

Rapid evidence checks are based on a simplified review method and may not be entirely exhaustive, but aim to provide a balanced assessment of what is already known about a specific problem or issue. This brief has not been peer-reviewed and should not be a substitute for individual clinical judgement, nor is it an endorsed position of NSW Health.

Face masks and COVID-19 transmission in the community

Evidence check question

What is the evidence that face masks help prevent the spread of COVID-19 in the community?

In brief

Context – transmission

- There is direct evidence of contact and droplet transmission of COVID-19. Flow physics and experimental models suggest, but have not demonstrated, airborne transmission. (1)
- Epidemiological data on infection rates and transmission patterns are difficult to reconcile with long-range aerosol-based transmission. Where symptomatic patients are cared for, no studies to date have found viable virus in air samples. (1, 2)

Context – other jurisdictions

- Community mask use is either encouraged or mandatory in over 80 countries. (3) Face coverings have been mandated in parts of Victoria. (4)
- In countries with community transmission, the adoption of mandatory face mask use has been associated with decreasing infection rates. (5-8) These decreases have not been directly attributed to face mask use, as a suite of measures is generally adopted.

Face mask evidence – non-COVID-19

- Multiple systematic reviews examine the effect of face masks in community settings on reducing influenza like illness. Results are conflicting, with some reporting a protective effect and others no significant reduction in influenza like illness transmission. (9-18)
- Respiratory etiquette, hand hygiene, social distancing, and isolation of cases, have a much stronger evidence base than face masks. Face masks are considered to be an additional measure, but there are concerns that masks can give a false sense of protection and may result in decreased compliance with other infection prevention practices. (17, 19)

Face mask evidence – COVID-19

- There is very little evidence on use of face masks on public transport, however some reviews conclude masks may have a role in settings where social distancing is not feasible. (9, 20, 21)
- Some experts counsel a precautionary approach despite a lack of clear evidence. (22)
- Cloth masks have variable filtration depending on the fabric. (23)
- A systematic review found no studies on mask use among COVID-19 negative people in community settings. (24)

Face masks for COVID-19 – an evidence timeline

● Effective ● No direct evidence ○ No effect



WHO Guidance*

29 March
Transmission via contact and droplet

6 April
Reserve medical masks for healthcare workers; alone they do not provide adequate protection.

5 June
Public should wear masks in areas with community transmission

9 July
Contact and droplet primary mode of transmission – prudent to encourage face masks in settings with community transmission

Systematic reviews

6 April ●
Brainard, 6% reduction in ILI

10 April ●
Marasinghe, no studies of use among COVID-19 negative people

6 May ●
Gupta, 3 RCTs suggest benefit in reducing ILI

11 May ●
Mondal, cloth masks variable filtration

1 June ●
Chu, meta analysis - efficacy for ILI

8 June ●
Taminato, cloth masks provide a barrier against droplets

7 April ○
Jefferson, no reduction of ILI

30 April ●
MacIntyre, effective with/ without hand hygiene, together more protective.

May ○
Xiao, no reduction in influenza transmission

28 May ●
Liang, masks had a protective effect

2 June ○
Aggarwal, no significant reduction in ILI with facemask alone

24 June ○
Chou, probably no difference surgical versus no mask in risk for ILI

Empirical data*

2 April
Lu, Restaurant outbreak of 3 families in Wuhan

23 April
Cheng, Hong Kong had 96.6% mask compliance/ lower incidence than other countries

12 May
Hamner, Following 2.5h choir practice, >50% of attendees infected (<1.5m)

16 June
Lyu, mandatory use in public associated with decline in growth rate

23 June
Deforche, Compulsory usage in Slovakia reduced transmission by half.

15 May
Jang, cluster associated with fitness dance class

Leffler, mask-wearing by public was associated with lower mortality

29 June
Mitze, face masks reduced number of cases
Pederson decay from peak may be explained by masks

Opinion*

9 April
Greenhalgh, argues for precautionary principle

29 April
Martin, urges restraint due to weak evidence and unintended consequences

8 July
Marawska, letter argues potential for airborne transmission

Coatsworth, Community transmission, if social distancing not possible, consider masks

13 July
Klompas, aerosol not primary transmission

14 July
MacIntyre, argues airborne transmission

*Selected publications
ILI = influenza-like illness

Face masks for COVID-19 – evidence themes

Mode of transmission	Viral load, dose, symptomatic	Efficacy of masks	Other protection	Prevalence and community spread	Setting (healthcare and community)
<ul style="list-style-type: none"> • Direct evidence of contact and droplet transmission – coughing, sneezing, singing • Airborne transmission occurs with aerosol generating procedures • Flow physics and experimental models suggest, but have not demonstrated, airborne transmission • No studies have found viable virus in air samples • Despite consistent evidence of surface contamination, there are no direct reports of fomite transmission of COVID-19 • No reports of faecal or urine transmission or intrauterine transmission in pregnant women 	<ul style="list-style-type: none"> • The infectious dose of viable SARS-CoV-2 required to cause infection in another person is unknown • RNA detected 1-3 days before symptom onset • highest viral load on day of symptom onset, with gradual decline • Duration of RT-PCR positivity is 1-2 weeks for asymptomatic cases, up to 3 weeks for mild to moderate disease, much longer in severe disease • Viable viral shedding for up to 8-9 days in mild-moderate cases • Extent of true asymptomatic cases is unknown • People without symptoms less likely to transmit virus 	<ul style="list-style-type: none"> • Conflicting evidence • Chu, Brainard, MacIntyre, Gupta, Liang, Taminato found masks associated with reduction in developing symptoms in community (ILI) or provided a barrier against droplets • Jefferson, Chou, Xiao, Aggarwal found probably no difference (ILI) between masks and no masks in community • Many people do not wear face masks correctly • For cloth masks, filtration efficacy varies depending on the material used 	<ul style="list-style-type: none"> • Limiting close contact between infected people and others is central to preventing transmission • Face masks are an additional measure used alongside other measures such as with respiratory etiquette, hand hygiene, social distancing, and isolation of cases • Universal masking may give a false sense of protection and may result in decreased compliance with other measures (Peltzman effect) 	<ul style="list-style-type: none"> • In settings with community transmission, face mask use is associated with lower infection rates • Incubation period is on average 5-6 days, but can be as long as 14 days 	<ul style="list-style-type: none"> • Reduction in risk of infection with face mask vs no face mask has stronger associations in healthcare settings compared with non-health-care settings • Limited evidence on face masks on public transport however reviews conclude masks may have a role in setting where social distancing is not feasible • No direct evidence on the added value of masks when handwashing and social distancing is already in place (although ecological studies in Italy and Germany suggest benefit)

