COVID-19 Evidence Update

COVID-19 Update from SAHMRI

9 August 2021

Masks in Community Settings

Executive Summary

Overview: This review covers the published evidence on the effectiveness of mask wearing in preventing transmission of COVID-19 in community settings. This evidence base is limited and largely confounded. Evidence from other settings shows that surgical and cloth masks contribute to source control and offer less in terms of protection for the wearer.

On balance, it is probable that mask wearing in community settings makes a contribution to slowing transmission, when community transmission is widespread. The size of this impact is not known. In the absence of community transmission, community mask wearing may offer some additional risk-mitigation against undetected virus in public spaces and is a question of proportionality against the size of the risk. Other COVID-19 controls remain a high priority even when masks in community settings are in use.

Heath care setting and laboratory studies of respiratory viruses *(evidence not presented in review):*

- There is **substantial high-quality evidence** that masks are important for **filtration for protection of the wearer** against COVID-19 in high-risk settings where virus is known to be present, as part of comprehensive PPE (including well-fitted N95 masks, complemented with face shield to protect the eyes, and other measures).
- There is **substantial high-quality evidence** that surgical masks contribute to **source control (reducing the number of virus-laden droplets and aerosols** emitted by an infected person).
- There is **quality evidence** that **surgical masks** offer **some (but lesser) potential protection for the wearer** against virus laden droplets and aerosols in high-risk settings when virus is known to be present. **Cloth masks** offer lesser protection again.

Studies of the effectiveness of mask in reducing or preventing community transmission:

- **The evidence base is limited,** predominantly **confounded** and of **lower quality.**
- 1 **RCT** on protection for wearers (null effect) [1]
- There are several **case studies**; multiple **observational studies of jurisdictions** (counties/states/countries) either before vs. after mask policies or with vs. without mask policies; and several reviews of the available evidence. Many of these studies conclude there is some benefit in community mask wearing. [Summarised in multiple reviews: [2-10]]
- These studies are **confounded** by a range of other factors at play at the same time (other COVID policies, disease dynamics, other places of transmission (e.g. households), and population factors which are virtually impossible to control for. These studies are considered lower quality evidence, in the hierarchy of evidence.
- Three studies estimate the contribution of **masking policy in Australia** (2 in Vic [11, 12], 1 in NSW [13]) and tried to separate its impact from phased in lockdowns (Vic), contact tracing and testing (NSW). Results varied. One Vic study [11] found masking contributed to changing (improving) the trajectory of the epidemic curve.
- There are very many **commentary pieces** advocating for masks in the community, predominantly written within the context of significant community transmission. These cite the above evidence and include expression of expert opinion.

Taken together, the evidence regarding the effectiveness of masks for slowing community transmission during an outbreak is compatible with a **small to moderate protective effect**, but there are **significant uncertainties about the size of this effect**.

Evidence-based policy recommendations:

- The World Health Organization, the US CDC, European CDC; and the Australian Government ICEG provide recommendations based on their reviews of evidence and information.
- In the presence of community transmission, masking is recommended in community settings (notably in indoor, crowded and poorly ventilated spaces) as a complement to other strategies.
- In areas with **sporadic transmission** or **no documented transmission**, the WHO recommends decision makers apply a **risk-based approach** when considering masks for the general public.

Transmission dynamics *(evidence presented in previous updates):*

- Transmission of SARS-CoV-2 is very unevenly distributed.
- Transmission rates are the highest in household settings, by a considerable margin.
- Significant transmission events (super-spreading) are also known to occur in private social settings, some hospitality settings, and some workplaces (factories, meat processing, aged care, frontline health care).
- Recent modelling by the Doherty shows the potential contribution (risk) of different population segments to transmission, in Australia. This has been done based on the current vaccine roll out and Delta variant of concern. It found that 20-39 year olds are the main transmission risk (and hence priority for vaccination), and 12-15 year olds make a negligible contribution to overall transmission risk.

Other considerations:

- In the absence of community transmission, masks wearing in the community would be an additional measure to mitigate against the risk of undetected transmission. In assessing the proportionality of this response, the following can be considered:
    - Risk of exposure to SARS-CoV-2:
        - based on epidemiology (e.g. local cases, risk of incursion events from interstate or hotel quarantine, R0 of variant)
        - by settings (e.g. indoor, poorly ventilated, crowded)
        - for individuals and cohorts (e.g. vulnerability)
    - Strength of other COVID-19 controls, notably: testing (community and wastewater), effectiveness of contact tracing, isolation and quarantine, density limits, vaccination rates, border controls.
    - The purpose of the mask – source control (more effective) and/or filter protection for the wearer (less effective).
    - The potential advantages and disadvantages e.g. communication difficulties, difficulties for people with disabilities and mental illness, discomfort including headaches, breathing difficulties, cultural acceptability.

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SCIENTIFIC EVIDENCE

Literature reviews

[2] Chou et al. (2020-21, Annals of Internal Medicine)

- Living rapid review - last updated 13 July 2021
- Initial results included only 2 studies specific to SARS-CoV-2 and these were both in health care settings. There have since been 6 updates. Updated searches were done up to 2 June 2021.
- The authors concluded that the **strength of evidence for any mask use versus nonuse in community settings remains low.**
- Included studies: (1 RCT, 3 observational):
- **RCT study:**
    - [1] Bundgaard et al. 2020. (DANMASK-19)
        - *Authors of review states*: good quality, open label trial of 6024 community-dwelling adults in Denmark evaluating the effects of wearing a surgical mask outside of the home, at a time when mask wearing in the community was neither recommended or common.
        - Results: surgical mask vs no mask OR=0.82 (95%CI 0.52-1.23) *[Note: **No significant effect**]*
        - Authors of review note: the trial was not designed to assess the effects of mask use as source control; in addition, high adherence to other infection control measures (e.g. physical distancing and handwashing) could have attenuated potential benefits.
        - *Additional details sourced from primary study:*
        - Conducted April-May 2020 with participants (18+ years) who spent more than 3 hours per day outside the home without occupational mask use. The intervention was encouragement to follow social distancing measures plus either no mask recommendation or a recommendation to wear a mask when outside the home among other persons (plus mask supply and instructions on proper use). Infection with SARS-CoV-2 occurred in 42/2392 (1.8%) of participants who were randomly assigned to the mask wearing group, compared to 53/2470 (2.1%) of the non-mask wearing group.
        - Limitations included: inconclusive results, missing data, variable adherence, patient-reported findings on home tests, no blinding, and no assessment of whether masks could decrease disease transmission from mask wearers to others.

