

Effectiveness of Face Masks in Preventing Transmission of COVID-19

INTRODUCTION

While there is consensus on the importance of face masks in protecting health workers against respiratory infections, the evidence on their effectiveness in community settings during a pandemic/epidemic is limited. However, some indirect evidence supports the use of face masks by the public. First, SARS-CoV-2 (novel coronavirus) can be transmitted through droplets and/or airborne particles generated when an infected person coughs or sneezes. Second, aerosolized SARS-CoV-2 can remain viable and infectious in the air for several hours in experimental conditions¹. Finally, possible asymptomatic/pre-symptomatic transmission has been reported with maximal virus shedding occurring early during disease²⁻⁶. This suggests that asymptomatic individuals with high viral shedding represent a significant risk of onward transmission. These findings, together with reports from laboratory studies that show that surgical face masks can act as a barrier from droplets and aerosols^{7,8}, hint at the usefulness of mass mask wearing.

Advice on the use of face masks to control the spread of COVID-19 varies; the World Health Organization (WHO) recommends that masks should only be worn by those showing symptoms of COVID-19, stating that they should otherwise be reserved for health workers. At the same time, they recognize that in a pandemic situation, masks may have a small protective effect in reducing transmission. The Centers for Disease Control and Prevention in the US originally advised the public against wearing masks but reversed this decision on 4th April 2020. Countries have adopted different practices; for example, in Czech Republic and the Philippines, masks are mandatory for the public whereas in the UK and Germany, they are not. These divergent recommendations introduce further confusion on the effectiveness of face masks in preventing transmission of COVID-19.

KEY MESSAGES

1. Recommendations on wearing face mask by the general public varies in different countries. Countries that have introduced mask wearing policies have done so based on the “precautionary principle”-that while the benefits of introducing mass masking policies may be uncertain, the harm caused would be negligible or improbable in the context of this pandemic.
2. While clear-cut evidence on the effectiveness of widespread use of mask by the public in the context of COVID-19 is limited, there is indirect evidence that masks can provide a small benefit at community level.
3. Several factors such as adherence, proper use, manufacturing capacity and overall economic cost, influence the effectiveness and choice of masks for use during COVID-19 pandemic. Emphasis should be placed on the fact that masks play a complementary role and is not a replacement of other infection control measures (hand, cough hygiene and social distancing).
4. Use of masks for the public should not curtail availability of masks to health care workers.
5. Rational use of masks in health care settings is important to optimize availability of face masks. In most clinical settings, surgical masks are sufficient and respirator masks should be reserved for aerosol generating procedures only.

About the brief

This brief summarizes the evidence on the effectiveness of face masks limiting droplet and airborne spread of COVID-19 in community settings and secondly highlights the recommendations on rational use of masks in healthcare settings.

Current Evidence On Effectiveness Of Face Masks In Community Settings

In a systematic review published in March 2020 on the effectiveness of masks in individuals who are not medically diagnosed with COVID-19, the authors reported that there were no randomized control trials or primary studies that assess effectiveness of masks in community settings⁹. Thus, all relevant evidence on mask use comes from studies on influenza and other

respiratory viruses and may not be directly applicable to COVID-19.

One experimental study examined the efficacy of surgical and respirator masks (N95) in filtering influenza viruses in volunteers with confirmed influenza infection. In this study, volunteers were asked to cough into one petri dish

while wearing a mask and into another without a mask. They reported that the masks could block the viruses. However, this study didn't account for sideways leakage of the virus⁷. Another experimental study found that transmission of influenza in exhaled breaths or coughs of infected individuals could be prevented by surgical masks. This implied that surgical masks were effective for source control. However, a major limitation of this study is that a large number of the participants had no viral shedding anyway making it difficult to fully interpret the findings⁸.