ILI = influenza-like illness

Limitations

The evidence and government advice and regulation in this area is rapidly changing. The efficacy of face masks in preventing transmission should be interpreted in the context of disease prevalence and this information is rarely provided by the studies. Publications included surgical masks (or similar) and/or cloth masks. The type of mask was not always clear in publications. The review focused on universal mask wearing in the community setting. Comparisons of different types of masks was beyond the scope of this review. This is a synthesis of existing reviews, and appraisal of the primary publications cited in the reviews was not undertaken. Additional publications were included as evidence emerged, as described under methods. Searches for individual publications reporting empirical data may not be complete.

Background

Containment and non-pharmaceutical measures are known to be important for limiting the spread of COVID-19. The World Health Organization updated its guidance on 5 June 2020, that the public should wear masks in areas with community transmission, and on 9 July 2020, reiterated that contact and droplet transmission is the primary mode of transmission, but it is prudent to encourage face masks in settings with community transmission. (1, 25)

Publications on the topic vary, with some recommending face masks on the basis of the precautionary principle acknowledging the potential for airborne spread, and others urging restraint in communication on the topic outlining weaknesses in the evidence base. (22, 26-29) There is concern about whether masks are worn in the correct way and that routine mask use by healthcare workers may increase the risk of transmission of COVID-19 through increased face touching. (30, 31)

Recommendations on face mask use in community settings varies by country. (32) Many countries are mandating masks to be worn in public in an attempt to slow the spread of COVID-19. (33) There are insufficient data to quantify all of the adverse effects that might reduce the acceptability, adherence, and effectiveness of face masks. (34)

Re-use of masks is not well described with some reviews stating there is no evidence. The Critical Intelligence Unit has completed an [evidence check on extended use or reuse of personal protective equipment including face masks](#).

Modelling studies

Mathematical assessment of the impact of non-pharmaceutical interventions on COVID-19 found that high use of face-masks in public could lead to COVID-19 elimination. (35) Pre-peer review modelling studies have been published showing universal use of face masks in the US in public, with at least moderate level of compliance, could halt the post-lockdown resurgence of COVID-19, and that nationally mandating face masks for could have reduced the growth rate and deaths. (36, 37) While others, estimated the impact of cloth mask adoption on reproduction number to be approximately 8.6% and found that face masks, even with a limited protective effect, can reduce infections and deaths, and can delay the peak time of the epidemic. (38, 39)

Face masks on public transport

There is limited evidence on face masks and public transport. In a review on the use of masks by asymptomatic people, some studies suggested that wearing masks on public transport and in workplaces where social distancing is less feasible may be useful at reducing transmission. (20) Another review concludes that face masks appear be most effective when worn to prevent primary

respiratory illness in relatively low risk situations: community settings where contact may be casual and relatively brief, such as on public transport. (9) An opinion piece from Taiwan states they have so far managed to prevent a large scale community outbreak because the city forces wearing face masks on public transportation, and maintaining social distancing. (40) A review of the science around face masks from New Zealand states that masks may provide protection in closed spaces, such as public transport. (21)

Methods (Appendix 2)

PubMed and Google were searched for existing evidence reviews on 21 April, 25 May, 19 June, 1 July and 8 July 2020. Both systematic and non-systematic reviews were included. As empirical data of face mask use in community settings in COVID-19 emerged, these were included. These papers were identified through the Critical Intelligence Unit's daily evidence digest with a rapid supplementary search on 8 July, however this search may not be complete. Publications were included if they were in community settings. If a review article included both healthcare workers and community settings it was included if analysed separately.

For the timeline summary, only systematic reviews in the peer reviewed or pre-peer reviewed literature were included. Non-systematic reviews and grey literature were not included. Empirical data on impact of masks for COVID-19 identified in this review were included, as well as studies areas of possible community aerosol transmission which were referenced in the latest World Health Organization document *Transmission of SARS-CoV-2: implications for infection prevention precautions*. (1) Studies modelling the potential impact of masks were not included. Opinion articles were identified through snowballing (as regularly cited publications) or by experts reviewing this document.

Results (Table 1)

Review articles on face masks are summarised in table 1 and studies reporting empirical data on mask use are included in table 2.

