The following information resources have been selected by the National Health Library and Knowledge Service Evidence Virtual Team in response to your question. The resources are listed in our estimated order of relevance to practicing healthcare professionals confronted with this scenario in an Irish context. In respect of the evolving global situation and rapidly changing evidence base, it is advised to use hyperlinked sources in this document to ensure that the information you are disseminating to the public or applying in clinical practice is the most current, valid and accurate. For further information on the methodology used in the compilation of this document—including a complete list of sources consulted—please see our National Health Library and Knowledge Service Summary of Evidence Protocol.

YOUR QUESTION
What is the current evidence for the effectiveness of using a visor rather than a surgical face mask in preventing the transmission of COVID-19 in a healthcare setting?

IN A NUTSHELL

The use of face masks is part of a comprehensive package of prevention and control measures that can limit the spread of certain respiratory viral diseases, including COVID-19. Masks can be used either for protection of healthy persons [worn to protect oneself when in contact with an infected individual] or for source control [worn by an infected individual to prevent onward transmission]. In the event of severe shortage of medical masks, face shields may be considered as an alternative in health facilities; however, the use of cloth masks as an alternative to medical masks is not considered appropriate for protection of health workers based on limited available evidence.4

When providing care for certain categories of patients, the wearing of masks can present practical difficulties. In such circumstances it is appropriate to perform an institutional risk assessment and to consider alternatives to mask use that adequately manage the risk of transmission. When aerosol-generating procedures (AGPs) are performed, FFP2 masks are required in addition to eye protection. If a valved, non-shrouded respirator mask is used, facial protection such as a visor must always be worn.1

When advising the general public, mask-wearing was originally discouraged on the grounds that limited stocks of personal protective equipment (PPE) at the time meant that health workers may not have been able to access face masks; however, with increased manufacture of PPE and the re-engineering of some supply chains, the widespread availability of masks has resulted in
greater encouragement of mask-wearing. In some cases, masks are now required to access certain premises. In certain circumstances where individuals may experience difficulty in wearing a face mask, the HSE suggests using a full face visor or face shield. While a visor is not as effective as a face mask in terms of protection, it may be utilised as an alternative. However, you should still wear a face mask if you have or have been caring for someone with COVID-19, or are self-isolating and cannot maintain a 2 metre distance from others in your household.2

CDC does not currently recommend the use of face shields as a substitute for masks as there is currently not enough evidence to support the effectiveness of face shields as a method of source control. However, the CDC acknowledges that wearing a mask may not be feasible in every situation for some people and offer some considerations for individuals who must wear a face shield instead of a mask.5

Advani (2020) discusses universal masking of all personnel in hospitals, suggesting that face shields have the potential to overcome some of the major drawbacks of face masks.22 Face shields provide a high level of protection for the wearer; given that fact that they cover the whole face—mouth, nose and eyes—a high percentage of viral particles are prevented from reaching the wearer. Shields can therefore be very useful tools for those facing very regular contact, at close proximity, with others: eg in medical settings.9 In a simulation study, face shields were shown to reduce immediate viral exposure by 96% when worn by a simulated healthcare worker within 18 inches of a cough.11 An important factor that distinguishes face shields from masks is protection of the eyes. Marra et al state that the importance of eye protection in the prevention of COVID-19 and other coronaviruses is underappreciated, but given the potential role of the conjunctival route, face shields that provide barrier protection for the entire face might offer superior protection.27

The use of face shields may act as a reminder to maintain social distancing; and allows visibility of facial expressions and lip movements for speech perception among the hearing impaired38. Wain and Sleat state that face shields may be valuable in giving protection and confidence, and should be procured and supplied to certain key groups such as those working in education, enabling a safer return to a classroom environment9.
Face shields can substantially reduce the short-term exposure of health workers to large infectious aerosol particles, but smaller particles can remain airborne longer and flow around the face shield more easily, and subsequently be inhaled. Thus, face shields provide a useful adjunct to respiratory protection for workers caring for patients with respiratory infections. However, they cannot be used as a substitute for respiratory protection when indicated.41

In a recent study, Verma et al used qualitative visualizations to examine the performance of face shields and exhalation valves in impeding the spread of aerosol-sized droplets, concluding that it may be preferable to use high quality cloth or surgical masks that are of a plain design instead of face shields and masks equipped with exhale valves.26

Further research on this question is urgently needed.27 Research is also needed on methods and designs to mitigate the downsides of facemask wearing, particularly the assessment of alternatives such as face shields.19 There is a lack of consensus across cultures on whether wearing face masks is an effective physical intervention against disease transmission leading to varied and sometimes conflicting policies and guidelines.23 39

In respect of the use of face masks among the general public, Professor Trish Greenhalgh encourages adopting the “precautionary principle which states we should sometimes act without definitive evidence, just in case. As with parachutes for jumping out of aeroplanes, it is time to act without waiting for randomised controlled trial evidence.”21

Similarly, the Royal Society and British Academy address the potential overreliance on the emergence of definitive evidence, adding that “there have been no clinical trials of coughing into your elbow, social distancing and quarantine, yet these measures are seen as effective and have been widely adopted.”9

Model simulations using data relevant to COVID-19 dynamics in the US states of New York and Washington suggest that broad adoption of even relatively ineffective face masks may meaningfully reduce community transmission of COVID-19 and decrease peak hospitalizations and deaths.18
When facemasks are used by the public all of the time—not only from the first onset of symptoms—the effective reproduction number can be decreased below 1, leading to the mitigation of epidemic spread.\textsuperscript{33}

Any type of general mask use is likely to decrease viral exposure and infection risk on a population level in spite of imperfect fit or imperfect adherence.\textsuperscript{65} Face masks and coverings should not be viewed in isolation but are part of policy packages.\textsuperscript{9} The use of a mask alone is insufficient to provide an adequate level of protection or source control; other personal- and community-level measures should also be adopted to suppress transmission of respiratory viruses.\textsuperscript{4} Masks are not a substitute for other public health interventions; they must always be used in combination with social distancing and hand hygiene.\textsuperscript{22} Whether or not masks are used, compliance with hand hygiene, physical distancing and other infection prevention and control (IPC) measures are critical to prevent human-to-human transmission of COVID-19.\textsuperscript{4}

**IRISH AND INTERNATIONAL GUIDANCE**

**What does the Health Protection Surveillance Centre (Ireland) say?**

**HPSC (26 May 2020) Current recommendations for the use of Personal Protective Equipment (PPE) for Possible or Confirmed COVID-19 in a pandemic setting v2.1, 26.05.2020\textsuperscript{1}**

This guidance applies to all healthcare settings including primary, secondary and tertiary care, and to the ambulance service.

- Surgical masks should be worn by healthcare workers when they are providing care to people and are within 2m of a person, regardless of the COVID-19 status of the person.
- Surgical masks should be worn by all healthcare workers for all encounters of 15 minutes or more with other healthcare workers in the workplace where a distance of 2m cannot be maintained.

For the purpose of this guidance healthcare workers should don a mask if they anticipate being within 2m of one or more other healthcare workers for a continuous period of 15 minutes or longer.
Actions for Healthcare Workers
  — Implement standard precautions for infection prevention and control with all patients at all times.

Personal protective equipment while important is the last line of defence. Wearing of masks when providing care for certain categories of patient—eg patients who may need to lip-read—can present practical difficulties for patient care. In such circumstances it is appropriate to perform an institutional risk assessment and to consider alternatives to mask use that manage the risk of transmission of COVID-19.
Administrative activities are permitted in reception areas where staff are separated by at least 2 metres from patients and work colleagues. Surgical face masks should be worn if unable to maintain a 2-metre distance from patients and work colleagues. This does not apply if a physical barrier such as a Perspex screen is in place.

Patients with respiratory symptoms/suspected/confirmed COVID-19 who require an aerosol generating procedure:
  — Hand hygiene
  — Disposable single-use nitrile gloves
  — Long-sleeved disposable gown
  — FFP2 respirator mask
  — Eye protection

Eye protection/face visor should be worn when there is a risk of contamination to the eyes from splashing of blood, body fluids, excretions or secretions, including respiratory secretions.

  — Surgical mask with integrated visor
  — Full face shield or visor
  — Goggles/ safety spectacles

HPSC (15 May 2020) Use of face masks by the general public²
Medical masks are not recommended for use by the public. Their use in the community may make it more difficult to ensure that they are available to healthcare workers in those particular situations where they are necessary.
— Do remember that proper hand hygiene is essential and remains a priority.
— Do not use face coverings instead of self-isolation.
— Do not use face coverings instead of keeping your distance of 2 metres from other people whenever possible.
— Do not use face coverings instead of hand hygiene.

**What does the Health Service Executive (Ireland) say?**

**HSE (18 Aug 2020) Face Coverings, medical masks and disposable gloves³**

Face Coverings
A face covering is a material you wear that covers the nose and mouth. Wearing a face covering reduces the spread of coronavirus in the community. It helps to reduce the spread of respiratory droplets from people infected with coronavirus. This helps to stop people who are not aware they have the virus from spreading.

