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## The use of face shields as personal protective equipment during the SARS-CoV-2 pandemic

### Executive summary:

This policy brief is to clarify the potential use and efficacy of face shields in the current COVID-19 pandemic. Face shields are distinct from face masks, and offer different advantages and disadvantages. They have been used for decades by medical staff and recently there has been interest in using them in business settings such as hotels and hair salons, often instead of face masks, to protect workers and customers. This document gives an overview of the uses and qualities of face shields and summarizes current knowledge about their effect on airborne viruses and their efficiency in preventing infections. In summary, face shields do not offer the same protection against airborne pathogens as face masks or respirators as they do not effectively block droplets in- or exhaled by the wearer. However, they do protect the eyes which may help in preventing infection. Therefore, face shields can act as a useful supplementary protection in addition to face masks and social distancing, but they are likely not sufficient when used on their own. To achieve better protection, face shields that wrap around the sides of the wearer's face and extend below the chin are recommended.

### Introduction

Face shields are a type of personal protective equipment (PPE) used by healthcare and other workers. They consist of a transparent visor covering the wearer's face as well as a suspension system to mount it on the wearer's head.

Their main function is to protect the wearer's face from flying particles, debris, splashes and droplets of hazardous or infectious materials. In healthcare settings they are commonly used by workers in conjunction with other protective equipment such as gowns, gloves and face masks to prevent infection from patients. Face shields are effective in blocking splashes of bodily fluids and prevent them from reaching the workers' mouth, nose and eyes where infections might occur. Face shields come in different variations. Some cover only a part of the face, while others shield it entirely and may extend over the side of the head; wider visors offer more peripheral protection and lessen the likelihood that a splash could go around the edge of the face shield, and create a risk of exposure. Generally, face shields are loose-fitting devices, which do not form a tight seal with the face they aim to protect.

The visor, also called lens or window, is typically made from polycarbonate and can be treated to prevent glare, fogging and scratches as well as provide protection from ultraviolet light. The frame of the visor is generally made out of lightweight plastic and can allow detachment of the visor to exchange it, and may include clips that allow it to be attached to eyeglasses. The suspension

system can be comprised of plastic headbands, elastic straps, temple bars, or nose pads and aims to maintain position and stability of the face shield on the head.

**Advantages/Disadvantages:**

Wearing face shields has a number of advantages and disadvantages: they are easy to use as they do not require a tight seal and one only needs to secure them on the head which improves comfort. They also cause less interference with breathing than face masks or respirators, and can be combined with other PPEs such as face masks. Face shields can be cheaply and easily mass-produced and may be cleaned and reused without losing effectiveness (however, it is advised to disinfect the shield after use). Because face shields do not visually obstruct the wearer’s face, facial expression is unimpeded, making them useful for people who rely on nonverbal communication such as lip-reading [1].

Unless treated, the transparent visor might cause glare or become foggy, causing visual strain. Face shields are bulkier than face masks making them less practical for use in the community. Table 1 provides a summary of the advantages and disadvantages of face shields compared with other forms of face/eye protection.

**Table 1** (Roberge, 2016) Advantages and disadvantages of face shields compared with other forms of face/eye protection (i.e., protective face masks [filtering facepiece respirators, medical/surgical masks], goggles, safety glasses). [2] [3]

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• More comfortable</li> <li>• Protect a large portion of the face</li> <li>• Less retained dermal facial heat</li> <li>• Less claustrophobic</li> <li>• Less fogging than goggles</li> <li>• No impact on breathing resistance</li> <li>• No fit testing required</li> <li>• Can be disinfected easily</li> <li>• Wearers do not need to be clean shaven</li> <li>• Easy to don and doff</li> <li>• Relatively inexpensive</li> <li>• No impact on vocalization</li> <li>• Can be worn concurrent to other face/eye PPE</li> <li>• Do not impede facial nonverbal communication</li> <li>• Reduce patient anxiety</li> <li>• Protects the face more generally (against solid objects for example)</li> <li>• Face shields require no special materials for fabrication and production lines can be repurposed fairly rapidly.</li> </ul>	<ul style="list-style-type: none"> <li>• Questionable protective effect and lacking clinical trials investigating their utility in terms of respiratory protection</li> <li>• Glare/fogging</li> <li>• Optically imperfect</li> <li>• May not fit properly over some respirators</li> <li>• Bulkier than goggles or safety glasses</li> <li>• Peripheral fit poorer than protective face masks</li> </ul>

**Comparison with other PPE:**

The European standards EN 166-168 [4] describes the general requirements for face shields, goggles, and safety glasses regarding their eye protection function. Goggles and safety glasses provide similar protection for the eyes, but do not cover the mouth and nose, making a face shield the preferred eye-safety device for infection control. However, in a healthcare setting, eye protection devices, including face shields, are designed to be worn in combination with other protective equipment.