Table 1: Evidence reviews and synthesis of face masks

Source	Summary
Peer reviewed sources	
<p>Masks for prevention of respiratory virus infections, including SARS-CoV-2, in health care and community settings. a living rapid review</p> <p>Chou, et al. 2020 (18)</p>	<ul style="list-style-type: none"> • Living rapid review to examine the effectiveness of N95, surgical, and cloth masks in community and healthcare settings. • 39 studies (18 randomised controlled trials and 21 observational studies; 33,867 participants) were included. • Evidence on SARS-CoV-2 was limited to two observational studies with serious limitations. • In high- or moderate-risk healthcare settings, observational studies found that risk for infection with SARS-CoV-1 and Middle East respiratory syndrome coronavirus probably decreased with mask use versus non-use and possibly decreased with N95 versus surgical mask use. • Randomised trials in community settings found possibly no difference between N95 versus surgical masks and probably no difference between surgical versus no mask in risk for influenza or influenza-like illness, but compliance was low. • Evidence on mask effectiveness for respiratory infection prevention is stronger in health care than community settings. • N95 respirators might reduce SARS-CoV-1 risk versus surgical masks in health care settings, but applicability to SARS-CoV-2 is uncertain.
<p>Homemade cloth face masks as a barrier against respiratory droplets - systematic review</p> <p>Taminato, et al. 2020 (17)</p>	<ul style="list-style-type: none"> • No randomised clinical trials involving cloth face masks for the general population were found. • Seven studies assessing different types of cloth to prevent the penetration of droplets at a laboratory level and a review study were included. • Using cloth face masks provides a barrier against droplets when compared with not using any face masks. The face mask is an additional preventive measure and must be used along with respiratory etiquette, hand hygiene, social distancing, and isolation of cases.
<p>Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a</p>	<ul style="list-style-type: none"> • Systematic review identified 172 observational studies across 16 countries, no randomised controlled trials and 44 comparative studies, totalling 25,697 patients in healthcare and non-healthcare settings.

Source	Summary
<p>systematic review and meta-analysis Chu, et al. 2020 (15)</p>	<ul style="list-style-type: none"> • Face mask use could result in a large reduction in risk of infection (n=2647; aOR 0.15, 95% CI 0.07 to 0.34, 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 (e.g., reusable 12-16 layer cotton masks; pinteraction=0.090; posterior probability >95%, low certainty). • Across 29 unadjusted studies and ten adjusted studies, the use of both N95 or similar respirators or face masks by those exposed to infected individuals was associated with a large reduction in risk of infection with face mask vs with no face mask, with stronger associations in healthcare settings compared with non-healthcare settings.
<p>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 MacIntyre, et al. 2020 (11)</p>	<ul style="list-style-type: none"> • 19 randomised controlled trials were included in this study, eight in community settings, six in healthcare settings and five as source control. • In the community, masks appeared to be more effective than hand hygiene alone, and both together are more protective. • In health care workers randomised controlled trials showed that respirators, if worn continually during a shift, were effective, but not if worn intermittently. • Medical masks were not effective, and cloth masks even less effective. • When used by sick patients randomised controlled trials suggested protection of well contacts.
<p>Nonpharmaceutical measures for pandemic influenza in nonhealthcare settings — personal protective and environmental measures Xiao, et al. 2020 (13)</p>	<ul style="list-style-type: none"> • 10 randomised controlled trials on face masks were included. • The evidence from randomised controlled trials suggested that the use of face masks, either by infected persons or by uninfected persons, does not have a substantial effect on influenza transmission.
<p>Facemasks for prevention of viral respiratory infections in community settings: a systematic review and meta-analysis</p>	<ul style="list-style-type: none"> • Nine studies were included in qualitative synthesis and eight studies in quantitative synthesis. • Risk of bias was assessed as low (n=4), medium (n=3), or high (n=1) risk. • Interventions included using a triple-layered mask alone or in combination with hand hygiene.

Source	Summary
Aggarwal, et al. 2020 (16)	<ul style="list-style-type: none"> There was no significant reduction in influenza like illness either with face mask alone or face mask with hand wash.
<p>Efficacy of face mask in preventing respiratory virus transmission: a systematic review and meta-analysis</p> <p>Liang, et al. 2020 (14)</p>	<ul style="list-style-type: none"> 21 studies were included. Meta-analyses suggest that mask use provided a significant protective effect (OR = 0.35 and 95% CI = 0.24-0.51). Use of masks by healthcare workers and non-healthcare workers can reduce the risk of respiratory virus infection by 80% (OR = 0.20, 95% CI = 0.11-0.37) and 47% (OR = 0.53, 95% CI = 0.36-0.79). The protective effect of wearing masks in Asia (OR = 0.31) appeared to be higher than that of Western countries (OR = 0.45). Masks had a protective effect against influenza viruses (OR = 0.55), SARS (OR = 0.26), and SARS-CoV-2 (OR = 0.04). In the subgroups based on different study designs, protective effects of wearing mask were significant in cluster randomised trials and observational studies.
<p>Use of N95, surgical, and cloth masks to prevent COVID-19 in health care and community settings: living practice points from the American College of Physicians (Version 1)</p> <p>Qaseem, et al. 2020 (19)</p>	<p>Community settings</p> <ul style="list-style-type: none"> ACP discourages the use of N95 respirators by asymptomatic or symptomatic persons in community settings. The decision to use cloth or surgical masks should follow community and statewide public health guidelines. Potential harms associated with mask use include self-contamination, breathing difficulties and creating a false sense of security that could potentially detract from taking other precautions, such as physical distancing. <p>Healthcare settings</p> <ul style="list-style-type: none"> All health personnel in close contact with suspected or known cases of COVID-19 should use N95 respirators in healthcare settings. All healthcare workers, not in close contact with suspected or known cases of COVID-19 should wear surgical masks in healthcare settings. All patients and visitors should wear surgical masks in healthcare settings. Healthcare workers should not wear cloth masks in healthcare settings. <p>Extended or reuse of N95 respirators</p> <ul style="list-style-type: none"> No evidence