Visors and Face Shields
If you find it difficult to wear a cloth face covering, it's okay to wear a full face visor or face shield instead. They are not as good as wearing a face covering, but you'll still get a good level of protection. The visor should wrap around the sides of your face (ear to ear) and extend to below the chin. Reusable visors should be cleaned after each use and then stored in a clean place until needed. You should still wear a mask if you:

— have coronavirus, think you have coronavirus or are waiting on a test result
— are caring for someone with coronavirus or who has suspected coronavirus
— are self-isolating and you cannot keep 2 metres between you and other people in your household

Medical face masks are for:

— healthcare workers
— people in self-isolation who cannot keep a distance of 2 metres between themselves and other people in their household

Some workers in specific jobs also use them. Medical masks are vital supplies. They are not intended for use by the general public unless you are
in self-isolation and cannot keep a distance of 2 metres between you and other people in your household. Wear a cloth face covering when shopping and on public transport. This will help to make sure that medical face masks are kept for those who really need them.

**What does the World Health Organization say?**

*WHO (05 June 2020) Advice on the use of masks in the context of COVID-19*<sup>4</sup>

The use of masks is part of a comprehensive package of the prevention and control measures that can limit the spread of certain respiratory viral diseases, including COVID-19. Masks can be used either for protection of healthy persons [worn to protect oneself when in contact with an infected individual] or for source control [worn by an infected individual to prevent onward transmission]. However, the use of a mask alone is insufficient to provide an adequate level of protection or source control and other personal and community level measures should also be adopted to suppress transmission of respiratory viruses. Whether or not masks are used, compliance with hand hygiene, physical distancing and other infection prevention and control (IPC) measures are critical to prevent human-to-human transmission of COVID-19.

Note: Respirators are recommended for settings where AGPs are performed. Based on values and preferences and if widely available, they could also be used when providing direct care to COVID-19 patients in other settings.

Alternatives to medical masks in health facilities: in the context of severe medical mask shortage, face shields may be considered as an alternative. The use of fabric masks as an alternative to medical masks is not considered appropriate for protection of health workers based on limited available evidence. One study that evaluated the use of fabric masks in a healthcare facility found that health workers using cotton cloth masks were at increased risk of influenza illness compared with those who wore medical masks.

When a patient is suspected or confirmed to have COVID-19 infection, community health workers should use contact and droplet precautions. Contact and droplet precautions include the use of a medical mask, gown, gloves and eye protection.

**What do the Centers for Disease Control and Prevention (United States) say?**
**CDC (07 Aug 2020) Considerations for Wearing Masks**

Masks with exhalation valves or vents should NOT be worn to help prevent the person wearing the mask from spreading COVID-19 to others [source control].

Evidence for Effectiveness of Masks

Masks 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 mask 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 masks 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 masks is particularly important in settings where people are close to each other or where social distancing is difficult to maintain.

Masks with Exhalation Valves or Vents

The purpose of masks is to keep respiratory droplets from reaching others to aid with source control. However, masks with one-way valves or vents allow air to be exhaled through a hole in the material, which can result in expelled respiratory droplets that can reach others. This type of mask does not prevent the person wearing the mask from transmitting COVID-19 to others. Therefore, CDC does not recommend using masks for source control if they have an exhalation valve or vent.

Face Shields

A face shield is primarily used for eye protection for the person wearing it. At this time, it is not known what level of protection a face shield provides to people nearby from the spray of respiratory droplets from the wearer. There is currently not enough evidence to support the effectiveness of face shields for source control. Therefore, CDC does not currently recommend use of face shields as a substitute for masks.

However, wearing a mask may not be feasible in every situation for some people: eg people who are deaf or hard of hearing, or those who care for or interact with a person who is hearing impaired. Although evidence on face shields is limited, the available data suggest that the following face shields may provide better source control than others:
— face shields that wrap around the sides of the wearer’s face and extend below the chin
— hooded face shields

Face shield wearers should wash their hands before and after removing the face shield and avoid touching their eyes, nose and mouth when removing it. Disposable face shields should only be worn for a single use and disposed of according to manufacturer instructions. Reusable face shields should be cleaned and disinfected after each use according to manufacturer instructions or by following CDC face shield cleaning instructions. Plastic face shields for newborns and infants are NOT recommended.

**What do the Centre for Evidence-Based Medicine (UK) say?**

*What is the efficacy of standard face masks compared to respirator masks in preventing COVID type respiratory illnesses in primary care staff?*[^6]

Standard surgical masks are as effective as respirator masks such as N95, FFP2 or FFP3 for preventing infection of healthcare workers in outbreaks of viral respiratory illnesses such as influenza. No head to head trial of these masks in COVID-19 has yet been published and neither type of mask prevents all infection. Both types of mask need to be used in combination with other PPE measures. Respirator masks are recommended for protection during aerosol generating procedures (AGPs).


Face masks, face shields and N95 respirators are devices when they meet the definition of a device set forth in section 201(h) of the Federal Food, Drug and Cosmetic (FDC) Act. Under section 201(h) of the FDC Act, these products are devices when they are intended for use in the diagnosis of disease or other conditions or in the cure, mitigation, treatment or prevention of disease. Other face masks, face shields and filtering facepiece respirators (FFRs) are marketed to the general public for general, non-medical purposes such as use in construction and other industrial applications. Wherever possible, healthcare personnel and the general public should continue to use Food and Drug Administration (FDA)-cleared face masks as
source control; or, when those are not available, face masks authorized under the Emergency Use Authorisation (EUA). However, to help maintain the availability of equipment during the COVID-19 outbreak, FDA is continuing its April 2, 2020 policy regarding face masks, recognizing that there is some overlap with the EUA. Thus, for the duration of the public health emergency, FDA does not intend to object to the distribution and use of face masks with or without a face shield that are intended for a medical purpose whether used by medical personnel or by the general public where the face mask does not create an undue risk in light of the public health emergency. Similarly, FDA does not intend to object to the distribution and use of face shields that are intended for a medical purpose whether used by medical personnel or the general public where the face shield does not create an undue risk in light of the public health emergency.

The Royal Society and the British Academy (26 June 2020) [Pre-print not subject to formal peer-review] Face masks and coverings for the general public: Behavioural knowledge, effectiveness of cloth coverings and public messaging

The lack of clear recommendations for the general public and low uptake of wearing face masks and coverings may be attributed to: 1. over-reliance on an evidence-based medicine approach and assertion that evidence is weak due to few conclusive randomised controlled trial (RCT) results in community settings, discounting high quality non-RCT evidence [There have been no clinical trials of coughing into your elbow, social distancing and quarantine, yet these measures are seen as effective and have been widely adopted.]; 2. inconsistent and changing advice from supranational organisations such as the World Health Organisation (WHO) or the European Centre for Disease Prevention and Control (ECDC), with variation in policy even within Britain; 3. concern over the applicability of findings across multiple settings — healthcare vs general public, other pandemics and countries — and yet many lessons learned from previous pandemics repeat themselves during COVID-19; and, 4. mix of supply concerns and shortages of surgical face masks with recommendations for face mask wearing among the general public.

Current knowledge on the effectiveness of face masks to prevent virus transmission from COVID-19, SARS, MERS and H1N1 is mostly limited to studies of surgical masks and N95 respirators. The majority of existing studies are conducted in healthcare settings and focus on protection of the mask wearer as opposed to wearing a mask for the protection of others. This
distinction is vital since mask wearing for the general public occurs in non-clinical situations and involves both protection of oneself but also others. Surgical masks and N95 respirators were included in the most recent systematic review and meta-analysis published in the Lancet. Based on 29 studies, the authors concluded that the use of both N95 respirators and surgical masks, including similar reusable masks, were associated with large reductions in virus transmission. In this meta-analysis, they also found that mask wearing in non-healthcare settings is protective and statistically significant (RR=0.56, CI 0.40–0.79). There were, however, some concerns about this study, including difficulty in separating effects of different types of PPE, potential confounders and the transferability of results to community settings. Another meta-analysis found that medical masks provided similar protection to N95 respirators in protecting against viral respiratory infections in healthcare settings. It should be emphasized that the majority of studies have been conducted in healthcare settings and there are therefore caveats in the ability to transfer results directly to community settings. Protective equipment in healthcare settings may be more effective because of training, knowledge and the environment. As we note in relation to package policies (Section 5.3), masks are generally introduced as one of many policies such as hand hygiene and distancing and thus difficult to examine in exclusion. Both distance and duration of contact are similarly vital, but rarely examined, which may differ across settings. The key points from this report are:

- Cloth face coverings are effective in reducing source virus transmission—ie 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.
- 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.

WAIN and SLEAT (13 June 2020) The Role of Face Shields in Responding to COVID-19
Face shields provide a high level of protection for the wearer: given they cover the whole face, a high percentage of viral particles are prevented from
reaching the wearer. Face shields are arguably best at protecting from coughs and sneezes. As studies have shown, however, viral droplets, particularly small airborne speech particles, can remain in the air for a period of time, and these particles can be sucked in around the shield. Shields can therefore be very useful tools for those facing very regular contact at close proximity with others: eg in medical settings. They also have great value in professions where nonverbal communication through facial expressions is important: eg teaching. They could be valuable in giving protection and confidence to teachers, enabling them to return to a classroom environment. For this reason, we recommend that face shields are procured and supplied to key groups such as teachers, healthcare workers, emergency services staff, transport workers and those working in education. Their use should also be encouraged in private sector settings such as retail, leisure and hospitality.

POINT-OF-CARE TOOLS

What does UpToDate say?
*Coronavirus disease 2019 (COVID-19): Infection control in healthcare and home settings*¹⁰
For eye or face protection, goggles or a disposable face shield that covers the front and sides of the face should be used; glasses are not sufficient. If a powered air-purifying respirator (PAPR) is used, additional eye protection is not needed.

