactory knowledge, attitudes and practices of health staff about the nature of the waste generated can be effective in the safe management of waste (World Health Organization, 2020). Sustainable management of medical waste management requires the existence of a waste treatment unit, allocating financial and labor resources, conducting regular training, monitoring, evaluating, and continuing to improve facilities and infrastructure (Das et al., 2021). Installation of biomedically marked waste disposal sites with trained administrators is the method used in many countries. For waste disinfection, using disinfectants and sort for 9 days if needed (Das et al., 2021).

In South Korea, the principles of managing the health and safety of health workers with a waste management approach, especially biomedical waste, are to reduce risk (Rhee, 2020). In Wuhan City it has improved its management processes by closing municipal waste dumps and investing more in disinfecting waste generated during the pandemic (Wang et al., 2021). Biomedical Waste is collected from specially marked containers, transported and disposed of by specially designed vehicles with trained workers (Sangkham, 2020). Healthcare staff must be sensitive to the environment; they must advocate for positive changes to manage the waste generated during the pandemic. In other words, maintaining the quality of patient care and worker safety must be considered in parallel with waste management. Producing exclusively educational or publicly available videos on proper waste management in COVID-19 and hosting webinars by environmental experts can help improve staff health knowledge, attitudes, and practices (Adam et al., 2019).

The focus of this research is the management of disposable mask waste in Pangandaran Regency, especially all Community Health Centers. The purpose of this study was to look at the relationship between the knowledge, attitudes and practices of the Public Health Centre (Puskesmas) staff towards the management of disposable mask waste at the Puskesmas. The choice of the Puskesmas as the study site was due to the fact that the incidence of COVID-19 among health workers working in Public Health Centre was higher (32.5%) compared to the incidence among health workers working in hospitals (17.9%). The study also found that health workers working in Public Health Centre tend to not use personal protective equipment (PPE) more often than health workers working in hospitals (Dhandapani et al., 2023).

Method

The type of research used is descriptive with a cross sectional study approach. The research sites were all puskesmas in Pangandaran Regency with the respondent population being puskesmas employees who were sampled using proportional random sampling (Riduwan, 2015). There are 1100 Puskesmas employees registered in 2021 in 15 Puskesmas. From this population, 91 samples were obtained which would become respondents with different proportions. Collecting data by interview using a questionnaire as well as observation with the observation sheet. Data collection was carried out from January - March 2023. Data analysis used univariate and bivariate with the chi square statistical test. Presentation of the results of the analysis in a descriptive manner with a frequency distribution and is presented in the form of a tabulation.

Result and Discussion

Demographic Characteristic Respondent

Table 1 describes the demographic characteristics of the respondents. Of the 70 respondents, the majority (72.9%) of respondents were women, dominated by age 23-35 years (75.7%). Most of the work areas (67.1%) were service areas related to patients who it is possible that during the pandemic someone was suffering from COVID-19. The history of respondents who had a history of being exposed to COVID-19 was 67.4% and a small proportion had never been exposed to COVID-19 while the history of the COVID-19 vaccination journey for the most part (85.7%) had received the complete COVID-19 vaccine.

Tabel 1. Demographic Characteristic Respondent

Variable	Category	Frequency	Percentage
Age	23-35 years	53	75.70
	36-45 years	11	15.70
	> 45 years	6	8.60
Gender	Male	19	27.10
	Female	51	72.90
Work Area	Service Area	47	67.10
	Non-Service Area	23	32.90
History of Covid-19	Yes	43	61.40
	No	27	38.60
Covid-19 Vaccine History	Complete	60	85.70
	Incomplete	10	14.30

Knowledge, Attitude and Practice of Managing Disposable Mask Waste

Table 2 presents the categorization (low/high) of knowledge, attitude and practice scores. From 70 respondents, knowledge scores with high scores were found at 41.4%, medium 50.0% and low 8.6%. Respondents who had a high attitude were 98.6%, while 1.4% and no one had a low score. Practices carried out by respondents with a high score were 44.3%, moderate 37.1% and 18.6% low.

