



Mask in COVID-19: A review

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ARTICLE DETAILS	ABSTRACT
<p><i>Article history:</i> Received on 02 August 2022 Modified on 12 September 2022 Accepted on 15 September 2022</p> <hr/> <p><i>Keywords:</i> COVID-19, Face Mask, N-95 masks, Disposal of Masks.</p>	<p>N-95 masks undoubtedly provide the most effective protection against minute particulates including the novel corona virus, but due to the extreme shortage of supply it's reserved for the front-line health care personals. Surgical masks can filter large droplets and big particulate matters but still it's not advisable for use to the common public, in such a scenario wearing a universal cloth face mask in combination with meticulous hand hygiene and social distancing can provide a complementary protection and can significantly block the spread of infection. Face mask wearing can block or filter airborne virus-carrying particles through the working of colloid and interface science. This paper assesses current knowledge behind the design and functioning of face masks by reviewing the selection of materials, mask specifications, relevant laboratory tests, and respiratory virus transmission trials, with an overview of future development of reusable masks for the general public. This review highlights the effectiveness of face mask wearing in the prevention of COVID-19 infection. Wearing medical masks when not indicated may cause unnecessary cost, procurement burden and create a false sense of security that can lead to neglecting other essential measures such as hand hygiene. Furthermore, using mask incorrectly may hamper its effectiveness to reduce the risk of transmission. Masks are part of a comprehensive package of measures to suppress transmission and save lives: the use of a mask alone is insufficient to provide an adequate level of protection. In areas in widespread transmission, where physical distancing of at least 1 meter cannot be achieved, fabric masks should be considered for use in public settings, such as public buses and trains, shops, grocery stores and workplaces.</p>

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INTRODUCTION

SARS in 2002-2003, H1N1 influenza (bird flu) in 2009-2010, the Middle East respiratory syndrome (MERS) in 2012, and Ebola in 2014-2016 are the five biggest epidemic/pandemic outbreaks of respiratory viral infections (RVIs) since the turn of the century. SARS-CoV-2 produces acute respiratory complication, coronavirus complication 2019 (COVID-19), which can be fatal in a small percentage of individuals affected. Treatment has mostly been supportive from the burst in January 2020 and no effective treatment adverse the virus was available up to the fourth quarter of 2020 [1, 2].

At the time of writing, widespread infections were still being recorded around the world, with the total number of COVID-19 curtains reaching

2,000,000 and the average number of illnesses approaching 80 million (WHO Coronavirus complication (COVID-19) Dashboard). The COVID-19 epidemic is putting enormous strain on world health and economic institutions.^{1,2} The SARS-CoV-2 virus is a spherical particle with a circumferences of 100 nm. They are quickly distributed in globules out of our breaths due to their small size. SARS-CoV-2 can remain engaged and causative in globules suspended in the air, according to scientific research [2, 3].

Following intimate contact in homes, hospitals, care homes, public transportation, schools, restaurants, and other public and social venues, droplets are usually regarded to be the principal mode of person-to-person transmission. SARS-CoV-2 can survive on surfaces for hours and

spread by contact with contaminated surfaces and mucous lamina of the eyes, nose, and mouth. 2,4 Respiratory masks (RM) are face masks that cover a portion of the face. They are made to protect both the person wearing them and the local area from breathing contaminants (respiratory toxins or other harmful substances). Full masks (normed according to EN 136) and a moderate and one-fourth of masks (normed according to EN 136) are two types of masks (EN 140). An entire or adequate mask protects the entire face, a half mask covers the area between the chin and the nose, and a quarter mask covers the area between the upper part of the nose and the upper part of the chin. The breathing resistance varies in direct proportion to the mask material density. Half masks include FFP masks (filtering face pieces) [1, 3-4].

Their use is necessary to prevent germs from entering the airway, and they serve to protect both the user and others around them. They're not the same as medical MNC (sometimes known as "surgical masks") or "homemade" masks for regular usage. Because air can clear out through MNCs and self-made masks, they are not "leak-proof" and do not deliver total respiratory protection. FFP masks are available with or without a valve. FFP (filtering face piece) masks with valves allow air to flow from within the mask to the outside. FFP 1 masks are pollen or besprinkle masks that are primarily used for this. They do not affect COVID-19 complications. FFP1 masks are appropriate for work situations that contain only non-toxic dust. FFP2 masks are absolute for use in work areas where infections and mutagens are present in the air [3, 4].

Using a medical mask is powerful ways to avoid the dispersion of respiratory infections, such as 2019-nCoV, in afflicted areas. However, wearing a mask lonely is inadequate to deliver effective protection, and additional, equally important steps should be taken. To avoid the human-to-human conveyance of 2019-now, masks must be used in conjunction with hand cleanliness and other IPC determines when contagion with 2019-nCoV is suspected, WHO has published recommendations for home care and health care context on infection avoidance and control (IPC) techniques to adopt. Wearing medical masks when they aren't needed can add to the cost, add to the procurement burden, and give a false sense of security, leading to the abandonment of other important precautions like hand cleanliness. Furthermore, inappropriate mask

use can impair the mask's effectiveness in reducing the danger of transmission [4, 5].