- **Observational studies**
    - *[Note: authors of review indicate **these studies have numerous methodological limitations,** e.g. **selection and recall bias, missing data, control for exposures** was limited]*
    - [14] Doung-Ngern et al. 2020:
        - Results: **surgical mask vs no mask**: **adjusted OR=0.25** (95%CI 0.12-0.53). Cloth mask vs no mask: adjusted OR 0.78 (95%CI 0.32-1.90). Any mask vs no mask: adjusted OR 0.46 (95%CI 0.13-1.64)
        - *Additional details sourced from primary study:* Retrospective case-control study using a cohort of contact tracing records in Thailand in March 2020. Included contact investigations of 18 primary index patients: 11 from a nightclub cluster, 5 from a boxing stadium cluster, and 2 from a state enterprise office cluster. 1,706 people were identified as close contacts, of which 1050 were included in the study. 211 (20.1%) tested positive, and were classified as cases, the remainder were classified as controls. **Wearing a mask all the time during contact with a COVID-19 patient** was associated with lower risk of infection (**aOR 0.23**; 95% CI 0.09–0.60), whereas wearing masks only sometimes was not (aOR 0.87; 95% CI 0.41–1.84). Study also showed that **handwashing**, and **social distancing** were independently associated with lower risk.
    - van den Broek-Altenburg et al. 2021:
        - [15] mask use outside of work (Y/N) OR=2.35 (0.67-8.25) [not significant].
    - [16] Wang Y et al. 2020:

- Household with secondary **infection of family member; mask use all the time by at least one family member or index case** vs no family members prior to index case illness onset, **adjusted OR=0.21** (0.6-0.79).
- *Additional details from primary study:* Retrospective cohort study of 335 people in 124 families, 28 Feb to 27 March, Beijing, China.

[3] Czypionka et al. (2021, Annals of Internal Medicine).

- Narrative review.
- Searched to 31 October 2020.
- Authors of review state that several studies have shown a **strong negative correlation between the introduction of universal masking and the incidence of new COVID-19 infections**.
- Included studies (all observational):
  - [17] Lyu et al. 2020.
    - Introduction of mandatory masking was associated with a decline in daily COVID-19 growth rates by 0.9, 1.1, 1.4, 1.7 and 2.0 percentage points at 1-5, 6-10, 11-15, 16-20 and 21+ days, respectively.
    - *Additional details from primary study:* Event study (similar to differences- in-differences design) examining changes in county-level growth rates between 31 Mar and 22 May 2020. Between April 8 and May 15, governors of fifteen states and the mayor of Washington, D.C., signed orders mandating all individuals who can medically tolerate the wearing of a face mask do so in public settings (for example, public transportation, grocery stores, pharmacies, or other retail stores) where maintaining six feet of “social distance” might not always be practicable. The face mask defined in these orders primarily refers to cloth face coverings or nonmedical masks. The orders also clearly specify that the face masks are not a replacement for any other social distancing protocols.
  - [18] Karaivanov et al. 2020.
    - Observational study comparing 34 regions of Ontario, Canada, which introduced mask mandates on different dates, found in the weeks after implementation, such mandates were associated with 25% fewer new cases of COVID-19 per week.
    - *Additional information from primary study:* [working paper, not peer reviewed] Data refers to March to Mid-August, 2020, models the effect of policy interventions on COVID-19 outcomes while controlling for information and behaviour.
  - [19] Leffler et al. 2020.
    - In a study across 200 countries, those with cultural norms/government policies supporting public masking, per capita mortality from COVID-19 increased by 16.2% per week, compared with 61.9% per week in the remaining countries.
    - *Additional details from primary study:* We identified 24 countries with recommendations or cultural norms favouring mask wearing by the public within 20 days of the estimated onset of the country’s outbreak, including Japan, the Philippines, Macau, Hong Kong, Sierra Leone, Cambodia, Timor-Leste, Vietnam, Malaysia, Bhutan, Venezuela, Taiwan, Slovakia, St. Kitts and Nevis, South Korea, Indonesia, Brunei, Grenada, Mozambique, Uzbekistan, Thailand, and Malawi. The average mortality by May 9 for these 24 early mask-wearing countries was 1.5 per million (SD 2.0).
    - An additional 17 countries recommended public masking within 30 days of the estimated onset of their outbreak: São Tome´ and Pr´ıncipe, Czechia, Dominica, Bangladesh, Zambia, Chad, Benin, Sudan, El Salvador, Antigua and Barbuda, Myanmar, Bosnia and Herzegovina, Coˆte d’Ivoire, South Sudan, Kenya, Saint Lucia, and Barbados. The average mortality by May 9 for this group was 8.5 per million (SD 12.4).
    - Depending on the model and dataset evaluated, **statistically significant independent predictors of per-capita mortality** included urbanization, fraction of the population **aged 60 years or older**, prevalence of **obesity**, and duration of the **outbreak** in the country. In addition, per-capita mortality was inversely (and independently) associated with **international travel restrictions** and the period of the outbreak subject to **cultural norms** or **government policies favouring mask-wearing** by the public.

- IHMR COVID-19 Forecasting team 2020.
  - A **simulation modelling** study estimated that 85-100% mask use across the US during the pandemic could prevent between 95,814 and 129,574 deaths during a 5-month period.
- Bungarrd et al. 2020. DANMASK-19 study (already noted above)
- Modelling studies:
  - The **main benefit of population masking is source control**.
  - Authors of the review state that the studies show that **if adherence is high, small reductions in individual transmission with 'imperfect' masks and face covering could lead to large effects on population spread, especially in crowded indoor settings.**

[4] Brooks et al. (2021; JAMA).

- Brief narrative review
- Cites 11 studies to **suggest that masks are effective** at reducing infections and deaths in community settings.
  - [20] Hendrix et al. 2020
    - US. Hair salon, 139 patrons with 2 infected and symptomatic stylists; with universal mask wearing, no COVID-19 infections among 67 patrons who were available for follow-up. [*Note: 72 refused and were not tested*]
    - *Additional information from primary study:* Observations were made in May 2020. Stylist A was the index case, and worked for 8 days after developing respiratory symptoms. Stylist B, who had been exposed to Stylist A, developed symptoms on day 3 and worked until day 8. During Stylist A's symptomatic period, the two stylists interacted while neither was masked during intervals between clients. The 139 clients were contact-traced and asked to self-quarantine for 14 days and were called or sent daily text messages to inquire about symptoms. No symptoms were reported. Testing was offered to all clients 5 days after exposure or ASAP if exposure >5 days before contact tracing began. Overall, 67(48.2%) volunteered to be tested and 72 (51.8%) refused. Appointment duration was generally about 15 mins (range 15-45mins).
    - Limitations of the study included not contact-tracing clients from the pre-symptomatic period, not being able to detect asymptomatic clients, and conducting only 1 PCR test around day 5.
  - [21] Payne et al. 2020
    - Guam. 382 Navy service members who self-reported mask wearing. Odds ratio of reduced infection associated with mask wearing was **OR 0.30** (95%CI 0.17-0.52).
    - *Additional information from primary study:* Convenience sample, data collected during an outbreak in April 2020. **Lower odds of infection were independently associated with self-report of wearing a face covering (55.8% versus 80.8%; OR = 0.3;** 95% CI = 0.2–0.5), **avoiding common areas** (53.8% versus 67.5%; OR = 0.6; 95% CI = 0.4–0.9), and **observing social distancing** (54.7% versus 70.0%; OR = 0.5; 95% CI = 0.3–0.8), compared with service members who did not report these behaviours.
  - Wang Y. et al. China. Included above.
  - Duong-Ngern et al. Thailand. Included above.
  - [22] Gallaway et al. 2020
    - US. State population in context of instituting a **policy of mandatory mask wearing** in public. **Temporal association between policy and subsequent decline in new diagnoses.**
    - *Additional information from primary study:* To assess the effect of mitigation strategies in Arizona, the numbers of daily COVID-19 cases and 7-day moving averages during January 22–August 7, 2020, relative to implementation of enhanced community mitigation measures, were examined. Decreases in daily COVID-19 cases were observed after widespread sustained community mitigation measures that promoted social distancing, limited large gatherings, paused operations of businesses where mask use and social distancing were difficult to maintain, mandated and enforced mask wearing, and promoted

voluntary resident actions to stay at home and wear masks (when and where not mandated).

