Hazard Risk Identification from Used Masks

by Meithyra Melviana S

Submission date: 25-May-2021 01:38PM (UTC+0700)
Submission ID: 1593720176
File name: Manuskrip_TREPSEA_Meithyra.docx (116.06K)
Word count: 4157
Character count: 23152

Hazard Risk Identification from Used Masks

Meithyra Melviana Simatupang [1], Erna Veronika [2]

[1] Public Health Study Program, Faculty of Health Science, Universitas Respati Indonesia

[2] Environmental Health Study Program, Faculty of Health Science, Universitas Esa Unggul

* Corresponding Author: meithyra@urindo.ac.id

Abstract: COVID-19 has brought many changes of lifestyle to people around the world. The obligation to use masks as the efforts to prevent the transmission of COVID-19 is such an example. This policy led to the increase of masks using in the general population. In fact, some particular procedures of masks usage and used masks handling must be applied thus prevent negative impacts. Many of these guidelines not generally known. This study was carried out to determine the handling of used masks at the beginning of pandemic. The research data were obtained from 152 random respondents who voluntarily filled out online questionnaires. Participants came from a number of areas in Jabodetabek that implemented Large-Scale Social Restrictions (PSBB) and required to wearing masks. Most of the respondents kept masks that had been used before to reused them without washed them first. Disposal of used masks, both medical masks and cloth masks, was also showed poor sanitation for some participants. The waste generation from used surgical masks by whole community at the start of the pandemic is also quite alarming. Education on handling of used masks is important to be widely publicized to prevent potential hazards that can be caused, such as the transmission of respiratory infections and environmental contamination risk.

Keywords: COVID-19; used masks; masks disposal; masks waste; environmental contamination

Background

One of preventive efforts of COVID-19 transmission carried out by using personal protective equipment (PPE). During pandemic, face masks are the most common PPE used to combat this respiratory infection, in community or health care (1), (2). Mask needed to suppress transmission, however the use of masks alone is not sufficient for adequate protection (3). It is required face mask usage as well, combined with social distancing to increase infection prevention effectiveness (4).

World Health Organization declared COVID-19 as a pandemic in March 2020, afterwards COVID-19 Response Acceleration Task Force, as a representative of the Indonesian government, issued the policy for community to use masks while activity outside, along with providing wash hands facility, as an effort to prevent transmission of the virus. This regulation applies in all regions of Indonesia (5).

In Indonesia, available type of mask is cloth face mask, surgical masks, N95 mask, and facepiece respirator (6). The handling of used masks has not been widely known in public (2). Medical masks that are classified as medical waste must be disposed in a specific way to prevent disease transmission from used masks. As for the cloth masks user, they must apply a clean and healthy behavior, even if cloth mask can be washed and used repeatedly (6).

The Public Behavior Survey during the COVID-19 pandemic organized by the Statistics Indonesia (Badan Pusat Statistik) found that the level of respondents compliance for wearing masks in September 2020 was quite high (91.98%) (7). Although the conclusion of this survey is a good thing, there are issues that quite worrying regarding the handling of used masks, such as disease transmission or the problem of solid waste generated by disposable masks.

This research was conducted to observe behavior of used mask handling in the community, reuse of masks, as well as perceive habit single use masks disposing. The results of this study are expected to provide recommendation regarding the importance of increasing public understanding and awareness of the procedures for handling used masks to dispose waste safely. The goal is to reduce pathogens transmission from used masks or contamination of pollutants contained in masks to the environment.

Method

This descriptive research used a cross sectional design and conducted on residents in the Province of DKI Jakarta, Kota Bogor, Kabupaten Bogor, Kota Depok, Kota Bekasi, Kabupaten Bekasi, Kota Tangerang, Kabupaten Tangerang, and Kota Tangerang Selatan (Jabodatabek) which implemented Large-Scale Social Restrictions (PSBB). This policy obligated to wear a mask when doing activity outside. The sample in this study at least 15 years old, amounted to 152 people. Used mask handling behavior data in period of February to May 2020 were collected using online questionnaire which respondents filled out voluntary (purposive sampling technique). Working in hospitals, Puskesmas, laboratories, medical practices, and midwives are the exclusion criteria, considered the standard procedure of usage and handling of masks must be known. Data collection was held after passing the ethical test Number: 024 / SK.KEPK / UNR / V / 2020 issued by the Research and Community Service Institution (LPPM) of the Universitas Respati Indonesia.