Source	Summary
<p>Face masks for the public during the covid-19 crisis</p> <p>Greenhalgh, et al. 2020 (22)</p>	<ul style="list-style-type: none"> • Evidence regarding whether masks will reduce transmission of COVID-19 in the general public is contested. • Review articles suggest limited protection can prevent some transmission. • Peer reviewed systematic reviews are summarised. The reviews had varying results either finding that there is some efficacy of masks worn by persons who have respiratory symptoms, or that there is no evidence to show the benefits of reducing transmission of a respiratory infection by wearing a mask. • One included review on influenza epidemics found some efficacy of masks if worn by those with respiratory symptoms but not if worn by asymptomatic individuals. • The authors discuss the precautionary principle to emphasis caution when recommending against face masks and urge decision makers to create good policy without waiting for a randomised control trial, to act without definitive evidence due to the serious nature of COVID-19 transmission.
<p>Comprehensive review of mask utility and challenges during the COVID-19 pandemic</p> <p>Tirupathi, et al. 2020 (41)</p>	<ul style="list-style-type: none"> • Narrative review article. • Universal masking should be coupled with other favourable practices like temperature checks and symptom screening on a daily basis to avail the maximal benefit from masking. • Despite varied opinions on the outcomes of universal masking, this measure helps improve healthcare workers' safety, psychological well-being, trust in their hospital, and decreases anxiety of acquiring the illness. • On the other hand, universal masking may give a false impression of protection and may result in increased face touching.
<p>Mask use during COVID-19: A risk adjusted strategy</p> <p>Wang, et al. 2020 (42)</p>	<ul style="list-style-type: none"> • Narrative review article. • Main transmission routes of SARS-CoV-2 include droplet, contact transmissions, and possible airborne transmissions, which are characterised by high proportion of cases with mild symptom or asymptomatic cases, strong infectivity, and a large number of clusters • The necessity of wearing masks by the public during COVID-19 pandemic has been under-emphasised. • A risk basis mask use strategy and compliance improvement are suggested.
<p>Non-peer reviewed sources</p>	

Source	Summary
<p>Facemasks and similar barriers to prevent respiratory illness such as COVID-19: A rapid systematic review</p> <p>Brainard, et al. 2020 (9)</p> <p>Pre peer review</p>	<ul style="list-style-type: none"> • Review included 31 studies to understand the value of wearing face masks. • Study found three randomised controlled trials that showed wearing a face mask may slightly reduce the odds of developing respiratory symptoms by 6% (OR 0.94, 95% CI 0.75 to 1.19, I2 29%). • An observational study showed that when housemates and an infected household member wore face masks the odds of further household member becoming ill was reduced by 19% (OR 0.81, 95%CI 0.48 to 1.37, I2 45%, five randomised controlled trials). • The protective effect was very small if only the well person (OR 0.93, 95% CI 0.68 to 1.28, I2 11%, two randomised controlled trials , low uncertainty evidence) or the infected person wore the face mask (very low certainty evidence).
<p>Face masks against COVID-19: an evidence review</p> <p>Howard, et al. 2020 (43)</p> <p>Pre peer review</p>	<ul style="list-style-type: none"> • An evidence review which informs: <ul style="list-style-type: none"> ○ transmission characteristics of COVID-19 ○ filtering characteristics and efficacy of masks ○ estimated population impacts of widespread community mask use ○ sociological considerations for policies concerning mask-wearing. • Evidence is in favour of widespread cloth or other mask use to reduce community transmission. • Non-medical masks can be used to obstruct droplets of a necessary size from transmitting into the community. • Non-medical masks have been effective in reducing the transmission of influenza, and in small trials have been shown to be effective at blocking transmission of coronaviruses. • Models suggest that public mask wearing is most effective at stopping spread of the virus when compliance is high. • See the complimentary article: Masks for all? The science says yes
<p>Utility of cloth masks in preventing respiratory infections: a systematic review</p> <p>Mondal, et al. 2020 (23)</p> <p>Pre peer review</p>	<ul style="list-style-type: none"> • The review was limited by a lack of sufficient clinical studies and lack of standardisation between studies. • Although cloth masks generally perform poorer than the medical grade masks, they may be better than no masks at all. • Filtration efficacy varied greatly depending on the material used.

Source	Summary
<p>A systematic review investigating the effectiveness of face mask use in limiting the spread of COVID-19 among medically not diagnosed individuals: shedding light on current recommendations provided to individuals not medically diagnosed with COVID-19</p> <p>Marasinghe 2020 (24)</p> <p>Pre peer review</p>	<ul style="list-style-type: none"> The review search did not find any studies that investigated the effectiveness of face mask use in limiting the spread of this specific virus, COVID-19 among this specific population, for those who are not medically diagnosed with COVID-19.
<p>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</p> <p>Jefferson, et al. 2020 (10)</p> <p>Pre peer review</p>	<ul style="list-style-type: none"> 15 randomised trials investigating the effect of masks in healthcare workers and the general population (14 trials) and of quarantine (1 trial). Compared to no masks there was no reduction of influenza-like illness cases (risk ratio 0.93, 95%CI 0.83 to 1.05) or influenza (risk ratio 0.84, 95%CI 0.61-1.17) for masks in the general population, nor in healthcare workers (risk ratio 0.37, 95%CI 0.05 to 2.50). There was no difference between surgical masks and N95 respirators: for influenza-like illness (risk ratio 0.83, 95%CI 0.63 to 1.08), for influenza (risk ratio 1.02, 95%CI 0.73 to 1.43). Harms were poorly reported and limited to discomfort with lower compliance. There was insufficient evidence to provide a recommendation on the use of facial barriers without other measures. Based on observational evidence from the previous SARS epidemic, included in the previous version of a Cochrane review, the use of masks combined with other measures is recommended.
<p>The use of facemasks by the general population to prevent transmission of COVID 19 infection: A systematic review.</p>	<ul style="list-style-type: none"> 14 articles were included. All the articles mentioned the role of face masks in preventing the spread of respiratory viruses like influenza, SARS, and SARS-CoV-2, in the community or experimental setting.

