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Article

DIFFERENT TYPE OF FACE MASKS AND THEIR PROTECTION AGAINST COVID-19

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Abstract— **Coronavirus diseases 2019 (COVID-19) have become a major pandemic and a gruesome burden worldwide. The infection is easily spread through respiratory droplets from infected individuals during coughing, sneezing or talking. People in their vicinity, within 1-meter distance, can get infected by breathing contaminated air and touching the contaminated surfaces or hands. WHO encouraged the use of facemasks in the community, together with regular hand washing with soap and social distancing to prevent the transmission of COVID-19. However, with the many types of facemasks available in the markets, it remains debatable as to which ones are the most effective in curbing the transmission of the disease. This paper reviews available literature on the types of face masks, their effectiveness in filtering droplets and the advantages and disadvantages of using disposable and fabric masks. As found out, the most superior mask is the N95 type, with a filtration rate of 95% of 0.3 micron particles. However, for respiratory droplets, which particle size is from 5 to 10 microns, a surgical mask is adequate with a filtration rate of 90% of 3 micron particles. Due to disposal and cost concerns, surgical masks are recommended to be used only by health care workers. Three-layer cotton masks offer almost the same filtration rate as surgical mask and are recommended by WHO to be used in the community to prevent the transmission of COVID-19. Surgical masks and 3-layered cotton masks are effective in preventing droplet transmission from infected to healthy individuals. To prevent COVID-19, the public should be reminded continuously on the proper use and disposal of masks, regular hand washing and physical distancing.**

Keywords— **COVID 19; surgical mask; fabric mask; cotton mask; facemask**

I. INTRODUCTION

Coronavirus diseases 2019 (COVID-19), first recognised in Wuhan China, is caused by 'Severe Acute Respiratory Syndrome Coronavirus 2' (SARS-CoV-2) [1]. The virus is found primarily in the nose and throat [2] that can be expelled in respiratory droplets when talking, coughing and sneezing. People within 1 to 2 meters from infected individuals may acquire the disease through breathing contaminated air and touching the contaminated surfaces or hands.

In the initial phase of the COVID-19 pandemic, the World Health Organization (WHO) recommended regular hand washing with soap and social distancing as the main preventive measures, while the use of mask was only recommended for those with symptoms [3]. Later, there was a shift of paradigm from not recommending to promoting the use of mask in the public [4]. This was due to the fact that, pre-symptomatic and asymptomatic patients had high viral loads before symptoms appeared, if any, thus capable of transmitting the virus in the community [5]. The main purpose of wearing facemask is for source control, which is to reduce the chance of transmission of respiratory droplets from infected to healthy individuals.

In certain countries including Malaysia, mask wearing in the public and crowded areas is mandatory [6]. There are many types of masks available in the market, including 3-ply surgical masks, a wide range of fabric masks as well as face shields. According to the Portuguese National Authority for Medication and Health Products, a mask for community use should be able to filter >70% of 3 um particles with air permeability of >8 L/min [7]. This paper reviews available literature on the types of face masks, their effectiveness in filtering droplets, and advantages and disadvantages of using disposable and fabric masks.

II SURGICAL MASK

Surgical masks consist of 3 layers with water absorbable inner layer, water resistant outer layer and a layer of filter in the middle. The main purpose of using surgical masks is to protect the user from droplet infection and splashes from blood and body fluids. A study showed that, various types and brands of surgical masks had significantly lower fitted filtration efficiencies (FFEs) than the N95 respirators, and their performance was largely dependent on the tightness of the mask (contact between the mask and skin). Interestingly, the

study also found that, FFE of mask with ties outperformed those with ear loops [8]. Even though N95 mask performs better, it is not encouraged to be used by the public during the COVID-19 pandemic. Respiratory droplets range from 5 to 10 microns in size, thus 3-ply surgical masks are adequate, except during aerosol-generating procedures. An earlier study among nurses working in high risk areas revealed that, the use of a surgical mask compared to an N95 respirator, resulted in non-inferior rates of laboratory-confirmed influenza [9].

Surgical masks are not intended to be used more than once and their extensive use may lead to a shortage in supply. Thus, WHO recommends their use only among healthcare workers and those at risk of severe diseases, such as diabetes and chronic lung disease [4]. In addition, the increase in the consumption of surgical mask across the world is a potential source of microplastics pollution [10]. When a country makes mask-wearing compulsory in the public, the financial burden caused to the underprivileged should also be looked into.

III FABRIC MASK

WHO recommends the use of fabric masks among public, except for those at risk of severe diseases [4]. However, most people worry about the effectiveness of fabric masks in filtering contaminated droplets or air. There are many types of fabric masks in the markets, depending on type of cloth, mask design and number of layers. The filtration effectiveness of fabric masks is generally lower than that of surgical masks, however, it may provide some protection, if it is well-designed and used properly [11]. A study on a total of 11 household fabric masks showed that, two to three layers of highly permeable cloth, such as T-shirt cloth, may block droplets with an efficiency similar to that of surgical masks [12]. This finding was in agreement with that in another study involving a total of 49 masks which found that, two-layered nonwoven and 'T-shirt' knit achieved the best performance, both in filtration and breathability [7].

Among the advantages of fabric mask is that, it is more comfortable and it is reusable. The fabric mask should be changed when it is wet, or soiled and it must be washed after each use. The fabric mask should be washed using 60°C water with detergent, or washed with room-temperature water and detergent, followed by soaking in 0.1% chlorine, or boiled for 1 minute [4].

IV FACE SHIELD

Face shield is a piece of square plastic that covers the whole face. WHO outlines the design of face shields, which must cover the sides of the face and extend below the chin [4]. The role of a face shield is to protect big droplets or splashes from penetrating the mucous membrane of nose, oral cavity and eyes. It can block 96% large droplets and 68% of small droplets [13]. However, it does not fit properly against the face, causing small droplets to pass through the sides or the bottom of the shield. Compared to a face mask, a face shield is inferior in terms of protection against droplet transmission, but when used together with facemask, its protection against COVID-19 is enhanced. Face shields can be used as an alternative for those with mental health disorder, developmental disorder and children who are difficult to comply with the use of facemask.

V. ISSUES WITH FACEMASK

The regulation on mandatory mask wearing in the public has given rise to a widespread misuse of face masks. In Malaysia for instance, some people have their masks on their jaws while talking to other people, covering only their mouth with the nose left open, while repeatedly touching the outer layer of the masks. The misuse and abuse of face masks were also reported in Nigeria [14]. The above practices would defeat the purpose of wearing masks and even increase the chance of getting various infections, not only due to COVID-19.

VI. CONCLUSIONS

Surgical masks and 3-layered cotton masks are effective in preventing droplet transmission from infected to healthy individuals. To prevent COVID-19, public should be reminded continuously on the proper use and disposal of masks, regular hand washing and physical distancing. Besides, the government should iron out the surgical mask disposal issue and explore other sustainable alternatives for effective source controls in community settings. Commercialisation of fabric mask should be controlled and subjected to certifications from authorized agencies.

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