Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

significance.[5] In June, 2020, WHO advised that governments encourage the public to wear masks under two conditions: when community transmission is apparent and when physical distancing is difficult, such as on public transport, in shops, or in other confined or crowded environments.[6] When community transmission is widespread, we agree with recommending face masks in hospitals, in assisted living communities, and where at-risk populations are cared for. Conversely, existing data do not support universal, often improper, face mask use in the general population as a protective measure against COVID-19. Nevertheless, universal face mask policy (ie, in any indoor environment) is still adopted in certain countries. Public health mandates must be based on unequivocal and strong evidence and metered on the current local epidemiological condition.

We declare no competing interests.

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Derek Chu and colleagues[1] examined whether physical distancing, face masks, and eye protection could prevent transmission of SARS-CoV-2. We are concerned that some of the data from the included preprints were out of date, affecting the results of the meta-analysis.

The systematic review included literature up to May 3, 2020. Seven articles, including four preprints, described the comparison of the risk of SARS-CoV-2 transmission between far and short physical distancing. Further physical distancing was associated with a lower risk of SARS-CoV-2 transmission (relative risk [RR] 0·15 compared with shorter physical distancing, 95% CI 0·03–0·73, I^2=59%; appendix).

We followed up on the status of the four preprints and found that one of them[2] was published online on May 1, 2020,[3] before the search cutoff date. The published version used a larger dataset (n=227 *vs* n=83 in the preprint), and the risk of SARS-CoV-2 transmission was almost equal between the physical distancing groups (RR 0·99 *vs* RR 0·55 in the preprint).

We updated the meta-analysis, replacing the results from the preprint by the corresponding published study.[3] The association between physical transmission and the risk of SARS-CoV-2 transmission became less evident (RR 0·16, 95% CI 0·02–1·06, I^2=70%; appendix).

Non-peer-reviewed preprints might be based on preliminary data that are later updated. We recommend that systematic reviews should check the latest situation of each included preprint, if necessary by contacting the authors, to ensure that the results are up to date.

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We read with great interest the results of the systematic review[1] on the effect of personal protective equipment (PPE) to prevent SARS-CoV-2 infection, predominantly based on evidence from other betacoronaviruses. As this work raised many more questions than it answered, and because its implications are far-reaching, we highlight several salient concerns.

To evaluate the association of mask use with viral infection, the Derek Chu and colleagues completed a meta-analysis of adjusted odds ratios (aORs). However, Seto and colleagues[2] reported only unadjusted ORs, whereas three other investigator groups adjusted for different sets of covariates.[3–5] Thus, the reported effect sizes are not comparable, and it might not be appropriate to combine them.[6] Furthermore, Seto and colleagues[2] reported results for

See **Online** for appendix

both N95 respirators and surgical masks, but it is unclear why Chu and colleagues only included the N95 respirator data and excluded the surgical mask data. Given that there were no severe acute respiratory syndrome (SARS) infections in the surgical mask group, exclusion of the group underestimates the benefit of surgical masks. Also, Alraddadi and colleagues' findings[4] were inappropriately included as in their comparison of N95 respirator versus no mask, 95% of the no-mask group were health-care workers (HCWs) who wore face masks more often than "not always".[4]

Our close evaluation also revealed two key instances of data duplication. First, a case-control study by Nishiura and colleagues of PPE use in a hospital in Vietnam.[7] A second report of the outbreak from the same hospital in the same month of the year was described by Nishiyama and colleagues[8] and included the same subjects as in the initial report by Nishiura and colleagues.[7] Only one of these studies should have been included. Second, a study by Liu and colleagues[9] is an English language duplicate of the earlier study by Ma and colleagues[3] as strictly stated by the authors.[9] Two questions arise: why did Chu and colleagues[1] include both studies of the same dataset as separate entities, and why does the subgroup analysis of N95 respirators only include data from Ma and colleagues, but the subgroup analysis of surgical masks only includes data from Liu and colleagues? Moreover, conducting an overall meta-analysis while there are repeated (ie, not independent) data is inappropriate—an alternative methodology, such as a network meta-analysis, would be preferred.

Beyond the issues with duplicated studies, might it even appropriate to combine data from health-care and non-health-care settings, for example, Lau and colleagues[10] and Wu and colleagues,[11] as the transmission dynamics are very different between the two settings? In addition, in the study by Lau and colleagues, the only reported analyses on mask use were for hospital visitors by household members of infected patients; in these analyses, any hospital visit was associated with a higher odds of infection, with a trend towards higher odds if neither patient nor visitor wore a mask.[11] It was therefore surprising that an aOR of 0·32 associated with this study was reported in figure 5 of the Article.[1]

Having done an unsystematic manual search of references of the included studies and a rapid literature search, we identified two additional studies that could have been eligible for inclusion in the systematic review: one by Pei and colleagues[12] and one by Loeb and colleagues.[13] Both studies included the risk of SARS acquisition associated with the use of surgical masks without apparent duplication of data with others.