Source	Summary
<p>Gupta, et al. 2020 (12) Pre peer review</p>	<ul style="list-style-type: none"> • Studies also suggested that early initiation of face mask usage was more effective. Masks were also reported to be more effective in viruses that transmit easily from asymptomatic individuals, as is now known in SARS-CoV-2. • Theoretical, experimental, and clinical evidence suggested that usage of face masks in a general population offered significant benefit in preventing the spread of respiratory viruses especially in the pandemic situation, but its utility is limited by inconsistent adherence to mask usage.
<p>Universal use of face masks for success against COVID-19: evidence and implications for prevention policies Esposito, et al. 2020 (44) Letter</p>	<ul style="list-style-type: none"> • Literature review focusing on the keywords ‘infection control’, ‘prevention’, ‘masks’, ‘respirators’, ‘viral infections’ and ‘COVID-19’. • Controlling a respiratory infection at source using a face mask is a well-established strategy. For example, symptomatic patients with cough or sneezing are generally advised to put on a face mask. • With the large number of asymptomatic patients unaware of their own infection, the comparable viral load in their upper respiratory tract, droplet and aerosol dispersion even during talking and breathing, and prolonged viral viability outside our body, authors strongly advocate universal use of face masks as a means of source control in public places during the COVID-19 pandemic. • A high degree of compliance will maximise the impact of universal masking in public.
<p>Face masks to prevent community transmission of viral respiratory infections: A rapid evidence review using Bayesian analysis Perski, et al. 2020 (45) Pre peer review</p>	<ul style="list-style-type: none"> • Eleven randomised controlled trials and 10 observational studies met the inclusion criteria. • Randomised controlled trials showed a moderate likelihood of a small effect of wearing surgical face masks in community settings in reducing self-reported influenza-like illness (cumulative posterior odds = 3.61). However, the risk of reporting bias was high. • Observational studies yielded evidence of a negative association between face mask wearing and influenza-like illness, but with high risk of confounding and reporting bias.
<p>Grey literature</p>	

Source	Summary
<p>Advice on the use of masks in the context of COVID-19</p> <p>World Health Organization 2020 (25)</p>	<ul style="list-style-type: none"> • This document in detail covers masks in healthcare settings, for the general public and for the care of patients at home. The advice to decision makers for the use of masks for the general public includes the following. <ul style="list-style-type: none"> ○ At the present time, the widespread use of masks by healthy people in the community setting is not yet supported by high quality or direct scientific evidence and there are potential benefits and harms to consider. However, taking into account the available studies evaluating pre- and asymptomatic transmission, a growing compendium of observational evidence, individual preferences and the challenges in physical distancing, the World Health Organization has updated its guidance to advise that to prevent COVID-19 transmission effectively in areas of community transmission, governments should encourage the general public to wear masks in specific situations and settings as part of a comprehensive approach to suppress SARS-CoV-2 transmission. ○ The World Health Organization advises decision makers to apply a risk-based approach focusing on the following criteria when considering or encouraging the use of masks for the general public: <ul style="list-style-type: none"> ▪ purpose of mask use ▪ risk of exposure to the COVID-19 virus ▪ vulnerability of the mask wearer and population ▪ setting in which the population lives ▪ feasibility (availability and costs of masks) ▪ type of mask: medical mask versus non-medical mask.
<p>The use of masks by asymptomatic people to reduce transmission of COVID-19</p> <p>Moore, et al. 2020 (20)</p>	<ul style="list-style-type: none"> • The review identified 13 peer reviewed studies and 14 commentary articles and agency reports. • The evidence overall is very limited and of low certainty. 10 out of 13 peer reviewed studies indicated that wearing masks in community settings is likely to reduce transmission of COVID-19. This finding appears to apply at both early and later phases of the pandemic. • Insufficient evidence that masks are effective in reducing transmission among asymptomatic people in community settings. • Two modelling studies found that using masks had a significant impact when adoption was nearly universal (80% of the population), when masks were adopted early (before day 50), and there was high compliance (> 50%).

Source	Summary
	<ul style="list-style-type: none"> • Some studies suggested that wearing masks on public transport and in workplaces where social distancing is less feasible may be useful at reducing transmission; the use of masks in recreational and mass gatherings was not found to be effective. • The general public appears to be amenable to masks use if it is coupled with the prospect of loosening of other restrictions, for example enabling a return to work. • There is no evidence that mask wearing reduces adherence to other measures such as hand washing and social distancing; but public health campaigns could further emphasise the importance of these protections used together. • Where there are insufficient masks or universal use is not implemented, high risk groups should be targeted, including the elderly, people living in high risk regions, people who are immunocompromised, those who are particularly vulnerable.
<p>What is the effectiveness of wearing medical masks, including home-made masks, to reduce the spread of COVID-19 in the community?</p> <p>Alberta Health Service (3)</p>	<ul style="list-style-type: none"> • Despite methodological flaws and small, underpowered studies, systematic reviews of low-quality studies in healthcare settings suggest a reduction in acute respiratory infections and influenza-like illness with medical mask use. • Laboratory studies investigating the efficacy of masks in filtering viral particles as well as studies in medical settings with laboratory-based endpoints for respiratory pathogens (pseudomonas aeruginosa and mycobacterium tuberculosis) point to a theoretical benefit to medical mask use, particularly as a form of source control (protecting others from the wearer). Data for SARS-CoV2 (or coronaviruses in general) are much more limited. • There is also some modelling, ecological, and anecdotal data suggesting benefit to medical mask use in the community. • There is limited evidence of any harms related to community mask wearing, specifically, as it relates to any behavioural modifications that may ensue or non-adherence to other protective interventions such as social distancing or optimal hand hygiene practices. • There is evidence of pre-symptomatic and asymptomatic transmission of COVID-19, although varied estimates of the degree to which this could impact community transmission. At this point, there is no direct