- [23] Rader et al. 2021
  - US. Anonymous survey of 374,021 people who **self-reported mask wearing in grocery stores and in the homes of family and friends**. A 10% increase in mask wearing increased the likelihood (adjusted Odds Ratio=3.53, 95%CI 2.03-6.43) of stopping community transmission.
  - *Additional information from primary study:* Responses recorded between 3 June and 27 July 2020. 84.6% indicated that they were very likely to wear a face mask to the grocery store, whereas 40.2% reported that they did so to visit friends and family. The authors state *"Our evidence supports the role of mask-wearing in controlling SARS-CoV-2 transmission; however, this ecological study cannot inform questions of causality or generalisable biological mechanisms.* ***It is difficult to disentangle individuals' engagement in mask-wearing from their adoption of other preventive hygiene practices, and mask-wearing might be serving as a proxy for other risk avoidance behaviours not queried (eg, avoiding crowded spaces).****"*
- Wang X et al. US - health care workers only
- [24] Mitze et al. 2020
  - Germany. **Estimated daily decline in new diagnoses of 1.32% after full implementation of mandatory mask wearing in public spaces** (e.g. public transport, shops).
  - *Additional information from primary study:* After face masks became mandatory in the city of Jena between 1-10 April 2020, the number of new infections fell almost to zero. Used a **synthetic control method** (create a comparison group through weighted averages of control regions that are structurally similar to treated regions). Depending on the region, face masks reduced the number of newly registered severe acute respiratory syndrome coronavirus 2 infections between 15% and 75% over a period of 20 days after their mandatory introduction. Assessing the credibility of the various estimates, face masks reduce the daily growth rate of reported infections by around 47%. *NOTE: Several public health measures were introduced in rapid procession in Jena, including closures of venues and capacity and contact limits.*
- [25] Van Dyke et al. 2020
  - US. Estimated case rate per 100,000 persons decreased by 0.08 in counties with mask mandates (in public spaces) but increased by 0.11 in those without.
  - The Kansas mandate requiring the wearing of face coverings in public spaces became effective July 3, 2020. For this study, counties in Kansas that, as of August 11, 2020, did not opt out of the state mandate or adopted their own mask mandate were considered to have a mask mandate in place; those that opted out of the state mandate and did not adopt their own mask mandate were considered to not have a mask mandate in place. Segmented regression was used to examine changes in COVID-19 incidence before and after July 3, 2020, among mandated and nonmandated counties. Although rates were considerably higher in mandated counties than in nonmandated counties by the executive order, rates in mandated counties declined markedly after July 3, compared with those in nonmandated counties.
- Lyu et al. US - included above
- Karaivanov et al. Canada - included above

[8] Liao et al (2021, Current Opinion in Colloid & Interface Science)

- Review of the design, functional performance, and effectiveness of various types of face masks; outlining the **working principle of face masks in reducing the risk of airborne infections** from a **basic viewpoint of colloid and interface science** *[Note: Interface and colloid science is an interdisciplinary intersection of branches of chemistry, physics, nanoscience dealing with particles between 1 nm and 1000 nm].*
- Review of the main scientific studies conducted over the past ~10 years to assess the effectiveness of face masks for both medical professionals and the general public. *[Note: All included elsewhere above]*

- ***Principle of protection from face masks: against aerosols and large droplets***
    - Theoretically, respiratory viruses can be transmitted through fine aerosols (droplets and droplet nuclei with aerodynamic diameters ≤ 5 μm), **respiratory droplets** (including larger droplets that fall rapidly near the source, as well as coarse aerosols with aerodynamic diameters > 5 μm), or direct contact with secretions.
    - **A face mask provides a barrier to prevent the respiratory tract from being exposed to droplets and airborne aerosols.** The physical interception, therefore, reduces the risk of RVIs.
    - Studies have revealed that SARS-CoV-2-containing particles can be ejected several meters from a coughing or sneezing patient. These particles vary significantly in size, which, in turn, affects the distance from the source that the particles travel through the air.
    - Large particles will precipitate on surfaces of laptops, desks, chairs, and any other items nearby, but the smaller ones will be suspended in air for a much longer time, and travel further, depending on airflow dynamics.
    - **Aerosols** refer to the small end of airborne water droplets exhaled from or sneezed out of a patient, with **typical sizes below 2–3 μm**. They remain airborne for prolonged periods because of their small size and low settling velocity.
    - Settling times for spherical particles of verified sizes, in a 3-m fall (the height of a room) for specific diameters, were 10 s for 100 μm, 4 min for 20 μm, 17 min for 10 μm and 62 min for 5 μm; and particles with diameters 1–3 μm essentially did not settle.
    - In addition to sizes, the settling time of aerosols can be affected by ambient airflow. In terms of the dynamic process, 'aerosol' is not an absolute but rather a relative term. In environments with strong cross-flow or natural ventilation, a larger respiratory droplet (>100 μm) can remain airborne for a longer time.
    - The filtration efficacy of cloth face masks varies and depends on a variety of factors:
        - the type of material used (structure and composition of the fabric),
        - number of layers,
        - moisture degree in a mask, and
        - the size and shape of the particles exposed.
    - A wide range of textiles could ensure the efficient removal of most airborne particles.
        - Masks made of quality cloth were capable of intercepting the majority of large respiratory droplets.
        - Macro particles (diameters > 0.6 μm, e.g., polluted aerosols and most bacteria) are usually larger than pore sizes of the mask filters and can be intercepted outside face masks.
        - Microparticles (~0.3–0.6 μm, e.g., some bacteria and large viruses) have a chance to move through the pores, but these particles will possibly get caught by the fibers and thus become hard to reach the wearers.
        - Nanoparticles with diameters <0.3 μm, such as viruses, can easily flow through the pores as air inhalation and do not become adhered to fiber walls.
    - Comments from the authors about the broad literature on masks:
        - Caution must, be drawn in reading the scientific data summarized from both laboratory-based studies and clinical trials
        - Many types of face masks aimed at the general public are fast coming into the market, but the amount of research that shows their fit-for-purpose is currently lacking
        - Face mask wearing may bear social, cultural, and geographical influences, with some **unfortunate politicization since the COVID-19 outbreak**.
        - Wearers may not wear them properly, have repeated handling and compromise hygiene, etc., resulting in a false sense of security that could actually make the transmissions worse.

Unintended consequences (from Czypionka et al. [3]):

- Masks may cause discomfort and communication difficulties.
- There is no evidence that masks result in significant physiologic decompensation (gas exchange) among to a clinically significant extent in healthy persons at rest.