Universal Use of Masks
All patients and any exempted visitors should bring or be given nonmedical or cloth masks to wear upon entry into the healthcare setting for universal source control. Masks with exhalation valves or vents should be avoided since they do not provide source control; patients or visitors wearing one of these masks should be provided with an appropriate alternative. Visitors should be asked to wear the mask throughout their visit. Once patients are in an appropriate room such as a single room with the door closed for patients with suspected COVID-19, they can usually remove the mask. However, patients should put the mask back on for source control whenever a healthcare worker enters the room. If the patient cannot don the mask themselves, the healthcare worker should put the mask on the patient while
in the room. If a patient cannot or will not wear a mask, a face shield provides additional protection. Healthcare workers should also wear a mask while in the hospital setting. A medical mask or respirator must be used when caring for patients. These typically provide both source control and respiratory protection. However, if the respirator has an exhalation valve or vent, a medical mask should be placed on top of it since these types of respirators are not sufficient for source control. When supplies are limited, cloth masks may be reasonable for certain workers in healthcare settings, but only for those who do not engage in patient care and for providers when they are not involved in direct patient care activities. These masks should not have exhalation valves. Hand hygiene should be performed immediately before and after any contact with the face masks, including cloth masks. Masks should be changed if they become soiled, damp or difficult to breathe through. Cloth masks should be laundered regularly. The goal of universal masking is to reduce transmission of SARS-CoV-2 from unsuspected virus carriers. Emerging data have demonstrated a reduction in SARS-CoV-2 infections in healthcare workers after implementation of universal masking. In one report that evaluated nearly 10,000 healthcare workers from Massachusetts who were tested for SARS-CoV-2, the proportion with positive test results steadily declined after universal masking from 14.7% to 11.5% over 29 days despite an increase in the number of cases in the community. Similarly, in a study from North Carolina, the cumulative incidence rate of healthcare-acquired COVID-19 stabilized after the introduction of universal masking, despite an increased incidence of COVID-19 in the community.

INTERNATIONAL LITERATURE


Could a simple and affordable face shield, if universally adopted, provide enough added protection when combined with testing, contact tracing and hand hygiene to reduce transmissibility below a critical threshold? This implies that simple and easy-to-use barriers to respiratory droplets, along with hand hygiene and avoidance of touching the face, could help
prevent community transmission when physical distancing and stay-at-home measures are relaxed or no longer possible. The 2 major options for such barriers are face masks and face shields. To preserve medical masks for healthcare facilities, the Centers for Disease Control and Prevention has recommended that face shields, which can be quickly and affordably produced and distributed, should be included as part of strategies to safely and significantly reduce transmission in the community setting. All persons wear a cloth mask in public for source control. Cloth masks have been shown to be less effective than medical masks for prevention of communicable respiratory illnesses, although in vitro testing suggests that cloth masks provide some filtration of virus-sized aerosol particles. Face shields may provide a better option. Face shields come in various forms, but all provide a clear plastic barrier that covers the face. For optimal protection, the shield should extend below the chin anteriorly, to the ears laterally and there should be no exposed gap between the forehead and the shield’s headpiece. Face shields require no special materials for fabrication and production lines can be repurposed fairly rapidly. Numerous companies have started producing face shields. The shields can be made from materials found in craft or office supply stores. Thus, availability of face shields is currently greater than that of medical masks. Face shields offer a number of advantages. While medical masks have limited durability and little potential for reprocessing, face shields can be reused indefinitely and are easily cleaned with soap and water, or common household disinfectants. They are comfortable to wear, protect the portals of viral entry and reduce the potential for autoinoculation by preventing the wearer from touching their face. People wearing medical masks often have to remove them to communicate with others around them; this is not necessary with face shields. The use of a face shield is also a reminder to maintain social distancing but allows visibility of facial expressions and lip movements for speech perception. Most important, face shields appear to significantly reduce the amount of inhalation exposure to influenza virus, another droplet spread respiratory virus. In a simulation study, face shields were shown to reduce immediate viral exposure by 96% when worn by a simulated healthcare worker within 18 inches of a cough. Even after 30 minutes, the protective effect exceeded 80% and face shields blocked 68% of small particle aerosols, which are not thought to be a dominant mode of transmission of SARS-CoV-2. When the study was repeated at the currently recommended physical distancing distance of 6 feet, face shields reduced inhaled virus by 92%, similar to distancing alone,
which reinforces the importance of physical distancing in preventing viral respiratory infections. Of note, no studies have evaluated the effects or potential benefits of face shields on source control when worn by asymptomatic or symptomatic infected persons. However, with efficacy ranges of 68% to 96% for a single face shield, it is likely that adding source control would only improve efficacy and studies should be completed quickly to evaluate this hypothesis. Major policy recommendations should be evaluated using clinical studies. However, it is unlikely that a randomized trial of face shields could be completed in time to verify efficacy. No clinical trial has been conducted to assess the efficacy of widespread testing and contact tracing, but that approach is based on years of experience. The effectiveness of adding face shields as a community intervention to the currently proposed containment strategies should be evaluated using existing mathematical models. The implicit goal of face shields alone or in combination with other interventions should be to interrupt transmission by reducing the R0 to less than 1. Notably, effective control of even the most infectious pathogens, such as measles, does not require a vaccine with 100% efficacy. No burden of 100% efficacy should be placed on face shields or any containment policy because this level of control is both impossible to achieve and unnecessary to drive SARS-CoV-2 infection levels into a manageable range. To minimize the medical and economic consequences, it is important to rapidly assess and adopt a containment intervention strategy that drives transmissibility to manageable levels. Face shields, which can be quickly and affordably produced and distributed, should be included as part of strategies to safely and significantly reduce transmission in the community setting. Now is the time for adoption of this practical intervention.

Khan and Parab (30 April 2020) Safety Guidelines for Sterility of Face Shields During COVID-19 Pandemic

Face shields are personal protective equipment devices that are to be used by many healthcare workers during the COVID-19 pandemic for protection of the facial area and associated mucous membranes (eyes, nose, mouth) from droplet spread of infection. Face shields are generally not used alone, but in conjunction with other protective equipment such as cap, mask, goggle and are therefore classified as adjunctive personal protective equipment.
CHATURVEDI et al (24 July 2020) Design, usage and review of a cost effective and innovative face shield in a tertiary care teaching hospital during COVID-19 pandemic

A protective face shield was developed and distributed among the orthopaedic surgeons and front line HCWs involved in the ICU in our hospital and neighbouring facilities. Feedback was obtained using a questionnaire utilising a Likert scale. 227 face shields were distributed to the HCWs in our hospital and neighbouring facilities. Design modifications were carried out as per the needs of the HCWs. 37 HCWs provided feedback giving the face shields an overall mean score of 7.92 out of 10. The poly vinyl chloride (PVC) film visors were better for airway management procedures as it can be tucked into PPE suit and visors with overhead projector (OHP) sheets were suitable for ICU and operative procedures.

GODOY et al (May 2020) Facial protection for healthcare workers during pandemics: a scoping review

The COVID-19 pandemic has led to critical shortages of medical-grade PPE. Alternative forms of facial protection offer inferior protection. More robust evidence is required on different types of medical-grade facial protection. As research on COVID-19 advances, investigators should continue to examine the impact on alternatives of medical-grade facial protection.

MACINTYRE and CHUGTAI (Aug 2020) A rapid systematic review of the efficacy of face masks and respirators against coronaviruses and other respiratory transmissible viruses for the community, healthcare workers and sick patients

A systematic review of randomized controlled clinical trials on use of respiratory protection by healthcare workers, sick patients and community members was conducted. The study suggests that community mask use by well people could be beneficial, particularly for COVID-19, where transmission may be pre-symptomatic. The studies of masks as source control also suggest a benefit and may be important during the COVID-19 pandemic in universal community face mask use as well as in healthcare settings. Trials in healthcare workers support the use of respirators continuously during a shift. This may prevent health worker infections and deaths from COVID-19, as aerosolisation in the hospital setting has been documented.

What this paper adds:
— In the community, masks may be more protective for well people.
— In healthcare settings, continuous use of respirators is more protective compared to the medical masks and medical masks are more protective than cloth masks. Depending on the fabric and design, some cloth masks may not be safe for healthcare workers.
— The use of masks by sick patients is likely protective and coronaviruses can be emitted in normal breathing, in fine airborne particles.

**DAU et al (29 June 2020). Why N95 Should Be the Standard for All COVID-19 Inpatient Care**

Medical masks are surgical or procedural masks that are regulated as medical devices on the basis of a set of standard test methods. The terms medical mask and surgical mask are often used interchangeably in the literature to indicate face masks that meet national or international standards and protect against droplet transmission but are not certified as respirators. Filtering facepiece respirators are high-performance filtering masks. N95 respirators approved by the National Institute for Occupational Safety and Health filter at least 95% of NaCl particles. N95 respirators provide a close facial fit, are regulated on filtration and prevent aerosol transmission to the wearer. All guidelines recommend their use in aerosol-generating procedures (AGPs). However, there is differing guidance for HCWs, particularly regarding N95 respirators versus medical masks for frontline HCWs working with patients with COVID-19. We believe that a thoughtful evaluation of past and existing data in the setting of the COVID-19 pandemic strongly supports the use of N95 respirators for all inpatient care of patients with COVID-19, not only during AGPs.