The purpose of this study is to look at how different types of face masks are designed, manufactured, and function. From a basic standpoint of colloid and associate science, it will begin by defining the working concept of face masks in minimizing the danger of airborne illnesses. It will next examine the effectiveness of face masks for both medical professionals and the general population by reviewing the major scientific studies completed over the last ten years or so.

It will also go over current design and production criteria and standards for face masks, as well as technical concerns for their functional performance. The oncoming development of reusable face masks, particularly for usage in resource-constrained contexts, is briefly discussed. The review is centered on the current issues posed by SARS-CoV-2 virus particles, which are highlighted by the authors' interdisciplinary expertise in colloid and interface science, fiber and textile technology, microbiology, and clinical medicine. Wearing a face mask poses several technological difficulties, many of which stem from existing droplet concepts and their intercommunication with fabric bunches or penetrable material [4].

Types of Masks and Their Users: Face Masks as Personal Protection Equipment (PPE):

Personal Protective Equipment (PPE) can be used with some face masks, such as respirator masks (PPE). In general, personal protective equipment (PPE) assign to any type of worn equipment or gear that is invented to safeguard the wearer against threats such as viral infection. Respiratory protection, as well as eye, body, and hand protection, are necessary for the management of suspected COVID19 patients. However, some of the existing public-recommended face masks do not meet the requirements for professional-level PPEs. They do not effectively filter the air to safeguard the bearer. They do, however, capture droplets from the bearer and therefore protect the general public [6, 7].



Figure 1: Face Masks as Personal Protection Equipment (PPE)

N95 Respirator Masks:

N95, NIOSH-approved tight-fitting respirator, decreases wearer exposure to aerosols and big droplets while filtering 95% of airborne particles. Of the seven varieties of particulate filtering face piece respirators, the N95 is the most frequent. Anyway 95% of airborne molecules are filtered by this product. It's a mechanical screen respirator, which protects against particles like viruses but not gases or vapor. In the European Union, these respirators are equivalent to FFP2 respirators, but in China, they are equivalent to KN95 respirators. Some N95 masks contain one-way cocks that make breathing through them easier. This form of a mask, however, does not protect the wearer from transmitting the virus because the outlet imitates unfiltered air when the user exhales [6, 8].

An N95 respirator is the other type of face mask. These masks are designed for medical personnel who are caring for persons who have highly contagious diseases. The objective of these items is to keep the wearer safe. They do so by filtering particles down to 0.3 microns in diameter, which is less than half the diameter of a single red blood cell. Individual fitting is also required so that they can establish an efficient seal around the wearer's nose and mouth. This keeps air from

leaking out around the borders. KN95 respirators function similarly to N95s, however, they are built to Chinese requirements and norms. Both are capable of filtering out 95% of every minute particle [6, 8, 9].



Figure 2: N95 Respirator Masks

Caution about Face Masks with Valves and Vents

Some people wear masks with expiration cocks or vents built-in. If you are diseased and/or do not know you are contaminated, these masks enable unfiltered air to escape when you breathe, cough, or sneeze, potentially endangering people around you. Coronavirus protection is not provided by masks with exhalation vents [6].



Figure 3: Face Masks with Valves and Vents

Unmarked Face Masks:

General face masks that resemble N95-respirator masks are frequently available in stores or online. Despite their appearance, these are not respirator masks. They have similar properties to simple fabric masks and should be used in the same way.



Figure 4: Unmarked Face Masks

Surgical Masks:

The FDA has approved a loose-fitting, fluid-resistant surgical mask that protects against big drops, splashes, or sprigs of bodily or hazardous fluids. Both are safe for the diseased person and the health care professional. A surgical mask (medical mask) is a disposable mask with a loose fit that protects the wearer's nose and mouth from germ-infested drops, splashes, and sprays. Large particles in the air are also filtered out using a surgical mask. Surgical masks may safeguard others by limiting exposure to the mask users slobber and respiratory secretions [6, 8].



Figure 5: Surgical Masks

Large sprays of bodily fluids, such as those encountered during surgery or other medical operations, are protected by loose-fitting disposable (procedure/surgical) face masks. A surgical mask can assist restrict the source of infection is an infection control scenario, such as with COVID-19. The sick person is the source. When a person sneezes or coughs, the droplets go into the mask rather than into the air or landing on another person or object, which helps to keep respiratory molecules from getting to the surrounding environment. A fabric face mask

accomplishes the same goal. Everyone wearing a cotton face mask in a community environment during an epidemic of a highly contagious respiratory virus helps prevent the transmission of the virus since even people who do not appear unwell can be infected and disperse the virus to surrounding environment. A textile facial covering, like a surgical mask, helps to preserve respiratory globules contained. Mask also protects the wearer from becoming infected with the COVID-19 virus, according to multiple research and case reports. Surgical face masks and other textile masks act as filters, preventing virus-infected particles from entering your lungs [6, 8, 9].