- Evidence was not found for risk compensation (the wearer reduces other protective behaviours out of a false sense of security) and fomite transmission (especially if there is increased face touching followed by touching of an environmental surface) are associated with mask wearing.
- The **psychological effects** of masks are **culturally shaped**. They may include threats to wellbeing in three ways:
    - (i) Autonomy (the ability to have free will and choice over one's actions),
    - (ii) psychological relatedness (feeling socially connected to others), and
    - (iii) competence (the feeling that we are effective and capable and have mastery over our circumstances).
    - Culture can be encouraging of masks e.g. as protection from pollution.
- Evidence suggests that the **potential benefits** of wearing masks **likely outweigh the potential harms when SARS-CoV-2 is spreading in a community**.
- However, mask mandates involve a trade-off with personal freedom, so **such policies should be pursued only if the threat is substantial and mitigation of spread cannot be achieved through other means.**

[26] O'Keefe (May 20, 2021), Evidence briefing from the National Collaborating Centre for Environmental Health, Canada.

- Recommendations for wearing a mask in public have typically applied to areas where there is a **high level of community spread of the virus** and **crowded locations** where it is difficult to maintain physical distancing.
- The review synthesises the key evidence [already cited elsewhere in this document] and concludes: "Masks vary widely in their design, construction, and the level of protection against respiratory viruses that they can provide to the wearer and to others as source control. The use of medical masks including approved respirators (e.g., N95s and similar) and surgical masks can reduce the transmission of respiratory infection in healthcare settings. The use of non-medical masks by the public may also reduce the risk of transmission of respiratory infection in community settings, especially when used by both infected and susceptible persons, but masking does not eliminate the risk of transmission entirely."
- Key messages
    - **Most face coverings are found to provide some reduction in the release of and exposure to larger droplets.**
    - **Performance against smaller aerosols varies widely**, with certified respirators providing the best performance. A very well-fitted surgical mask (e.g., with modifications to improve fit) can also provide good protection against aerosol spread.
    - Across the wide range of material types, layers and aerosol sizes tested, cloth masks are most efficient for blocking large particles (droplets), but performance against smaller aerosols varies and can be dependent on material type, construction and fit.
    - The most effective cloth masks are those that provide a good fit around the nose, sides, and chin, and are made of materials that provide a high level of particle filtration, while maintaining breathability.
    - Systematic reviews and modelling studies have indicated that mask-wearing has reduced the number of cases and growth rate of COVID-19 infections where there was early uptake, widespread adherence, and when used in combination with other non-pharmaceutical interventions such as hand hygiene and physical distancing.

Recent primary studies not included in the literature reviews

[27] Hong et al. (2020, Travel Medicine and Infectious Diseases)

- 197 local residents had definite close-contact with 41 pre-symptomatic patients. Of these close contacts, 123 were exposed to a mask-wearing patient and 74 were exposed to a non-mask-wearing patient. The **incidence of COVID-19 was significantly higher for those exposed to the non-mask-wearing patient** (19.0%) **than the mask-wearing patient** (8.1%).
- *NOTE: the data from this study was from the start of the pandemic in Wuhan when few people were aware of the seriousness of the situation.*

[28] Cheng et al. (2020, Journal of Infection)

- Assessed the effect of community-wide mask usage to control coronavirus disease 2019 (COVID-19) in Hong Kong Special Administrative Region (HKSAR). In HKSAR, community-wide masking was practiced by the general population at an early stage of the local COVID-19 epidemic. The epidemiology of COVID-19 of HKSAR was compared to that of the representative countries in North America, Europe, and Asia where face mask usage was not common.
- Results: Up to day 100 of the epidemic, a total of 961 cases of COVID-19 were confirmed in HKSAR. Transmission of COVID-19 was divisible into four phases: phase 0 (from day 1 to 21) with no confirmed cases of COVID-19 in HKSAR; phase 1 (from day 22 to 30) with 10 imported cases; phase 2 (from day 31 to 71) with 111 cases (predominantly local cases) and; phase 3 (from day 72, WHO declared COVID-19 pandemic, onwards) with 840 cases (predominantly imported cases with local clusters of cases)
- Among the 961 confirmed cases, there were 11 clusters of 113 persons that were directly engaged in mask-off activities such as dining and drinking in a restaurant or bar, singing at karaoke, and exercise in fitness clubs. There were only three clusters involving 11 persons engaged in mask-on settings at the workplace.
- The incidence of COVID-19 in HKSAR was significantly less than that of the selected countries where face mask usage was not universally adopted in the community
- *NOTE: Uses Singapore and South Korea as a no-mask comparator but there is almost no details on the change in mask usage in these countries over the 100 days included in the study.*

[29] Fischer et al. (2021, Plos One)

- Examines mask wearing policy and adherence in association with COVID-19 case rates across US states. Mask wearing policy and adherence data were collected for April-September 2020 and compared to monthly COVID-19 case rates in the subsequent month (May-October 2020).
- Results: 14/15 states with no mask wearing policy reported a high COVID-19 rate. Of the 8 states with at least 75% mask adherence, none reported a high COVID-19 rate. States with the lowest levels of mask adherence were most likely to have high COVID-19 rates in the subsequent month, independent of mask policy or demographic factors. Mean COVID-19 rates for states with at least 75% mask adherence in the preceding month was 109.26 per 100,000 compared to 249.99 per 100,000 for those with less adherence.
- *NOTE: the adjusted model (which included population differences and yes/no stay-home order) had wide confidence intervals and most of the results indicated null finding for mask adherence and mask policy.*

[30] Joo et al. (2021, MMWR)

- During March 22–October 17, 2020, 10 sites participating in the COVID-19–Associated Hospitalization Surveillance Network in states with statewide mask mandates reported a decline in weekly COVID-19–associated hospitalization growth rates by up to 5.5 percentage points for adults aged 18–64 years after mandate implementation, compared with growth rates during the 4 weeks preceding implementation of the mandate.
- *NOTE: Model did not control for other policies that might affect hospitalization growth rates.*

[31] Guy et al. (2021, MMWR)

- During March 1–December 31, 2020, state-issued mask mandates applied in 2,313 (73.6%) of the 3,142 U.S. counties. Mask mandates were associated with a 0.5 percentage point decrease ($p = 0.02$) in daily COVID-19 case growth rates 1–20 days after implementation and decreases of 1.1, 1.5, 1.7, and 1.8 percentage points 21–40, 41–60, 61–80, and 81–100 days, respectively, after implementation ($p<0.01$ for all). Mask mandates were associated with a 0.7 percentage point decrease ($p = 0.03$) in daily COVID-19 death growth rates 1–20 days after implementation and decreases of 1.0, 1.4, 1.6, and 1.9 percentage points 21–40, 41–60, 61–80, and 81–100 days, respectively, after implementation ($p<0.01$ for all).
- Reported numbers are from regression models, which controlled for county, time (day), COVID-19 tests per 100,000 persons, closure of restaurants for any on-premises dining, closure of bars for any on-premises dining, and the presence of gathering bans and stay-at-home orders, but did not control for other types of business closures, physical distancing recommendations, policies issued by localities.

[32]Volpp et al. (2021, MMWR)

- A comprehensive mitigation strategy that included compulsory pre-arrival isolation and screening, universal masking, upgraded air-handling equipment to improve ventilation, physical distancing of 6+ft, twice-weekly SARS-CoV-2 testing, technology-enhanced contact tracing and quarantine, and an enforced behavioral agreement was implemented in a US high school comprising of residential and commuter students.
- Over a 14-week period (Aug 20-Nov 27 2020), of 19 cases among faculty and staff members and 8 cases among students, 2 (7%; both students) were considered to represent on-campus transmission. There was a substantial increase in the number of weekly cases in the county during the same period.