Source	Summary
	<p>evidence that the use of a medical or homemade cloth mask or the wider use of masks in the community significantly reduces this risk.</p>
<p>Cloth (fabric) masks as an alternative to N95 respirators in a health care setting: supplemental information Ontario Health Quality 2020 (46)</p>	<ul style="list-style-type: none"> • Only one randomised trial assessed cloth masks in a healthcare setting and found significantly higher rates of infection in the cloth mask group compared with the medical mask group. • Guidance advises that cloth masks should be last resort in a health care setting.
<p>What is known about the use of medical masks by essential non-medical workers (e.g., grocery store and other food outlet workers; transportation employees; supply chain workers supporting essential products; and law enforcement) to prevent community transmission of COVID-19? McMaster University 2020 (47)</p>	<ul style="list-style-type: none"> • Seven documents identified. • Employees should wear a face mask at all times while in the workplace for 14 days after being in contact with a COVID-19 case. • Medical masks should be worn by frontline workers, including police and military. • Recommendations for face mask use among the general public in community settings were inconsistent in a comparison of recommendations from different jurisdictions. • Medical masks may be worn among professions that have close proximity with other people (e.g. cashiers, police force) when asymptomatic cases are thought to be high. • Some staff working in points of entry at airports, ports, and ground crossing should be wearing medical masks (e.g. screeners, interviewers, cleaners). • Medical or surgical masks should be made available in workplaces for workers developing respiratory symptoms including prisons and other places of detention. • Medical masks are not fully protective in hospitals, but are useful in community settings. When there is a shortage of medical masks, homemade masks made of four-layer kitchen paper and layer of polyester cloth should be helpful.
<p>What are the most effective non-medical masks (e.g., homemade cloth masks and other types of non-medical face coverings) for</p>	<ul style="list-style-type: none"> • 11 documents identified. • Low quality systematic review found a lack of evidence about the use of masks by those not diagnosed with COVID-19 to limit the spread. • Three rapid reviews found that:

Source	Summary
<p>preventing community transmission of COVID-19, and should they be required for all of society?</p> <p>McMaster University 2020 (48)</p>	<ul style="list-style-type: none"> ○ there was no evidence that cloth masks in the community prevent viral respiratory illness ○ evidence is not strong enough to recommend universal wearing of masks, but such masks may be slightly protective against infection from casual community contact ○ the use of cloth masks in healthcare settings might increase the rates of infection. ● Key findings from seven guidelines <ul style="list-style-type: none"> ○ The best evidence should be used to recommend everyone wear face masks. ○ Recommendations on use in community setting were inconsistent. ○ It is recommended to wear cloth face coverings in public settings where other social distancing measures are difficult to maintain and in areas of community transmission. ○ Evidence is inconclusive about effectiveness of cloth face coverings worn by the public ○ Non-medical face masks are less effective than medical face masks. ○ Cloth masks are not recommended under any circumstances to prevent transmission in low risk community settings. ○ There is no current evidence to make a recommendation for or against the use of masks in the community setting.
<p>Should cloth masks be used by the general public for preventing transmission of SARS-CoV-2?</p> <p>College of Public Health Medicine Evidence-based COVID-19 Task Team, Cochrane South Africa and South African Medical Research Council Health Systems Research Unit 2020 (49)</p>	<ul style="list-style-type: none"> ● No trials exist which compare cloth masks to medical masks and nil covering in the community setting. ● The review included a trial in 15 hospitals in Vietnam in healthcare workers. It was addressed for relevance in the community setting and showed moderate certainty evidence that clinical and laboratory-confirmed respiratory infections are increased approximately 1.5 times when wearing cloth masks compared with medical masks.

Source	Summary
<p>Cloth face coverings worn by public to reduce transmission of viral respiratory infection</p> <p>ECRI 2020 (50)</p>	<ul style="list-style-type: none"> • Evidence is inconclusive: too few data on outcomes of interest. • No published clinical or epidemiologic studies. • Data from two small laboratory studies suggest that cloth face covers may filter avian influenza virus (a COVID-19 surrogate) particles, but not COVID-19 particle spread by patients with COVID-19 who coughed while wearing cloth face masks. • Centers for Disease Control and Prevention guidelines have recommended wearing cloth face coverings in public in response to the COVID-19 outbreak, but the WHO has not endorsed the practice, citing insufficient evidence of effectiveness.
<p>Should medical masks be used by the general public for preventing transmission of SARS-CoV-2?</p> <p>Rees, et al. 2020 (51)</p>	<ul style="list-style-type: none"> • Medical masks may provide little to no protection in the community setting, but the certainty of this evidence is low. • Medical masks may provide a small amount of protection to members of households from household members who are ill, but the certainty of this evidence is low and some harms may also be present. • The generalisability of these findings to the SARS-CoV-2 pandemic remains unclear
<p>What is the effectiveness of face masks in preventing respiratory transmission in the community?</p> <p>University of Edinburgh 2020 (52)</p>	<ul style="list-style-type: none"> • Based on the evidence from four recent systematic reviews and meta-analyses, wearing face masks in the community is not significantly associated with a reduction in influenza-like-illness and the overall assessment of the quality was classified as low.
<p>Review of science and policy around face masks and COVID-19</p> <p>NZ Government (21)</p>	<ul style="list-style-type: none"> • May reduce viral spread from viral shedders. • Masks may provide protection in closed spaces, such as public transport. • Masks may provide some protection at mass gatherings. • Masks can be effective when used alongside hand hygiene. • Improper use of face masks, such as not changing disposable masks, could jeopardise the protective effect and even increase the risk of infection. • Homemade cloth masks may be too porous to protect against SARS-Cov-2. • Masks are not as effective as hand-washing, and may present a false sense of security. • Used or dirty masks not disposed of correctly become a health hazard.

