COVID-19 Rapid Briefing*

COVID-19 Update from SAHMRI

24 January 2022

Effectiveness of masks in reducing or preventing community transmission
Addendum to "Masks in Community Settings" (9 Aug 2021)

Key points from the updated evidence

- The evidence continues to suggest that masks can slow community transmission associated with indoor settings, although the size of the effect remains uncertain due to heterogeneity across studies.
    - A meta-analysis of 6 studies [1] assessing mask wearing and COVID-19 incidence reported a 53% reduction in incidence (Relative Risk=0.47, 95%CI 0.29-0.75) but the studies had significant heterogeneity and moderate to high risk of bias.
    - A modelling study [3] using observational data from Europe found that mask-wearing in most or all shared/public spaces reduced transmission by 12% [95% CI: 7–17%].
    - A cluster-randomised trial [4] of a community-level mask intervention in Bangladesh found that there was a relative reduction in symptomatic COVID-19 of 11.1% when **surgical masks** were used, although the impact of the intervention was concentrated among individuals aged over 50.
        - Cloth masks were not found to have an effect on reducing symptomatic COVID-19.
    - Two US studies [5,6] have examined the rate of exposure among close contacts depending on whether both parties were wearing masks at the time of exposure (based on self-report questionnaires).
        - One study [5] found that the secondary attack rate (SAR) was 25.6% (22.3-29.4) when both parties were unmasked, and 12.5% (9.6-16.3) when both parties were masked.
        - The other study [6] of university students found that unmasked exposure corresponded to a SAR of 32.4% compared to 7.7% for those who were masked.

From Previous review

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

- ***The evidence base is limited,*** *predominantly* ***confounded*** *and of* ***lower quality.***
- *1 Randomised Control Trial (**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***

*Rapid briefings are intended as a quick summary of the emerging literature, not a comprehensive synthesis of all available literature

EVIDENCE - reviews

- Talic [1] BMJ, published 18 Nov 2021
  - Systematic review and meta-analysis on the evidence on the effectiveness of public health measures in reducing the incidence of COVID-19, SARS-CoV-2 transmission and COVID-19 mortality. Note, search was completed on 7 June 2021.
  - 12 studies included in the review assessed personal protective measures, with 6 of these assessing mask wearing and COVID-19 incidence (See Figure below). Overall pooled analyses showed a 53% reduction in COVID-19 incidence (0.47, 0.29 to 0.75), with substantial heterogeneity and moderate to critical risk of bias across studies.
  - A meta-analysis could not be conducted on studies assessing mask wearing and transmission because of substantial differences in outcomes, but results indicate a reduction in transmission associated with mask wearing.
  - The authors also noted the following in the discussion: "Additional empirical evidence from a recent randomised controlled trial (originally published as a preprint) indicates that mask wearing achieved a 9.3% reduction in seroprevalence of symptomatic SARS-CoV-2 infection and an 11.9% reduction in the prevalence of covid-19- like symptoms [Abaluck – Cluster-Randomised trial in Bangladesh]. Another systematic review showed stronger effectiveness with the use of N95, or similar, respirators than disposable surgical masks, [Smith – Pre-COVID-19] and a study evaluating the protection offered by 18 different types of fabric masks found substantial heterogeneity in protection, with the most effective mask being multilayered and tight fitting.108 However, transmission of SARS-CoV-2 largely arises in hospital settings in which full personal protective measures are in place, which suggests that when viral load is at its highest, even the best performing face masks might not provide adequate protection.51 Additionally, most studies that assessed mask wearing were prone to important confounding bias, which might have altered the conclusions drawn from this review (ie, effect estimates might have been underestimated or overestimated or can be related to other measures that were in place at the time the studies were conducted). Thus, the extent of such limitations on the conclusions drawn remain unknown."

