

Chu et al. Physical distancing, face masks, and eye protection to prevent person-to-person transmission of SARS-CoV-2 and COVID-19: a systematic review and meta-analysis

Short citation:

Chu et al. 2020. [https://doi.org/10.1016/S0140-6736\(20\)31142-9](https://doi.org/10.1016/S0140-6736(20)31142-9)

The systematic review by Chu et al is an important piece of work. It's a large and complex review that summarises data from studies of the impacts of physical distance, masks and eye/face protection on risk of transmission of COVID-19. Many of these topics are highly relevant to policies being enacted in countries that are reducing restrictions introduced at the height of their Covid-19 epidemics. The review relies on data from non-randomized studies conducted during the outbreaks of SARS, MERS and COVID-19.

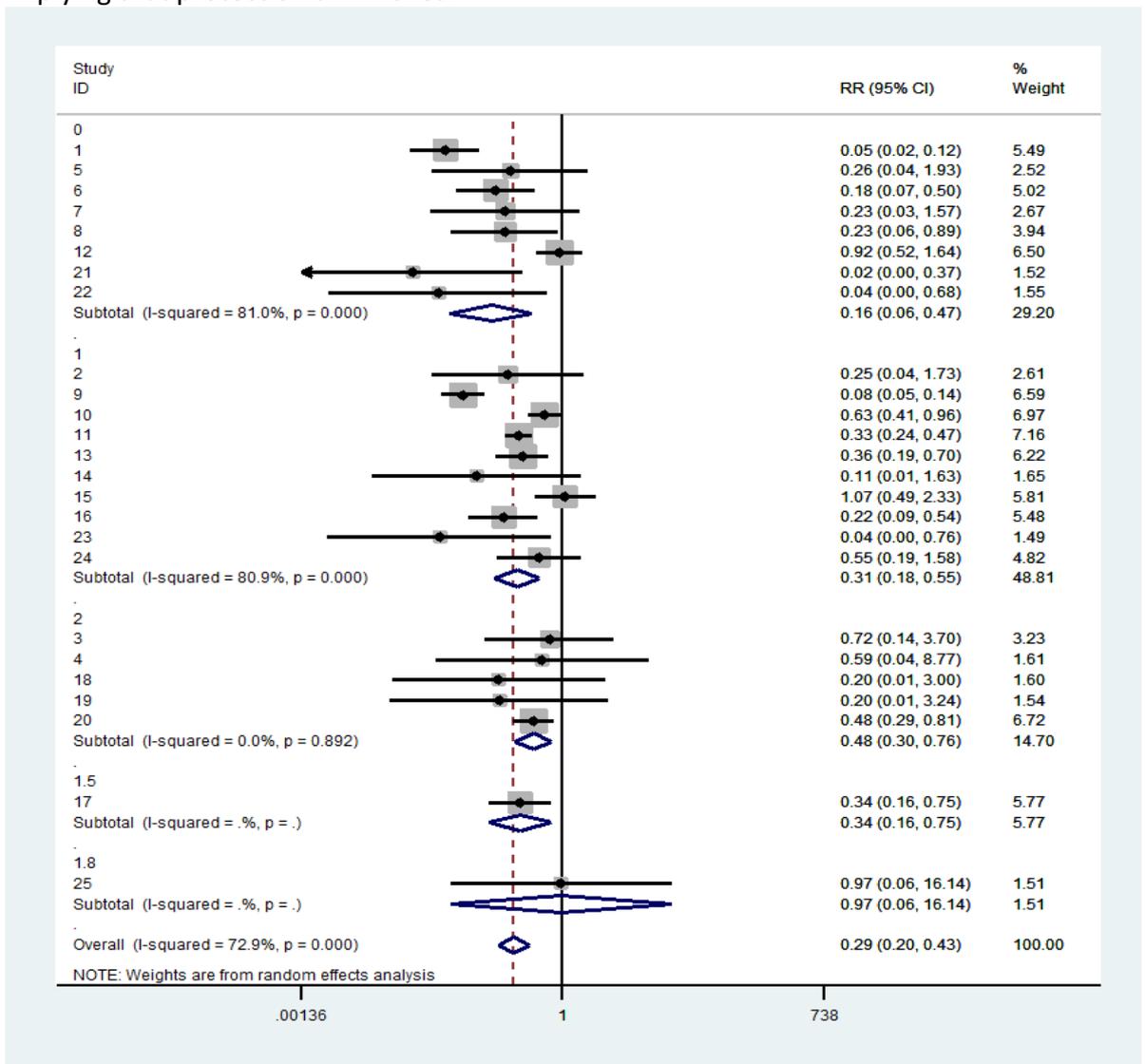
The authors did not include studies conducted during seasonal or pandemic influenza and confined their selection to coronavirus infections. The reviewers quote a study of influenza randomized prevention trials whose authors judged the data to be of low applicability to novel coronaviruses. However, there was no biological rationale provided for believing that mask protection from influenza did not apply to coronavirus and influenza viruses are similarly sized RNA viruses.

