



Non-pharmaceutical interventions to prevent transmission of COVID-19: A systematic review and meta-analysis

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Summary

Methods:

- The authors did a systematic review and meta-analysis to assess the effect of physical distancing, use of face masks and eye protection on person-to-person transmission of SARS-CoV-2, SARS-CoV and MERS-CoV in healthcare and non-healthcare settings.
- Search for studies with any design in any setting that included patients with WHO-defined confirmed or probable COVID-19, SARS or MERS and people in close contact with them reporting the effect of non-pharmaceutical interventions of interest in various online databases and clinical trial registries from the date of inception of the database to 26 March 2020 and in pre-print servers up to 3 May 2020 (Search was not limited by filters for language)
- Authors screened titles and abstracts, reviewed full texts and extracted data for study identifier, study design, setting, population characteristics, intervention and comparator characteristics and quantitative outcomes among others. Risk of bias was assessed by two authors and independently by prepiloted forms (Covidence; Veritas Health Innovation, Melbourne, VIC, Australia). Screening results were cross-checked using artificial intelligence (Evidence Prime, Hamilton, ON, Canada). Disagreements were resolved by consensus.
- Outcomes of interest were risk of transmission (i.e. WHO-defined confirmed or probable COVID-19, SARS, or MERS) to people in healthcare or non-healthcare settings by those infected; hospitalisation; intensive care unit admission; death; time to recovery; adverse effects of interventions; and contextual factors such as acceptability, feasibility, effect on equity, and resource considerations related to the interventions of interest.
- Meta-analysis of associations by pooling risk ratios (RRs) or adjusted odds ratios (aORs) depending on availability of these data from observational studies was done using DerSimonian and Laird random-effects models. Authors adjusted for variables including age, sex and severity of source case as these were not the same across studies.
- Newcastle-Ottawa scale was used to rate risk of bias for comparative non-randomised studies corresponding to every study's design (Cohort or case-control). Certainty of evidence was rated according to COCHRANE methods and the GRADE approach.
- Since the interventions varied across studies assessing physical distancing measures to prevent viral transmission (e.g. direct physical contact: 0, 1 or 2 m), effect of distance on size of associations was assessed by random-effects univariate meta-regressions.
- PRISMA and MOOSE guidelines were followed for reporting.

Results:

- Search identified 172 observational studies across 16 countries and 6 continents, with no randomised controlled trials and 44 relevant comparative studies in health-care and non-health-care settings (n=25 697 patients).
- **Transmission of viruses was lower with physical distancing of 1 m or more, compared with a distance of <1m** (n=10,736, pooled adjusted odds ratio [aOR] 0.18, 95% CI 0.09 to 0.38; risk difference [RD] -10.2%, 95% CI -11.5 to -7.5; moderate certainty); **protection was increased as distance was lengthened (change in relative risk [RR] 2.02 per m; $P_{\text{interaction}}=0.041$; moderate certainty).**
- **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 (aOR 0.04, 95% CI 0.004-0.30) compared with disposable surgical masks (0.33, 0.17-0.61) or similar** (eg, reusable 12-16-layer cotton masks; $P_{\text{interaction}}=0.090$; posterior probability >95%, low certainty).
- **Eye protection also was associated with less infection** (n=3713; aOR 0.22, 95% CI 0.12 to 0.39, RD -10.6%, 95% CI -12.5 to -7.7; low certainty).

Conclusion:

- Physical distancing of 1m has significant protective effect, and distances of 2 m could be more effective against viral transmission.
- Use of N95/surgical/12-16-layer cotton face masks reduces risk of infection in both healthcare and non-healthcare settings.
- Stronger association with protection is in the order of:
 - N95 or similar respirators > Surgical face masks and 12-16-layer cotton face mask
 - N95 or similar respirators and Surgical masks > Single-layer face masks
- For healthcare workers and administrators, N95 or similar respirators offer better protection from viral transmission than surgical masks.
- Eye protection is associated with lower risk of infection in the healthcare setting.
- For the general public in non-healthcare settings, physical distancing of more than 1 m or more is highly effective and use of disposable surgical masks or reusable 12-16-layer cotton face mask offers protection.

Appraisal

Strengths: Adherence to systematic review methods, including use of artificial intelligence supported dual screening of titles and abstracts, full text evaluation, assessment of risk of bias and no limitation on the inclusion of studies by language. Certainty of evidence was rated using the GRADE approach and sensitivity analyses were done using Bayesian meta-analyses to test the robustness of the study findings.

Limitations: All studies eligible to be included had a non-randomised design, not always fully adjusted for confounders and might suffer from recall and measurement bias. Most evidence was from studies on SARS and MERS and not from the current pandemic (6674 patients of COVID-19, out of 25,697).

Opinion

- This systematic review and meta-analysis provides the best available evidence on effectiveness of 3 important non-pharmaceutical interventions—(i) physical distancing, (ii) use of face masks and (iii) eye protection to prevent person-to-person transmission of SARS, MERS and COVID 19 in healthcare and non-healthcare settings.
- Although limited by non-randomised design of available studies, the findings reveal the extent of protection conferred by these non-pharmaceutical interventions against transmission of SARS-CoV, MERS-CoV and SARS-CoV-2.
- It provides quantitative estimates for models on physical distancing and generates an evidence base to validate the use of face masks in non-healthcare settings and, the use of N95 or similar respirators and eye protection in healthcare settings.
- The strength of associations between use of different types of masks (N-95, surgical masks, 12-16 layer cotton masks) and their protection against different viruses (SARS-CoV MERS, and SARS-CoV-2) should be treated with caution, due to contextual factors.

Appraisers

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