Result and Discussion

Data collection was carried out in May 2020. Most of participants is woman (70,4%) and have completed high school education (98%). Respondent characteristics by age group attach in the following figure:

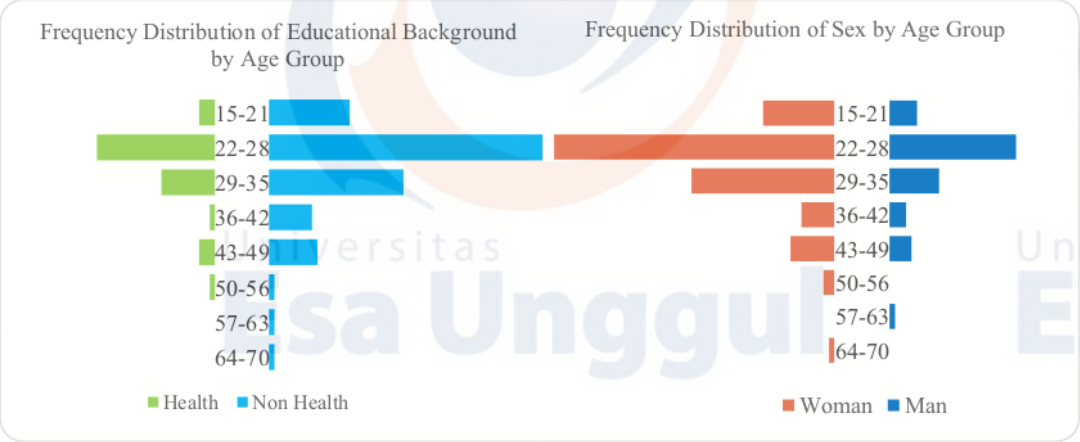

Figure 1. Frequency distribution of respondent characteristics by age group

At the beginning of the pandemic, scarcity of masks led to price spikes, people chose to use cloth masks as a protection against Covid-19 infection. It can be seen from the data based on the type of mask used, 93.4% (142/152) of participants had used cloth masks in the last 3 months, while the figure is lower at the respondents who had used surgical masks (74.3%; 113/152). Most of the respondents used both types, surgical masks and cloth masks (68.4%; 104/152), only 30.9% (47/152) of respondents used only one type.

Used Mask Handling

The handling of used masks could be concluded as less sanitary. Proven by only 39.5% (60/152) of participants who immediately threw away or washed used masks. The majority of respondents would reuse mask by store it (51.3%; 78/152) or actually hang masks around their necks temporarily (9.2%; 14/152). Among the respondents who stored the masks for reuse, some had folded the masks inward then rolled with mask straps (48.7%; 38/78). The rest did not fold the mask and put it on the surface of the object (28.2%; 22/78), or did not fold it and store it in various storage places such as in pockets, bags, drawers, or cupboards (23.1%; 18/78).

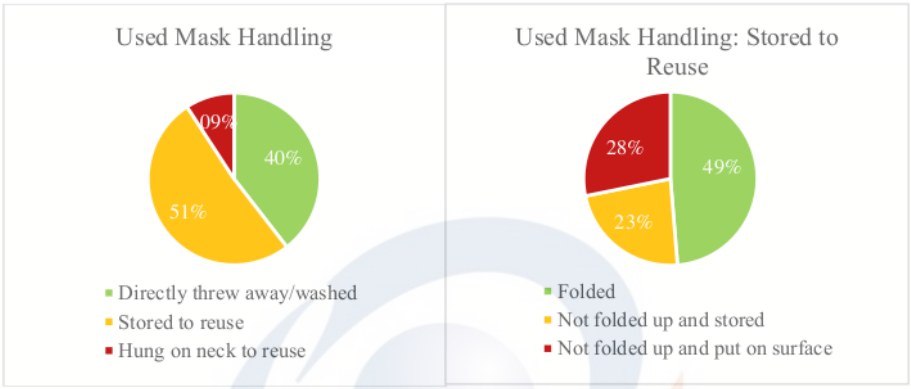

Figure 2. Respondent's used mask handling

Scalvenzi et al. mentioned that costs and the difficulty of obtaining masks during the pandemic affected the repeated use of masks. Even though some part of community did not know how to use, reuse and disposal masks properly. Between uses, the mask was put on wrist or stored in a trousers pocket. Only a small proportion who kept the folded masks in a specific plastic bag before reused. This non-sterile method was common and might increase the risk of mask contamination. Even the non-correctly method of reuse masks over a long period of time repeatedly can reduce filtration efficacy (2).