Source	Summary
<p>Masks for prevention of COVID-19 in community and healthcare settings</p> <p>Agency for Healthcare Research and Quality 2020 (53)</p>	<p>Community settings</p> <ul style="list-style-type: none"> • Possibly no different between an N95 respirator or equivalent versus a surgical mask in risk of non-coronavirus respiratory infections, but estimates were imprecise. • Probably no difference between surgical mask versus no mask in risk of non-coronavirus respiratory infections, but compliance with mask use was low. • Mask use is probably associated with a decreased risk of SARS-CoV-1 infections versus no use. <p>Healthcare settings</p> <ul style="list-style-type: none"> • N95 respirators and surgical masks are probably associated with similar risk of influenza-like illness, some inconsistency in effects. • N95 possibly associated with a decreased risk of SARS-CoV-1 infections versus surgical masks. • Mask use probably associated with decreased risk of SARS-CoV-1 infections versus no use. • More consistent mask use is probably associated with decreased risk of SARS-CoV-1 infections versus less consistent use. <p>Extended or reuse of N95 respirators</p> <ul style="list-style-type: none"> • No evidence. <p>Harms</p> <ul style="list-style-type: none"> • No serious harms reported with N95 or surgical masks in randomised controlled trials • Discomfort, breathing difficulty and skin issues common with N95 respirators and masks. • Limited evidence of no difference in harms by mask type.
<p>Cloth masks for community compared to medical grade masks or nothing to prevent spread of respiratory viruses</p> <p>Cochrane rapid review 2020 (54)</p>	<ul style="list-style-type: none"> • In progress, to be published soon



Table 2: Empirical data on mask use in COVID-19

Source	Summary
<p>The role of community-wide wearing of face mask for control of coronavirus disease 2019 (COVID-19) epidemic due to SARS-CoV-2.</p> <p>Cheng, et al. 2020 (55)</p>	<ul style="list-style-type: none"> • Within first 100 days (31 December 2019 to 8 April 2020), 961 COVID-19 patients were diagnosed in Hong Kong Special Administrative Region (HKSAR). • The COVID-19 incidence in HKSAR (129.0 per million population) was significantly lower ($p < 0.001$) than that of Spain (2983.2), Italy (2250.8), Germany (1241.5), France (1151.6), US (1102.8), UK (831.5), Singapore (259.8), and South Korea (200.5). • The compliance of face mask usage by HKSAR general public was 96.6% (range: 95.7% to 97.2%).
<p>Association of country-wide coronavirus mortality with demographics, testing, lockdowns, and public wearing of masks.</p> <p>Leffler, et al. 2020 (6)</p> <p>Pre peer review</p>	<ul style="list-style-type: none"> • Potential predictors of per-capita coronavirus-related mortality in 198 countries were examined, including age, sex ratio, obesity prevalence, temperature, urbanisation, smoking, duration of infection, lockdowns, viral testing, contact tracing policies, and public mask-wearing norms and policies. • In a multivariable analysis of 194 countries, the duration of infection in the country, and the proportion of the population 60 years of age or older were positively associated with per-capita mortality, while duration of mask-wearing by the public was negatively associated with mortality (all $p < 0.001$).
<p>Community use of face masks and COVID-19: evidence from a natural experiment of state mandates in the US.</p> <p>Lyu, et al. 2020 (5)</p>	<ul style="list-style-type: none"> • This study provides evidence from a natural experiment on effects of state government mandates in the US for face mask use. • Mandating face mask use in public is associated with a decline in the daily COVID-19 growth rate by 0.9, 1.1, 1.4, 1.7, and 2.0 percentage-points in 1-5, 6-10, 11-15, 16-20, and 21+ days after signing, respectively. • Estimates suggest as many as 230,000-450,000 COVID-19 cases were possibly averted by 22 May 2020 by these mandates. • The findings suggest that requiring face mask use in public might help in mitigating COVID-19 spread.
<p>Behavioral changes before lockdown, and decreased retail and recreation mobility during lockdown, contributed most to the successful control of the COVID-</p>	<ul style="list-style-type: none"> • This paper shows that in 33 of 35 Western countries (32 European, plus Israel, US and Canada), the reproduction number fell to around or below one during lockdown (March - May 2020). • Country-wide compulsory usage of masks was implemented only in Slovakia 10 days into lockdown, and on its own reduced transmission by half.

Source	Summary
<p>19 epidemic in 35 Western countries.</p> <p>Deforche, et al. 2020 (7)</p> <p>Pre peer review</p>	
<p>Face masks considerably reduce COVID-19 cases in Germany.</p> <p>Mitze, et al. 2020 (8)</p> <p>Pre peer review</p>	<ul style="list-style-type: none"> • Regional variation in the point in time when face masks became compulsory. • Depending on the region analysed, results showed that face masks reduced the cumulative number of registered COVID-19 cases between 2.3% and 13% over a period of 10 days after they became compulsory.
<p>Data-driven estimation of change points reveal correlation between face mask use and accelerated curtailing of the COVID-19 epidemic in Italy</p> <p>Pederson, et al. 2020 (56)</p>	<ul style="list-style-type: none"> • Results indicate that lockdowns managed to cause the epidemic to peak in late March 2020. Surprisingly, a change point was found during the decay from the peak, which does not correspond to obvious drastic legal interventions, but may be explained by widespread promotion and mandatory use of face masks. • These interpretations were confirmed at regional levels.

Appendix 1

Forest plot showing unadjusted estimates for the association of face mask use with viral infection causing COVID-19, SARS or MERS.

