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The Use of Masks, as an Effective Method in Preventing the Transmission of the COVID-19, During Pandemic and the New Normal Era: A Review

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Review Article

The Use of Masks, as an Effective Method in Preventing the Transmission of the COVID-19, During Pandemic and the New Normal Era: A Review

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ABSTRACT

The transmission of Coronavirus 2019 infection also known as COVID-19, occurs when in direct contact, i.e., within one meter, with an infected person through respiratory droplets, which are produced from coughing, sneezing, or nasal and mouth fluids. Therefore, this study aims to explore the use of face mask, as a method of preventing COVID-19 transmission. The use of face masks is an important and comprehensive part of the effort to prevent the COVID-19 transmission. It is used by healthy people as protection when in contact those infected or as a control, to prevent further transmission. Also, WHO recommends using masks to protect medical workers during routine care for patients, especially those confirmed with the virus. Furthermore, there are several types of masks, such as cloth, medical and respirator, also known as N-95 masks. This brand, which are available in the US as N95 and in the UK as FFP ('filtering face piece'), are used to prevent the entry of small particles in the air that produce aerosols. The use of a respirator mask is a priority, and when the availability in a health care center is limited, then medical types are to be used as alternative.

Keywords: mask, prevention, Covid-19

INTRODUCTION

The Novel Coronavirus 2019 infection, also known as COVID-19, is a new and mysterious disease, which first showed symptoms at the end of December 2019 and originated from Wuhan, China. This disease was considered as a type of pneumonia when it was newly discovered, and the cause was still unknown. However, on January 8, 2020, China's Disease Control and Prevention (CDC China) announced that COVID-19 was a new and unprecedented type of coronavirus. This virus development is increasingly widespread, therefore on January 31, 2020, the World Health Organization (WHO) announced it, as a public health emergency and a high risk for international concern. Globally, the spread is very rapid, to the extent that on March 11 2020, WHO declared Covid-19 as a pandemic after the virus had spread to over 114

countries (C. Pramana et al., 2020; WHO, 2020a, 2020b).

Moreover, since the COVID-19 virus transmission is very fast, preventive measures are important. And the best way to achieve this, is to keep a distance of at least 2 meters from other people, when possible. Also, covering the mouth and nose with a mask when around other people to reduce the risk of spread, either through close contact or through airborne transmission. Prevention is also accomplished by washing the hands frequently with soap and water, and when not available, a hand sanitizer that contains at least 60% alcohol should be used. Furthermore, avoiding crowded room and making sure the room is well ventilated, in general, both outdoors and indoors with good ventilation reduces the risk of exposure to infectious respiratory droplets. Subsequently, routinely cleaning and disinfecting

frequently touched surfaces, to stop the spread of Covid-19 in the home (CDC, 2020b).

The high risk of transmission and the rapid disease progression increases the mortality rate. The spread through respiratory droplets occurs, when within 1 meter of an infected person, who produces these droplets, through coughing, sneezing, nasal and mouth fluids. Furthermore, it is also transmitted through contact with the vomit of infected people (Ong et al., 2020). Covid-19 transmission occurs through direct contact with an infected person, or indirectly, when in contact with surfaces in the immediate environment or even with objects that have been used by an infected person such as a thermometer and stethoscope. Many studies explain transmission from people without symptoms, such as in China, there were 63 people who were infected with Covid-19 without any symptoms (Wang et al., 2020).

WHO urges the public to use masks in order to prevent Covid-19 transmission as a fairly effective preventive effort (Eikenberry et al., 2020) Masks are recommended as an effort to limit a disease's transmission that has not been typically detected, including in Covid-19 (Cheng et al., 2020). al., 2020; T. Greenhalgh et al., 2020; Li et al., 2020). The use of masks is part of a comprehensive effort to prevent the spread of certain respiratory viruses. Furthermore, it is also used for healthy people as protection when in contact with an infected person to prevent transmission. However, the use of masks is certainly not enough to break the chain of Covid-19 transmission, there is still a need for people to be obedient to healthy living behaviors, such as diligently washing hands, exercising physical and social distancing, isolating, quarantining, taking other precautions, by carrying out infection control measures (CDC, 2020a).