Long-term use or reuse of single-use surgical masks (with or without reprocessing) should only be considered in critical lack situations. Guidance should be provided to enable safest practice for reuse and prolonged mask usage. Prohibited to long-term use or reuse mask if soiled, damaged, moist, or hard to breathe through. Since the risk of contact transmission is lower than reuse, it's preferably to extended use. However, the evidence for the impact of prolonged use on masks is still limited (8).

However, N95 as face filtering respirator (FFR) can be decontaminated with ultraviolet germicidal irradiation, sterilization by steam, ethylene oxide and vaporous hydrogen peroxide. The equipment for most of the methods are available in hospitals. These methods can reduce the source of infection in N95, although the level of particle penetration efficiency varies depending on the procedure performed (9).

Contamination has to be prevented during storage by fold outer surface inward to decrease contact with inner surface, then kept in clean and sealable bag or box (8). Potential hazards sourced from masks that

were not treated sanitary when stored. Occur because the respondent has noted coughs or sneezes when wearing mask (64.5%; 98/152) or around people who cough/sneeze when wearing mask (65.1%; 99/152).

Table 1. Potential source of contamination

	Stored between Uses n (%)	Hung on Neck n (%)	Immediately Disposed/Washed n (%)
Coughs or sneezes during mask usage			
Ever	13 (13.2)	48 (49.0)	37 (37.8)
Never	1 (1.8)	30 (55.6)	23 (42.6)
Around people who cough/sneeze during mask usage			
Ever	12 (12.1)	50 (50.5)	37 (37.3)
Never	2 (3.8)	28 (52.8)	23 (43.4)

Coughing and sneezing expels droplets from the respiratory tract that can contain pathogen which can lead to infection (10). Droplet nuclei can be dispersed in the environment and suspended in indoor air, then inhaled by host and enter the respiratory system. In fact, SARS-CoV-2 also estimated to be able to transmitted via aerosols under certain circumstances (11).

A literature study summarized the resistance of pathogens that reported to have infectivity on the surface of various objects. The study concluded some types of viruses can survive up to several days on surfaces. For example, Influenza A-virus survived on surfaces made of plastic <2 hours-4 days and on cloth <2 hours-1 week; influenza B-virus lasted for 24 hours on plastic and 6-8 hours on cloth, whereas SARS -CoV-2 was found to stay on cloth for 1 day and in surgical masks for 4-7 days (12).
Nosocomial bacteria have longer persistence on any kind of inanimate surfaces. *Mycobacterium tuberculosis* was known to be able to survive for 1 day - 4 months on dry surfaces, while *Streptococcus pneumoniae* was able to survive for 1 - 20 days (13). These findings are the basis for the importance of sanitary and immediately handling of used masks before causing contamination or transmission of infection.

Cloth Mask

Most of the respondents soaked cloth masks (78.2%) and separated the used masks from other clothes (68.3%) before washed. Although dry clothes in the sun after washing is community behavior, some respondents did not expose their used masks to the sunlight (7.7%).

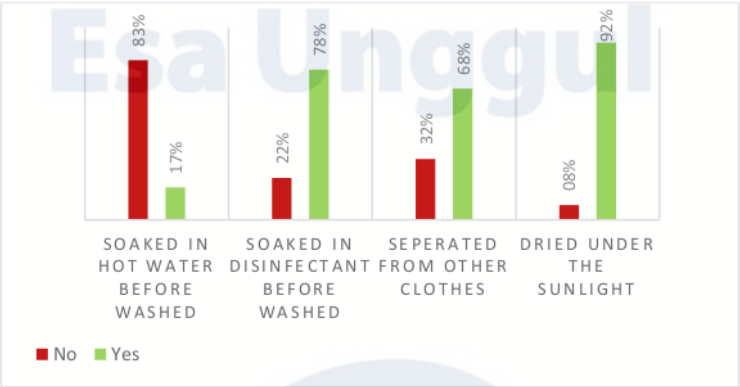

Figure 3. Washed methods of cloth masks

Cloth masks may have lower filtration abilities due to the larger average size of pores than surgical masks, allowing more particles and microorganisms to penetrate. However, the use of this type of face mask can also reduce the excretion of microorganisms, better then not using any masks (14). Therefore, the use of cloth masks is not recommended for health care workers (6).