[33]Shacham et al. (2020, medRxiv pre-print)

- Quasi-experimental longitudinal study conducted from June 12 to September 15, 2020 to assess the impact of new COVID-19 cases when a mask ordinance was implemented (M+) in 2 of a 5-county Midwestern US metropolitan region. Over the 15-week period, the average daily percent growth of reported COVID-19 cases across all five counties was 1.81% (±1.62%). The average daily percent growth in incident COVID-19 cases was similar between M+ and M- counties in the 3 weeks prior to implementation of mandatory mask policies (0.90% [±0.68] vs. 1.27% [±1.23%], respectively, p=0.269). Crude modeling with a difference-in-difference indicator showed that after 3 weeks of mask mandate implementation, M+ counties had a daily percent COVID-19 growth rate that was 1.32 times lower, or a 32% decrease. At 12 weeks post-mask policy implementation, the average daily COVID-19 case growth among M- was 2.42% (±1.92), and was significantly higher than the average daily COVID case growth among M+ counties (1.36% (±0.96%)) (p<0.001).

Australian evidence not included in the above

[Note: Constantino paper and Scott paper are both based on Melbourne's second outbreak (2020) but used different time points and analyses and the conclusions on strength of evidence for masks differs]

[12] Costantino & MacIntryre (21 April 2021; Frontiers in Public Health)

- Face masks were mandated in Victoria from 23 July 2020 onward, along with a 6-week stage three lockdown which commenced on 9 July 2020.
- A **mathematical modeling study** using an age structured deterministic model for Victoria, was simulated for 123 days between 1 June 2020 and 1 October 2020, incorporating lockdown, contact tracing, and case findings with and without mask use in varied scenarios.
- In the base case scenario, the authors tested medical masks. The effectiveness of wearing medical masks on disease transmission is estimated from a meta-analysis of mask use against beta coronaviruses which found that wearing a medical mask or high-quality cloth mask is 67% effective in the community setting. The authors conducted a sensitivity analyses on the proportion of people wearing masks (20–90%) and mask effectiveness in the range of 20–90% to allow for a range of choices from poor quality cloth face coverings to N95 respirators.
- No mask use, with a 6-week lockdown, results in 67,636 cases and 120 deaths by 1 October 2020 if no further lockdowns are used. If mask use at 70% uptake commences on 23 July 2020, this is reduced to 7,961 cases and 42 deaths.
- For good epidemic control, at least 40% of the population needs to wear good quality masks.
- With 70% of the population wearing masks, epidemic control is good with masks of effectiveness of 40% or greater.
- By fitting the model to observed cases and knowing the approximate uptake of masks at the time, **we estimated that masks were 11% effective against SARS-COV-2 in Victoria**, but that this still markedly reduced cases. The **estimated real-world effectiveness of masks in Victoria was low,** and **likely reflects a wide range of poor-quality masks being used**, including single-layered cloth face coverings of poor quality.

[11] Scott et al. (July 2021; PLoS ONE)

- Assessed the impact of mandatory mask use on the growth rate of COVID-19 cases during a resurgence in Melbourne from June 2020 onward. The study uses daily cases detected between 10th July and 10th August. Stage 3 restrictions for all of metropolitan Melbourne were introduced on July 8 at 11.59pm. The

announcement that mandatory masks would be introduced in public settings was made on July 20, coming into effect on July 22 at 11.59pm. Curfews and distance restrictions came into effect on August 2 and stage 4 restrictions came into effect on August 5 at 11.59pm.

- Used a **linear spline model** with one knot to compare two related linear segments of the growth/decay in the natural log of daily case numbers. **The hinge day was estimated as 8 days post-introduction of masks**, which was based on how long it took for stage 3 restrictions to impact case numbers, along with interval and testing times for detecting a case. The cut-off date (Aug 10) was based on 8 days post the introduction of the curfew, to avoid including the impact of the curfew on the analysis.
- Changes in mask-wearing behaviours was assessed using a digital archive of The Age newspaper images (n=44), as well as through an online survey (n=1700). The mandatory mask policy corresponded with a large increase in the proportion of Victorian residents wearing masks.
- Possible confounders accounted for in the analysis included: 1) daily cases from regional Victoria, 2) daily cases in health care workers, 3) daily COVID-19 tests, 4) the proportion of diagnosed cases assigned to a known cluster within 24 hours of testing, and 5) mobility indices for Melbourne residents.
- There were 11,714 cases reported in Melbourne between 10th July and 10th August inclusive, with daily cases increasing from 143 cases on 10th July 10 to a peak of 686 cases on 5th August, before declining to 310 cases on 10th August. Pre-mask, the growth in daily cases ($k = +0.042$, standard error [s.e.] = 0.007; $p<0.001$) was projected to equate to a doubling of cases every 16.5 days ((95% CI: 12 to 25 days). Post-mask, the decay in daily cases ($k = -0.023$, s.e. = 0.017; $p = 0.190$) was projected to equate to a halving of cases every 30 days (95% CI: doubling every 65 days to halving every 12 days). **The change in growth rates was statistically significant** $\Delta k = -0.065$, s.e. = 0.022; $p = 0.006$). Over a range of reported serial intervals for SARS-CoV-2 infection, these growth rates correspond to a 22–33% reduction in an effective reproduction ratio **before and after mandatory mask use**.
- Subtracting rural cases or cases in healthcare workers from the total cases made no significant difference to the calculated growth constants. Including daily tests and the mobility index as additional covariates in the multivariate linear regression made little difference to the estimated growth rates
- Potential limitations: **This took place in the context of existing stringent control measures and it is unclear what effect the masks would have had in the absence of these other measures.** Cannot determine whether it was masks themselves, or the masks serving as a reminder to engage in other behaviours (e.g. regular hand hygiene, physical distancing). Reductions in mobility and social interactions could have influenced the results. **The analysis could not take into account the transmission of COVID-19 in settings where mask use was not required, such as households or some workplaces.**

[13] Stuart et al. (March 2021; BMJ Open)

- Use an **agent-based model** to e**stimate the combination of testing, community-based contact tracing and mask usage** required to maintain epidemic control in a low-transmission, high-mobility setting.
- During the **prolonged period of low transmission that NSW experienced in the second half of 2020** prior to 15 December 2020, mobility remained high and transmission was controlled via NPIs. Masks were recommended by the government for the general public and made mandatory for staff in various businesses including supermarkets, but were not universally adopted.
- The model was fitted using NSW data from 1 March to 30 September 2020, and then various scenarios were tested for 3 months (1 Oct to 31 Dec). For each scenario, the probability of the epidemic exceeding certain thresholds is quantified, and then compared to the observed epidemic outcomes for that period.

Table 1 Overview of the scenarios analysed during 1 October to 31 December 2020	
Core scenarios	
4× combinations of symptomatic testing	50%, 65%, 80%–90% tested over the course of their symptoms
Asymptomatic testing of known contacts	Asymptomatic contact testing rate equal to symptomatic testing rate
5× combinations of contact tracing for community contacts	0%, 25%, 50%, 100% of contacts traced within 1 week (Poisson distribution with a mean of 1 day)
4× combinations of mask uptake	0%, 25%, 50%, 75%
Mask efficacy	30%
Sensitivity analyses	
Sensitivity to asymptomatic contact testing rate assumption	We run the same 80 (4×5×4) scenarios described above, but with the asymptomatic contact testing rate half of the symptomatic testing rate.
Sensitivity to the mask efficacy assumption	We run the same 80 (4×5×4) scenarios described above, but with individual mask efficacy assumed to be 15% or 45% instead of 30%.

