Question: Are cloth face masks likely to provide protection against COVID-19?

Response by Infection Control Expert Group (ICEG)

Assumptions: (not addressed in this response)

- Transmission of COVID-19, including from asymptomatic, presymptomatic or minimally symptomatic people, occurs particularly within closed environments and in the context of prolonged, close contact or via contaminated fomites/surfaces.
- Hence the importance of physical distancing, hand and respiratory hygiene, environmental cleaning and staying at home when experiencing even minimal respiratory symptoms or fever, combined with high rates of testing and appropriate isolation and quarantine.
- Face masks can provide additional protection, when these measures, particularly physical distancing, are difficult to maintain (e.g. in public transport, shops, some workplaces etc.).
- Face masks are most likely to be effective when worn by infected persons (source control) to protect others. They may be less effective in protecting uninfected people exposed to a COVID-19-infected person not wearing a mask (as the conjunctivae are a possible site of mucosal contamination).
- The effectiveness of face masks depends on consistent and correct use, including covering the nose and mouth adequately.
- Touching the front of the mask, pulling it down intermittently to smoke, drink or eat and reuse of disposable masks can contaminate the hands, then the wearer's face or nearby fomites or surfaces.

Summary and ICEG recommendations

- Previous advice still applies:
    - when there is absent or localised COVID-19 transmission, the general use of masks in the community is not recommended, although some people choose, and are free, to do so;
    - during outbreaks or in the presence of sustained community transmission the use of masks can supplement other control measures, in situations in which physical distancing is difficult to maintain, especially in closed environments;
    - the use of masks should not reduce adherence to physical distancing rules.

- There is limited, indirect, experimental evidence that certain types of cloth mask can reduce transmission of respiratory droplets, but they are significantly less efficient than surgical masks.
- The effectiveness of different types of cloth mask, in blocking respiratory droplets, varies depending on the weave and the number of layers – at least 2–3 layers are needed.
- Reusable cloth masks should be washed after each use or at least daily. Prolonged use, reuse without washing and touching or adjusting masks can lead to self-contamination and infection (of the wearer). They are increasingly less effective as they become increasingly damp. These issues may have contributed to results of a clinical comparison of cloth versus medical masks or no mask:
    - >1600 healthcare workers in Vietnam were randomised to wear cloth masks, medical masks or no masks, when at work, over a 4-week period. Results showed a significantly higher rate of clinical respiratory infection, influenza-like illness (ILI) and laboratory-confirmed viral infections among cloth mask, than medical mask, users and of ILI among cloth mask, than non-mask, users. (see below)
- Cloth masks may be preferred for community use, if indicated, to preserve supplies of surgical masks for use in healthcare and aged care and by people at high risk of severe COVID-19 disease. Their use would also reduce non-biodegradable waste from widespread use of disposable surgical masks.
- Unlike those of surgical masks, the quality and effectiveness of cloth masks are not regulated in Australia. If governments were to purchase bulk supplies of cloth masks for community use, the specifications likely to correspond with greatest effectiveness include: 2-3 layers, preferably of different fabrics; fabrics with adequate filtering/droplet blocking efficiency but sufficient permeability to not restrict breathing; adequate fit to prevent significant leakage of exhaled air.

Efficacy of cloth masks to prevent respiratory viral infections (including COVID-19)

Cloth face masks were first used by surgeons in 1897 to prevent contamination of the surgical site, and in the early 20th century to prevent the spread of infectious diseases in the community, including during the 1918–19 influenza pandemic. In the 1920s and 30s their efficiency in excluding bacteria, and clinical efficacy in reducing surgical site infections, were demonstrated in experimental and observational studies. These studies showed that mask efficiency was directly related to the closeness of the mesh and the number of thicknesses of gauze. They also showed that increasing dampness of the mask progressively reduced its effectiveness (1).

Mask research waned after the advent of antibiotics in the 1940s and cloth masks have been rarely used in high income countries since the development of moisture resistant surgical masks in the 1960s. However, they continued to be used widely in both healthcare and community settings in low and middle-income countries, particularly in Asia. In 2013 a review of the use of cloth masks for infection control (2) again came to the conclusion that some cloth masks may reduce transmission of respiratory aerosols, but their efficacy is unproven in the absence of randomised control trials (RCT).