REVIEW

1. RECOMMENDATIONS ON THE USE OF MASK

The use of masks was recommended by WHO, the United States Center for Disease Control and Prevention (CDC) and the European Center for Disease Prevention and Control (ECDC), is principally for the prevention of Covid-19 transmission. Although, prevention is also accomplished by maintaining physical and social distancing, as well as frequently washing the hands with soap (CDC, 2020b; Nanotkar et al., 2020; WHO, 2020a). Masks were originally designed to be used to prevent the spread of viruses between the wearer and the people around. Moreover, it also serves to protect against infections transmitted by droplets, blood splashes

and body fluids, which enters the body system through vulnerable mucosal surfaces, when within a certain distance (usually less than 1 meter), and these are contacted through breathing, face-to-face conversations, coughing and sneezing. Droplets also form aerosols that are able to spread over a wider distance (more than 1 meter) with the air flow and last longer in the surrounding environment. There was a confirmed case that a 2-hour bus ride, caused the infection in 7 people, and there was no direct contact between them, which it implies the possibility of aerosol transmission. It was also found that the Covid-19 virus survive in aerosols for 3 hours and more stable on plastic surfaces (72 hours), stainless steel (48 hours), copper (4 hours), and cardboard (24 hours) (Wang et al., 2020).

2. VARIOUS MASK TYPES FOR THE PREVENTION OF COVID-19 TRANSMISSION

2.1. Cloth Mask for the Prevention of COVID-19 Transmission

In the general public, masks made of cloth are also used to prevent the transmission of COVID-19 disease, although this material is less effective to protect against aerosol transmission. Cloth masks are washable and have the possibility of being used multiple times. Therefore, it serves as an alternative solution, when medical mask is unavailable (Mahase, 2020). MacIntyre's research with the RCT method on the use of cloth masks for health workers shows that they are not recommendable for health workers, especially in high-risk situations. Laboratory tests have shown, that the penetration of particles through cloth masks is very high (97%) compared to medical masks (44%). Previous studies have also revealed that the test results on various types of cloth masks (made of cotton, gauze and other fibers) in vitro showed lower filtration capacities compared to disposable masks (MacIntyre et al., 2015).

2.2. Surgical Mask for the Prevention of COVID-19 Transmission

According to WHO (2020), surgical masks are also known as medical masks, has been proven to be able to stop transmission of influenza by preventing the spread of infectious droplets from an infected person to healthy people in the surrounding (Chandini Raina MacIntyre et al., 2016).

Furthermore, surgical masks are designed to protect the wearer from transmitting microorganisms, and from droplets. However, it does not prevent the inhalation of small air particles (Zhiqing et al., 2018). Moreover, it is designed to prevent droplet transmission from health workers to surgical patients, and also

infections from being transmitted by patients to health workers through blood splashes during health care (Chan & Yuen, 2020).

Surgical masks are less effective at filtering SARS-CoV-2 infection during coughing by infected patients, because the size and concentration of this virus in aerosols, that are generated during coughing is unknown (Bae et al., 2020).

Moreover, there are previous evidences that these masks effectively screen the influenza virus (Johnson et al., 2009). People recommended to use surgical masks include health workers, laboratory workers, people with respiratory symptoms, caregivers for COVID-19 positive patients at home and hospital cleaners. (WHO, 2020a)



Fig.1: A. Flat or natural surgical face mask B. Tie-On Surgical Mask 1818 blue

2.3. N95 Mask for the Prevention of COVID-19 Transmission

N95 masks have long been used to prevent infectious transmission, involving acute respiratory diseases. Health workers who provide services prone to aerosol transmission, are advised to use a respirator mask, such as an N95 (Poston et al., 2020). This mask is used to prevent users from inhaling small airborne particles and is designed to fit snugly on the face (Zhiqing et al., 2018).

WHO recommends the use of medical masks in low-risk situations, and N95 respirators for high-

risk, however, the Centers for Disease Control and Prevention (CDC) recommends using respirators in both low-risk and high-risk situations (Long et al., 2020). During a pandemic, the principle of caution should be considered, especially for health workers, therefore, the use of a respirator is a priority in the health care setting, and when this is limited, then medical masks should be used. The masks and respirators should only be used once, because reusing a mask, increases the risk of infection for the user (Li et al., 2020).



Fig.2: A) N95 Respirator without exhalation valve; b) N95 Respirator flat fold without cool flow exhalation valve C) N95 Respirator with exhalation valve and D) N95 Respirator flat fold with cool flow exhalation valve. (N95 Mask, n.d.)

KN95 Mask for the Prevention of COVID-19 Transmission

The KN95 mask is almost the same as the N95, since they are both respirators, N95 is commonly used in the USA while KN95 is mostly used in China. The number 95 means that it is able to filter 95% particles with a size of 0.3 μm (Bhanu Neupane and Basant Giri, n.d.). Meanwhile, the letter N means that it does not survive in oil, Viruses consist of low lipid (fats and oils) in small viral particles, therefore this does not affect the filtering performance of N series respirators. They are recommended for protection against respiratory viruses, For example, N95 or KN95 respirators have been recommended for MERS - CoV, SARS - CoV - 1 and SARS - CoV - 2. (CDC, 2020c).

