COVID-19 Evidence is lacking for 2 meter distancing

cebm.net/covid-19/covid-19-evidence-is-lacking-for-2-meter-distancing/

June 19, 2020

Carl Heneghan Tom Jefferson.

In a transmission review for which our group is extracting data, we included some studies also included in the review recently published in The Lancet:

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. Lancet. 2020 Jun 1:S0140-6736(20)31142-9.

In assessing the distance measures reported in Figure 2 of this review we analysed the SARs and COVID-19 studies and found we could not replicate the results reported in the review for 13 out of the 15 papers.

We reported some of these issues in the Telegraph. T*here is no scientific evidence to support the disastrous two-metre rule. Poor quality research is being used to justify a policy with enormous consequences for us all* (Access here)

Expression of our concerns

We emailed the authors and The Lancet editors on the 15th June the following table. We independently checked the data and found multiple inaccuracies in the data extraction for the Lancet review and a number of the data points that are implausible. When assumptions have been used we found we could not replicate any of them. Our main concerns set out below are with the extraction and use of precise distance estimates.

Our concerns are detailed below with author responses, which are also detailed here.

Heinzerling 2020 reports a relative risk but one of the arms has zero events. There are no methods for a continuity correction for dealing with zero cells. Exposure risk of HCW was defined on the basis of CDC criteria, distance is not cited.

The following line: "Reported direct skin-to-skin contact with index patient" in which body contact is 0/3 (0) vs 8/34 (24) (COVID + vs -) is not used in the analysis and contradicts the previous line in the table. The low number of cases limits the ability to detect statistically significant differences in exposures and did not allow for multivariable analyses to adjust for potential confounding.

Transmission of COVID-19 to health care personnel during exposures to a hospitalized patient: Solano County, California, February 2020 https://www.cdc.gov/mmwr/volumes/69/wr/mm6915e5.htm?s_cid=mm6915e5_w

Liu 2020: we could not find a distance measure reported in the paper but a distance of 1m is referred to in the meta-analysis

Analysis of the spatio-temporal characteristics and transmission path of COVID-19 cluster cases in Zhuhai DOI:10.13284/j.cnki.rddl.003228

Cheng 2020: we could not find the 1m distance measure reported in the paper referred to in the meta-analysis. (which is an estimated value) For health care settings, close contact was defined by contacting an index case within two meters without appropriate PPE". There is no comparator (i.e. non-close contacts) – See Table 3. "Distancing" appears three times at pages 2,3, and 8. The aim of the study is reported as "Using the contact tracing data in Taiwan, we aimed to delineate the transmission dynamics of COVID-19, evaluate the infection risk at different exposure windows, and estimate the infectious period"

The numbers extracted actually relate to infections in a household (which the review authors class as less than one meter) as opposed to family (which the review authors class as more than one meter) contacts. The review ignores the hospital contacts which is the only group where distance was described. We could not verify the 1 measure in the footer of Fig 2.

High transmissibility of COVID-19 near symptom onset DOI: 10.1101/2020.03.18.20034561

Burke 2020: we could not find a distance of 1m reported in the paper but a distance is referred to in the meta-analysis

Enhanced contact investigations for nine early travel-related cases of SARS-CoV-2 in the United States DOI: 10.1101/2020.04.27.20081901

Rea 2007: in the paper, there were no test positive cases only probable and suspected cases – this paper should be excluded as there were no positive cases of SARs data. The study reports the level of contact (by distance) and setting definition for SARS 1. However, when you get to the text below Table 3 on attack rates the text says "A total of 61 persons became probable and eight became suspect cases as a result of the 8662 community exposures, yielding a crude attack rate (probable cases) of 0·70% (95% CI 0·54−0·90%)". Abstract "In total, 8662 community-acquired exposures resulted in 61 probable cases;....."

Duration and distance of exposure are important predictors of transmission among community contacts of Ontario SARS cases Epidemiol Infect, 135 (2007), pp. 914-921 https://pubmed.ncbi.nlm.nih.gov/17217552/

Chen 2009: we could not find a distance measure reported in the paper but a distance of 1m is referred to in the meta-analysis.