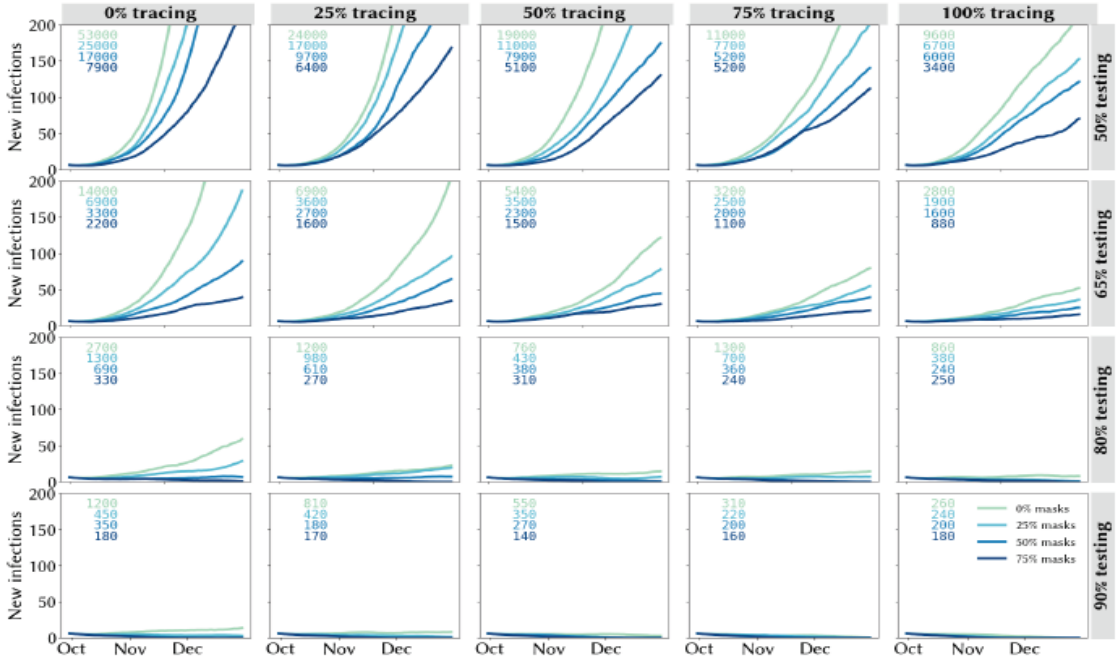

Figure 3 Trailing 14-day average of daily locally acquired infections under different assumptions about the testing rate (rows), proportion of community contacts that can be traced within 1 week (columns) and mask uptake (line colours). Projections represent the median of 100 simulations. Text boxes in each panel display the cumulative number of infections during 1 October to 31 December 2020.

- Key finding: the effectiveness of high levels of testing, along with at least some level of contact tracing, to maintain control. Holding masks and contact tracing constant, the number of infections would be 2-3 times higher if testing rate was 80% instead of 90%, 8-12 times higher if the testing rate was 65%, or 30-50 times higher if the testing rate was 50%.
- Key finding: the lower the testing rate, the greater the impact of masks and contact tracing. For example, masks strengthen the resilience of the epidemic outcome to decreases in contact tracing efficacy: without masks, a reduction in community contact tracing from 75% to 50% would lead to a

70% increase in total infections, whereas it would have no impact if 75% of the population were wearing masks.
    - Conclusions: "**We found that the relative impact of masks is greatest when testing and tracing rates are lower (and vice versa)**. With very high testing rates (90% of people with symptoms, plus 90% of people with a known history of contact with a confirmed case), we estimate that epidemic control would be possible even without widespread mask uptake, provided that fast and effective contact tracing is in place. However, under any scenario where testing rates are lower, we estimate that mask use can play an important role in reducing the potential for epidemic resurgence."
    - "In NSW, mask use was encouraged in particular settings since July 2020, but not mandated until January 2021; at the same time, there was a strong focus on contact tracing. The results from this work suggest that the **prioritisation of contact tracing may mitigate the relative importance of masks to some extent, but that this relies on continued high levels of community testing**."
    - Limitations: modelling is based on assumptions based on data available at the time, which is not always high quality, the scenarios do not include all possible parameters that might influence results, could not account for seeded cases that arose from international or interstate arrivals.

Other review studies

- [9]Chu et al. (2020, The Lancet):
    - Only 3 studies assessed mask use in non-health-care settings and these all referred to SARS.
- [10] Abboah-Offei et al. (2021; International Journal of Nursing Studies Advances)
    - Searched up to June 2020.
    - Nearly all studies are viruses other than COVID-19 and the review doesn't clearly separate out healthcare from community settings
- [5] Howard et al. (2021, Proceedings of the National Academy of Sciences).
    - Studies already summarised in other reviews
- [6] Li (2021; American Journal of Infection Control)
    - Studies already summarised in other reviews
- [7] Liang (2020; Travel Medicine and Infectious Diseases)
    - Studies already summarised in other reviews

Government briefings and reports

Australian Government – Infection Control Expert Group (ICEG).

The use of face masks and respirators in the context of COVID-19 (Updated March 2021).

- This guidance was developed by the Infection Control Expert Group (ICEG). It provides a summary of recent evidence around the use of face masks and respirators in the context of COVID-19.
- This advice is for **health and residential care workers** and **other occupational groups** who may have contact with suspected or **confirmed cases of COVID-19**, or **people in quarantine**.
- There have been recent reports of the emergence of more transmissible variants of SARSCoV-2. This increase in transmissibility may relate to:
    - higher viral load in people infected with one of these variants,
    - increased duration of infectiousness, or
    - increased propensity to bind to the ACE2 receptors on the cells of their susceptible contacts.
- ICEG have reviewed and updated this advice on the use of masks and respirators in the care of COVID-19 patients. **The updated advice reflects the increased level of uncertainty associated with emerging variants of concern (VOC)** and ensures those at risk of infection are properly protected.
- **The importance of different modes of transmission is still unknown. However, it is clear being close to an infected person carries the highest risk of infection.** A mask (surgical or cloth) can be used by a person with a respiratory viral infection, including COVID-19, with or without symptoms. A mask can protect

others by decreasing the spread of infected respiratory secretions. This is called **source control**. Please note, cloth masks are not suitable for use by health and residential care workers or quarantine workers.