We respectfully disagree with the authors of the linked Comment, who called for a review of all guidelines that recommend a medical mask for HCWs caring for COVID-19 patients.[14] This recommendation was based on a seriously flawed analysis of low-certainty evidence that should be interpreted with extreme caution, and we believe the conclusion should be contrary: there is currently no evidence that N95 respirators are more effective than surgical masks for HCW protection.

Finally, the major limitation, acknowledged by the authors, was comparing apples (in this case, SARS-CoV-2) and oranges (other betacoronaviruses). Indeed, both their clinical courses and transmission settings (community *vs* health-care settings) were very different. The protection of HCWs from the nosocomial acquisition of respiratory viruses is critical. However, as we are making important decisions regarding PPE, it is even more critical that we include the appropriate studies, avoid data duplication, and synthesise the data appropriately.

We declare no competing interests.

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The systematic review and meta-analysis by Derek Chu and colleagues[1] has several problems. First, the investigators combine data on SARS-CoV-2, SARS-CoV, and MERS-CoV. The characteristics of the diseases caused by these viruses are different.[2,3] The basic reproduction number of MERS-CoV is close to 1,[2] mild illness was infrequent for SARS-CoV,[3] and relevant pre-symptomatic, paucisymptomatic, or asymptomatic transmission occurs commonly only with SARS-CoV-2,[3,4] which will affect performance of control measures. Therefore, findings of the meta-regression on physical distancing shown in figure 3 of the Article[1] and the meta-analysis of mask use shown in figure 4 of the Article[1] cannot be interpreted.

Second, even if combining data from different diseases were valid, the assumed linear association between distance and the log risk ratio of disease in the meta-regression of physical distancing appears inappropriate: visual inspection of figure 3A in the Article suggests that the relationship is non-linear. Modelled absolute risk estimates of figure 3B are therefore problematic.

Third, only three studies on SARS-CoV-2 contributed to the meta-analysis of masks versus respirators. As detailed in the appendix (pp 1–2), one study was erroneously included, another was incorrectly extracted. When doing a random-effects meta-analysis of the two eligible studies on SARS-CoV-2 using corrected data, we found a pooled unadjusted risk ratio of SARS-CoV-2 infection comparing masks versus respirators with control of 0·22 (95% CI 0·01–8·96; appendix). The third study[5] was appropriately included, but crude and adjusted risk ratios for SARS-CoV-2 infection comparing masks versus respirators with control shown in figure 5 of the Article[1] are confounded because mask use was fully correlated with intensive hand hygiene (appendix).

In view of the observed errors, we did an audit of a random sample of 14 studies included in the analysis. For ten out of 14 studies, we found errors (appendix pp 3–20).

We declare no competing interests.

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Authors' reply

We appreciate the comments we received on our urgent evidence synthesis addressing use of masks, eye protection, and distancing early on in the COVID-19 pandemic.[1] Although we appreciate Willem Lijfering's concerns, he appears to have misunderstood the intent of our analysis to be a comparison of rates between countries, which would be an ecological analysis. As clearly reflected in our stated objective and eligibility criteria, we included only comparative studies and focused on relative effects for all intervention effects. Furthermore, we do not claim that our study has no bias but describe how we minimised bias in our evidence synthesis, assessed the risk of bias in included studies, did sensitivity analyses to test the robustness of our findings, and rated the certainty in the effects based on a structured approach to assessing the evidence. Indeed, we generally rated the certainty as low and adopted a conservative approach by not rating up the certainty of evidence for large effects found for face masks and eye protection. We also reflected our low certainty ratings by using terms such as might and probably in our interpretation of the findings.

We were cautious to not compare apples with oranges, as Didier Pittet and colleagues appear to suggest, and that is why we included betacoronaviruses rather than all respiratory viruses. We made that decision a priori and at a time when little direct evidence was available (March, 2020) to inform public health decision making. We acknowledged this indirectness in our review.

Luca Scorrano and colleagues suggest that we recommended universal face mask use. We intentionally made no recommendations and described in the Article and elsewhere that baseline risk is critical in any decision making about mask use and that many factors (particularly the baseline risk of infection) would have to be considered before making recommendations. It is not the role of a systematic review to make practice recommendations.[2] What we did recommend was that robust randomised trials be undertaken "to better inform the evidence for these interventions". We further agree that it is challenging to evaluate the independent effect of eye protection. That is the reason why we attempted to identify studies that correctly adjusted for the use of other personal protective equipment.


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