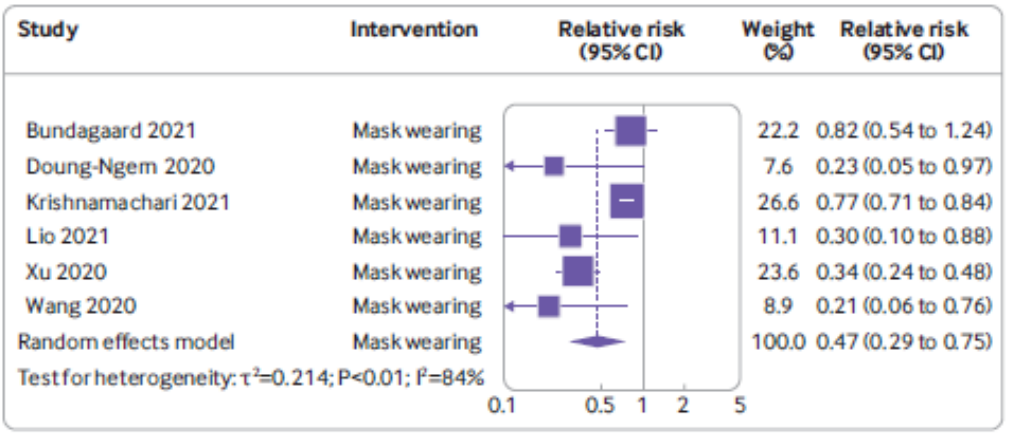

Fig 5 | Meta-analysis of evidence on association between mask wearing and incidence of covid-19 using unadjusted random effect model

Table 1 | Study characteristics and main results from studies that assessed individual personal protective and environmental measures

Reference, country	Study design	Public health measure	Sample size	Outcome measure	Study duration	Effect estimates: conclusions	Risk of bias
Doung-Ngern et al,[63] Thailand	Case-control	Handwashing	211 cases, 839 controls	Incidence	1-31 Mar 2020	Regular handwashing: adjusted odds ratio 0.34 (95% confidence interval 0.13 to 0.87): associated with lower risk of SARS-CoV-2*	Serious or critical
Llo et al,[36] China	Case-control	Handwashing	24 cases, 1113 controls	Incidence	17 Mar-15 Apr 2020	Adjusted odds ratio 0.30 (95% confidence interval 0.11 to 0.80): reduction in odds of becoming infectious*	Moderate
Xu et al,[60] China	Cross sectional comparative	Handwashing	n=8158	Incidence	22 Feb-5 Mar 2020	Relative risk 3.53 (95% confidence interval 1.53 to 8.15): significantly increased risk of infection with no handwashing*	Moderate
Bundgaard et al,[66] Denmark	Randomised controlled	Mask wearing	2392 cases, 2470 controls	Incidence	Apr and May 2020	Odds ratio 0.82 (95% confidence interval 0.54 to 1.23): 46% reduction to 23% increase in infection*	Moderate
Doung-Ngern et al,[63] Thailand	Case-control	Mask wearing	211 cases, 839 controls	Incidence	1-31 Mar 2020	Adjusted odds ratio 0.23 (95% confidence interval 0.09 to 1.60): associated with lower risk of SARS-CoV-2 infection*	Serious or critical
Llo et al,[36] China	Case-control	Mask wearing	24 cases, 1113 controls	Incidence	17 Mar-15 Apr 2020	Odds ratio 0.30 (95% confidence interval 0.10 to 0.86): 70% risk reduction*	Moderate
Xu et al,[60] China	Cross sectional comparative	Mask wearing	8158 people	Incidence	22 Feb-5 Mar 2020	Relative risk 12.38 (95% confidence interval 5.81 to 26.36): significantly increased risk of infection*	Moderate
Krishnamachari et al,[43] US	Natural experiment	Mask wearing	50 states	Incidence (cumulative rate)	Apr 2020	3-6 months, adjusted odds ratio 1.61 (95% confidence interval 1.23 to 2.10): >6 months, 2.16 (1.64 to 2.88): higher incidence rate with later mask mandate than with mask mandate in first month*	Serious or critical
Wang et al,[57] China	Retrospective cohort	Mask wearing	335 people	Incidence (assessed as attack rate†)	28 Feb-27 Mar 2020	Odds ratio 0.21 (95% confidence interval 0.06 to 0.79): 79% reduction in transmission of SARS-CoV-2*	Moderate
Cheng et al,[68] China	Longitudinal comparative	Mask wearing (South Korea *v* HKSAR)	961 cases (HKSAR), average control not available	Incidence	31 Dec 2019-8 Apr 2020	Incidence rate 49.6% (South Korea) *v* 11.8% (HKSAR) P <0.001: 37.8% less SARS-CoV-2 cases*	Moderate
Leffler et al,[49] US	Natural experiment	Mask wearing	200 countries	Mortality (per capita)	Jan-9 May 2020	No masks: mortality rate 61.9% (95% confidence interval 37.0% to 91.0%); masks: 16.2% (−14.4% to 57.4%): 45.7% fewer mortality*	Moderate
Lyu et al,[50] US	Natural experiment	Mask wearing	15 states	Case growth rate	31 Mar-22 May 2020	Mandatory mask wearing: case growth rate 2%: 2% decrease in daily covid-19 growth rate at ≥21 days (P<0.05)*	Moderate
Rader et al,[45] US	Cross sectional	Mask wearing	378 207 people	R0	3 Jun-27 Jul	Adjusted odds ratio 3.53 (95% confidence interval 2.03 to 6.43): 10% increase in self-reported mask wearing was associated with an increased odds of transmission control*	Moderate
Liu et al,[58] US	Natural experiment	Mask wearing	50 states	Rt	21 Jan-31 May 2020	Risk ratio 0.71 (95% confidence interval 0.58 to 0.75): 29% reduction in Rt*	Moderate
Wang et al,[57] China	Retrospective cohort	Chlorine or ethanol based disinfectant	335 people	Incidence (attack rate†)	28 Feb-27 Mar 2020	Odds ratio 0.23 (95% confidence interval 0.07 to 0.84): 77% reduction in transmission of SARS-CoV-2*	Moderate