- Health and care workers (and some other occupational groups) use masks and particulate filter respirators (PFR) with eye protection to provide respiratory protection. They use these when it is impractical or inappropriate to maintain physical distancing from a person with a respiratory infection, including COVID-19.
- Masks and respirators are easily contaminated during use when adjusted by hands or during doffing. This creates an infection risk and underpins the importance of education in their proper use. Masks and respirators must have a good comfortable fit. Always perform effective hand hygiene before applying a mask or respirator and after doffing.
- In occupational settings, controls higher in the hierarchy of controls than personal protective equipment (PPE) such as masks and respirators, are more effective in managing risk. Always use more effective control measures in conjunction, rather than sole reliance on PPE.
- A mask or respirator is not a substitute for other precautions which must be used to prevent spread of COVID-19: • seeking testing for COVID-19 if even mild respiratory symptoms develop or following close contact with someone with confirmed COVID-19, • staying at home when unwell, with even mild respiratory symptoms or while awaiting the result of a test for COVID-19. Especially if employed in a high-risk occupation such as health or aged care. • physical distancing (staying >1.5 m away from others), • good internal ventilation (including sufficient air exchanges and safe direction of flow), • hand hygiene (avoid touching possibly contaminated surfaces), and • cough etiquette/respiratory hygiene.
- **Community Mask Use**
    - In places with **little or no community transmission, wearing a mask is not essential and need not be mandated.** Some states and territories in Australia may recommend or require the use of masks in public places or where physical distancing is not feasible, e.g. in public transport. This will depend on local COVID-19 epidemiology and public health advice.
    - Some Australian states and territories also recommend or require the use of masks in indoor public places, in geographic areas with community transmission. This may include on public transport or at the shops.
    - Follow the jurisdictional guidance for your relevant state or territory.

US Centers for Disease Control and Prevention (CDC)

Scientific Brief: Community use of cloth masks to control the spread of SARS-CoV-2 (updated May 7, 2021)

NOTE: this is an update to the published paper by Brooks et al. (2021; JAMA), cited above.

- **CDC recommends community use of masks**, specifically non-valved multi-layer cloth masks, to prevent transmission of SARS-CoV-2. **Masks are primarily intended to reduce the emission of virus-laden droplets ("source control"),** which is especially relevant for asymptomatic or presymptomatic infected wearers who feel well and may be unaware of their infectiousness to others, and who are estimated to account for more than 50% of transmissions. **Masks also help reduce inhalation of these droplets by the wearer ("Filtration for wearer protection").** The community benefit of masking for SARS-CoV-2 control is due to the combination of these effects; individual prevention benefit increases with increasing numbers of people using masks consistently and correctly.
- Data regarding the "real-world" effectiveness of community masking are limited to observational and epidemiological studies. All of the papers cited have already been noted above.
- The report states that at least 10 studies have confirmed the benefit of universal masking in community level analyses, most of which were conducted in the US.
- The report states that research supports that mask wearing has no significant adverse health effects for wearers.
- The report concludes: Adopting universal masking policies can help avert future lockdowns, especially if combined with other non-pharmaceutical interventions such as social distancing, hand hygiene, and adequate ventilation.

World Health Organization.

Mask use in the context of COVID-19: Interim guidance (1 December 2020, *reviewed April 2021)*

- The World Health Organization (WHO) advises the use of masks as part of a comprehensive package of prevention and control measures to limit the spread of SARS-CoV-2, the virus that causes COVID-19. **A mask alone, even when it is used correctly, is insufficient to provide adequate protection or source control.** Other infection prevention and control (IPC) measures include hand hygiene, physical distancing of at least 1 metre, avoidance of touching one's face, respiratory etiquette, adequate ventilation in indoor settings, testing, contact tracing, quarantine and isolation. Together these measures are critical to prevent human-to-human transmission of SARS-CoV-2.
    - ***Mask use in community settings*:**
        - Decision makers should apply a risk-based approach when considering the use of masks for the general public.
        - In areas of known or suspected community or cluster SARS-CoV-2 transmission
            - WHO advises that the general public should wear a non-medical mask in indoor (e.g. shops, shared workplaces, schools - see Table 2 for details) or outdoor settings where physical distancing of at least 1 metre cannot be maintained.
            - If indoors, unless ventilation has been be assessed to be adequate, WHO advises that the general public should wear a non-medical mask, regardless of whether physical distancing of at least 1 metre can be maintained.
    - ***Mask use in children:***
        - Children aged up to five years should not wear masks for source control.
        - For children between six and 11 years of age, a risk-based approach should be applied to the decision to use a mask; factors to be considered in the risk-based approach include intensity of SARS-CoV-2 transmission, child's capacity to comply with the appropriate use of masks and availability of appropriate adult supervision, local social and cultural environment, and specific settings such as households with elderly relatives, or schools.
        - Mask use in children and adolescents 12 years or older should follow the same principles as for adults.
        - Special considerations are required for immunocompromised children or for paediatric patients with cystic fibrosis or certain other diseases (e.g., cancer), as well as for children of any age with developmental disorders, disabilities or other specific health conditions that might interfere with mask wearing.
    - ***Mask use during physical activity***
        - There are limited studies on the benefits and harms of wearing medical masks, respirators and non-medical masks while exercising.
        - WHO advises that people **should not wear masks during vigorous intensity physical activity** (143) because masks may reduce the ability to breathe comfortably. The most important preventive measure is to maintain physical distancing of at least 1 meter and ensure good ventilation when exercising.
- WHO acknowledges the **limited evidence of protective efficacy of mask wearing in community settings.**
- WHO acknowledges the need to **evaluate the impact** (positive, neutral or negative) of using masks in the general population (including behavioural and social sciences) **through good quality research.**

Table 2. Mask use in community settings depending on transmission scenario, setting, target population, purpose and type*

Transmission scenario	Situations/settings (where)	Target Population (who)	Purpose of mask use (why)	Mask type (which one)
Known or suspected community or cluster transmission of SARS-CoV-2	Indoor settings, where ventilation is known to be poor or cannot be assessed or the ventilation system is not properly maintained, regardless of whether physical distancing of at least 1 meter can be maintained	General population in public* settings such as shops, shared workplaces, schools, churches, restaurants, gyms, etc. or in enclosed settings such as public transportation. For households, in indoor settings, when there is a visitor who is not a member of the household	Potential benefit for source control	Fabric mask
	Indoor settings that have adequate [4] ventilation if physical distancing of at least 1 metre cannot be maintained			
	Outdoor settings where physical distancing cannot be maintained	General population in settings such as crowded open-air markets, lining up outside a building, during demonstrations, etc.		
	Settings where physical distancing cannot be maintained, and the individual is at increased risk of infection and/or negative outcomes	Individuals/people with higher risk of severe complications from COVID-19: • People aged ≥60 years • People with underlying comorbidities, such as cardiovascular disease or diabetes mellitus, chronic lung disease, cancer, cerebrovascular disease, immunosuppression, obesity, asthma	Protection	Medical mask
Known or suspected sporadic transmission, or no documented SARS-CoV-2 transmission	Risk-based approach	General population	Potential benefit for source control and/or protection	Depends on purpose (see details in the guidance content)
Any transmission scenario	Any setting in the community	Anyone suspected or confirmed of having COVID-19, regardless of whether they have symptoms or not, or anyone awaiting viral test results, when in the presence of others	Source control	Medical mask

**Public indoor setting includes any indoor setting outside of the household*

- In addition to the guidance listed in Table 2, the following points were made in regard to **risk assessment in areas with known or suspected sporadic transmission or no documented transmission.**
    - *Purpose of mask use.* Is the intention source control (preventing an infected person from transmitting the virus to others) or protection (preventing a healthy wearer from the infection)?
    - *Risk of exposure to SARS-CoV-2*. Based on the epidemiology and intensity of transmission in the population:
        - is there transmission and limited or no capacity to implement other containment measures such as contact tracing, ability to carry out testing and isolate and care for suspected and confirmed cases?

