# Evidence Review - Mouth and Nose Coverings: INTERNAL FULL

As of 20th October 2020

This review is far from extensive but collates much of the evidence base behind the use of mouth and nose coverings within community settings. This document begins with a summary of the evidence and is followed by links to key, secondary and primary evidence sources. The final section contains relevant tables from key evidence sources, some of which have been adapted to include local context or to combine different sources into one.

The evidence review is ongoing and is being used to underpin the development of updated guidelines on masks and other mouth and nose coverings in the community. Policy officers are working to achieve a consensus on the environments and settings where mask, mouth and nose coverings would be used as a priority.

## Brief overview of evidence

### Effectiveness

The effectiveness of mouth and nose coverings falls into three main categories depending on intended purpose – source control, personal protective equipment (PPE), and in prevention of outbreaks or epidemics. Claims that masks are ineffective tend to stem from mismatched evidence and purpose. For example, there is a wide consensus that cloth masks are not deemed effective as PPE within clinical contexts and equally valved respirators for clinical PPE are not deemed effective for source control in community use contexts. These conclusions do not state masks are ineffective but rather that the type and design of masks needs to match their intended purpose and setting. Therefore, cloth masks are appropriate for use in the right circumstances.

### As Source Control (to prevent infecting others)

Source control refers to the primary intention of protecting others from exhaled respiratory droplets that could contain the virus. The *source* is the person who is wearing the mask and the mask itself is a physical barrier which prevents viral droplets from infecting others (the *control*). Source control is important because COVID-19 spreads mainly through respiratory droplets and smaller particles (aerosols) which are produced when we breathe out, sigh, clear our throat or cough and sneeze. Even if someone is infected and feels healthy and does not have any symptoms (either asymptomatic or pre-symptomatic) they are still able to spread COVID-19 and other respiratory viruses in this way.

There is good evidence for source control even when the worst performing masks are used as these still retain a strong ability to retain respiratory droplets and aerosols within the mask, preventing them from being released into the air. A key finding by the DELVE Institute concluded cloth-based case masks reduce emission of viral particles by between 50 to 100% depending on mask design.

### As Personal Protective Equipment (to protect the individual from being infected by others)

There is very good evidence for medical masks and respirators for the purpose of preventing inhalation of another person's respiratory droplets. There is also emerging evidence non-medical

cloth masks offering some personal protection to the wearer (especially alongside 1m physical distancing and in comparison to not wearing a mask at all).

### In prevention of respiratory disease outbreaks

Due to previous respiratory epidemics (H1N1, MERS and SARS) there is strong evidence for community mask wearing as a preventative public health measure. As the current COVID-19 pandemic has progressed so has research directly on masks and COVID-19 which again has shown a significant benefit. A recent systematic review found wearing a facemask reduced chance of viral infection or transmission from 17.4% (no mask) to 3.1% (with mask). Studies in Germany suggest mask wearing has reduced the daily growth rate of Covid-19 infections by around 40%.

Comparisons of counties with and without mask use polices has also yielded beneficial results of early and sustained community wide mask wearing. The ECDC publish weekly country overviews of EU/EEA and the UK which details non-pharmacological interventions (such as mask use) alongside infection and testing data. While evidence of community mask use can be inferred through these weekly updates the wider contexts of each countries' strategic aims, compliance levels, testing capacity and other key factors need to also be taken into account.

## Emerging hypothesis on mask use, reduced severity and potential immune response

A new hypothesis based on past and current evidence of respiratory viruses and mask use has also emerged. As this is a relatively new hypothesis further evidence is needed to confirm the validity and strength of this hypothesis. It is thought that universal mask wearing might help reduce the severity of disease and ensure that a greater proportion of new infections are asymptomatic. This possibility is consistent with a long-standing theory of viral pathogenesis, which holds that the severity of disease is proportionate to the viral inoculum received. Since masks can filter out some virus-containing droplets (with filtering capacity determined by mask type), masking might reduce the viral particles that an exposed person inhales. In other words, if a mask allows for a small number of virus particles to reach the wearer then it is potentially exposing them to just enough of the virus to mount an immune response but not cause harm - which could offer some immunity protection in the future. The concept is similar to variolation an early medical immunisation treatment before vaccinations existed in which as small amount of smallpox infected tissue or liquid secretions was inserted into cuts in the skin.