Table 2. Distribution of Knowledge, Attitude and Practice of Among Respondent

Variable	Category	Frequency	Percentage
Knowledge	High	29	41.40
	Medium	35	50.00
	Low	6	8.60
Attitude	High	69	98.60
	Medium	1	1.40
	Low	0	0.00
Practice	High	31	44.30
	Medium	26	37.10
	Low	13	18.60

Table 3. Cross Tabulation between low/medium, high Practices Score and Demographic Characteristic

Variable	Waste Classification			Waste Collection & Transport			COVID-19 Pandemic Waste Management			COVID-19 Post-Pandemic Waste Management		
	Low/Medium	High	p-value	Low/Medium	High	p-value	Low/Medium	High	p-value	Low/Medium	High	p-value
Age	26	44	0.818	35	35	0.009*	32	38	0.555	38	32	0.788
23-35	19	34		21	32		23	30		28	25	
36-45	5	6		9	2		5	6		7	4	
>45	2	4		5	1		4	2		3	3	
Gender	26	44	0.781	35	35	0.592	32	38	0.592	38	32	0.592
Male	8	11		8	11		10	9		9	10	
Female	18	33		27	24		22	29		29	22	
Work Area	26	44	0.054	35	35	0.296	32	38	0.215	38	32	0.453
Service Area	13	33		21	25		18	28		23	23	
Non-Service Area	13	11		14	10		14	10		15	9	
History of Covid-19	26	44	0.884	35	35	0.179	32	38	0.147	38	32	0.683
Yes	14	26		22	18		18	22		23	17	
No	12	18		13	17		14	16		15	15	
Covid-19 Vaccine History	26	44	0.734	35	35	0.306	32	38	0.745	38	32	1.000
Complete	23	37		32	28		28	32		33	27	
Incomplete	3	7		3	7		4	6		5	5	

Relationship between Demographic and Practice

The practice of managing disposable masks is divided into 4 parts, namely: (1) Segregation of waste; (2) Collection and transportation of waste; (3) Waste management during the Covid-19 pandemic; (4) Waste management after the Covid-19 pandemic.

Table 3 show the results of the analysis of the demographic relationship with the practice of managing disposable mask waste turned out to only have one result that was significantly related, namely the relationship between age and the practice of collecting and transporting waste with a p-value of 0.009. Other results show no relationship between the demographics of respondents and the practice of managing disposable mask waste.

Relationship between Knowledge, Attitude and Practice

The results of the analysis can be seen in table 4, it turns out that there is a relationship between knowledge and all disposable mask waste management practices including knowledge and practice of waste sorting with a p-value of 0.003; Knowledge with the practice of collecting and transporting waste with a p-value of 0.026; Knowledge with waste management practices during the Covid-19 pandemic with a p-value of 0.002 and Knowledge with waste management during the post-Covid-19 pandemic with a p-value of 0.000. For Attitude, it turns out that there is no relationship with the practice of managing disposable mask waste.

Table 4. Cross Tabulation between Knowledge, Attitude and Practice

Variable	Waste Classification			Waste Collection & Transport			COVID-19 Pandemic Waste Management			COVID-19 Post-Pandemic Waste Management		
	Low/Medium	High	p-value	Low/Medium	High	p-value	Low/Medium	High	p-value	Low/Medium	High	p-value
Knowledge	26	44	0.003*	35	35	0.026*	32	38	0.002*	38	32	0.000*
Low/Medium	21	20		25	16		25	16		30	11	
High	5	24		10	19		7	22		8	21	
Attitude	26	44	0.371	35	35	0.500	32	38	0.543	38	32	0.543
Low/Medium	1	0		1	0		0	1		1	0	
High	25	44		34	35		32	37		37	32	

Discussion

Medical waste generated especially mask waste at health care facilities may pose a serious threat to health care worker, common people and the surrounding environment if handling improper (World Health Organization, 2018). Since the health care worker play an important role in regulated biomedical waste disposal, it is important to have a high level of awareness. This emphasizes the importance of evaluating the knowledge, attitude, and practice of health care worker with respect to biomedical waste management and the factors that influence them.