The wearing of face masks has become usual and ubiquitous, not only in hospitals but also in the community. Without necessarily needing them, the general public is over-consuming surgical and filtering facepiece (FFP) masks, irrespective of their specificity. This may lead to supply shortages for HCWs in the frontline of patient care, as already reported in several countries.

Simple barrier measures of hand hygiene and respiratory measures through the use of anti-projection or surgical masks are effective measures for preventing the transmission of SARS-CoV-2. Wearing FFP masks is strictly
reserved for HCWs exposed to aerosols during invasive or specific procedures for patients suspected or confirmed as having COVID-19, although airborne transmission cannot completely be excluded. Hand hygiene is a key additional barrier measure to control the transmission of SARS-CoV-2.

EIKENBERRY et al (21 April 2020) To mask or not to mask: Modeling the potential for face mask use by the general public to curtail the COVID-19 pandemic

Face mask use by the general public for limiting the spread of SARS-CoV-2 is controversial, though increasingly recommended, and the potential effectiveness of this intervention is not well understood. We develop a compartmental model for assessing the community-wide impact of mask use by the general, asymptomatic public, a portion of which may be asymptotically infectious. Model simulations, using data relevant to COVID-19 dynamics in the US states of New York and Washington, suggest that broad adoption of even relatively ineffective face masks may meaningfully reduce community transmission of COVID-19 and decrease peak hospitalizations and deaths. Even very weak masks can still be useful if the underlying transmission rate is relatively low or decreasing.

Our results suggest that use of face masks by the general public is potentially of high value in curtailing community transmission and the burden of the pandemic. The community-wide benefits are likely to be greatest when face masks are used in conjunction with other non-pharmaceutical practices such as social-distancing and when adoption is almost universal and compliance high.

BAKHIT et al (19 June 2020) [This article is a preprint and has not been peer-reviewed] Downsides of face masks and possible mitigation strategies: a systematic review and meta-analysis

The authors aimed to identify, appraise and synthesise studies evaluating the downsides of wearing face masks in any setting, and also to discuss potential strategies to mitigate these downsides. The primary outcomes were compliance, discomforts, harms and adverse effects of wearing facemasks. There are insufficient data to quantify all of the adverse effects that might reduce the acceptability, adherence and effectiveness of face masks. New research on facemasks should assess and report potential harms and
downsides. Urgent research is also needed on methods to mitigate the
downsides of wearing face masks, particularly the assessment of
alternatives such as face shields.

**LEUNG et al (03 April 2020) Respiratory virus shedding in exhaled breath and efficacy of face masks**

We identified seasonal human coronaviruses, influenza viruses and
rhinoviruses in exhaled breath and coughs of children and adults with acute
respiratory illness. Surgical face masks significantly reduced detection of
influenza virus RNA in respiratory droplets and coronavirus RNA in aerosols,
with a trend toward reduced detection of coronavirus RNA in respiratory
droplets. Our results indicate that surgical face masks could prevent
transmission of human coronaviruses and influenza viruses from
symptomatic individuals.

**GREENHALGH et al (09 April 2020) Face masks for the public during the COVID-19 crisis**

In the face of a pandemic, the search for perfect evidence may be the enemy
of good policy. As with parachutes for jumping out of aeroplanes, it is time to
act without waiting for randomised controlled trial evidence. A recently
posted preprint of a systematic review came to the same conclusion. Masks
are simple, cheap and potentially effective. We believe that, worn both in the
home, particularly by the person showing symptoms, and also outside the
home in situations where meeting others is probable, [face masks] could
have a substantial impact on transmission with a relatively small impact on
social and economic life.

**Key Messages**

— The precautionary principle states that we should sometimes act
  without definitive evidence, just in case.
— Whether masks will reduce transmission of COVID-19 in the general
  public is contested.
— Even limited protection could prevent some transmission of COVID-19
  and save lives.
— Because COVID-19 is such a serious threat, wearing masks in public
  should be advised.
ADVANI et al (29 April 2020) Universal masking in hospitals in the COVID-19 era: Is it time to consider shielding?22

With concerns for pre-symptomatic transmission of COVID-19 and the increasing burden of contact tracing and employee furloughs, several hospitals have supplemented pre-existing infection prevention measures with universal masking of all personnel in hospitals. Other hospitals are currently faced with the dilemma of whether or not to proceed with universal masking in a time of critical mask shortages. We summarize the rationale behind a universal masking policy in healthcare settings, important considerations before implementing such a policy and the challenges with universal masking.

Universal Face Shields as an Alternative

Face shields are face coverings made of clear material attached to a headpiece to cover the eyes, nose and mouth. The design is intended to protect the facial area and associated mucous membranes from infectious droplets and spatter of body fluids. Face shields have the potential to overcome some of the major drawbacks of face masks. Face shields provide better coverage of the face compared with masks, hence reducing the risk of self-contamination. Additionally, face shields are durable and can be cleaned and reused; and, given their simpler design, durability and reuse potential, face shields are less likely to be in short supply. Additionally, face shields do not impede facial nonverbal communication; they can be worn concurrently with other face and eye protective equipment, and do not impact vocalization. However, the absence of a good seal around the face shield may lead to aerosol penetration and the shield may be subject to fogging or glare. Although additional studies are needed, universal face shielding offers a promising solution in a time of critical mask shortages.

In conclusion, universal masking, when implemented together with strict visitor restrictions and employee screening, may incrementally reduce healthcare-associated transmission of SARS-CoV-2. Additionally, such a policy will reduce the burden of contact tracing and subsequent furloughs of HCPs in a time of acute HCP shortages. It also provides reassurance to HCPs as they care for patients with known or suspected COVID-19 infection. A universal masking policy may not be appropriate for all hospitals because successful implementation requires an adequate supply of face masks. Furthermore, whether such a policy can indeed prevent transmission of SARS-CoV-2 is uncertain; nor is it known whether the benefits of such a
policy outweigh the disadvantages discussed above. Masks are not a substitute for other public health interventions; they must always be used in combination with social distancing and hand hygiene. Future studies are needed to examine the frequency of viral contamination of masks worn for long hours or multiple shifts, as are studies needed to compare rates of healthcare-associated SARS-CoV-2 in hospitals and long-term care facilities that do and do not utilize universal masking policies. Finally, exploring other approaches such as universal use of face shields or more durable face masks could provide much-needed scientific evidence related to the efficacy of universal masking polices or the use of other barrier methods.


In the context of Coronavirus Disease (2019) (COVID-19) cases globally, there is a lack of consensus across cultures on whether wearing face masks is an effective physical intervention against disease transmission. This study: 1. illustrates transmission routes of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2); 2. addresses controversies surrounding the wearing of masks; and 3. provides a suggestion that the public should wear masks during the COVID-19 pandemic according to local context.

Key Messages

- Masks are an effective non-pharmaceutical intervention mitigating the spread of SARS-CoV-2.
- The imperative of the general public wearing masks during the COVID-19 pandemic is under-emphasized.
- Mask use could prevent contact, droplet and possible aerosol transmission.
- Risk-adjusted strategies of mask use by the general public in different scenarios should be developed.
- Mutual cooperation, publicizing and sufficient supply of masks are recommended.

**RONEN et al (07 July 2020) [Preprint] Examining the protection efficacy of face shields against cough aerosol droplets using water sensitive papers**

Simple plastic face shields have many advantages compared to regular medical masks. They are easily cleaned for reuse and comfortable to wear. In light of the spreading COVID-19 pandemic, the potential of face shields as a
substitution for medical masks as a recommendation to the general population was tested. Testing the efficacy of the protective equipment utilized a cough simulator that was carefully tuned to replicate human cough in terms of droplet size distribution and outlet velocity. The tested protective equipment was worn on a manikin head simulating human breathing. An Aerodynamic Particle Sizer (APS) was used to analyze the concentration and size distribution of small particles that reach the manikin head respiration pathways. Additionally, water sensitive papers were taped over and under the tested protective equipment and were subsequently photographed and analyzed. For droplets larger than 3μm by diameter, the efficiency of shields to block cough droplets was found to be comparable to that of regular medical masks, with enhanced protection on face parts the mask does not cover. Additionally, for finer particles of the order 0.3 to few microns, a shield was found to perform even better, blocking about 10 times more fine particles than the medical mask. This implies that for the general population that is not intentionally (sic) exposed to confirmed infected individuals, recommending the use of face shields as an alternative to medical masks should be considered.