## Other relevant or secondary findings

### Potential social and behavioural consequences of mask wearing

Aside from viral transmission there is emerging but limited evidence that mask wearing has potential for improved social and behavioural consequences.

### Mandatory rather than voluntary policies

Research in Germany found that implementing a mandatory rather than voluntary mask wearing policy increased compliance (despite moderate acceptance), reduced stigma around mask use, and was perceived as more "fair" than voluntary policies.

### Perceptions or changes of behaviour due to mask use

The same researchers in Germany found masks use (independent of voluntary or mandatory policies) creates a social contract in which compliant mask-wearing people perceive each other more

positively, while perceiving and socially punishing non-compliant non-mask wearers. Due to the effect of social desirability non-compliant people will likely begin to change their behaviour

### Mask use as a social nudge and reminder of the virus

Some studies argue that ubiquitous mask wearing, as a very visual reminder of the dangers of the virus, could actually act as a "behavioural nudge" to populations for following overall better personal hygiene. The mask reminds people not to touch their faces or serve as a visual reminder of a dangerous virus lurking.

## Key sources – see appendix for tables relating to some of the below

- Using face masks in the community Reducing COVID-19 transmission from potentially asymptomatic or pre-symptomatic people through the use of face masks. ECDC 2020
- Guidelines for the implementation of non-pharmaceutical interventions against COVID-19. ECDC 2020
- Advice on the use of masks in the context of COVID-19. WHO 2020
- Advice on the use of masks for children in the community in the context of COVID-19. WHO 2020
- Coronavirus disease (COVID-19) advice for the public: When and how to use masks. WHO 2020
- Coronavirus disease (COVID-19): Masks FAQ. WHO 2020
- Face Masks for the General Public. DELVE Institute 2020
- Report on Face Masks for the General Public - An Update. DELVE Institute 2020
- Face coverings: when to wear one, exemptions, and how to make your own. PHE 2020

## Secondary evidence sources for mask use within community settings (systematic reviews, evidence-based synopses, guidelines, regulatory guidelines)

- Physical interventions to interrupt or reduce the spread of respiratory viruses. Part 1 - Face masks, eye protection and person distancing: systematic review and meta-analysis. Jefferson et al. 2020, preprint
- Physical interventions to interrupt or reduce the spread of respiratory viruses. Cochrane Review 2011
- Evidence summary for face mask use by healthy people in the community. Health Information and Quality Authority.
- Canadian Thoracic Society recommendations regarding the use of face masks by the public during the SARS-CoV-2 (COVID-19) pandemic. Canadian Thoracic Society 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. Chu et al. 2020, The Lancet
- Considerations in the Use of Homemade Masks to Protect Against COVID-19. Covid-19 Ad hoc papers, Government of Canada 2020
- COVID 19 – Masks on or off? Oxford COVID-19 Evidence Service 2020
- The use of masks by asymptomatic people to reduce COVID transmission Sax Institute Evidence Check 2020

- Respiratory Infection Transmission (Community): Face Masks and Respirators Covid-19 Ad hoc papers 2020, JBI
- Masks for Prevention of COVID-19 in Community and Healthcare Settings: A Living Rapid Review. JBI 2020
- Effectiveness Of Fabric Mask In The Community. MaHTAS Covid-19 Rapid Evidence Updates 2020
- Efficacy of face mask in preventing respiratory virus transmission: A systematic review and meta-analysis. Travel Med Infect Dis 2020
- Guidelines for the implementation of nonpharmaceutical interventions against COVID-19. ECDC Sept 2020 update
- Face Masks Against COVID-19: An Evidence Review. Preprint Version 3, July 2020
- Face coverings: when to wear one, exemptions, and how to make your own. PHE 2020

Other resource (primary research and other peer reviewed or evidence based communications)