HKSAR=Hong Kong Special Administrative Region of China; R0=reproductive number; Rt=time varying reproductive number.
*Interpretation of findings as reported in the original manuscript.
†Percentage of individuals who tested positive over a specified period.

- Ford [2] EClinical Medicine, Published 19 July 2021
  - Systematic review to summarise the study designs, outcomes, and key quality indicators of using ecological data to evaluate the association between mask wearing and COVID-19 outcomes. [search completed March 2021]
  - Twenty one articles were identified that analysed ecological data to assess the protective effect of policies mandating community mask wearing. All studies reported SARS-CoV-2 benefits in terms of reductions in either the incidence, hospitalisation, or mortality, or a combination of these outcomes. Few studies assessed compliance to mask wearing policies or controlled for the possible influence of other preventive measures such as hand hygiene and physical distancing, and information about compliance to these policies was lacking.
  - All studies reported a protective benefit in terms of either reduced incidence, mortality, hospitalization, or a combination of these outcomes.
  - However, few studies provided any information about where masks were worn and by whom, type of mask (medical or non-medical), rate of mask wearing and level of compliance, and studies were limited in their ability to control for other infection control measures and confounders.

EVIDENCE – studies published since the reviews were completed

- Sharma [3] Nature Communications, Published 5 Oct 2021
  - Estimated the effectiveness of 17 non-pharmaceutical interventions (NPIs) in Europe's second wave using modelling techniques on observational data.
  - Results for mask wearing: The introduction of policies that require mask-wearing in most or all shared/public spaces reduced transmission by 12% [95% CI: 7–17%].
- Abaluck [4] Science, Published 2 Dec 2021
  - Cluster-randomized trial to measure the effect of community-level mask distribution and promotion on symptomatic SARS-CoV-2 infections in rural Bangladesh from November 2020 to April 2021 (N = 600 villages, N = 342,183 adults).
  - Proper mask-wearing increased from 13.3% in the control group to 42.3% in the intervention arm (adjusted percentage point difference = 0.29 [0.26, 0.31]). The intervention reduced symptomatic seroprevalence (adjusted prevalence ratio = 0.91 [0.82, 1.00]), especially among adults 60+ years in villages where surgical masks were distributed (adjusted prevalence ratio = 0.65 [0.45, 0.85]).
  - Specifically, a roughly 9% decline in symptomatic seroprevalence in the treatment group {adjusted prevalence ratio (aPR) = 0.91 [0.82, 1.00]} for a 29 percentage point increase in mask wearing over 8 weeks.
  - Found clear evidence that surgical masks lead to a relative reduction in symptomatic seroprevalence of 11.1% (aPR = 0.89 [0.78,1.00]; control prevalence = 0.81%; treatment prevalence = 0.72%). Although the point estimates for cloth masks suggests that they reduce risk, the confidence limits include both an effect size similar to surgical masks and no effect at all. (aPR = 0.94 [0.78,1.10]; control: 0.67%; treatment: 0.61%).
  - Generally found that the impact of the intervention is concentrated among individuals over age 50. In villages randomized to receive surgical masks, the relative reduction in symptomatic seroprevalence was 11% overall, 23% among individuals aged 50-60, and 35% among those over 60 in preferred specifications.
  - Limitation: Because the study was powered to detect differences in symptomatic seroprevalence it could not distinguish whether masks work by making symptoms less severe (through a reduced viral load at transmission) or by reducing new infections.
- Riley [5] Emerging Infectious Diseases, Published Jan 2022
  - In September of 2020, the Iowa Department of Public Health released guidance stating that persons exposed to someone with coronavirus disease (COVID-19) need not quarantine if the case-patient and the contact wore face masks at the time of exposure.
  - Matched exposure information from COVID-19 case investigations with reported test results and calculated the secondary attack rates (SARs) after masked and unmasked exposures. Compared calculated SARs when both parties were wearing masks with SARs when >1 person was not wearing a mask at the time of exposure.
  - From October 23, 2020, through February 28, 2021, 969 nonhousehold contacts were identified who met inclusion criteria and for whom they were able to collect both exposure (mask usage) and outcome (test result) data. These 969 contacts were associated with 431 cases. The age range of contacts was 0‑90 years; median age was 18 years. Of the 966 contacts included in the analysis, 768 tested negative and 198 tested positive, resulting in an overall SAR of 20.5% (95% CI 18.1%‑23.2%).
  - Results: that proper mask use is very effective for reducing transmission of SARS-CoV-2, lowering the SAR among contacts by half. However, consistent with a more recent study (8), SARs for both groups were notably higher than originally anticipated.
  - Duration of exposure was a significant predictor of SARS-CoV-2 transmission.