CHU et al (27 June 2020) Physical distancing, face masks and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis

We aimed to investigate the effects of physical distance, face masks and eye protection on virus transmission in healthcare and non-healthcare settings. We carried out a systematic review and meta-analysis to investigate the optimum distance for avoiding person-to-person virus transmission and to assess the use of face masks and eye protection to prevent the transmission of viruses. We obtained data for SARS-CoV-2 and the betacoronaviruses that cause severe acute respiratory syndrome and Middle East respiratory syndrome from 21 standard WHO-specific and COVID-19-specific sources. We searched these data sources from database inception to May 3, 2020, with no restriction by language, for comparative studies and for contextual factors of acceptability, feasibility, resource use and equity. We screened records, extracted data and assessed risk of bias in duplicate. We performed frequentist and Bayesian meta-analyses and random effects meta regressions. We rated the certainty of evidence according to Cochrane and GRADE. This study is registered with PROSPERO, CRD42020177047. Findings: Our search identified 172 observational studies across 16 countries and six continents, with no randomised controlled trials and 44 relevant
comparative studies in healthcare and non-healthcare settings \( n=25697 \) patients). Transmission of viruses was lower with physical distancing of 1 m or more, compared with a distance of less than 1 m \( n=10736 \), pooled adjusted odds ratio \( \text{aOR} \; 0.18 \), 95% CI 0.09 to 0.38; risk difference \( \text{RD} \) −10.2%, 95% CI −11.5 to −7.5; moderate certainty); protection was increased as distance was lengthened (change in relative risk \( \text{RR} \) 2.02 per m; pinteraction=0.041; moderate certainty). Face mask use could result in a large reduction in risk of infection \( n=2647 \); \( \text{aOR} \; 0.15 \), 95% CI 0.07 to 0.34, \( \text{RD} \) −14.3%, −15.9 to −10.7; low certainty), with stronger associations with N95 or similar respirators compared with disposable surgical masks or similar (eg reusable 12–16-layer cotton masks; pinteraction=0.090; posterior probability >95%, low certainty). Eye protection also was associated with less infection \( n=3713 \); \( \text{aOR} \; 0.22 \), 95% CI 0.12 to 0.39, \( \text{RD} \) −10.6%, 95% CI −12.5 to −7.7; low certainty). Unadjusted studies and subgroup and sensitivity analyses showed similar findings. Interpretation The findings of this systematic review and meta-analysis support physical distancing of 1 m or more and provide quantitative estimates for models and contact tracing to inform policy. Optimum use of face masks, respirators and eye protection in public and healthcare settings should be informed by these findings and contextual factors. Robust randomised trials are needed to better inform the evidence for these interventions, but this systematic appraisal of currently best available evidence might inform interim guidance.

**VERMA et al (04 Aug 2020)** Visualizing droplet dispersal for face shields and masks with exhalation valves

Several places across the world are experiencing a steep surge in COVID-19 infections. Face masks have become increasingly accepted as one of the most effective means for combating the spread of the disease, when used in combination with social-distancing and frequent handwashing. However, there is an increasing trend of people substituting regular cloth or surgical masks with clear plastic face shields and with masks equipped with exhalation valves. One of the factors driving this increased adoption is improved comfort compared to regular masks. However, there is a possibility that widespread public use of these alternatives to regular masks could have an adverse effect on mitigation efforts. To help increase public awareness regarding the effectiveness of these alternative options, we use qualitative visualizations to examine the performance of face shields and exhalation valves in impeding the spread of aerosol-sized droplets. The
visualizations indicate that although face shields block the initial forward motion of the jet, the expelled droplets can move around the visor with relative ease and spread out over a large area depending on light ambient disturbances. Visualizations for a mask equipped with an exhalation port indicate that a large number of droplets pass through the exhale valve unfiltered, which significantly reduces its effectiveness as a means of source control. Our observations suggest that to minimize the community spread of COVID-19, it may be preferable to use high quality cloth or surgical masks that are of a plain design, instead of face shields and masks equipped with exhale valves.


An important factor that distinguishes face shields from masks is eye protection. The importance of eye protection in the prevention of COVID-19 and other coronaviruses is underappreciated — which may have led to public health authorities recommending cotton face masks over potentially more protective alternatives such as face shields. It has been increasingly recognized that severe acute respiratory coronavirus virus 2 (SARS-CoV-2) can be transmitted from infected individuals when they are asymptomatic or presymptomatic. Thus, to prevent transmission in the community, personal protective equipment (PPE) must be worn at all times in addition to other containment measures such as 2 metre distancing and avoiding large gatherings. Both droplet and contact transmission routes have been implicated in the spread of SARS-CoV-2. PPE has 2 potential benefits when worn in the community: 1. PPE can provide source control by containing the respiratory droplets generated through coughs, sneezes or during speech; and 2. PPE can act as a barrier preventing respiratory droplets from landing on facial mucosal membranes or other parts of the face. Additionally, PPE can prevent contact transmission by preventing contaminated hands from reaching the mucosal membranes of the mouth, nose and eyes. Eye protection might provide additional benefits. A detailed investigation of risk factors for HCW acquisition of SARS, including multivariate generalized estimating equation logistic regression models, identified unprotected eye contact with body fluids as an independent risk factor for infection (odds ratio [OR], 7.34; P = .001). However, in a survey of 8 of the 9 US healthcare facilities in which SARS-CoV-1-infected patients were evaluated, 70% of HCWs reported some exposure to
patients without wearing some level of eye protection and none acquired infection. Although conjunctivitis has been described in a few patients with COVID-19 and other coronavirus syndromes, emerging evidence supports that coronavirus can enter the host via the conjunctival route. Conjunctiva may be a potential portal for infection because it is directly exposed to extraocular pathogens and the mucosa of the ocular surface and upper respiratory tract are connected by the nasolacrimal duct and have been shown to share the same entry receptors for some respiratory viruses, including angiotensin-converting enzyme 2 (ACE2) for SARS-CoV-1 and SARS-CoV-2. In addition, SARS-CoV-2 was detectable in several nasolacrimal system-associated tissues, including the conjunctiva, lacrimal gland, nasal cavity and throat, thus validating the anatomical bridge between ocular mucosa and the respiratory tract. Finally, macaques were susceptible to SARSCoV-2 infection via the conjunctival route and progressed to lung infections suggesting the biological importance of eye infection. Given that SARS-CoV-2 can be transmitted by fomites and droplets that contact the mucous membranes of the mouth and nose as well as the eyes, it appears that until proven otherwise, HCWs and at-risk citizens in the community should use barriers to protect their entire face, including their eyes. Current public health guidance [in the United States] recommends cotton face masks, but given the potential role of the conjunctival route, face shields that provide barrier protection for the entire face might be the superior option. Further research in this area is critically needed.

FLANAGAN & BALLARD (June 2020) 3D Printed Face Shields: A Community Response to the COVID-19 Global Pandemic\textsuperscript{28}

The evolution of medical 3D printing over the last decade has followed paths of both imagination and problem-solving. Beginning as a novelty with limited practical value, 3D printing has grown to find mainstream uses and acceptance in various industries including engineering, automotive manufacturing, military production and healthcare. While the diversity of these paths is impressive, we now must merge efforts to meet a collective need. Focused efforts of 3D printing enthusiasts and 3D printing laboratories can help address the critical shortage of personal protective equipment (PPE) during the global COVID-19 pandemic. The purpose of this letter is to discuss the role of 3D printing particularly in the production of face shields, examine its feasibility and adherence under new Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA) pandemic
guidelines, and recommend a focused effort by 3D printing hobbyists and industries. Ambitious and imaginative medical professionals saw the potential capabilities of 3D printing early on, sparking a robust medical 3D printing industry that continues to evolve. Current indications for 3D printing include anatomic models and surgical guides for preoperative planning and intraoperative guidance. These 3D printing applications, often facilitated by radiology departments, have found success with several applications such as orthopedic and maxillofacial surgery. There are category III current procedural terminology codes for anatomic models and guides, an effort facilitated by the Radiological Society of North America 3D Printing Special Interest Group and American College of Radiology. However, we as a medical community are now faced with a new collective requirement in the face of the current COVID-19 global pandemic: to protect ourselves despite a critical shortage of PPE.

Healthcare providers across the nation are improvising and rationing, often outside the lines of CDC and FDA guidelines. Healthcare frontliners in NYC have worn trash bags and rain ponchos due to lack of sufficient PPE and healthcare facilities have distributed policies regarding reuse and rationing of PPE on the frontlines. New CDC and FDA guidelines outline acceptable alternatives and improvisation to the standard PPE within limits. CDC guidelines for contact with COVID-19 patients, readily available from their website, require that eye protection be worn—either in the form of goggles or a disposable face shield. While ideally worn with an N95 mask, a face shield and surgical mask are now identified as an acceptable alternative. Usually these face shields are subject to FDA enforcement guidelines, but the FDA has relaxed these guidelines, stating they do not intend to object to the distribution of improvised face shields as long as they create no undue risk, citing an attempt to help foster greater availability of PPE for the duration of the public health emergency. Requirements for face shields are now bare bones: the products must be labeled as face shields, include a list of the materials which contact the body and must not be flammable. The evolution of 3D printing now must follow a merged path of both imagination and problem-solving in the production of improvised PPE as we collectively face the global pandemic caused by COVID-19. With relaxed guidelines on the regulation of PPE by the FDA, there is a clear need for 3D printed face shields by both hobbyists and developed 3D printing industries. 3D printers of the world, please unite together with singular focus: to keep our frontliners safe in our collective fight against COVID-19.
VIOLA et al (19 May 2020) Face Coverings, Aerosol Dispersion and Mitigation of Virus Transmission Risk

In some countries, the public has been asked to use face covers to mitigate the risk of virus transmission; and yet, their outward effectiveness is not ascertained. We used a Background Oriented Schlieren technique to investigate the air flow ejected by a person while quietly and heavily breathing, while coughing and with different face covers. We found that all face covers without an outlet valve reduce frontal flow through jet by more than 90%. For the FFP1 and FFP2 masks without exhalation valve, the frontal throughflow does not extend beyond $\frac{1}{2}$ and $\frac{1}{4}$ of a metre, respectively. Surgical and hand-made masks and face shields, generate several leakage jets including intense backward and downwards jets that may present major hazards. We also simulated an aerosol generating procedure [extubation] and showed that it is a major hazard for clinicians. These results can aid policy makers to make informed decisions and PPE developers to improve their product effectiveness by design.