- The role of community-wide wearing of face mask for control of coronavirus disease 2019 (COVID-19) epidemic due to SARS-CoV-2. Journal of Infection 2020
- Professional and Home-Made Face Masks Reduce Exposure to Respiratory Infections among the General Population. PloS One 2008
- Protection by Face Masks against Influenza A(H1N1)pdm09 Virus on Trans-Pacific Passenger Aircraft. Emerg Infect Dis 2009.
- Respiratory virus shedding in exhaled breath and efficacy of face masks. Nature Medicine 2020
- Public use of masks to control the coronavirus pandemic. Preprint 2020
- Influenza Virus Aerosols in Human Exhaled Breath: Particle Size, Culturability, and Effect of Surgical Masks. PloS Pathog 2013
- Rational use of face masks in the COVID-19 pandemic. The Lancet 2020
- Simple Respiratory Mask. Emerg. Infect Dis 2006
- Facemasks and hand hygiene to prevent influenza transmission in households: a cluster randomized trial. Ann Intern Med 2009
- SARS Transmission, Risk Factors, and Prevention in Hong Kong. Emerg Infect Dis 2004
- Mass masking in the COVID-19 epidemic: people need guidance. The Lancet 2020
- Time to encourage people to wear face masks as a precaution, say experts. British Medical Journal 2020
- Facial Masking for Covid-19 — Potential for "Variolation" as We Await a Vaccine. New Engl J. Med 2020
- Social and behavioral consequences of mask policies during the COVID-19 pandemic. Proc Nat Acad Sciences 2020
- Face Masks Considerably Reduce COVID-19 Cases in Germany: A Synthetic Control Method Approach. IZA Institute of Laboor Economics 2020
- Comparison of Face-Touching Behaviors Before and During the Coronavirus Disease 2019 Pandemic. JAMA 2020
- How to wear a facemask – results from an experiment with 4,099 UK adults. BI Team 2020
- Facemasks: would you wear one? BI Team 2020

**Specific to Mask design**

- Coronavirus disease (COVID-19) advice for the public: When and how to use masks. WHO 2020
- Covid-19: 3D Printing of N95 Respirators and Face Shields: Supplemental Information Health Quality Ontario 2020
- https://www.consumer.org.hk/ws_en/news/2020/covid-19-diymasks Hong Kong Consumer Council 2020
- https://smartairfilters.com/en/blog/best-diy-coronavirus-homemade-mask-material-covid/ Testing of multiple materials (as micron particle filters)
- Face coverings: when to wear one, exemptions, and how to make your own. PHE 2020

**Other resources used**

- Guidance on cleaning face shields - https://www.dentistryiq.com/dental-hygiene/infection-control/article/14176826/understanding-face-shield-maintenancepractical-steps-to-insure-cleanliness-and-optical-clarity

# Appendix – Tables from or adapted from key sources

The below tables have been reproduced or adapted from some of the Key Sources above.

## 1) Types of masks and their applications

The below table has been retrieved from (https://www.who.int/publications/i/item/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak)

| Type of mask | Respirator (also known as filtering face piece / FFP) | Medical (also known as surgical or procedure mask) | Non-medical (also known as cloth or community masks) |
|---|---|---|---|
| **Indented use** | PPE to protect inhalation of viral particles. Valved respirators insufficient for source control | PPE to protect inhalation of viral particles and/or as source control | Source control to reduce exhalation of viral particles |
| **Recommended for** | Healthcare professionals during aerosol generating procedures | - Healthcare professionals in health settings and in community settings if there is widespread community transmission<br>- Vulnerable people in community settings if there is widespread community transmission<br>- Vulnerable people, symptomatic or assumed Covid-19 positive when in healthcare settings | - Healthy not-at risk populations<br>- Not for clinical use or by healthcare professionals, not considered PPE |
| **Standards** | N95 or FFP2 or FFP3 standard, or equivalent. | ASTM F2100, EN 14683, or equivalent | Unlikely to be standardised although recommended standards have been developed by AFNOR*<br><br>WHO have released guidelines on most effective 3-layer masks |
| *French Standardization Association (AFNOR Group) define minimum performance in terms of filtration (minimum 70% solid particle filtration or droplet filtration) and breathability (maximum pressure difference of 0.6 mbar/cm2 or maximum inhalation resistance of 2.4 mbar and maximum exhalation resistance of 3 mbar) see: (https://masquesbarrieres.afnor.org/home/telechargement) | | | |

## 2) Table of benefits vs harms/disadvantages

The below table combines two existing tables showing the potential benefits and harms/disadvantages on use of masks in community settings. The information in this table provides a wide overview of concerns around the use of cloth masks in the community which will be taken into consideration when developing further guidelines and policy.