Cloth Masks:

A cloth mask is a face covering fashioned from a well-secured cloth (shirt, bandana, or scarf) that encloses the mouth and nose and is appropriate for those who are not diseased. When a person talks, coughs, or sneezes, droplets are released. A cotton mask is designed to catch these droplets. Masks can be manufactured from a variety of materials, including tightly woven cotton sheets. Numerous layers of fabric should be included in cloth masks [7, 10].



Figure 6: Cloth Masks

Why Mask Is Needed?

When someone is breathing, speaking, sneezing, or coughing, only a tiny amount of aerosol comes out. Only a small quantity of aerosol is released when someone breathes, speaks, sneezes, or coughs. Many of these droplets will then evaporate, resulting in 3 to 5-fold smaller aerosolized particles. Smaller, dehydrated aerosols can float in the air for extended periods of time. The purpose of wearing a mask is to prevent this from happening.

If an aerosol droplet collides with the weave of the mask fabric rather than the hole, the droplet is stopped, the aerosol is reduced at the R0 [reproduction number], and the epidemic is slowed. They're not a cure, but they can help people reach the longer, flatter curve that everyone strives for, according to Ian Jones, a virology professor at the University of Reading [11, 12].

Direct or indirect contact is also a way for this virus to spread. It can enter the eyes or spread from fomites to asymptomatic and pre-symptomatic people's nasal, oral, or ocular mucosa through their hands. So, in addition to a fabric mask, eye protection (close-fitting goggles), and full-sleeved clothing, social distancing (intrapersonal distance > 6 feet) is required [12].

How to Wear a Mask?

Before putting on the mask, make sure to wash your hands well. Carefully place the mask over the mouth and nose, and fasten it with a knot to prevent any gaps between the mask and the face. When wearing the mask, keep your hands away from it. Replace damp masks with new clean and dry masks as soon as possible. Before contacting the mask, wash your hands well. Remove the mask by untying it from behind or from the straps, rather than touching the front. Clean hands with an alcohol-based hand rub or soap and water if they are noticeably unclean after removal or anytime a worn mask is mistakenly touched [13, 14].

How to Put on a Face Mask Made of Cloth? Cloth face masks should fit firmly but pleasantly against the side of the face, be attached with ties or ear loops, and have numerous layers of fabric that allow for unrestricted breathing. They should also be able to be washed and machine dried without losing their shape. Cloth face masks should not be worn by children under the age of two, or by anyone who is having difficulty breathing, is unconscious, or is otherwise disabled or otherwise, unable to remove the mask without assistance. Neither surgical masks nor N-95 respirators are suggested fabric face masks. As indicated by current CDC recommendations, these are crucial supplies that must be kept aside for healthcare workers and other medical first responders. Only when used in conjunction with periodic hand cleansing with an alcohol-based hand rub or soap and water is

mask use effective. It is necessary to use and dispose of the mask correctly [14, 15].

Reusable fabric masks need to be cleaned every now and then. Depending on how often they are used, they should be washed with soap and warm water. A face mask can be washed in a washing machine. The mask must dry for at least 5 hours in the sun. The mask can also be boiled for 10 minutes in a pressure cooker or for 15 minutes in hot water with salt. After washing, a third option is to iron the mask for 5 minutes. When removing their face masks, people should be careful not to touch their eyes, nose, or mouth, and wash their hands right away [16].

Disposals of Mask:

Used masks should be disposed of as potentially contagious medical waste.

Hospital Setting:

In a hospital context, it should be disposed of using a bleach solution (5%) or sodium hypochlorite solution in an indicated infectious waste disposal bag/covered container (1 percent). Used masks should be disposed of according to approved Bio-medical Waste Management protocols by health care facilities [17, 18].

Community Setting:

When the medical waste treatment method cannot be followed, it can be stored in a closed container with a 5% bleach solution before being burned or buried.

- 1. Do not reuse triple-layer masks:** Masks used by patients, caregivers, or close contacts during home care should be preserved in a covered receptacle and disposed of either by burning or deep burial after cleaning with bleach (5%), sodium hypochlorite (1%), or an appropriate concentration of Quaternary Ammonium household disinfectant.
- 2. Reusable fabric facemask:** Before being disposed of by burning or deep burial, community members' masks should be cleansed with a solution of common bleach (5%) or sodium hypochlorite (1%) or a suitable concentration of Quaternary Ammonium household disinfectant [17, 18].

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