A cluster-randomized trial comparing standard surgical masks, respirator masks and no mask in household settings during an influenza epidemic in Australia showed that while there was no benefit of respirator masks over surgical masks, mask use significantly reduced the incidence of influenza-like illnesses¹⁰. In addition, a systematic review on the evidence of use of surgical and respirator masks in influenza outbreaks found some effectiveness if worn by those with respiratory symptoms but not by asymptomatic individuals¹¹. However, a meta-analysis of 10 randomized control trials that tested the effectiveness of face masks (surgical and paper face masks for the public) for preventing influenza found no significant reduction of influenza transmission¹². Another recent systematic review on 31 studies including 12 randomized control trials examined whether face masks or other barriers such as shields, veils or goggles reduced transmission of respiratory illnesses. They reported that there was a small but statistically non-significant reduction in infection rates when masks were worn by the general public and by infected members within households¹³. In a recent evidence review, the authors concluded that evidence favored widespread use of masks as masks decrease the transmissibility of COVID-19 when compliance is high. A rapid review assessing the effectiveness of surgical

masks against COVID-19 in the general population found that the evidence for mask use was inconclusive.

Considering these studies, we surmise that masks may offer some protection against primary respiratory infections and source control in community settings. In the absence of clear consensus and faced with a crisis of this magnitude, some countries have introduced widespread mask wearing based on the "precautionary principle". This assumes that while there may be uncertainties on the benefits of mask wearing, there is some evidence to suggest plausible benefit and more importantly, that the harm caused would be negligible or improbable. However, there are several factors to consider in the practice of face mask wearing. One of these is adherence to mask wearing; the trial in Australia reported that less than 50% of the household participants wore masks most of the time¹⁰. However, adherence may be higher in a pandemic setting. For example, during the SARS outbreak of 2003, compliance with mask wearing was high (76%) in Hong Kong¹⁴. Adherence may also vary depending on tolerability of masks. Wearing facemasks consistently and correctly for long periods may not be easy for many people. Another uncertainty is the public's awareness on proper mask use. Prevention depends on people not touching their mask repeatedly to avoid self-contamination. Thus, the public need to be educated on the proper use of masks. It is also important to emphasize that mask use is complementary to core control measures such as social distancing and cough plus hand hygiene and not a replacement. Widespread use of masks may provide a false sense of security and undermine control measures in place. Cost-benefit analyses on mask use will also be important as mass mask wearing has economic implications especially in low-resource settings. In instances where most of the population cannot afford to buy surgical masks regularly, reusable cloth masks could be an alternative.

Evidence on the effectiveness of cloth/homemade masks

There is little evidence on the effectiveness of non-medical masks made from various materials (such as cotton fabrics). In one study evaluating the filter efficiency of different fabrics, non-medical face masks were shown to have very low filter efficiency compared to respirator masks¹⁵. Another study found that while home-made masks could block some micro-organisms expelled by infected individuals, surgical masks were 3 times more effective¹⁶. A randomized control trial comparing the use of cloth masks to surgical masks in healthcare settings found that cloth masks were not effective and could increase the risk of infection due to poor filtration and moisture retention¹⁷. Although these studies show that home-made/cloth masks are not as effective at preventing transmission as surgical and respirator masks, they still offered some level of protection (~15% filtration efficiency^{16,18}). More research is needed on the best type of fabric to use, number of layers needed for improved filtration and how best to prevent moisture retention. It is also possible that when properly used, these non-medical masks may have some efficacy because of the relatively lower infective dose exposure in the community but this is unclear.