Compared with face masks, face shields have the advantage of covering the entire face, including the eyes which may be a route of infection for COVID-19, although the frequency of such events is unclear [5]. Unlike face masks, face shields do not filter the air that is in- or exhaled. This allows pathogens that are exhaled in small droplets from the wearer to fly around the edges of a face shield, contaminating the surrounding air. Face shields also offer little protection against inhaled small airborne droplets, only efficiently protecting against large droplets, which are blocked by the visor.

In contrast to face shields, full facepiece respirators are tight-fitting, air-purifying respirators with replaceable filters or cartridges attached to a rubber or silicone facepiece. They cover the user's eyes and face and can also protect against liquid splashes and irritating vapors. A full facepiece respirator can provide a high level of protection if it is well fitted (Protection factor of 50 [6]). Jean Schmitt et al. (2020) adapted a snorkel mask as a full facepiece respirators for healthcare workers and showed that its protection efficiency could reach 95% and higher [7].

**Experimental studies on the protection efficiency of face shields**

While face shields have demonstrated some advantages over face masks (Table 1) and have been shown to reduce the number of pathogens inhaled when worn, their efficiency for combating the spread of SARS-CoV-2, and other viruses is still debated in literature. In a recent study, as yet unpublished, Ronen et al reported that a face shield could block droplets larger than 3 micrometers with the same efficiency as a surgical mask and its protective efficiency was even better than the surgical masks for droplets down to 0.3 micron diameter. [6] They also reported that face shields used as source control had the same performance as surgical masks. However, these findings stand in contrast to those of Verma et al, who reported, in a study based on qualitative visualization that particles emanating from a simulated cough of a face shield wearer could spread quickly into the surrounding air (about 1 m within 10 seconds, with varying results depending on local turbulence) [8]. They also found that filtering face masks released far fewer particles and created a smaller spread than face shields. In a study using a cough aerosol simulator and a breathing simulator, a face shield reduced the number of infectious particles inhaled by the wearer by as much as 96% for a face shield 46 cm away from a cough (Lindsay et al. 2014). However, this effectiveness could only be achieved for large droplets and immediately after the cough. For smaller droplets the efficiency of a face shield was reduced to 68% and when exposed to the resulting aerosols for 30 minutes the efficacy was further lowered to 23% [9].

**Epidemiological studies**

There are few epidemiological studies that focus exclusively on the effect of eye protection and face shields. A meta-analysis of studies about COVID-19 and other *betacoronaviruses* showed that wearing a face shield or goggles was associated with fewer infections and the infection risk was lowered by 10.6%, but the conclusion was qualified as having low certainty [10].

Another study found that people who wear eyeglasses for at least 8 hours a day may be less susceptible to COVID-19, but these data also had low certainty and no proof was given that the added eye protection from wearing eyeglasses was the cause for the effect [11].

Anecdotal evidence from a COVID-19 outbreak among staff of a hotel in Graubünden showed that people who used face shields were infected, whereas face mask-wearing personnel avoided

infection. Following this, the cantonal health authorities spoke out against face shields, claiming they offered little protection [12].

### Recommendations

A number of medical professionals have called for the introduction of face shields in the community as a viable alternative to face masks in containing COVID-19, due to the face shield's advantages in reusability, ease of production and low impairment of facial visibility or speech [3]. According to the US Center for Disease Control and Prevention (CDC), there is currently not enough evidence to support the effectiveness of face shields in stopping an infected person from spreading respiratory droplets and pathogens [13]. Therefore, the CDC does not recommend the use of face shields as a substitute for face masks. Face shields are classified primarily as eye protection and not as protection from aerosols. For possibly better source control, the CDC recommends face shields that wrap around the sides of the wearer's face and extend below the chin, or hooded face shields, thus preventing aerosols from traveling from or to the wearer along the sides of the face shield.

The world health organization (WHO) suggests using face shields only in the context of a face mask shortage and considers them inferior to face masks with respect to prevention of droplet transmission. The WHO also emphasizes that a face shield should cover the sides of the face and extend below the chin [14].

### Conclusions

In summary, face shields do not offer the same protection against airborne pathogens as do face masks/respirators, because they do not effectively block droplets in- or exhaled by the wearer. However, they do protect the eyes which may help in preventing infection. Therefore, face shields can act as a useful supplementary protection in addition to face masks and physical distancing, but are likely not sufficient when used on their own. To achieve better protection, face shields that wrap around the sides of the wearer's face and extend below the chin are recommended.

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