Experimental studies

Some recent studies have demonstrated the transmission reduction potential of individual cloth masks under experimental conditions (3-5). The presence of moisture, distance travelled by droplets and mask design were identified as important determinants of in-vitro filtration efficacy. In one study, homemade cloth masks, made from cotton tea shirts, were compared with surgical masks or no mask, using several air sampling techniques. Compared with no mask, both types reduced the number of microorganisms in aerosols expelled by volunteers, but surgical masks were 3 times more effective than homemade masks. The median-fit factor of the homemade masks was one-half that of the surgical masks. The conclusion was that cloth masks may be better than no protection but should be used only as a last resort.(5) Two recent studies have compared a range of different fabrics for their ability to filter particles of different sizes but their relevance to real-life effectiveness in protection against COVID-19 is uncertain.(6-8)

One study examined the filtration efficiency of common fabrics, including cotton, silk, chiffon, flannel and various synthetics, individually and in combination. Filtration efficiencies of single layers were highly variable but improved, consistently, when different fabrics were combined in multiple layers. For example, hybrids (such as cotton−silk, cotton−chiffon, cotton−flannel) had filtration efficiencies of >80%, for particles <300 nm, and >90%, for particles >300 nm. Cotton performed better at higher thread counts. The authors commented that significant decrease in filtration efficiency could result from poor fit, leading to leakage of exhaled air.(6).[1]

Another (unpublished, not peer reviewed) experimental study, examined the effectiveness of 11 household fabrics, including knit or woven cotton, cotton/polyester or polyester/polyamide mix or silk, using a commercial medical mask as a benchmark. The ability of these fabrics to block high velocity droplets similar to those released by sneezing, coughing or speaking and carrying 100 nm viruses, such as SARS-CoV-2, were quantified. All fabrics tested had considerable efficiency, even in single layers; with 2 or 3 layers, even permeable fabrics, such as T-shirt cloth, achieved droplet blocking efficiency similar to that of medical mask, while maintaining comparable breathability. Breathability is critical for mask design, because a high-efficiency mask with low breathability may let air flow through gaps between the mask and face. Droplet blocking efficiency was inversely proportional to breathability (and comfort). The authors concluded that, during a pandemic, wearing a 2 or 3-layered home-made cloth mask, supported by proper education and training in mask making and appropriate usage, in conjunction with physical distancing and other interventions, may reduce transmission of respiratory droplets by infected individuals and protect healthy individuals from inhaling droplets. They also commented that washable, reusable

[1] A published correction noted that measurements were carried out at low differential pressure values, across the fabrics, resulting in flow rates significantly lower than typical resting respiratory rates. The authors suggested that “the focus on cloth masks should center around lower pressure differentials that can be sustained practically in unfitted cloth masks” and that the focus of mask design should “significantly increase the area of the cloth to increase net airflow while not overly exerting the face seal.” (7)

fabrics such as cotton would reduce adverse environmental effects of widespread use of disposable, non-biodegradable face masks. (8)

Clinical studies

In a cluster-RCT, >1600 Vietnamese HCWs were randomised (by ward) to wear cloth masks (made in Vietnam, with two layers of cotton or 50/50 cotton polyester mix), single-use medical masks or no masks. Over the 4-week study period, respiratory infection rates were significantly higher in the cloth mask than the medical mask arm (ranging from 1.67 times higher for laboratory confirmed viral illness to 13 times higher for ILI). Paradoxically, the rates of ILI in the cloth mask arm were also significantly higher than in controls. The authors suggested that moisture retention, prolonged use, reuse without washing and poor filtration of cloth masks may have resulted in increased risk of self-contamination and infection.(9)

There are no randomised controlled studies of cloth masks in community or household settings. (10) However, a recent report provides anecdotal evidence of cloth masks' effectiveness for source control. A hair stylist in a US hair salon worked for 8 days while symptomatic, until diagnosed with COVID-19. Another stylist, who had been in unprotected contact with the first, developed symptoms 3 days later, but continued to work until also diagnosed with COVID-19 4 days later. The stylists and clients at this salon were required, by a city ordinance and the salon policy, to wear face masks during client interactions. Both stylists and most clients wore double-layered cloth or surgical masks whilst attending to clients. No symptomatic secondary cases occurred among 139 clients exposed to them for periods of 15-45 minutes while they were symptomatic and none of the 67 clients who agreed to be tested for SARS-CoV-2 returned positive results.(11)

International recommendations

Recently the World Health Organization, Centers for Disease Control and Prevention, European Centre for Disease Control have updated their advice on the community use of masks. Selected quotes from their recent publications:

World Health Organization, June 5 2020. (12).

"Many countries have recommended the use of fabric masks/face coverings for the general public. At the present time, the widespread use of masks by healthy people in the community setting is not yet supported by high quality or direct scientific evidence and there are potential benefits and harms to consider.

However, taking into account the available studies evaluating pre- and asymptomatic transmission, a growing compendium of observational evidence on the use of masks by the general public in several countries, individual values and preferences, as well as the difficulty of physical distancing in many contexts, WHO has updated its guidance to advise that to prevent COVID-19 transmission effectively in areas of community transmission, governments should encourage the general public to wear masks in specific situations and settings as part of a comprehensive approach to suppress SARS-CoV-2 transmission."