Knowledge may lead to improper application of knowledge that may be detrimental to any healthcare organization, the value Knowledge is an essential resource in health science education (Karimi et al., 2014)(Shahmoradi et al., 2017). The present study results revealed that less than half (41.4%) of the participants had high knowledge of medical waste management generated at their work settings. Similar to our study findings, a recent survey conducted by Jalal SM in the Al-Hasa region of the KSA also found that only 41% of the healthcare professionals had excellent knowledge of biomedical waste disposal (Jalal et al., 2021). Other surveys conducted in some other countries also reported that a low proportion of the health care worker (HCWs) had favourable knowledge of healthcare handling and disposal (Deress et al., 2018)(Olaifa et al., 2018)(Woromogo et al., 2020)(Krithiga et al., 2021). Different from our study, a study conducted by (Reddy & Al Shammari, 2017) in the Hail region of the Kingdom of Saudi Arabia and (Akkajit et al., 2020) in Thailand stated that a higher proportion of healthcare professionals had good knowledge. The possible difference between our study and the latter studies could be the inclusion of healthcare facilities. The present study only from public health centre.

A positive attitude will guide the HCWs to follow the standards, protocols, and evidence-based practices this study found 98.8 5 have high score. Excellent attitude toward BMWs found in study conduct by (Dalui et al., 2023). Another study conducted in Cairo, Egypt, reported that the duration of work experience was not significantly associated with attitude (Hakim et al., 2014). These huge variations in the results among different studies could be due to the variations in data collection tools, survey settings, and cultural variations.

The results of the study show that there is a significant relationship with a p-value below 0.05 between age and one section of practice with p value 0.026, ither research have same result (Woromogo et al., 2020). The results of the relationship between knowledge and practice of the 4 sections of waste management showed all significant results (p-value <0.05) indicating that the knowledge of health workers about waste management is very important to improve proper waste management practices in health facilities. Therefore, it is necessary to make efforts to increase the knowledge of health workers about waste management and ensure that proper waste management practices are carried out in health facilities. Other research also states the same the knowledge of health workers and waste management practices similar according research by Tobin et al (Tobin et al., 2013)(Mathur et al., 2011). Different in other studies as said by N. Gupta (Dalui et al., 2023) that inadequate knowledge result low on precaution

Conclusion

The present study assessed knowledge, attitude and practice towards disposable mask management among public health center less than half of the participants had insufficient knowledge and practice scores but have good attitude scores. Furthermore, our results conclude that the health care worker (HCW's) good attitude does not affect to good practice but knowledge may lead to a proper practice. Findings of this study suggest that a regular training program for the HCWs on BMW specially on disposable mask

management is necessary through symposiums, role-play, interactive lectures, and other feasible training methods. These training programs can be focused and targeted oriented to the HCWs category with low and medium scores in knowledge may lead to good practice in the management of disposable mask waste.

References

Adam, M., McMahon, S. A., Prober, C., & Bärnighausen, T. (2019). Human-centered design of video-based health education: An iterative, collaborative, community-based approach. In *Journal of Medical Internet Research* (Vol. 21, Issue 1). https://doi.org/10.2196/12128

Akkajit, P., Romin, H., & Assawadithalerd, M. (2020). Assessment of Knowledge, Attitude, and Practice in respect of Medical Waste Management among Healthcare Workers in Clinics. *Journal of Environmental and Public Health*, 2020. https://doi.org/10.1155/2020/8745472

Barcelo, D. (2020). An environmental and health perspective for COVID-19 outbreak: Meteorology and air quality influence, sewage epidemiology indicator, hospitals disinfection, drug therapies and recommendations. *Journal of Environmental Chemical Engineering*, 8(4), 104006. https://doi.org/10.1016/j.jece.2020.104006