The material of cloth face masks affected the filtering efficiency. Polyester is considered to be the best fabric material of mask (14). Face mask made of fabric is washable, has low density and permeable filter. The material able to transfer heat and moisture, so not easily dampen and deteriorate, make it more comfortable to use (15). Cloth masks should be wash in detergent, but not rub too much to prevent the pores of the fabric from widening. Cloth masks suggested not to be used for more than 4 hours to prevent the development of bacteria or fungi due to damped masks (6).

Used masks from patient are included in infectious waste. If the same treatment must be applied, it's recommended to placed used mask in certainly bag or container, then washing it in washing machine with hot water at 60-90 ºC and detergent. Masks can also be soaked in hot water and soap in certain containers if a washing machine is not available. After that, soak it in 0.05% chlorine for about 30 minutes. After rinsing with clean water, dry the mask in the sun till completely dry (16). According to those methods, in case to categorized the result as "sanitary" if 3 or more of the methods was practiced, most of respondents (92.3%) are concluded had sanitary handling of cloth mask.

Surgical Mask

Used surgical masks washed to reuse by 8% (9/113) of respondents. In the other hand, some others did not apply sanitary behavior in throwing away used medical masks too. Only a small proportion of used mask that was tore off, folded up, wrapped, and soaked in disinfectant before disposal. If categorized into the sanitary and non-sanitary handling groups (sanitary in case performs 3 or more of the procedures) then 98.2% (111/113) of respondents do not dispose surgical mask waste in a sanitary practice.

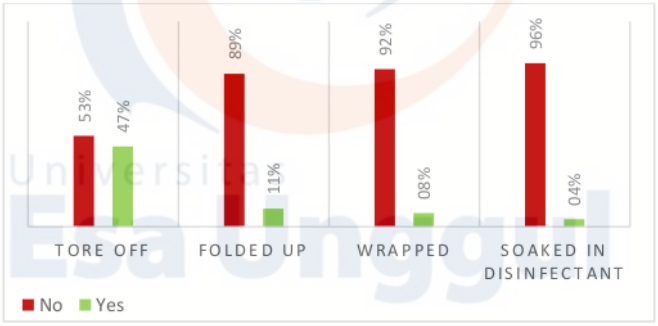

Figure 4. Disposal methods of surgical masks

Most of respondents disposed masks in public trash bins or trash containers at home (93.8%; 106/113), only 5.3% (6/113) in hazardous bin, some even threw masks in any place (0.9%; 1/113). Meanwhile, trash cans at home are in the form of plastic bags (39/113; 34,5%), trash bins without lid (35/113; 31,0%), or types that have lid (39/113; 34,5%).

Disposable surgical masks have become the standard for protection against the COVID-19 virus for reasons that are light, flexible, adequate filtering efficiency, affordable, comfortable to wear, easy of breathing. The bad thing is the significant increase in the number of mask wearers globally. This phenomenon is potential

environmental risk due to improper disposal (17). This medical mask has better filtration of bacteria and air permeability than cloth mask (18).

Several survey have found that surgical mask is the most frequent type of medical mask that use as personal protective equipment during COVID-19 pandemic (2) (18). This study reveals that the average respondent used 4 masks in a week. Considering the data submitted regarding behavior at the beginning of pandemic, February - May 2020, this figure possibly increase since masks are more widely produced and easy to obtain.
Individually, the number of waste masks generated per week depending on the duration of usage, type of mask, personal hygiene, or place visited. A survey of Selvaranjan et al. recorded that 25% of participants generate 5 masks waste a week, might be influenced by the lock down policy which decreased community activities outside, thus reducing the use of masks as well. Necessity of wearing masks around the world can significantly increase the amount of waste masks dumped into the environment (18).

Indonesia ranks 3rd in the largest number of daily mask users after China and India, based on observations in the Pandemic database on July 31, 2020. This total daily face mask use calculated based on 273,753,080 of population, 106,336 cases of COVID-19, 73% of urban population, face masks acceptance rate is 80%, and the estimate of 1 mask is needed by general population each day. This calculation estimates that 159,214,791 masks are disposed with a total weight of 420.03 tons/day (19).