Table 1: Arguments for and against introducing widespread mask wearing in the community setting

Arguments for masks	Arguments against masks
There is some evidence that aerosols released by infected individuals can be blocked by surgical masks thereby contributing to reducing transmission in addition to other measures	The evidence base on effectiveness of masks is limited
SARS-CoV-2 shedding has been shown to occur early after infection. Asymptomatic individuals therefore contribute to disease transmission. This supports the idea of mask wearing of individuals with no symptoms.	Masks are in short supply. Demand for surgical and respirator masks by the public means that health workers may lack necessary PPE
Non-medical and cloth masks are easy to produce and can be washed and reused. These lower demands for surgical and respirator masks that can be reserved for health workers	People are unlikely to wear masks properly and consistently. Self-contamination may occur if the public is not educated on how to put on and take off masks
Face masks have been used extensively in the public in Asian countries and can be adapted in other regions considering the gravity of the pandemic. Public information campaigns educating the public on the use of masks would be beneficial.	Wearing masks may give the public a false sense of security and undermine social distancing rules
	Acceptability/tolerance of masks may be difficult and affect adherence

Rational use of masks for healthcare settings

Recommended infection control measures for healthcare workers by the WHO include surgical masks to protect against droplet-spread respiratory transmissible infections and respirator/N95 masks to protect against aerosol-spread infections. In this pandemic setting, shortages of personal protective equipment (PPE) including face masks has been a recurring and widespread problem. The capacity to expand production of face masks is limited in most countries therefore the WHO recommends optimizing the use of available face masks in the healthcare setting by minimizing the need of masks, promoting their appropriate use, and coordinating the supply chain (Table 2).

CONCLUSION

Direct evidence on the effectiveness of face masks in limiting COVID-19 spread is not conclusive. However, even while direct evidence is not clear, the recommendation for widespread mask use in the community should be considered and weighed against several factors. Firstly, considering the seriousness of this pandemic, even a small benefit may be important for the control of COVID-19. Secondly, demand for masks need to be met by increased manufacturing capacity, which may be challenging in low-resource settings, and also places an added financial pressure on people who may have already lost their source of income due to COVID-19 restrictions. Thirdly, to ensure compliance and prevent self-contamination, public information campaigns

informing the public on mask use will be necessary. It is also important to emphasize that mask wearing is just one of several non-pharmaceutical interventions and should not undermine social distancing, cough and hand hygiene recommendations. Finally, use of masks by frontline healthcare workers is essential. Due to shortages concerns, respirator masks (N95) should be reserved for health workers. To optimize on availability, respirator masks should only be used for aerosol generating procedures as surgical masks are sufficient in most clinical settings. Therefore, rational use of masks should also be promoted within the healthcare setting to prevent shortages.

Table 2: Rational use of face masks in the healthcare setting (Inpatient and outpatient facilities).

In patient facilities			
Healthcare setting	Target personnel	Activity	Mask type
Patient room	Healthcare workers	Providing direct care to COVID-19 patients	Surgical mask
		Performing aerosol generating procedures (AGP) on COVID-19 patients	Respirator/N95 or FFP2 mask
	Cleaners	Entering room of COVID-19 patient	Surgical mask
	Visitors	Entering room of COVID-19 patient	Surgical mask
Triage	Healthcare workers	Preliminary screening with no direct contact	Not required
	Patients with respiratory symptoms	Any	Surgical mask optional
	Patients without respiratory symptoms	Any	Not required
Laboratory	Lab technicians	Manipulation of respiratory samples	Surgical mask

Out patient facilities			
Healthcare setting	Target personnel	Activity	Mask type
Consultation room	Healthcare workers	Physical examination of patients with respiratory symptoms	Surgical mask
	Healthcare workers	Physical examination of patients without respiratory symptoms	PPE according to standard precaution
	Patients with respiratory symptoms	Any	Surgical mask optional
	Patients without respiratory symptoms	Any	Not required
	Cleaners	Cleaning after and between consultations with patients with respiratory symptoms	Surgical mask
Triage	Healthcare workers	Preliminary screening with no direct contact	Not required
	Patients with respiratory symptoms	Any	Surgical mask optional
	Patients without respiratory symptoms	Any	Not required
Waiting room	Patients with respiratory symptoms	Any	Surgical mask optional
	Patients without respiratory symptoms	Any	Not required

Source: World Health Organization (https://apps.who.int/iris/bitstream/handle/10665/331215/WHO-2019-nCov-IPCPPE_use-2020.1-eng.pdf)

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