Chand, S., Shastry, C. S., Hiremath, S., Joel, J. J., Krishnabhat, C. H., & Mateti, U. V. (2021). Updates on biomedical waste management during COVID-19: The Indian scenario. *Clinical Epidemiology and Global Health*, 11(February), 100715. https://doi.org/10.1016/j.cegh.2021.100715

Dalui, A., Banerjee, S., & Roy, R. (2023). Knowledge, attitude and practices of biomedical waste management among health care personnel in selected primary health care centres in Lucknow. *Indian Journal of Public Health*. https://doi.org/10.18203/2394-6040.ijcmph20151582

Das, A. K., Islam, M. N., Billah, M. M., & Sarker, A. (2021). COVID-19 pandemic and healthcare solid waste management strategy – A mini-review. *Science of the Total Environment*, 778, 146220. https://doi.org/10.1016/j.scitotenv.2021.146220

Deress, T., Hassen, F., Adane, K., & Tsegaye, A. (2018). Assessment of Knowledge, Attitude, and Practice about Biomedical Waste Management and Associated Factors among the Healthcare Professionals at Debre Markos Town Healthcare Facilities, Northwest Ethiopia. *Journal of Environmental and Public Health*, 2018. https://doi.org/10.1155/2018/7672981

Dhandapani, S., Rajshekar, D., Priyadarshi, K., Krishnamoorthi, S., Sundaramurthy, R., Madigubba, H., & Sastry, A. S. (2023). Comparison of hand hygiene compliance among healthcare workers in Intensive care units and wards of COVID-19: A large scale multicentric study in India. *American Journal of Infection Control*, 51(3), 304–312. https://doi.org/10.1016/j.ajic.2022.09.028

Haji, J. Y., Subramaniam, A., Kumar, P., Ramanathan, K., & Rajamani, A. (2020). The state of personal protective equipment practice in indian intensive care units amidst covid-19 pandemic: A nationwide survey. *Indian Journal of Critical Care Medicine*, 24(9), 809–816. https://doi.org/10.5005/jp-journals-10071-23550

Hakim, S. A., Mohsen, A., & Bakr, I. (2014). Knowledge, attitudes and practices of health-care personnel towards waste disposal management at Ain Shams University Hospitals, Cairo. *Eastern Mediterranean Health Journal*, 20(5), 347–354. https://doi.org/10.26719/2014.20.5.347

Jalal, S. M., Akhter, F., Abdelhafez, A. I., & Alrajeh, A. M. (2021). Assessment of knowledge, practice and attitude about biomedical waste management among healthcare professionals during COVID-19 crises in Al-Ahsa. *Healthcare (Switzerland)*, 9(6).

https://doi.org/10.3390/healthcare9060747

Karimi, H., Hosseinian, zahramarzieh, & Ahanchian, M. (2014). knowledge management in Medical Education. *Journal of Medical Education Development*, *7*(16). http://zums.ac.ir/edujournal/article-1-264-en.html

Krithiga, P., Sudharsana, V., Sribalaji, R., & Snega, C. (2021). COVID 19 pandemic: Assessment of knowledge and attitudes in biomedical waste management among health care professionals in Tamil Nadu. *Asia Pacific Journal of Health Management*, *16*(3), 1–11. https://doi.org/10.24083/apjhm.v16i3.987

Mathur, V., Dwivedi, S., Hassan, M. A., & Misra, R. P. (2011). Knowledge, attitude, and practices about biomedical waste management among healthcare personnel: A cross-sectional study. *Indian Journal of Community Medicine*, *36*(2), 143–145. https://doi.org/10.4103/0970-0218.84135

Olaifa, A., Govender, R. D., & Ross, A. J. (2018). Knowledge, attitudes and practices of healthcare workers about healthcare waste management at a district hospital in KwaZulu-Natal. *South African Family Practice*, *60*(5), 137–145. https://doi.org/10.1080/20786190.2018.1432137