CHUGHTAI et al (08 July 2020) Effectiveness of Cloth Masks for Protection Against Severe Acute Respiratory Syndrome Coronavirus

Cloth masks have been used in healthcare and community settings to protect the wearer from respiratory infections. The use of cloth masks during the coronavirus disease (COVID-19) pandemic is under debate. The filtration effectiveness of cloth masks is generally lower than that of medical masks and respirators; however, cloth masks may provide some protection if well designed and used correctly. Multilayer cloth masks, designed to fit around the face and made of water-resistant fabric with a high number of threads and finer weave, may provide reasonable protection. Until a cloth mask design is proven to be equally effective as a medical or N95 mask, wearing cloth masks should not be mandated for healthcare workers. In community settings, however, cloth masks may be used to prevent community spread of infections by sick or asymptptomatically infected persons and the public should be educated about their correct use.

SWAIN, Ian (27 July 2020) Why the mask? The effectiveness of face masks in preventing the spread of respiratory infections such as COVID-19 – a home testing protocol

Since the start of the COVID-19 pandemic there has been much debate in the media on whether masks should be worn to stop the spread of the virus.
There are two ways in which masks may be effective: 1. to protect the person wearing the mask; and 2. to reduce the potential of the person wearing the mask passing on the disease to anyone else. The method used in this study [to estimate the effectiveness of mask wearing] was to measure the change in relative humidity when wearing a mask compared to no mask in various scenarios based on the assumption that as the virus is airborne the smaller the increase in humidity the less the spread of the virus. The results show that the use of a mask, excluding some simple homemade ones, significantly reduces the spread of humidity; however, their effectiveness is device specific and needs to be considered in greater detail for each type of mask, especially in respect of the direction of escaping air when forward flow is blocked.

**MACINTYRE et al (July 2020) Human coronavirus data from four clinical trials of masks and respirators**

There are few published data on the efficacy of masks or respirators against coronavirus infections. This is an important research question to inform the response to the COVID-19 epidemic. The transmission modes of human coronaviruses are similar, thought to be by droplet, contact and sometimes airborne routes. There are several randomized clinical trials of masks and respirators, but most used clinical endpoints or tested only for influenza. We reviewed and analyzed the coronavirus data from 4 of our trials. Laboratory-confirmed coronavirus infections were identified in our community household trial [n=1 case], health worker trials [n=8 cases], and trial of mask use by sick patients [n=19 cases]. No coronavirus infections were transmitted in households to parents who wore P2 or surgical masks, but one child with coronavirus infection transmitted infection to a parent in the control arm. No transmissions to close contacts occurred when worn by sick patients with coronavirus infections. There was a higher risk of coronavirus infection in HCWs who wore a mask compared to a respirator, but the difference was not statistically significant. These are the only available clinical trial data on coronavirus infections associated with mask or respirator use. More clinical trials are needed to assess the efficacy of respiratory protection against coronavirus infections.
STUTT et al (10 June 2020) A modelling framework to assess the likely effectiveness of facemasks in combination with 'lockdown' in managing the COVID-19 pandemic

COVID-19 is characterized by an infectious pre-symptomatic period when newly infected individuals can unwittingly infect others. We are interested in what benefits facemasks could offer as a non-pharmaceutical intervention, especially in the settings where high-technology interventions such as contact tracing using mobile apps or rapid case detection via molecular tests are not sustainable. Here, we report the results of 2 mathematical models and show that facemask use by the public could make a major contribution to reducing the impact of the COVID-19 pandemic. Our intention is to provide a simple modelling framework to examine the dynamics of COVID-19 epidemics when facemasks are worn by the public, with or without imposed lockdown periods. Our results are illustrated for a number of plausible values for parameter ranges describing epidemiological processes and mechanistic properties of facemasks in the absence of current measurements for these values. We show that, when facemasks are used by the public all the time — not just from when symptoms first appear — the effective reproduction number, $R_e$, can be decreased below 1, leading to the mitigation of epidemic spread. Under certain conditions, when lockdown periods are implemented in combination with 100% facemask use, there is vastly less disease spread, secondary and tertiary waves are flattened and the epidemic is brought under control. The effect occurs even when it is assumed that facemasks are only 50% effective at capturing exhaled virus inoculum with an equal or lower efficiency on inhalation. Facemask use by the public has been suggested to be ineffective because wearers may touch their faces more often, thus increasing the probability of contracting COVID-19. For completeness, our models show that facemask adoption provides population-level benefits, even in circumstances where wearers are placed at increased risk. At the time of writing, facemask use by the public has not been recommended in many countries, but a recommendation for wearing face-coverings has just been announced for Scotland. Even if facemask use began after the start of the first lockdown period, our results show that benefits could still accrue by reducing the risk of the occurrence of further COVID-19 waves. We examine the effects of different rates of facemask adoption without lockdown periods and show that, even at lower levels of adoption, benefits accrue to the facemask wearers. These analyses may explain why some countries where adoption of facemask use by the public is around 100% have experienced significantly lower rates of COVID-19 spread.
and associated deaths. We conclude that facemask use by the public, when used in combination with physical distancing or periods of lockdown, may provide an acceptable way of managing the COVID-19 pandemic and re-opening economic activity. These results are relevant to the developed as well as the developing world, where large numbers of people are resource poor, but fabrication of home-made, effective facemasks is possible. A key message from our analyses to aid the widespread adoption of facemasks would be: my mask protects you, your mask protects me.

**LONG et al (13 Mar 2020) Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis**

We aimed to assess the effectiveness of N95 respirators versus surgical masks for prevention of influenza by collecting randomized controlled trials. The use of N95 respirators compared with surgical masks is not associated with a lower risk of laboratory-confirmed influenza, suggesting that N95 respirators should not be recommended for the general public or non-high-risk medical staff — ie those not in close contact with influenza patients or other suspected COVID-19 patients.

**RADONOVOICH JR et al (03 Sep 2019) N95 Respirators vs Medical Masks for Preventing Influenza Among Healthcare Personnel: A Randomized Clinical Trial**

Clinical studies have been inconclusive about the effectiveness of N95 respirators and medical masks in preventing healthcare personnel (HCP) from acquiring workplace viral respiratory infections.

Objective: To compare the effect of N95 respirators vs medical masks for prevention of influenza and other viral respiratory infections among HCP.

Design, setting and participants: A cluster randomized pragmatic effectiveness study conducted at 137 outpatient study sites at 7 US medical centers between September 2011 and May 2015, with final follow-up in June 2016. Each year for 4 years, during the 12-week period of peak viral respiratory illness, pairs of outpatient sites (clusters) within each center were matched and randomly assigned to the N95 respirator or medical mask groups.

Interventions: Overall, 1993 participants in 189 clusters were randomly assigned to wear N95 respirators (2512 HCP-seasons of observation) and 2058 in 191 clusters were randomly assigned to wear medical masks (2668 HCP-seasons) when near patients with respiratory illness.
Main outcomes and measures: The primary outcome was the incidence of laboratory-confirmed influenza. Secondary outcomes included incidence of acute respiratory illness, laboratory-detected respiratory infections, laboratory-confirmed respiratory illness and influenza-like illness. Adherence to interventions was assessed.

Results: Among 2862 randomized participants (mean [SD] age, 43 [11.5] years; 2369 [82.8%] women), 2371 completed the study and accounted for 5180 HCP-seasons. There were 207 laboratory-confirmed influenza infection events (8.2% of HCP-seasons) in the N95 respirator group and 193 (7.2% of HCP-seasons) in the medical mask group (difference, 1.0%, [95% CI, -0.5% to 2.5%]; P = .18) (adjusted odds ratio [OR], 1.18 [95% CI, 0.95-1.45]). There were 1556 acute respiratory illness events in the respirator group vs 1711 in the mask group (difference, -21.9 per 1000 HCP-seasons [95% CI, -48.2 to 4.4]; P = .10); 679 laboratory-detected respiratory infections in the respirator group vs 745 in the mask group (difference, -8.9 per 1000 HCP-seasons, [95% CI, -33.3 to 15.4]; P = .47); 371 laboratory-confirmed respiratory illness events in the respirator group vs 417 in the mask group (difference, -8.6 per 1000 HCP-seasons [95% CI, -28.2 to 10.9]; P = .39); and 128 influenza-like illness events in the respirator group vs 166 in the mask group (difference, -11.3 per 1000 HCP-seasons [95% CI, -23.8 to 1.3]; P = .08). In the respirator group, 89.4% of participants reported always or sometimes wearing their assigned devices vs 90.2% in the mask group.

Conclusions and Relevance: Among outpatient healthcare personnel, N95 respirators vs medical masks as worn by participants in this trial resulted in no significant difference in the incidence of laboratory-confirmed influenza.

MACINTYRE et al (2016) Cluster randomised controlled trial to examine medical mask use as source control for people with respiratory illness

Medical masks are commonly used by sick individuals with influenza-like illness (ILI) to prevent spread of infections to others, but clinical efficacy data are absent.

Objective: Determine whether medical mask use by sick individuals with ILI protects well contacts from related respiratory infections.

Setting: 6 major hospitals in 2 districts of Beijing, China.

Design: Cluster randomised controlled trial.

Participants: 245 index cases with ILI.

Intervention: Index cases with ILI were randomly allocated to medical mask (n=123) and control arms (n=122). Since 43 index cases in the control arm...
also used a mask during the study period, an as-treated post hoc analysis was performed by comparing outcomes among household members of index cases who used a mask (mask group) with household members of index cases who did not use a mask (no-mask group).