The increase in disposable masks consumption contributes to a large amount of plastic waste and plastic particles to the environment. Disposable masks that are disposed in landfills, dumpsites, freshwater, oceans or littering in public places create new sources of microplastic fibers due to the degrade process or break down into smaller sizes (<5 mm) (20). Solid waste open dumping method causes environmental and health risks due to irresponsible disposal, release of various types of waste, particularly plastics. Some of these materials enter water bodies, contaminating rivers, lakes, right down to marine environments adding to the presence of plastics in aquatic medium (20) (21).

Surgical masks can be produce from different polymer materials as well, such as polypropylene, polyurethane, polyacrylonitrile, polystyrene, polycarbonate, polyethylene, or polyester, which have been used as raw materials for various plastic products. This single-use mask consists of three layers; the inner layer which is fibrous material, the middle layer (as filter part), and the outer layer (non-woven, waterproof and colored). The three layers of surgical face masks are confirmed to be plastic polymers (22). The major material to produce surgical masks is polypropylene, as a polymer for fabrication of surgical mask fiber (18), (17). Polypropylene as a polymeric material have been recognized as a significant source of macroplastics and microplastic contamination in the environment (23).

Disposable masks develop a new source of environmental pollution if not disposed with appropriate methods. Artificial weathering experiments were carried out to predict the release of surgical mask microfibers disposed to marine environment. The study found that a surgical mask that was stirred vigorously in seawater and exposed to UV for 180 hours released 173,000 fibers / day. These results were corroborated by observations on surgical masks found on an Italian beach that showed signature of morphological and chemical degradation similar to this experiment (17). Even though, the degradation process may depend on various environmental conditions such as temperature, humidity, and salinity (23).

Microplastics can be ingested by microorganisms, and even higher organisms in aquatic life, such as fish, which will have an impact on the food chain and cause health problems for humans (22). Urgent action is needed to limit the number of surgical masks disposed to marine ecosystems, namely a campaign to promote proper disposal and improve the management waste. An alternative biodegradable mask or contain materials that can be used for a long time should be provided (17).

The law regarding solid waste or Environmental Health Standards for Hospitals has drawbacks in its practical application. These policies do not cover the entire region, occasionally. Indeed, it tends to be applied only to urban areas because of the limited infrastructure in rural areas (24).

Several local governments in Indonesia stated directly burn the waste each day or collected and, in Padang, transported to a cement factory incinerator for burning process is how they treat and dispose of healthcare waste source from households or quarantine locations (24).

Some countries in Asia have not implemented appropriate infectious waste management methods. Another problem is lack of medical waste containers that impact the potential contamination from medical waste, infection disease transmission or environmental pollution, to general people. Therefore, an appropriate medical waste management strategy (standardization, procedures, guidelines, and strict implementation) is necessary within hospital, household, and public places, in line with the increase of mask disposal in pandemic period, particularly (19).

Medical waste of household collection method has some consideration. The study Nowakowski et al. showed the additional costs required to change the collection method, route, and schedule. Special vehicle for medical waste need to be used for collection, which is difficult to provide. Specific trash quarantine area must also be prepared. Medical waste products produced by households have to be predictable, along with efforts to increase public awareness to separate medical waste from other waste prior to garbage collection (25).

All of PPE (used masks, used gloves, and personal clothes related to COVID-19 infection) in households must be incinerated or landfilled. It's recommended to stored used masks in plastic bag or another container, to separate from another household waste, as this medical waste must be separated from other types of waste before being taken to the incinerator facility, without recycling process (26). Although the research that have tried several strategies to recycle single-use masks by conducting thermal, morphological, and chemical analysis occur, this experiment still requires other investigations (27).

The proper management of medical waste is an effort to prevent environmental pollution and disease transmission, incineration is either of the potential methods. Incineration is able to destroy pathogenic bacteria and reduce up to 99.95% volume of waste. The disadvantages of this process are ash residue and waste, contained heavy metals, which require further process so that it does not cause health impacts and contaminate the environment (28).

The number of incinerator facilities can be categorized as insufficient when compared to medical waste generation, within hospitals and households. Out of 646 hospitals that treat COVID-19 patients, only 20 have their own licensed incinerators in general, 110 incinerators with licenses in regular hospitals, and 9 incinerators located in urban areas. Some of the incinerators were in a damaged condition or did not have license from the Ministry of Environment and Forestry (24).