Table 1. Mask effectiveness for preventing secondary cases of coronavirus disease, Johnson County, Iowa, USA

Mask use, case-patient/contact	Negative	Positive	Secondary attack rate (95% CI), %
Overall	768	198	20.5 (18.1– 23.2)
Total unmasked*	439	151	25.6 (22.3–29.4)
Unmasked/unmasked	364	131	26.4 (22.9– 30.7)
Unmasked/masked	36	4	10.0 (4.0– 25.3)
Masked/unmasked	39	16	29.1 (19.3–43.9)
Masked/masked	329	47	12.5 (9.6–16.3)
Unknown	69	23	25 (17.5–35.6)
School-age, 5–18 y			
Unmasked*	156	53	25.2 (20.1–32.0)
Masked/masked	191	26	12.0 (8.4–17.2)

*When ≥1 person was unmasked during exposure.

Table 2. Additional variables for study of mask effectiveness for preventing secondary cases of coronavirus disease, Johnson County, Iowa, USA

Variable	Negative	Positive	Secondary attack rate (95% CI), %
Case-patient			
Symptomatic	365	100	21.5 (18.1–25.6)
Not symptomatic	340	90	20.9 (17.4–25.2)
Exposure duration, h			
≥2	413	142	25.6 (22.2–29.5)
<2	193	30	13.5 (9.6–18.8)
Exposure setting			
Indoors	488	107	18 (15.1–21.3)
Outdoors	27	9	25 (14.2–44.0)
Direct exposure	9	5	35.7 (17.7–72.1)
Multiple settings	72	25	25.8 (18.4–36.1)

Table 3. Multiple logistic regression for study of mask effectiveness for preventing secondary cases of coronavirus disease, Johnson County, Iowa, USA

Parameter	Estimate	Odds ratio (95% CI)	p value
Intercept	−1.67	0.19 (0.11–0.32)	<0.001
Mask score	−0.36	0.70 (0.57–0.84)	<0.001
Exposure: indoors	−0.37	0.69 (0.48–1.01)	0.052
Case-patient symptomatic	0.25	1.28 (0.93–1.78)	0.131
Exposure >2 h	0.65	1.92 (1.35–2.76)	<0.001
Age, 0-y increase	0.13	1.13 (1.04–1.23)	0.003

- Unexpectedly, the SAR was lower for persons who were exposed indoors than those who were exposed outdoors, although this finding did not remain significant in the multivariable analysis. There was considerable residual variability in the regression model, indicating that although we can quantify elevated risk, the measured information is not sufficient to predict transmission events on an individual level.
- Other limitations were that data was self-reported, and many persons could not be contacted or declined to cooperate, and the exclusion of these people is likely to have influenced the results.

- Rebmann [6] MMWR, Published 10 Sep 2021
  - In January 2021, the St. Louis City Health Department allowed Saint Louis University (SLU) to implement a modified quarantine protocol that considered mask use when determining which close contacts required quarantine.
  - During January– May 2021, 265 students received a positive SARS-CoV-2 test result; these students named 378 close contacts. Among the 378 close contacts, 116 (30.7%) received a positive test result. Percentages of positive test result rates were substantially higher among contacts with any unmasked exposure (114 of 352; 32.4%) than among those who had masked exposure only (two of 26; 7.7%) (aOR = 5.4, 95% CI = 1.5–36.5; p = 0.008).
  - Any additional exposures were associated with a 40.0% increase in odds of a positive test result (aOR = 1.4; 95% CI = 1.2–1.6). These findings reinforce that universal masking and having fewer encounters in close contact with persons with COVID-19 prevents the spread of SARS-CoV-2 in a university setting.

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