Pieper, U., Hayter, A., & Montgomery, M. (2017). Safe management of wastes from health - care activities A summary*. *Geneva*, *WHO/FWC/WSH/17.05*, 1–24. https://apps.who.int/iris/bitstream/handle/10665/259491/WHO-FWC-WSH-17.05-eng.pdf;jsessionid=BE197A8BAB73EC864CA3573E15D4F0E6?sequence=1

Reddy, L. K. V, & Al Shammari, F. (2017). Evaluation of biomedical waste management in primary health care centres in Saudi Arabia: A knowledge, attitudes and practices study. *Eastern Mediterranean Health Journal*, *23*(9), 637–641. https://doi.org/10.26719/2017.23.9.637

Rhee, S. W. (2020). Management of used personal protective equipment and wastes related to COVID-19 in South Korea. *Waste Management and Research*, *38*(8), 820–824. https://doi.org/10.1177/0734242X20933343

Riduwan. (2015). *Skala Pengukuran Variabel-Variabel Penelitian*.

Sangkham, S. (2020). Face mask and medical waste disposal during the novel COVID-19 pandemic in Asia. *Case Studies in Chemical and Environmental Engineering*, *2*(September), 100052. https://doi.org/10.1016/j.cscee.2020.100052

Scott, N., Saul, A., Spelman, T., Stoove, M., Pedrana, A., Saeri, A., Grundy, E., Smith, L., Toole, M., McIntyre, C. R., Crabb, B. S., & Hellard, M. (2021). The introduction of a mandatory mask policy was associated with significantly reduced COVID-19 cases in a major metropolitan city. *PLoS ONE*, *16*(7 July), 1–14. https://doi.org/10.1371/journal.pone.0253510

Shahmoradi, L., Safadari, R., & Jimma, W. (2017). Knowledge Management Implementation and the Tools Utilized in Healthcare for Evidence-Based Decision Making: A Systematic Review. *Ethiopian Journal of Health Sciences*, *27*(5), 541–558. https://doi.org/10.4314/ejhs.v27i5.13

Singh, N., Tang, Y., & Ogunseitan, O. A. (2020). Environmentally Sustainable Management of Used Personal Protective Equipment. *Environmental Science and Technology*, *54*(14), 8500–8502. https://doi.org/10.1021/acs.est.0c03022

Suryani, A. S. (2021). Limbah Medis Covid-19. *Pusat Penelitian BKSJ DPR*, *2021*, 1. https://berkas.dpr.go.id/puslit/files/isu_sepekan/Isu Sepekan---II-PUSLIT-Agustus-2021-236.pdf

Tobin, E. A., Ediagbonya, T. F., Asogun, D. A., & Oteri, A. J. (2013). Assessment of Healthcare Waste Management practices in Primary Health Care Facilities in a Lassa Fever Endemic Local Government Area of Edo state , Nigeria . *AFRIMEDIC Journal*, *4*(2), 16–23.

Wang, J., Chen, Z., Lang, X., Wang, S., Yang, L., Wu, X., Zhou, X., & Chen, Z. (2021). Quantitative evaluation of infectious health care wastes from numbers of confirmed, suspected and out-patients during COVID-19 pandemic: A case study of Wuhan. *Waste Management*, *126*, 323–330. https://doi.org/10.1016/j.wasman.2021.03.026

World Health Organization, (WHO). (2018). *Health-care waste*. Newsroom World Health Organization. https://www.who.int/news-room/fact-sheets/detail/health-care-waste

World Health Organization, (WHO). (2020). Cleaning and Disinfection of Environmental Surfaces in the context of COVID-19: Interim guidance. *Who*, *May*, 7.

Woromogo, S. H., Djeukang, G. G., Yagata Moussa, F. E., Saba Antaon, J. Saint, Kort, K. N., & Tebeu, P. M. (2020). Assessing Knowledge, Attitudes, and Practices of Healthcare Workers regarding Biomedical Waste Management at Biyem-Assi District Hospital, Yaounde: A Cross-Sectional Analytical Study. *Advances in Public Health*, *2020*. https://doi.org/10.1155/2020/2874064