Respirator-type masks are independently certified by 2 main entities: the European Committee for Standardization (EN) and the National Institute for Occupational Safety and Health (NIOSH). Both entities guarantee a high filtering ability, up to particles with diameter of 0.3 microns. Respirator masks have multiple layers of polypropylene and an electrostatic charge, therefore providing adequate protection in both directions. This means that, the mask is able to filter air in and out, as well as being resistant to sprays, blood splashes, and other body fluids. The use of the KN95 respirator from China has a filtration particle capacity of 94-95% with 4 overlapping layers, which are joined together to avoid the release of aerosol particles that sometimes contain viruses. These mask have a similar function to the NIOSH certified N series. (Arellano-Cotrina et al., 2020).



Fig.3: KN95 face mask (KN95 Face Masks On Sale, n.d.)

3. DISCUSSION

The use of masks in public areas during the Covid-19 pandemic has been under-emphasized

in several countries. Aiello et. al. conducted a randomized intervention trial on certain university boarders, during the influenza season in 2006-2007, a 35% - 51% reduction was observed in the mask-use and hand hygiene group, compared to the no mask group. Therefore, the use of masks and hand hygiene is advised especially during a pandemic, and the vaccine is not yet available. The effectiveness of using masks was found to be associated with, reducing the risk of clinical infection, by preventing pathogens inhalation and reducing hand-to-face contact (Wang et al., 2020), therefore, WHO recommended the use of masks for health workers and the public.

Personal protective equipment is a set of tools used by workers to protect part or all of the body from the potential or danger of work accidents. According to Occupational Health and Safety (K3), Personal Protective Equipment (PPE) is not able to eliminate hazards, however it is useful for the reduction of the severity level of the hazard impact. One example of PPE for breathing is a mask, which serves as a protective breathing device from dust or larger particles that enter the respiratory system. These organs especially the lungs, should be protected when the air is polluted or there is the possibility of a lack of oxygen in the air (Pratiwi, 2020).

Prevention is carried out by using appropriate PPE, always keeping hands and breathing clean. It is also important to dispose PPE in a suitable waste container and to clean hands before and after wearing PPE. All members of the rapid response team are to be trained in hand hygiene as well as how to wear and remove PPE to avoid personal contamination.

Health workers should be able to provide information to the public, when visiting patient rooms, giving clear instructions on how to wear and remove PPE, and hand hygiene before and after that. Currently, the use of masks by the general public to limit the COVID-19 spread is still controversial, although the government has increasingly recommended it, however the reason for this intervention is not well understood by the public.

WHO states that masks are effective when used together with proper hand hygiene and together with the knowledge of it proper use and disposal. Furthermore, it is needed by health workers, people in public places, with symptoms of COVID-19, people living in cramped conditions, transportation, and vulnerable populations (WHO, 2020a). In contrast to SARS-CoV-1 and MERS-CoV, SARS-CoV-2 tends to infect people during incubation, i.e., asymptomatic patients also have the potential to infect. For example, if only the

symptomatic cases were wearing masks, leaving out the asymptomatic cases, a spike in the transmission rate is observed, because people have been infected before realizing that the asymptomatics carry the virus. (Wang et al., 2020).

Covid-19 transmission through these cases being in a higher proportion is a difficult problem. In some areas, cases related to cluster transmission reaches 50% - 80% of the total cases. Currently, COVID-19 cluster cases have been reported in relatively limited or accumulated places such as shopping centers, offices, buses, cruise ships, prisons, hospitals and nursing homes. Research conducted by Ong et al., 2020 observed that the detection results of samples collected in hospital outlets were positive, indicating that SARS-CoV-2 pollute the environment through patient droplets. (Chia et al., 2020; Ong et al., 2020).

Eikenberry et al., 2020 showed that the use of masks by the general public has a high potential in limiting the Covid-19 transmission among the community. The benefits across society tend to be greatest when face masks are used in conjunction with other non-pharmaceutical practices (such as distancing in public places), as well as when adherence is high.

The use of masks has been made mandatory in several states, such as Rio de Janeiro and Sao Paulo, Brazil. Brazil is the second worst-hit country in the world regarding the COVID-19 pandemic, since the Brazilian president did not initially order wearing masks in public. As of 12 April, 2020 adherence to using masks in Brazil was 56%, however, with many cases of death, the use of masks became mandatory starting from August 1, 2020. The South African Ministry of Health recommends that the general public wear cloth masks when going to public places on April 10. From 8 - 24 April 2020, 85.6% of South Africans adhered to this instruction (Shanay Rab, Mohd vaid, Abid HaleemVaishya, 2020).