- WHO, (black text on white background) (https://www.who.int/publications/i/item/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak

- ECDC, (black text on blue background) (https://www.ecdc.europa.eu/sites/default/files/documents/COVID-19-use-face-masks-community.pdf)

Notes:
The use of plastic face shields (not included in original WHO or ECDC tables) could mitigate some of the potential harms/disadvantages described below. Situations in which face shields could be a reasonable alternative or notes on new information have been added in as **bold text**. It is also important to note that many potential harms/disadvantages can also be mitigated with easy to follow instructions, awareness/education campaigns and clear policies in place.

| **Potential benefits to mask use by healthy people in the general public** | **Potential harms/disadvantages** |
|---|---|
| Reduced potential exposure risk from infected persons before they develop symptoms | Potential increased risk of self-contamination due to the manipulation of a face mask and subsequently touching eyes with contaminated hands |
| Reduced potential stigmatization of individuals wearing masks to prevent infecting others (source control) or of people caring for COVID-19 patients in non-clinical settings; | Potential self-contamination that can occur if nonmedical masks are not changed when wet or soiled. This can create favourable conditions for microorganism to amplify |
| Making people feel they can play a role in contributing to stopping spread of the virus; | Potential headache and/or breathing difficulties, depending on type of mask used |
| reminding people to be compliant with other measures (e.g., hand hygiene, not touching nose and mouth). However, this can also have the reverse effect (see below) | Potential development of facial skin lesions, irritant dermatitis or worsening acne, when used frequently for long hours; **(Potential for face shields)** |
| potential social and economic benefits. Amidst the global shortage of surgical masks and PPE, encouraging the public to create their own fabric masks may promote individual enterprise and community integration. Moreover, the production of non-medical masks may offer a source of income for those able to manufacture masks within their communities. Fabric masks can also be a form of cultural expression, encouraging public acceptance of protection measures in general. The safe re-use of fabric masks will also reduce costs and waste and contribute to sustainability. | Disadvantages for or difficulty wearing them, especially for children, developmentally challenged persons, those with mental illness, elderly persons with cognitive impairment, those with asthma or chronic respiratory or breathing problems, those who have had facial trauma or recent oral maxillofacial surgery, and those living in hot and humid environments<br>**(Potential for face shields)** |
| Consider the feasibility of use, supply/access issues, social and psychological acceptance (of both wearing and not wearing different types of masks in different contexts) | Waste management issues; improper mask disposal leading to increased litter in public places, risk of contamination to street cleaners and environment hazard |
| Continue gathering scientific data and evidence on the effectiveness of mask use (including different types and makes as well as other face covers such as scarves) in non-health care settings; | A false sense of security, leading to potentially lower adherence to other critical preventive measures such as physical distancing and hand hygiene |
| Evaluate the impact (positive, neutral or negative) of using masks in the general population (including behavioral and social sciences). | Poor compliance with mask wearing, in particular by young children **(Potential for face shields)** |
| Due to increasing evidence that persons with mild or no symptoms can contribute to the spread of COVID-19, face masks and other face covers may be considered a means of source control complementary to other measures already in place to reduce the transmission of COVID-19. | Potential discomfort **(Potential for face shields)** |
| Evidence is growing that viral shedding of SARS-CoV-2 is higher just before onset of symptoms and for the initial 7–8 days after onset | Difficulty communicating for deaf persons who rely on lip reading **(Potential for face shields)** |
| Face masks have been used extensively in the public in Asian countries and have been linked to a slightly lower risk of SARS among persons without known contact with SARS patients during the 2003 SARS epidemic. | Difficulty with communicating clearly **(Potential for face shields)** |

| | |
|---|---|
| Non-medical face masks and other face covers made of textiles have the advantage that they can be produced easily; they are washable and reusable. | Medical face masks are currently in short supply. In view of the current pressure to the health systems, their use by healthcare workers needs to be clearly prioritised and protected. |
| | There is only limited indirect evidence that non-medical face masks are effective as a means of source control. (**More evidence now available since ECDC publication)** |
| | Wearing a face mask may create a false feeling of security, leading to relaxing of physical distancing and increased frequency of face touching (mask adjustment, etc.) |
| | Face masks need to be carefully put on and taken off in order to prevent self contamination |
| | Face masks are not well tolerated by certain population groups (e.g. children) or by persons with chronic respiratory disease |
| | There are no established standards for non-medical face masks used as a means of source control or personal protection (S**tandards have been developed by ADFNOR Group however no guarantee homemade masks etc will comply – minimum 70% solid particle or droplet filtration and breathability maximum pressure difference of 0.6mbar/cm2 or maximum inhalation of 2.4mbar and maximum exhalation of 3mbar)**<br><br>**WHO have since released guidelines on mask type (3-layer design)** |