

Managing respirators and gloves in the fight against COVID-19

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Over the next few weeks or months, many of us will start using personal protective equipment (PPE) for the first time. PPE includes everything from disposable gloves and masks to ear plugs and gas tight suits.

In the workplace we normally refer to PPE as a ‘last resort’, which should only be worn in circumstances when all other controls are unsuitable. Workers typically don’t like wearing PPE, which can be uncomfortable, especially when worn for long periods of time. However, if worn and used correctly, PPE can be an effective way of protecting workers.

We are now in circumstances where PPE is an important way to protect healthcare staff working at the front line fighting COVID-19. They are relying on respirators, eye and body protection to prevent them being exposed to contaminated aerosols released when treating infected patients.

In our community we see many citizens using disposable gloves to form a barrier between their skin and potential COVID-19 contamination on door handles, money or a petrol pump. People have started to wear facemasks in the street and in shops.

Occupational health and safety practitioners have for decades been managing PPE programmes across a range of workplaces and can offer a lot of guidance on this topic.

Face masks and gloves are just two of an array of infection control measures used by those working at the Covid-19 front line. Face masks or tight-fitting respirators, also referred to as filtering face pieces (FFPs), operate as negative pressure (relative to ambient air) respirators and provide protection from airborne transmission of contaminated aerosols, i.e. tiny droplets released when coughing, sneezing and even during normal breathing. The wearer inhales air through a filter, and the contaminant is caught in the filter material.

Theoretically FFPs can provide protection factors (PF) (ratio of concentration inside the mask to outside) ranging from 4 to 20 (from FFP1 to FFP3), depending on the design, particle size of the contaminant and the facial fit. A PF of 20 implies that the virus concentration inhaled by the wearer is reduced by 95%. However, air can also bypass the filter and pass between the mask and the face, which is why a tight seal is necessary to get the best possible protection.

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TABLE: Key points to observe in managing respirators and gloves

- Repetitive training on how to fit and remove respirators and gloves is essential before use.
- Gloves are the most frequently used form of personal protective equipment (PPE) in healthcare settings, but wearing gloves does not substitute for washing hands, gloves should never be re-used and wearers should avoid touching personal items or their skin when gloved.
- Achieving the best possible protection with a tight-fitting respirator depends on the mask fitting closely to the face and the wearer performing a pre-use fit test or seal check.
- The protection factor provided by a powered air purifying respirator (PAPR) does not rely on the wearer achieving a good facial fit to the face. PAPRs are more comfortable to wear for longer periods, offer a higher level of protection than a tight-fitting respirator and they are particularly suitable for high-risk aerosol generating tasks.

Surgical face masks are also used in healthcare settings. Although not classed as tight-fitting respirators, they offer some protection against airborne aerosols, but the PF can be much lower than that of a FFP, typically only reducing the contaminant concentration by around 65%. Surgical masks are therefore not recommended for high-risk aerosol generating tasks in a healthcare settings^{1,2}

Correct respirator use has previously been shown to reduce transmission of the SARS-CoV virus in healthcare settings³.

Achieving the full PF of the tight-fitting respirator largely depends on the wearer having a good fit to the face and performing a pre-use fit test or seal check. Training on how to correctly fit and remove respirators is essential prior to use.

Contamination can occur if one handles the outside of the respirator after use. We all have different shaped faces, and the mask may not match the face shape, some males have facial hair, which can make a tight fit impossible. These are all factors which have been shown to reduce the facial fit, lowering the actual PF achieved by the wearer¹.

An incorrect fit can potentially lead to contact transmission. Studies among chemical users have shown that when a respirator doesn't fit correctly, the worker is more inclined to 'fidget' with the mask, inadvertently touching their face and increasing the risk of transferring virus contamination to the face from their gloves⁴.

Although many FFPs are designed for one use only, during a pandemic FFPs can run short in supply and questions regarding decontamination options and the impact of such on the PF arise.

Thankfully, previous research has shown that successful decontamination treatments involving UV or steam can successfully eliminate viruses such as H5N1 for some respirator models⁵. This decontamination should also work for corona viruses, but it is best to avoid chemical sanitisation methods such as bleach or alcohol because they may affect the performance of the filter.

Powered air purifying respirators (PAPRs) are positive pressure respirators which use a battery-operated blower (usually worn on a belt) to filter the contaminated air and blow the cleaned air into a loose fitting hood and visor. The efficacy of a PAPR does not rely on the wearer achieving a good facial fit.

Although more expensive than an FFP, PAPR are more comfortable to wear for longer periods of time, as the wearer is supplied with fresh air and does not have to breathe through a filter. PAPRs offer higher PFs compared to a tight-fitting half face respirator. Studies have shown that healthcare workers find them easier to put on and remove and tend to feel safer when using them compared to a tight fitting mask⁷.

PAPRs have in the past been recommended for healthcare workers working with patients with MERS, especially for high-risk aerosol generating tasks, and these respirators could also be used for similar potentially high-risk tasks involving COVID-19⁶.

We are constantly reminded that the COVID-19 virus is persistent on surfaces such as plastic or metal for a few days, and frequent hand washing and disinfection of surfaces is important to avoid infection and contact transmission of the virus.

Again, training on how to fit and remove gloves is very important, to ensure that one doesn't contaminate the first hand they unglove when removing the second glove – and gloves should never be re-used. Workers should also avoid touching their skin or personal items such as mobile phones when gloved.

Studies among gloved chemical users have shown re-used gloves to be a source of chemical contamination on the face, and on personal items such as phones⁴. We touch our faces on average 16 times per hour⁸, frequent face touching can also lead to inadvertent ingestion of contaminants⁴, including virus particles. Therefore face touching, particularly when gloved, can be a significant mode of transmission for viruses.

Most importantly, wearing gloves does not substitute for washing hands. Gloves only reduce contact transmission when worn and used correctly and when hands are thoroughly washed before and after use.

The reader interested in more information on PPE, and how to correctly put it on and take it off, can find out more by clicking on the following links:

<https://www.hpsc.ie/a-z/microbiologyantimicrobialresistance/infectioncontrolandhai/guidelines/>

<https://www.nejm.org/doi/full/10.1056/NEJMvc1412105>

<https://www.ecdc.europa.eu/sites/default/files/documents/COVID-19-infection-prevention-and-control-healthcare-settings-march-2020.pdf>

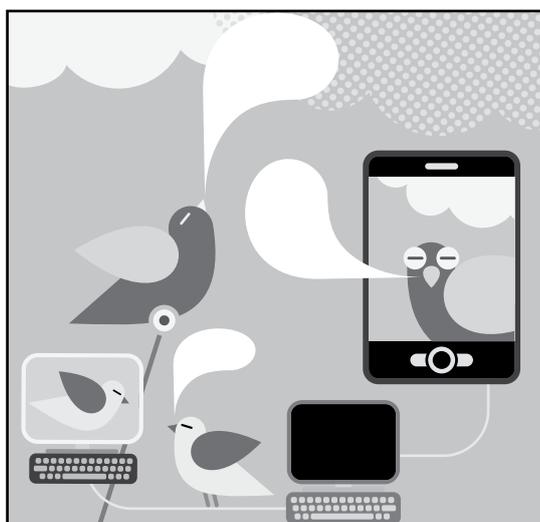
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