The use of masks as a method of reducing COVID-19 transmission outside of health services has the effect of preventing infection in wearers, and hindering transmission by individuals with sub-clinical infections. This simple model shows that the widespread use of masks is a determinant in suppressing the COVID-19 epidemic in an area (Fisman et al., 2020). Most European countries have responded to the threat of COVID-19 by implementing preventive measures.

Research by (Ventura et al., 2020) on emergency room workers in 50 US states, found that 31% of emergency service workers had to wear the same mask for 1 week or more, because the limited access to N95 respirators and 1/3 of the surveyed participants were not sure when a COVID-19

patient was contagious even though they still wore a mask. The use of masks by healthy populations in Hong Kong Special Administrative Region (HKSAR) communities to reduce the risk of the respiratory virus transmission is controversial. Wearing masks contribute to COVID-19 control by reducing the amount of infected saliva emissions and respiratory droplets from individuals with subclinical or mild COVID-19 (Cheng et al., 2020).

Some circumstantial evidence of the mask benefits is emerging for example, a longitudinal ecological study from Hong Kong, conducted before and after the introduction of various non-pharmaceutical measures, which included masks for the public. The result found that this prevents a pandemic (statistically significant change for the combined use of masks and distancing measures, though the effects of masks was not separated).

There is also analogical evidence of the viruses behavior with the same chemical composition. Given these indirect findings and the seriousness of the outbreak, there is a moral argument that people should be given the opportunity to change their behavior, in line with the precautionary principle, even when direct and experimental evidence for benefit is not yet certain. (Greenhalgh et al., 2020).

The use of masks is an effort made to minimize the COVID-19 transmission and this step became an obligation stipulated by the Indonesian government on April 5, 2020. The standard masks used are N95 and surgical masks, however, since the increase in cases, there has been a scarcity of medical masks on the market. To fulfill the need for masks, SNI standard masks (N95 and surgical masks) are used by medical personnel, while the general public is encouraged to use cloth masks. The Community Empowerment Agency (LPM) partner of Anyar Village, North Lombok Regency, as a part of the "Independent Beginner Group", conducted a training with the aim to motivate and train the "Independent Beginner Group" skills in making cloth masks. From the training, 1000 masks were obtained and then distributed to the public, to increase awareness and compliance of using masks in public places, as an effort to curb the Covid-19 transmission (Sucika Armiani, Siti Rabiatul Fajri, Akhmad Sukri, 2020).

A survey in the communities of Muna Regency, Southeast Sulawesi, showed that, 249 respondents claimed to always use masks when going out of the house and most of them used medical masks (76.3%), cloth masks (22.5%) and N95 masks (1.2%). Even though cloth masks are not as effective as surgical masks, however it is a good alternative, when dealing with scarcity of surgical

masks, also it serves as a transmission barrier during a pandemic than not wearing a mask at all. (Pratiwi, 2020).

Research conducted by Cipta Pramana et al., on Knowledge, Attitudes, and Practices of Using Masks towards 501 respondents. Those who used 329 (65.7%) participants who used cloth masks 329 (65.7%), surgical masks 112 (22.4%) and used both types of masks (cloth and surgical) 60 (12%). Most of the public's level of knowledge about masks and their use during the COVID-19 pandemic is very good. Knowledge, attitudes and practices of using masks by the general public are very effective in preventing the spread of COVID-19 infection. A positive attitude and community discipline in using cloth masks and surgical masks helps to deal with disease transmission. Therefore, an awareness campaign for the use of appropriate face masks is needed to prevent infection transmission and overcome the COVID-19 pandemic. (Cipta Pramana et al., 2020)

CONCLUSION

The effectiveness of virus prevention depends on compliance with the usage and the type of masks used. The N95 or KN95 respirators are very effective in the protection against the COVID-19 virus. However, In vitro studies have showed that surgical masks have less protective effectiveness than the respirator masks. Cloth masks are the least effective when compared to other types, therefore it is not recommended for healthcare workers in hospitals. Cloth masks are to be used by the general public in public spaces, when surgical masks are in limited supply. However, when in the hospital, it is advisable to use a surgical mask, because it prevents the influenza infection or SARS-CoV-2 from being transmitted through droplets or aerosol particles. Although proven by several studies, the use of surgical masks is less effective in preventing viral infections transmission mediated by aerosols.

For health workers in direct contact with COVID-19 patients, it is recommended to use N95 or KN95 respirator masks because of the high effectiveness in preventing SARS-CoV-2 transmission. However, it is known to cause discomfort, which results in shortness of breath and a psychological burden for the user when used for a long time. Selecting the right type and knowing how to use the masks appropriately, are one of the effective methods to prevent SARS-CoV-2 infection transmission.

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CONFLICT OF INTEREST

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