

Covid-19: The Burden of a Pandemic and Effectiveness of Face Masks in Curtailing Its Spread

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Accepted 10 March 2021

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ABSTRACT

The outbreak of Covid-19 presents an unprecedented threat to public health with a devastating effect on the world economy and health system. In March 2020, the government of the United States responded by adopting the use of face masks as one of the measures to prevent the spread of coronavirus in public places. The increase in the spread of coronavirus necessitated the need for researchers to evaluate the effectiveness of face masks as a measure to control the spread of coronavirus. It became of more concern when alternatives to face masks were observed in public places. This article reviewed factors that affect the effectiveness of face masks and the choice of an effective face mask as reported by several studies. The use of appropriate face masks and other measures to prevent the spread of coronavirus should be encouraged at all levels.

Keywords: COVID-19, SARS-CoV-2, FACE-MASKS.

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INTRODUCTION

In December 2019, the world was thrown into an unprecedented pandemic with the emergence of the novel coronavirus (SARS-CoV-2). This virus-causing disease was first reported by the Chinese Center for Disease Control (CCDC) and is suspected to have emerged from the Hubei province in Wuhan City, China. It was named Coronavirus Disease 2019 (COVID-19) by the World Health Organization, as it first became identified in 2019. COVID-19 patients are known to present with mild symptoms such as sore throat, fever, and dry cough. However, the outbreak of the virus, its rapid transmission, and the infection rate caught many countries and governments unexpectedly. It turns out that the health systems of most countries were hugely unprepared for this magnitude of disease burden (Leola et al., 2020).

Coronaviruses are evolving continuously and notable examples that caused terrible outbreaks previously include the Middle East Respiratory Syndrome (MERS) and the Severe Acute Respiratory Syndrome (SARS). The family of the coronaviruses that are presently causing a global pandemic is the SAR-CoV-2, which was ab initio expressed as pneumonic cases of unknown origin (Deng and Peng, 2020). Within the first month of its identification, the virus known to be highly infectious and transmitted via close human-to-human contacts had spread through many International borders (Alfonso et al., 2020; Huang, et al, 2020). As such, on the first day of February 2020, the World Health Organization (WHO) pronounced the virus infection an international public

health emergency (Noah et al., 2020). Currently, the virus has spread to almost every continent and country on the globe except Antarctica (Alfonso et al., 2020).

Impact of COVID-19

The global situation of the COVID-19 pandemic as of 3:59 pm CET, 3rd February 2021 indicates that there are about 103,362,039 confirmed cases of viral infection in humans and not less than 2,244,713 deaths have been recorded (WHO, 2021). The United States of America (U.S.A) was significantly hit by the COVID-19 pandemic and became one of its epicenters. As of 3rd February 2020, at 3:59 pm CET, there are about 125,444 reported confirmed cases of SARS-CoV-2 infection in the United States of America. At present, data from the John Hopkins coronavirus resources center, suggests that global confirmed cases stand at 114,725,033; global deaths, 2,545,582; U.S. confirmed cases, 28,714,851 and U.S. deaths is about 516,346 (John Hopkins CRC, 2021).

The disruptions caused by the COVID-19 pandemic to the U.S. social systems are so enormous that it glaringly revealed the loopholes in many of the hitherto assumed foolproof institutions and systems (Sawyer and Wagner, 2020). It further amplified the vulnerabilities and systemic defects in the US health care system in responding to the challenges brought by the outbreak of COVID-19. In addition to the overwhelming of the public health care system; the COVID-19 outbreak has also placed

enormous pressure on economic and financial institutions (Leola et al., 2020).

Factors Promoting the Spread of COVID-19 and Preventive Mechanisms

COVID-19 is majorly transmitted from human to human mostly in areas where there are no physical distancing measures in place. Respiratory droplets, contaminated areas, and fomites aid disease transmission. Contact transmissions and droplets account for the major pathways through which the virus spreads. There is also the possibility of transmission of the virus through aerosols in certain situations including bronchoscopy, endotracheal cannulation, etc. (WHO, 2020c). Also, studies suggest that the proportional contribution of the 4 major exposure routes to the flu virus accounts for 17%, 0.52%, 31%, and 52% chances of influenza attack (Nicas and Jones, 2009). These routes are (a) breathing-in of cough particles of respirable sizes, (b) breathing-in of cough particles that are inspirable, (c) touching of facial mucous membranes with hands contaminated with the virus, and (d) dispersion of droplets from coughing unto facial mucus membrane respectively (Nicas and Jones, 2009). The strategic objective of control efforts on COVID-19 is to slow down or halt its spread thereby reducing the impact of the pandemic on the social life of people, economic activities of countries, and stability of health systems (WHO, 2020d). Therefore, as part of the stringent measures to curtail the spread of CoV infection, the World Health Organization recommends a policy of 1-meter social distancing. It is believed that the social distancing measure can significantly reduce the number of viruses that are transmissible mainly through isolated droplets within that range (WHO, 2020b). Furthermore, guidelines by WHO and the Center for Disease Control and Prevention (CDC) encourages the use of face masks to forestall the transmission of COVID-19 (WHO, 2020e and CDC, 2021). Nevertheless, information on the efficacy of the face mask to prevent contact with coronaviruses by filtering respiratory viruses and preventing the release of coronaviruses from individuals' respiratory tracts is sparse (MacIntyre and Chughtai, 2015). Most previous studies have focused on the efficacy of facemasks to protect against contact with influenza (Johnson et al., 2009 and Milton et al., 2013). Meanwhile, other methods recommended by CDC and WHO for the prevention of coronavirus as well as other pathogens include the use of hand sanitizer, wearing gloves, regular house cleaning, and disinfection of surfaces.