Main outcome measure: Primary outcomes measured in household members were clinical respiratory illness, ILI and laboratory-confirmed viral respiratory infection.

Results: In an intention-to-treat analysis, rates of clinical respiratory illness (relative risk (RR) 0.61, 95% CI 0.18 to 2.13), ILI (RR 0.32, 95% CI 0.03 to 3.13) and laboratory-confirmed viral infections (RR 0.97, 95% CI 0.06 to 15.54) were consistently lower in the mask arm compared with control, although not statistically significant. A post hoc comparison between the mask versus no-mask groups showed a protective effect against clinical respiratory illness, but not against ILI and laboratory-confirmed viral respiratory infections.

Conclusions: The study indicates a potential benefit of medical masks for source control, but is limited by small sample size and low secondary attack rates. Larger trials are needed to confirm efficacy of medical masks as source control.

BARASHEED et al (2016) Uptake and effectiveness of facemask against respiratory infections at mass gatherings: a systematic review

Objectives: The risk of acquisition and transmission of respiratory infections is high among attendees of mass gatherings. Currently used interventions have limitations yet the role of facemask in preventing those infections at mass gatherings has not been systematically reviewed. We have conducted a systematic review to synthesise evidence about the uptake and effectiveness of facemask against respiratory infections in mass gatherings.

Methods: A comprehensive literature search was conducted according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines using major electronic databases such as, Medline, EMBASE, SCOPUS and CINAHL. Results: Of 25 studies included, the pooled sample size was 12710 participants from 55 countries aged 11 to 89 years, 37% were female. The overall uptake of facemask ranged from 0.02% to 92.8% with an average of about 50%. Only 13 studies examined the effectiveness of facemask and their pooled estimate revealed significant protectiveness against respiratory infections (relative risk [RR] = 0.89, 95% CI: 0.84–0.94, p < 0.01), but the study end points varied widely. Conclusion: A
modest proportion of attendees of mass gatherings use facemask, the practice is more widespread among healthcare workers. Facemask use seems to be beneficial against certain respiratory infections at mass gatherings but its effectiveness against specific infection remains unproven.

ROBERGE, RJ (2016) Face shields for infection control: A review

Face shields are personal protective equipment devices that are used by many workers for protection of the facial area and associated mucous membranes from splashes, sprays and spatter of body fluids. Face shields are generally not used alone but in conjunction with other protective equipment, and are therefore classified as adjunctive personal protective equipment. Although there are millions of potential users of face shields, guidelines for their use vary between governmental agencies and professional societies and little research is available regarding their efficacy.


Objective: The aim of this study was to compare the efficacy of cloth masks to medical masks in hospital healthcare workers (HCWs). The null hypothesis is that there is no difference between medical masks and cloth masks.
Participants: 1607 hospital HCWs aged ≥18 years working full-time in selected high-risk wards.
Intervention: Hospital wards were randomised to: medical masks, cloth masks or a control group [usual practice, which included mask wearing]. Participants used the mask on every shift for 4 consecutive weeks.
Main outcome measure: Clinical respiratory illness (CRI), influenza-like illness (ILI) and laboratory-confirmed respiratory virus infection.
Results: The rates of all infection outcomes were highest in the cloth mask arm, with the rate of ILI statistically significantly higher in the cloth mask arm (relative risk (RR)=13.00, 95% CI 1.69 to 100.07) compared with the medical mask arm. Cloth masks also had significantly higher rates of ILI compared with the control arm. An analysis by mask use showed ILI (RR=6.64, 95% CI 1.45 to 28.65) and laboratory-confirmed virus (RR=1.72, 95% CI 1.01 to 2.94) were significantly higher in the cloth masks group compared with the medical masks group. Penetration of cloth masks by particles was almost 97% and medical masks 44%.
Conclusions: This study is the first Randomised Controlled Trial (RCT) of cloth masks and the results caution against the use of cloth masks. This is an important finding to inform occupational health and safety. Moisture retention, reuse of cloth masks and poor filtration may result in increased risk of infection. Further research is needed to inform the widespread use of cloth masks globally. However, as a precautionary measure, cloth masks should not be recommended for HCWs, particularly in high-risk situations and guidelines need to be updated.

MACINTYRE and CHUGHTAI (2015) Facemasks for the prevention of infection in healthcare and community settings

Several randomised clinical trials of facemasks have been conducted in community and healthcare settings using widely varying interventions including mixed interventions such as masks and handwashing. The clinical trials found that facemasks and facemasks + hand hygiene may prevent infection in community settings, subject to early use and compliance. 2 clinical trials in healthcare workers favoured respirators for clinical respiratory illness. The use of reusable cloth masks is widespread globally, particularly in Asia, which is an important region for emerging infections, but there is no clinical research or guidance to inform their use. Health economic analyses of facemasks are scarce and the few published cost effectiveness models do not use clinical efficacy data. The lack of research on facemasks and respirators is reflected in varied and sometimes conflicting policies and guidelines. Further research should focus on examining the efficacy of facemasks against specific infectious threats such as influenza and tuberculosis, assessing the efficacy of cloth masks, investigating common practices such as reuse of masks, assessing compliance, filling in policy gaps and obtaining cost effectiveness data using clinical efficacy estimates.

LINDSLEY et al (2014) Efficacy of face shields against cough aerosol droplets from a cough simulator

Healthcare workers are exposed to potentially infectious airborne particles while providing routine care to coughing patients. However, much is not understood about the behavior of these aerosols and the risks they pose. We used a coughing patient simulator and a breathing worker simulator to investigate the exposure of healthcare workers to cough aerosol droplets and to examine the efficacy of face shields in reducing this exposure. Our results showed that 0.9% of the initial burst of aerosols from a cough can be inhaled by a worker 46 cm (18 inches) from the patient. During testing of an
influenza-laden cough aerosol with a volume median diameter (VMD) of 8.5 µm, wearing a face shield reduced the inhalational exposure of the worker by 96% in the period immediately after a cough. The face shield also reduced the surface contamination of a respirator by 97%. When a smaller cough aerosol was used [VMD = 3.4 µm], the face shield was less effective, blocking only 68% of the cough and 76% of the surface contamination. In the period from 1 to 30 minutes after a cough, during which the aerosol had dispersed throughout the room and larger particles had settled, the face shield reduced aerosol inhalation by only 23%. Increasing the distance between the patient and worker to 183 cm reduced the exposure to influenza that occurred immediately after a cough by 92%. Our results show that healthcare workers can inhale infectious airborne particles while treating a coughing patient. Face shields can substantially reduce the short-term exposure of healthcare workers to large infectious aerosol particles, but smaller particles can remain airborne longer and flow around the face shield more easily to be inhaled. Thus, face shields provide a useful adjunct to respiratory protection for workers caring for patients with respiratory infections. However, they cannot be used as a substitute for respiratory protection when it is needed.

JEFFERSON et al (2011) Physical interventions to interrupt or reduce the spread of respiratory viruses

Although respiratory viruses usually only cause minor disease, they can cause epidemics. We searched for evidence for the effectiveness of simple physical barriers such as handwashing or wearing masks in reducing the spread of respiratory viruses, including influenza viruses. Respiratory virus spread can be reduced by hygienic measures, especially around younger children. Frequent handwashing can also reduce transmission from children to other household members. Implementing barriers to transmission, such as isolation and hygienic measures, can be effective in containing respiratory virus epidemics or in hospital wards. We found no evidence that the more expensive, irritating and uncomfortable N95 respirators were superior to simple surgical masks. There is insufficient evidence to support screening at entry ports and social distancing [spatial separation of at least one metre between those infected and those non-infected] as a method to reduce spread during epidemics.

Influenza viruses circulate around the world every year. From time to time new strains emerge and cause global pandemics. Many national and international health agencies recommended the use of face masks during the 2009 influenza A (H1N1) pandemic. We reviewed the English-language literature on this subject to inform public health preparedness. There is some evidence to support the wearing of masks or respirators during illness to protect others and public health emphasis on mask wearing during illness may help to reduce influenza virus transmission. There are fewer data to support the use of masks or respirators to prevent becoming infected. Further studies in controlled settings and studies of natural infections in healthcare and community settings are required to better define the effectiveness of face masks and respirators in preventing influenza virus transmission.

COWLING et al (2009) Facemasks and hand hygiene to prevent influenza transmission in households: a cluster randomized trial

Background: Few data are available about the effectiveness of nonpharmaceutical interventions for preventing influenza virus transmission.
Objective: To investigate whether hand hygiene and use of facemasks prevents household transmission of influenza.
Design: Cluster randomized, controlled trial. Randomization was computer generated; allocation was concealed from treating physicians and clinics and implemented by study nurses at the time of the initial household visit. Participants and personnel administering the interventions were not blinded to group assignment.
Setting: Households in Hong Kong.
Patients: 407 people presenting to outpatient clinics with influenza-like illness who were positive for influenza A or B virus by rapid testing (index patients) and 794 household members (contacts) in 259 households.
Intervention: Lifestyle education (control) (134 households), hand hygiene (136 households), or surgical facemasks plus hand hygiene (137 households) for all household members.
Measurements: Influenza virus infection in contacts, as confirmed by reverse-transcription polymerase chain reaction (RT-PCR) or diagnosed clinically after 7 days.
Results: 60 (8%) contacts in the 259 households had RT-PCR-confirmed influenza virus infection in the 7 days after intervention. Hand hygiene with or without facemasks seemed to reduce influenza transmission, but the differences compared with the control group were not significant. In 154 households in which interventions were implemented within 36 hours of symptom onset in the index patient, transmission of RT-PCR-confirmed infection seemed reduced, an effect attributable to fewer infections among participants using facemasks plus hand hygiene (adjusted odds ratio, 0.33 [95% CI, 0.13 to 0.87]). Adherence to interventions varied. Limitation: The delay from index patient symptom onset to intervention and variable adherence may have mitigated intervention effectiveness. Conclusion: Hand hygiene and facemasks seemed to prevent household transmission of influenza virus when implemented within 36 hours of index patient symptom onset. These findings suggest that nonpharmaceutical interventions are important for mitigation of pandemic and interpandemic influenza.