        - Is there risk to individuals working in close contact with the public (e.g., social workers, personal support workers, teachers, cashiers)?
        - Vulnerability of the mask wearer/population. Is the mask wearer at risk of severe complications from COVID-19? Medical masks should be used by older people (> 60 years old), immunocompromised patients and people with comorbidities, such as cardiovascular disease or diabetes mellitus, chronic lung disease, cancer and cerebrovascular disease (117).
        - Setting in which the population lives. Is there high population density (such as in refugee camps, camp-like settings, and among people living in cramped conditions) and settings where individuals are unable to keep a physical distance of at least 1 metre (for example, on public transportation)?
    - *Feasibility*. Are masks available at an affordable cost? Do people have access to clean water to wash fabric masks, and can the targeted population tolerate possible adverse effects of wearing a mask?
    - *Type of mask***.** Does the use of medical masks in the community divert this critical resource from the health workers and others who need them the most? In settings where medical masks are in short supply, stocks should be prioritized for health workers and at-risk individuals.
- WHO also describe potential benefits and harms
    - **Advantages** of mask use by healthy people in the general public include:
        - reduced spread of respiratory droplets containing infectious viral particles, including from infected persons before they develop symptoms (121);
        - reduced potential for stigmatization and greater of acceptance of mask wearing, whether to prevent infecting others or by people caring for COVID-19 patients in non-clinical settings (122);
        - making people feel they can play a role in contributing to stopping spread of the virus;
        - encouraging concurrent transmission prevention behaviours such as hand hygiene and not touching the eyes, nose and mouth (123-125);
        - preventing transmission of other respiratory illnesses like tuberculosis and influenza and reducing the burden of those diseases during the pandemic (126).
    - **Disadvantages** of mask use by healthy people in the general public include:
        - headache and/or breathing difficulties, depending on type of mask used (55);
        - development of facial skin lesions, irritant dermatitis or worsening acne, when used frequently for long hours (58, 59, 127);
        - difficulty with communicating clearly, especially for persons who are deaf or have poor hearing or use lip reading (128, 129);
        - discomfort (44, 55, 59)
        - a false sense of security leading to potentially lower adherence to other critical preventive measures such as physical distancing and hand hygiene (105);
        - poor compliance with mask wearing, in particular by young children (111, 130-132);
        - waste management issues; improper mask disposal leading to increased litter in public places and environmental hazards (133);
        - disadvantages for or difficulty wearing masks, especially for children, developmentally challenged persons, those with mental illness, 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 (55, 130).

European Centre for Disease Control and Prevention.

Using face masks in the community: first update - Effectiveness in reducing transmission of COVID-19 Technical Report (15 Feb 2021)

- Assessment of the evidence: The evidence regarding the effectiveness of medical face masks for the prevention of COVID-19 in the community is **compatible with a small to moderate protective effect**, but there are still **significant uncertainties about the size of this effect**. Evidence for the effectiveness of non-medical face masks, face shields/visors and respirators in the **community is scarce and of very low certainty**.
- Recommendations: Although the evidence for the use of medical face masks in the community to prevent COVID-19 is limited, face masks should be considered as a non-pharmaceutical intervention in combination with other measures as part of efforts to control the COVID-19 pandemic. Taking into account the available evidence, the transmission characteristics of SARS-CoV-2, the feasibility and potential harms associated with the use of various types of face masks, the following options are proposed:
    - **In areas with community transmission** of COVID-19, wearing a medical or non-medical face mask is recommended in **confined public spaces** and can be considered **in crowded outdoor settings**.
    - For **people vulnerable to severe COVID-19**, such as the elderly or those with underlying medical conditions, the use of medical face masks is recommended as a means of personal protection in the above-mentioned settings.
    - **In households**, the use of medical face masks is recommended for people with symptoms of COVID-19 or confirmed COVID-19 and for the people who share their household.
    - **Based on the assessment of the available scientific evidence, no recommendation can be made on the preferred use of medical or non-medical face masks in the community**.
    - When non-medical face masks are used, it is advisable that masks that comply with available guidelines for filtration efficacy and breathability are preferred.
- The use of face masks in the community should complement and not replace other preventive measures such as physical distancing, staying home when ill, teleworking if possible, respiratory etiquette, meticulous hand hygiene and avoiding touching the face, nose, eyes and mouth.
- The appropriate use of face masks and promoting compliance with their use when recommended as public health measures are key to the effectiveness of the measure and can be improved through education campaigns.
- Justification for the recommendations: Although there is only low to moderate certainty of evidence for a small to moderate effect of the use of medical face masks in the community for the prevention of COVID-19, the balance of results towards a protective effect across the wide variety of studies reviewed, the very low risk of serious adverse effects and **applying the precautionary principle** leads us to conclude that face masks should be considered an appropriate non-pharmaceutical intervention in combination with other measures in the effort to control the COVID-19 pandemic.
- Summary of risk assessment of included studies:

Table. **Certainty assessment and summary of findings from interventional and observational studies included in the systematic review (GRADE) [1]**

Certainty assessment								Summary of findings			
Number of studies	Design	Setting	Risk of bias	Indirectness	Inconsistency	Imprecision	Other considerations	Number of persons intervention/ no of cases (for observational studies)	Number of persons comparison / no of controls (for observational studies)	Effect estimate	Certainty
Question: Effectiveness of medical face masks for the prevention of COVID-19 in the community										Small Moderate	Moderate Low
One [2]	RCT, SARS-CoV-2	Community	Serious, intervention bias due to participants in intervention group not consistently wearing face masks	No	N/A	No	Low community transmission at the time of the study	3 030	2 994	OR: 0.82 (0.53-1.23) p 0.33	Moderate
One [3]	Case-control SARS-CoV-2	Community	Serious	No	N/A	No	No	211	839	OR: 0.16 (0.07-0.36) p < 0.001	Low
Four [4-7]	Cross-sectional SARS-CoV-2	Community	Very serious Two studies not providing adjusted estimates of the effect	Serious One study in US Navy ship, one study in school	No	No	No	174	1 082	One study with favourable non-statistically significant effect (OR 0.58) Three studies with very favourable statistically significant effect (OR 0.21-0.3)	Low
11 [8-18]	Ecological SARS-CoV-2	Community	Very serious	No	No. All studies except one (No 214) indicated effect of use of mask as the COVID-19 cases were reduced during the period of study.	No	No	Not possible to measure. Multiple countries and regions included	Not possible to measure. Multiple countries and regions included	Nine studies indicated reduction in the number of COVID-19 cases ranging from 6% to 82% or with p value ranging from p<0.000 to p<0.021 and one study showed a significant reduction in the number of deaths due to COVID-19 (p<0.001). One study did not find a significant decrease in the number of new daily COVID-19 cases in the month before vs. after introduction of mandatory use of face masks.	Very low

[Note, all published references cited above]

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Expert input: Prof Steve Wesselingh

Suggested citation: Miller C, Dono J, Wesselingh S. (2021) *Masks in Community Settings – COVID-19 Evidence Update.* SAHMRI. https://www.sahmri.org/covid19/

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