The Usefulness of Facemasks as PPE

Surgical face masks were initially mostly recommended by health authorities to be used by people who are treating patients and wounds or injuries to prevent cross-transmission of infections within healthcare facilities. This method of control at source was later adopted to protect health workers from contracting diseases from their patients (Fong et al., 2020). There is, however, inadequate information on the precise efficacy of facemasks in protecting individuals from disease transmission especially viruses that are <math><5\mu\text{m}</math> in size

(MacIntyre and Chughtai, 2015). Since coronavirus is most likely to be enclosed in other different particles that are mostly submicron-sized and present in biological materials expelled from the buccal or nasal cavities of individuals, it further makes it difficult to determine the efficacy of face masks on preventing the transmission of COVID-19 (Esposito et al., 2020). Nevertheless, surgical masks have the capability of protecting individuals from inhaling large spray droplets or particles (University of Maryland, 2020), and has been shown to trap other known human coronaviruses during coughing episodes (Leung et al., 2020a). Furthermore, the facemasks have been shown in patients with pulmonary tuberculosis (which is a well-known infectious disease and airborne) who wear the masks to have a much lesser (by 56%) infectivity to guinea pigs (Migliori et al., 2019).

Types of masks and alternatives to masks

Some facemasks are known to be effective than others mostly because of the material used in producing them and how they are utilized by the final user (Brosseau and Berry, 2009). The use of facemasks at a population level has been shown to help reduce the spread of COVID-19 and in flattening the epidemic curve (Chu et al., 2020 and Leung et al., 2020b). There are different kinds of facemasks including fabric or cloth masks, surgical masks, N95 masks, and face masks with valves. The shortfalls in the supply of N95 respirators and surgical facemasks, concerns about the discomfort they pose after prolonged use, and issues related to their side effects are some of the main reasons that have resulted in the public using a variety of other alternatives that are somewhat less restrictive (including face covers bandanas and homemade cotton masks) (Ong et al., 2020).

The availability of adequate information on face shields and neck gaiters as proposed alternatives to face masks and as source control devices is limited (William et al., 2020). The determination of the efficacy of face masks is further made a complex and active research field because COVID-19 infection pathways are not completely understood as other uncommon transmission routes have been discovered. Also, differences in environmental variables and correct fitting or usage of face masks contribute to the complexity of determining the efficacy of these protective materials (Bunyan et al., 2013). There are recent research studies that suggest gaiter-type face covering, handkerchiefs, and bandanas are not effective in controlling or preventing the transmission of coronaviruses. The submission was made because these materials are said to be mostly single-layered and do not have secured fitting around the face.

Although some textiles used to make face masks have been assessed, the level of performance of individual types of textile materials as protective covers needs to be studied (Konda et al., 2020). A recent study out of Duke University firmly supports the notion that all face coverings do not offer equal protection against the spread of COVID-19 (Emma et al., 2020). However, research by the University of Georgia argues that neck gaiters can give a protection level that is equivalent to facemasks when used as face-covering (Ryan, 2020).

Neck gaiters that have double layers are said to offer up to 81% reduction of respiratory droplets while single layer and multilayer ones reduce the droplets on average by up to 77% and 96% respectively (Minh et al., 2020).

Need for Continuous Prevention

The need to wear a face mask by everyone, whether sick and showing or not exhibiting flu-like symptoms cannot be over-emphasized. Different regulatory agencies and governments have encouraged the use of face masks especially during the present COVID-19 pandemic (WHO, 2020) because some patients infected with the coronavirus may be asymptomatic but contagious for several days (Klompas et al., 2020). There has been a significant shift on the earlier stance of WHO recommending that only individuals who are sneezing or coughing or those who are taking care of COVID-19 patients should wear a facemask to CDC's recommendation that everyone should put on a facemask in open settings where adequate social distancing is relatively impossible. The latter recommendation was borne out of findings of the ease of spread of the virus from person-to-person among people who are interacting or relating nearby; the transmission could be through coughing, speaking, sneezing, and even yawning irrespective of whether they are asymptomatic (Esposito et al., 2020).

CONCLUSION

The Centers for Disease Control and Prevention (CDC) suggests that facemasks should be worn by everyone in public places, including all outdoor gatherings, especially where social distancing is not feasible or difficult. Although the use of face masks by people in all public places is much supported, it is averred however that cloth masks (especially single-layered ones) and face coverings should be advocated for use in the prevention of COVID-19 spread with caution (Brosseau and Margaret, 2020). This is because the materials undeniably have limited capability of preventing small particles inhalation, restricted ability to forestall the emission of small particles, and therefore should not be expressly encouraged as ready alternatives to the use of facemasks, maintenance of physical distancing measures, or reduction of time spent in enclosed areas with people that might be potentially infectious. Comparatively, disposable surgical masks are known to more effective than cloth masks in repressing exposure to infectious particulate matter (Kabindra et al., 2017) and the former should be rather encouraged while the latter discouraged, unless in extreme situations where the disposable surgical masks or N95 respirators are not available.

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