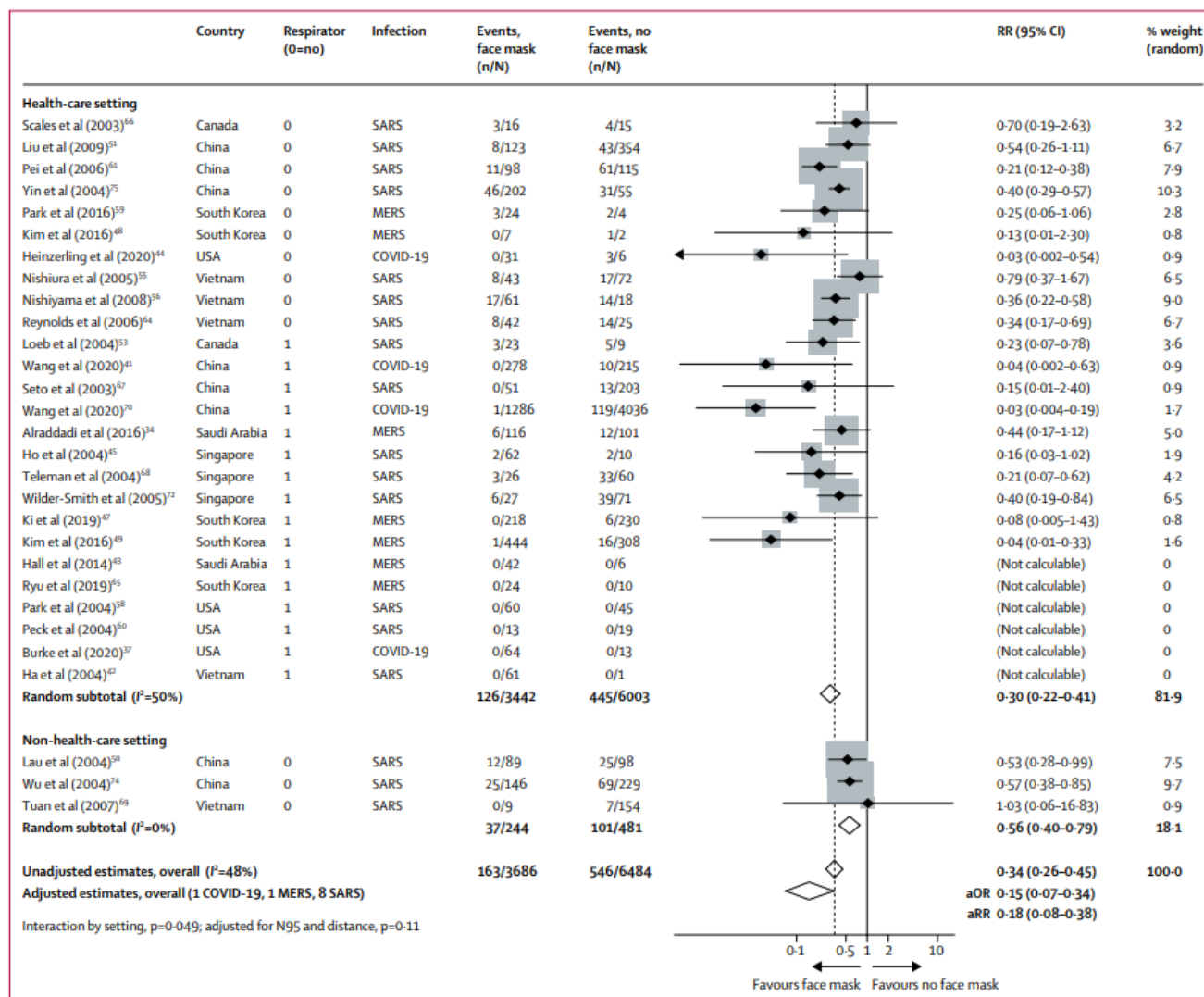


Figure 4: Forest plot showing unadjusted estimates for the association of face mask use with viral infection causing COVID-19, SARS, or MERS
SARS=severe acute respiratory syndrome. MERS=Middle East respiratory syndrome. RR=relative risk. aOR=adjusted odds ratio. aRR=adjusted relative risk.

Source: [Chu, et al. 2020](#). (15)

Appendix 2

PubMed search terms

PubMed: (mask*) AND (2019-nCoV[title/abstract] or nCoV*[title/abstract] or covid-19[title/abstract] or covid19[title/abstract] OR "covid 19"[title/abstract] OR "coronavirus"[MeSH Terms] OR "coronavirus"[title/abstract] OR sars-cov-2[title/abstract] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept]) Filters: review or systematic review (or Review[title])

Supplementary search:



transport* AND (mask*) AND (2019-nCoV[title/abstract] or nCoV*[title/abstract] or covid-19[title/abstract] or covid19[title/abstract] OR "covid 19"[title/abstract] OR "coronavirus"[MeSH Terms] OR "coronavirus"[title/abstract] OR sars-cov-2[title/abstract] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept]) AND (2019:2020[pdat])

Supplementary search:

(community) AND (mask*[ti]) AND (2019-nCoV[title/abstract] or nCoV*[title/abstract] or covid-19[title/abstract] or covid19[title/abstract] OR "covid 19"[title/abstract] OR "coronavirus"[MeSH Terms] OR "coronavirus"[title/abstract] OR sars-cov-2[title/abstract] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept])

Google and Twitter search terms

- Google 1: "Cloth face masks" AND COVID-19
- Google 2: Cloth face masks – limit to 2020
- Google 3: Face masks in the community review
- Google 4: Face masks systematic review
- Google 5: Masks public transport

MedRxiv was searched using the term 'masks' on 8 July 2020 to include recent papers (since 1 July 2020) supplementing empirical data publications found in the daily evidence digest.

Glossary

aOR adjusted odds ratio

CI confidence interval

n number

OR odds ratio

RD risk difference

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Original search	Updates
21 April 2020	
25 May 2020	<ul style="list-style-type: none"> Updated search and included new reviews, in-brief updated accordingly.
19 June 2020	<ul style="list-style-type: none"> Social distancing changed to physical distancing in the in-brief. Search was updated to include new reviews, in-brief updated accordingly. In response to changing and evolving positions internationally around face mask use, we removed individual country advice on face masks from background.
1 July 2020	<ul style="list-style-type: none"> Search re-run and table 1 updated, question broadened to face masks rather than cloth face masks specifically. Results expanded to provide some empirical data on the effectiveness of face masks. Supplementary search done on public transport and face masks. In-brief adjusted to reflect updates. Appendix included to show forest plot from one systematic review.
8 July 2020	<ul style="list-style-type: none"> Included statement from the World Health Organization and open commentary on transmission in background. Re-ran and updated searches, with a supplementary search. Updated in-brief as relevant.
20 July 2020	<ul style="list-style-type: none"> Inclusion of timeline and evidence themes. New opinion pieces included in background and timeline. Updated Victorian advice on masks included. In-brief reformatted. Searches were not updated.