Conclusion

The reuse of masks indicated a non-sterile method, since respondents did not store used masks folded and stored in specific closed containers, such as plastic bags, to prevent contamination and avoid pathogens from masks to infect people or other objects. The method of cleaning cloth masks was appropriate, considered the habits of respondents who mostly washed cloth masks with disinfectants, separated from other clothes, then dried under the sun. Disposal of used masks need more attention, as becoming the potential environmental pollutants and sources of infection.

Funding

This research was funded by research grant from the Research and Community Service Institution (LPPM) of the Universitas Respati Indonesia.

Authors' Contributions

MMS compiled the structure, data, and result of this study. EV and MMS searched and selected reference for discussion section. MMS arranged the draft of manuscript and both authors collaborated to accomplish the final manuscript.

Referensi

1. Chughtai AA, Khan W. Use of Personal Protective Equipment to Protect Against Respiratory Infections in Pakistan: A Systematic Review. J Infect Public Health. 2019;12(4):522–7.
2. Scalvenzi M, Villani A, Ruggiero A. Community Knowledge About the Use, Reuse, Disinfection and Disposal of Masks and Filtering Facepiece Respirators: Results of a Study Conducted in a Dermatology Clinic at the University of Naples in Italy. J Community Health. 2020 Nov;1–8.
3. World Health Organization. Updated Guidance on the Use of Masks (COVID-19) Update No. 30. 2020.
4. Li T, Liu Y, Li M, Qian X, Dai SY. Mask or No Mask for COVID-19: A Public Health and Market Study. PLoS One [Internet]. 2020 Aug 14;15(8):e0237691. Available from: https://doi.org/10.1371/journal.pone.0237691
5. Kementerian Kesehatan Republik Indonesia. Surat Edaran Nomor HK.02.02/I/385/2020 Tentang Penggunaan Masker dan Penyediaan Sarana Cuci Tangan Pakai Sabun (CTPS) Untuk Mencegah Penularan Coronavirus Desease 19 (COVID-19). 2020.
6. Yudhastuti R. The Use of Masks during the Pandemic Period in Indonesian People. Kesmas J Kesehat Masy Nas (National Public Heal Journal) [Internet]. 2020;(Special Issue 1):32–6. Available from: https://journal.fkm.ui.ac.id/kesmas/article/view/3945
7. Badan Pusat Statistik. Perilaku Masyarakat di Masa Pandemi COVID-19. 2020.
8. EC T, Y C, C B, S S, M S, XS C, et al. Extended Use or Re-use of Single-use Surgical Masks and Filtering Facepiece Respirators: A rapid Evidence Review. Infect Control Hosp Epidemiol. 2021;42(1):75–83.
9. Polkinghorne A, Branley J. Evidence for Decontamination of Single-use Filtering Facepiece Respirators. J Hosp Infect. 2020 Aug;105(4):663–9.
10. Bahl P, de Silva CM, Chughtai AA, MacIntyre CR, Doolan C. An Experimental Framework to Capture the Flow Dynamics of Droplets Expelled by a Sneeze. Exp Fluids. 2020;61(176).
11. Dhand R, Li J. Coughs and Sneezes: Their Role in Transmission of Respiratory Viral Infections, Including SARS-CoV-2. Am J Respir Crit Care Med [Internet]. 2020 Jun 16;202(5):651–9. Available from: https://doi.org/10.1164/rccm.202004-1263PP

12. Wißmann JE, Kirchhoff L, Brüggemann Y, Todt D, Steinmann J, Steinmann E. Persistence of Pathogens on Inanimate Surfaces: A Narrative Review. Microorganisms. 2021 Feb;9(2).

13. Kramer A, Schwebke I, Kampf G. How Long do Nosocomial Pathogens Persist on Inanimate Surfaces? A Systematic Review. BMC Infect Dis. 2006 Feb 1;6:130.

14. Rizki SA, Kurniawan A. Efficacy of Cloth Face Mask in Reducing COVID-19 Transmission: A Literature Review. Kesmas J Kesehat Masy Nas (National Public Heal Journal). 2020;43–48(Special Issue 1).

15. Lee K-P, Yip J, Kan C-W, Chiou J-C, Yung K-F. Reusable Face Masks as Alternative for Disposable Medical Masks: Factors that Affect their Wear-Comfort. Vol. 17, International Journal of Environmental Research and Public Health . 2020.