The principal aims of the review were to quantify the reduction in transmission of coronavirus by physical spacing, mask wearing and eye/face protection.

Our appraisal of this systematic review includes the following observations:

- 1) Overall a thorough search was conducted by the research team; however, we have two concerns with the search strategy used to identify viruses of interest. First, established subject headings for MERS and SARS have not been used. Second a search limitation was placed on the "betacoronavirus" search terms from November 2019 to March 2020. This may have missed some relevant MERS and SARS articles identified.
- 2) The review includes exclusively observational studies of intervention effects that included a comparator group. The authors found no randomized trials of coronavirus protection.
- 3) The authors relied on a dated and rather insensitive risk of bias instrument – The Newcastle Ottawa Scale. The investigators do not appear to have identified the principal sources of confounding and other biases (selection and measurement biases) ahead of the analyses and thus didn't determine the extent to which these were addressed and adjusted for in the component studies. The use of a more sophisticated instrument (e.g. ROBINS-I) would have enabled specification of critical bias domains that might constitute a threat to the validity of the component studies and enabled analyses that were confined to low Risk Of Bias studies.
- 4) There appears to have been a misclassification of some study designs. A sampling of 3 studies included in the analysis of benefits of mask wearing in non-healthcare settings showed that data had been extracted as if they were from cohort studies when they were analysed by the original authors as case control designs.
- 5) Estimating effect sizes was made (in the main) with raw data, which does not enable adjustment for confounding. The authors appear to have calculated relative risks, treating the exposed (e.g. face mask users) and non-exposed (e.g. non-users) as cohorts when in some cases (e.g. mask wearing in non-healthcare settings) the original authors have provided data in a case control format. Rates of outcome cannot be estimated from these data, only the odds of exposure in cases and non-cases. The relative risk estimations are not an accurate representation of the protection provided by masks in this setting. In addition, it was not possible to replicate analyses by Chu et al of the raw data in some cases.

- 6) The test for interaction between the effects of mask wearing in the healthcare setting was borderline significant, but this has been played down in the Discussion by Chu et al. We caution that this value is dependent on appropriate analyses of the raw data and we are concerned this hasn't been provided.
- 7) The analyses of the protection provided by distance appear contradictory and counter-intuitive. Figure 3 (A) appears to show relative risk decreases with increasing distance and consequently this analysis suggests protection decreases with increasing distance. However, the interpretation provided in the abstract is that "protection was increased when distance was lengthened". We checked this interpretation by extracting data from Figure 2 of the paper and conducting subgroup analysis (below) which showed a similar pattern: as distance increases, relative risks decrease implying that protection diminishes.



This is at odds with Figure 3(B) which clearly shows a diminishing absolute risk with increasing distance.

- 8) Although the authors have assessed some of their findings as 'low certainty' they come to quite strong conclusions about the benefits of distancing and masks in their Discussion section.

In conclusion this is a very ambitious review that relies heavily on the appraisal and interpretation of the observational studies that were the source of estimates of effect of interventions against COVID-19 infection. The review was a major undertaking involving an international team under time pressures in the middle of a pandemic. The principles laid out for the conduct and reporting of systematic reviews were followed and the literature search was of high quality.

Our main concerns relate to the methods used to assess risk of bias in the observational studies, the extraction of raw data without confounder adjustment and the possible assumption of cohort designs in some cases where case-control analyses were used by the original authors. This could lead to miscalculations and we were unable to reproduce calculations in the section of the results dealing with mask wearing outside healthcare settings. It is possible that re-analysis will continue to support the authors' conclusions about the benefits of preventive strategies, particularly in healthcare settings where the use of gloves, body shielding, masks and face/eye protection is in common use. However, the public are being asked to make major changes to the way they conduct their lives and must have faith in the science that underpins these requests.