We assessed transmission reduction potential provided by personal respirators, surgical masks and home-made masks when worn during a variety of activities by healthy volunteers and a simulated patient. All types of masks reduced aerosol exposure, relatively stable over time, unaffected by duration of wear or type of activity, but with a high degree of individual variation. Personal respirators were more efficient than surgical masks, which were more efficient than home-made masks. Regardless of mask type, children were less well protected. Outward protection (mask wearing by a mechanical head) was less effective than inward protection (mask wearing by healthy volunteers). Any type of general mask use is likely to decrease viral exposure and infection risk on a population level, in spite of imperfect fit and imperfect adherence, personal respirators providing most protection. Masks worn by patients may not offer as great a degree of protection against aerosol transmission.
DAVIS et al (2007) A survey of Alberta physicians' use of and attitudes toward face masks and face shields in the operating room setting

There is little evidence that surgical mask use by physicians in the operating room (OR) reduces surgical site infections (SSIs), but masks do protect the wearer from potentially infectious splashes. Face shields offer even more protection because they cover the eyes, but they may be perceived as offering less protection to the patient than do masks.

OTHER

MUNDELL (April 2020) Are Face Shields Better Than Face Masks for Coronavirus?

Now, a team of experts say face shields might replace masks as a more comfortable and more effective deterrent to COVID-19.

"Face shields, which can be quickly and affordably produced and distributed, should be included as part of strategies to safely and significantly reduce transmission in the community setting," said a trio of physicians from the University of Iowa.

Reporting in the April 29 Journal of the American Medical Association, experts led by Dr. Eli Perencevich, of the university’s department of internal medicine and the Iowa City VA Healthcare System, said the face shield’s moment may have come.

While the US Centers for Disease Control and Prevention began advocating the use of cloth masks to help stop COVID-19 transmission in April, laboratory testing "suggests that cloth masks provide [only] some filtration of virus-sized aerosol particles."

According to Perencevich’s group, "face shields may provide a better option."

To be most effective in stopping viral spread, a face shield should extend to below the chin. It should also cover the ears and "there should be no exposed gap between the forehead and the shield's headpiece," the Iowa team members said.

Shields have a number of advantages over masks, they added. First of all, they are endlessly reusable, simply requiring cleaning with soap and water or common disinfectants. Shields are usually more comfortable to wear than masks and they form a barrier that keeps people from easily touching their own faces.

When speaking, people sometimes pull down a mask to make things easier — but that isn’t necessary with a face shield. And "the use of a face shield is
also a reminder to maintain social distancing, but allows visibility of facial expressions and lip movements for speech perception," the authors pointed out.

And what about the ability of a face shield to prevent coronavirus transmission?

According to the Iowa team, large-scale studies haven't yet been conducted [but] "in a simulation study, face shields were shown to reduce immediate viral exposure by 96% when worn by a simulated healthcare worker within 18 inches of a cough."

"When the study was repeated at the currently recommended physical distancing distance of 6 feet, face shields reduced inhaled virus by 92%," the authors said.

No studies have yet been conducted to see how well face shields help keep exhaled or coughed virus from spreading outwards from an infected wearer, Perencevich and his colleagues said and they hope that studies on that issue will be conducted.

And they stressed that face shields should only be one part of any infection control effort, along with social distancing and handwashing.

There will never be any intervention—even a vaccine—that can guarantee 100% effectiveness against the coronavirus, the authors said, so face shields shouldn't be held to that standard.

Dr. Robert Glatter is on the front lines of the COVID-19 pandemic in his role as emergency physician at Lenox Hill Hospital in New York City. Reading over the new report, he agreed that common sense measures are crucial in curbing infections.

"One approach that makes the most sense, especially in light of the limitations of face masks and face coverings, is the use of face shields," Glatter said.

"While we don't have hard trials or data on the efficacy of face shields at this time, early data from their use in patients with influenza [which is droplet-spread] is promising," he noted. "What's clear is that their success in hospital settings provides the basis for their utility in the community setting as we relax physical distancing going forward."

**SIDDIQUE, H (18 May 2020) Face visors may protect wearer but not other people against COVID-19**

Face visors and shields could protect workers who have close contact with others against infection from COVID-19, but may not prevent the wearer spreading the virus, experts have said. Linda Bauld, a professor of public
health at the University of Edinburgh, said research was needed into the alternative forms of face protection before they could be recommended for general use.


BACHER and LANZITO (23 July 2020) Are Face Shields Better Than Masks for Coronavirus Protection?: The advantages of wearing a clear plastic face covering and how to make your own in minutes
Produced by the members of the National Health Library and Knowledge Service Evidence Team. Current as at 14 Sept 2020. This evidence summary collates the best available evidence at the time of writing and does not replace clinical judgement or guidance. Emerging literature or subsequent developments in respect of COVID-19 may require amendment to the information or sources listed in the document. Although all reasonable care has been taken in the compilation of content, the National Health Library and Knowledge Service Evidence Team makes no representations or warranties expressed or implied as to the accuracy or suitability of the information or sources listed in the document. This evidence summary is the property of the National Health Library and Knowledge Service and subsequent re-use or distribution in whole or in part should include acknowledgement of the service.

The following PICO(T) was used as a basis for the evidence summary.

<table>
<thead>
<tr>
<th>Population</th>
<th>Intervention</th>
<th>Comparator</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACE MASKS/COVERINGS</td>
<td>VISORS/FACE SHIELDS</td>
<td>PROTECTION FROM COVID-19</td>
<td></td>
</tr>
</tbody>
</table>

The following search strategy was used:

[ABBREVIATED] COVID-19 OR CORONAVIRUS OR "CORONA VIRUS" OR (WUHAN N3 VIRUS) OR ("2019-NCOV" OR "2019 NCOV")) OR "SEVERE RESPIRATORY SYNDROME CORONAVIRUS2" OR ("2019" AND (NEW OR NOVEL) AND CORONAVIRUS)) (HCOV-19) AND ("FACE MASK" OR "FACE COVERING") AND ("FACE SHIELD" OR "VISOR")

† Pauline Ryan, Librarian, University Hospital Waterford [Author]; Emma Quinn, Librarian, St. Luke's General Hospital, Kilkenny [Author] [Editor]; Brendan Leen, Area Library Manager, HSE South [Editor].


19 BAKHIT et al (19 June 2020) [This article is a preprint and has not been peer-reviewed] Downsides of face masks and possible mitigation strategies: a systematic review and meta-analysis. https://www.medrxiv.org/content/10.1101/2020.06.16.20133307v1 [Accessed 08/09/2020]

https://www.bmj.com/content/369/bmj.m1435.short [Accessed 08/09/2020]

22 ADVANI et al (29 April 2020) Universal masking in hospitals in the COVID-19 era: Is it time to consider shielding? 


24 RONEN et al (07 July 2020) (Preprint) Examining the protection efficacy of face shields against cough aerosol droplets using water sensitive papers. 
https://www.medrxiv.org/content/10.1101/2020.07.06.20147090v1 [Accessed 08/09/2020]


26 VERMA et al (04 Aug 2020) Visualizing droplet dispersal for face shields and masks with exhalation valves. 


28 FLANAGAN & BALLARD (June 2020) 3D Printed Face Shields: A Community Response to the COVID-19 Global Pandemic. 
https://nrchi.nlm.nih.gov/pmc/articles/PMC7764919/ [Accessed 08/09/2020]


30 CHUGHTAI et al (08 July 2020) Effectiveness of Cloth Masks for Protection Against Severe Acute Respiratory Syndrome Coronavirus 2. 

31 SWAIN, Jan (27 July 2020) Why the mask? The effectiveness of face masks in preventing the spread of respiratory infections such as COVID-19 – a home testing protocol. 

32 MACINTYRE et al (July 2020) Human coronavirus data from four clinical trials of masks and respirators. 


34 LONG et al (13 Mar 2020) Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis. 

35 RADONOVICH JR, et al (03 Sep 2019) N95 Respirators vs Medical Masks for Preventing Influenza Among Healthcare Personnel: A Randomized Clinical Trial. 


38 ROBERGE, RJ (2016) Face shields for infection control: A review. 


https://www.bmj.com/content/350/bmjh694.abstract?casa_token=WPYdm_M-GrkAAAAAAA:VlIHOPJiZ2YV/eY7c89DC3DHp0 [Accessed 08/09/2020]

41 LINDSLEY et al (2014) Efficacy of face shields against cough aerosol droplets from a cough simulator. 

42 JEFFERSON et al (2011) Physical interventions to interrupt or reduce the spread of respiratory viruses. 