16. World Health Organization. Water, Sanitation, Hygiene, and Waste Management for the COVID-19 Virus. 2020.

17. Saliu F, Veronelli M, Raguso C, Barana D, Galli P, Lasagni M. The release process of microfibers: from surgical face masks into the marine environment. Environ Adv [Internet]. 2021;4:100042. Available from: https://www.sciencedirect.com/science/article/pii/S2666765721000132

18. Selvaranjan K, Navaratnam S, Rajeev P, Ravintherakumaran N. Environmental Challenges Induced by Extensive Use of Face Masks During COVID-19: A Review and Potential Solutions. Environ Challenges [Internet]. 2021;3. Available from: https://www.sciencedirect.com/science/article/pii/S2667010021000184

19. Sangkham S. Face Mask and Medical Waste Disposal During the Novel COVID-19 Pandemic in Asia. Case Stud Chem Environ Eng. 2020;

20. Fadare OO, Okoffo ED. Covid-19 Face Masks: A Potential Source of Microplastic Fibers in the Environment. Sci Total Environ [Internet]. 2020/06/16. 2020 Oct 1;737:140279. Available from: https://pubmed.ncbi.nlm.nih.gov/32563114

21. Ferronato N, Torretta V. Waste Mismanagement in Developing Countries: A Review of Global Issues. Vol. 16, International Journal of Environmental Research and Public Health . 2019.

22. Aragaw TA. Surgical face masks as a potential source for microplastic pollution in the COVID-19 scenario. Mar Pollut Bull. 2020 Oct 25;159:111517.

23. Schmidt N, Thibault D, Galgani F, Paluselli A, Sempéré R. Occurrence of Microplastics in Surface Waters of the Gulf of Lion (NW Mediterranean Sea). Prog Oceanogr [Internet]. 2018;163:214–20. Available from: https://www.sciencedirect.com/science/article/pii/S0079661117300484

24. UNEP (United Nation Environment Programme). Waste Management during the COVID-19 Pandemic [Internet]. 2020. Available from: http://wedocs.unep.org/bitstream/handle/20.500.11822/33416/WMC-19.pdf?%0Asequence=1&isAllowed=y

25. Nowakowski P, Kuśnierz S, Sosna P, Mauer J, Maj D. Disposal of Personal Protective Equipment during the COVID-19 Pandemic Is a Challenge for Waste Collection Companies and Society: A Case Study in Poland. Vol. 9, Resources . 2020.

26. Rhee S-W. Management of Used Personal Protective Equipment and Wastes Related to COVID-19 in South Korea. Waste Manag Res [Internet]. 2020 Jun 10;38(8):820–4. Available from:

https://doi.org/10.1177/0734242X20933343

27. Battegazzore D, Cravero F, Frache A. Is it Possible to Mechanical Recycle the Materials of the Disposable Filtering Masks? Polymers (Basel) [Internet]. 2020;12(11). Available from: https://www.mdpi.com/2073-4360/12/11/2726

28. Sutrisno H, Meilasari F. Review: Medical Waste Management for COVID19. J Kesehat Lingkung. 2020;12(Special Issue No. 1):104–20.

Hazard Risk Identification from Used Masks

ORIGINALITY REPORT

5%	1%	3%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	wedocs.unep.org Internet Source	1%
2	Kajanan Selvaranjan, Satheeskumar Navaratnam, Pathmanathan Rajeev, Nishanthan Ravintherakumaran. "Environmental challenges induced by extensive use of face masks during COVID-19: A review and potential solutions", Environmental Challenges, 2021 Publication	1%
3	Elaine Toomey, Yvonne Conway, Christopher Burton, Simon Smith et al. "Extended use or re-use of single-use surgical masks and filtering facepiece respirators: A rapid evidence review", Cold Spring Harbor Laboratory, 2020 Publication	1%
4	Tadele Assefa Aragaw. "Surgical face masks as a potential source for microplastic pollution in the COVID-19 scenario", Marine Pollution Bulletin, 2020 Publication	1%

5 D R Darman, F C Wibowo, A Suhandi, W Setiawan, H Abizar, S Nurhaji, L Nulhakim, A Istiandaru. "Virtual media simulation technology on mathematical representation of sound waves", Journal of Physics: Conference Series, 2019 — 1%

Publication

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		