WHO recommends a risk-based approach to use of medical vs non-medical masks in the community based on purpose of mask use, risk of exposure to COVID-19, vulnerability of population, setting in which population lives, feasibility of use (cost, availability) as outlined in the Table below.

Table. Examples of where the general public should be encouraged to use medical and non-medical masks in areas with known or suspected community transmission.

Reproduced from: World Health Organization. Advice on the use of masks in the context of COVID-19. 2020 (10)

Situations/settings	**Population**	**Purpose of mask use**	**Type of mask to consider wearing if recommended locally**
Areas with known or suspected widespread transmission and limited or no capacity to implement other containment measures such as physical distancing, contact tracing, appropriate testing, isolation and care for suspected and confirmed cases	General population in public settings, such as grocery stores, at work, social gatherings, mass gatherings, closed settings, including schools, churches, mosques, etc.	Potential benefit for source control	Non-medical mask
Settings with high population density where physical distancing cannot be achieved; surveillance and testing capacity, and isolation and quarantine facilities are limited	People living in cramped conditions, and specific settings such as refugee camps, camp-like settings, slums	Potential benefit for source control	Non-medical mask
Settings where a physical distancing cannot be achieved (close contact)	General public on transportation (e.g., on a bus, plane, trains) Specific working conditions	Potential benefit for source control	Non-medical mask

Situations/settings	Population	Purpose of mask use	Type of mask to consider wearing if recommended locally
	which places the employee in close contact or potential close contact with others e.g., social workers, cashiers, servers		
Settings where physical distancing cannot be achieved and increased risk of infection and/or negative outcomes	Vulnerable populations: • People aged ≥60 years • People with underlying comorbidities, such as cardiovascular disease or diabetes mellitus, chronic lung disease, cancer, cerebrovascular disease, immunosuppression	Protection	Medical mask
Any setting in the community*	Persons with any symptoms suggestive of COVID-19	Source control	Medical mask

*This applied to any transmission scenario

European Centre for Disease Control, April 8, 2020 (13)

“There is limited indirect evidence showing that non-medical face masks made from various materials may decrease the release to the environment of respiratory droplets produced by coughing, but available evidence suggests that non-medical face masks are less effective than medical masks as a means for source control.“ (5)

There are no established standards for self-made non-medical face masks. One of the advantages of non-medical face masks made of cloth or other textiles is that they can be made easily and can be washed.”

Centers for Disease Control and Prevention, July 16, 2020 (14)

"CDC recommends that people wear cloth face coverings in public settings and when around people who don't live in your household, especially when other social distancing measures are difficult to maintain.

Cloth face coverings may help prevent people who have COVID-19 from spreading the virus to others.

Cloth face coverings are most likely to reduce the spread of COVID-19 when they are widely used by people in public settings."

"Cloth face coverings are recommended as a simple barrier to help prevent respiratory droplets from traveling into the air and onto other people when the person wearing the cloth face covering coughs, sneezes, talks, or raises their voice. This is called source control. This recommendation is based on what we know about the role respiratory droplets play in the spread of the virus that causes COVID-19, paired with emerging evidence from clinical and laboratory studies that shows cloth face coverings reduce the spray of droplets when worn over the nose and mouth. COVID-19 spreads mainly among people who are in close contact with one another (within about 6 feet), so the use of cloth face coverings is particularly important in settings where people are close to each other or where social distancing is difficult to maintain."

Cloth face coverings should NOT be worn by children under the age of 2 or anyone who has trouble breathing, is unconscious, incapacitated, or otherwise unable to remove the mask without assistance."

Masks in the workplace

Workplace risk mitigations should be managed in accordance with How to Manage Work health and Safety" Code of Practice (2011) and also consider Safework Australia advice on masks and personal protective equipment for COVID-19.

Conclusions

Time did not permit extensive review of this topic, but the key points (reproduced below) from a rapid review (July, 2020 in preprint) from the Royal Society anonymous concur with ICEG's conclusions/recommendations (bold added): (15)

- Cloth face coverings are effective in reducing source virus transmission, i.e., outward protection of others, when they are of optimal material and construction (high grade cotton, hybrid and multilayer) and fitted correctly and for source protection of the wearer.
- Socio-behavioural factors are vital to understanding public adherence to wearing face masks and coverings, including public understanding of virus transmission, risk perception, trust, altruism, individual traits, perceived barriers.
- Face masks and coverings cannot be seen in isolation but are part of 'policy packages' and it is imperative to review interrelated non-pharmaceutical interventions in tandem including hand hygiene, sanitizers and social distancing when maintaining the 2 metre or 1 metre+ distancing rule is not possible.
- Consistent and effective public messaging is vital to public adherence of wearing face masks and coverings. Conflicting policy advice generates confusion and lack of compliance. Populations without a previous history of mask wearing have rapidly adopted face coverings during the COVID-19 period.

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