Searching under "distancing", "proximity" and "metres" failed to identify hits. Ditto with visual inspection of Tables. Abstract Results report: "After adjusting for age, gender, marital status, educational level, professional title, and the department in which an

individual worked, the results of multivariate logistic regression analysis indicated that incidence of SARS among HCWs was significantly and positively associated with: performing tracheal intubations for SARS patients, methods used for air ventilation in wards, avoiding face-to-face interaction with SARS patients, the number of pairs of gloves worn by HCWs, and caring for serious SARS cases". we are unable to identify any proximity measurement.

Which preventive measures might protect health care workers from SARS? BMC Public Health, 9 (2009), p. 81 https://link.springer.com/article/10.1186/1471-2458-9-81

Lau 2004: The lancet review data do not tally with the paper's data. There are reported as Never 22.5% (24) of 107 cases vs 48.4 % (988) of 2041 controls, which gives a total of 2,148. But the review meta-analysis gives a different total – 2089

The following risk factors were significantly associated with SARS (matched multivariate analysis OR with 95% CIs):

- Visit to mainland China 1.95 (1.11 to 3.42)
- Visited Prince of Wales Hospital 7.07 (1.62 to 30.75)
- Visited other hospitals 3.70 (2.54 to 5.39)
- Visited Amoy Gardens 7.63 (3.77 to 15.43)

The following activities/interventions had a significant protective function:

- Thorough disinfection of living quarters 0.41 (0.29 to 0.58)
- Wore a mask in public places frequently 0.36 (0.25 to 0.52)
- Washed hands 11 or more times a day 0.58 (0.38 to 0.87)

The paper is included in Jefferson et al. Physical Interventions to Interrupt or Reduce the Spread of Respiratory Viruses. Cochrane review

Probable secondary infections in households of SARS patients in Hong Kong Emerg Infect Dis, 10 (2004), pp. 235-243 https://pubmed.ncbi.nlm.nih.gov/15030689/

Pei 2006: The Lancet Review used the incorrect data: 'avoiding face to face contact with patients' in the meta-analysis, and not 'the keeping a certain distance > 1 metre' which is reported in the table – the two items are combined in the text (item 5) but in the table they are presented as separate data. Authors have taken control numbers from the wrong line in Table 2 "keeping a certain distance" should be 29 cases vs 109 controls and in the forest plot of the Lancet publication, it says 8/61 vs 139/382.

Pei 2006 is an example of why analysing unadjusted factors is unsound methodology: there were 22 factors (19 protective factors and 3 risk factors), among the total 56 factors that were associated with SARS infection in the study. In the paper 22 independent factors were re-analysed to see which remained protective : double exposure suits, education, gloves, hands sterilized by iodine, room air ventilation remained significant. Distance is dependent on other factors and therefore requires adjustment in any analysis for it to be a valid approach.

Investigation of the influencing factors on severe acute respiratory syndrome among health care workers Beijing Da Xue Xue Bao Yi Xue Ban, 38 (2006), pp. 271-275 https://pubmed.ncbi.nlm.nih.gov/16778970/

Wong 2004: In bed nos. 10 and 12 (adjacent to index patient) 3/3 were exposed (deemed to be < 1m). The data from Bed nos. 9, 9x, and 13–16x (beds in the same cubicle except bed nos. 10–12) 4/8 exposed (deemed to be >1m in the review) and other beds in the ward (not in the cubicle 0/8 exposed.

The total gives 4/16 exposed for > 1 m. But the review reports 0/4 as it fails to use the 4/8 exposed data. This is incorrect as they should be included in the further distance group for 1m. The 4/8 are instead included in the 2 metre plot in the shorter distance arm. For 2m, the shorter distance should be 7/11 exposed vs. 0/8 exposed longer distance. The data are therefore inaccurate

This study is used to provide evidence of exposure less than 1 metre and again for less than 2 metres. Two meters is never discussed as a distance so appears to have been inferred. The one meter examined patients whose bed was within one meter of the index patient. This is not the same as being within one meter of the index patient. All infected students were within close proximity of the index patient for 40 minutes whilst he was being examined. As the actual distance from the index patient cannot be determined then this should not be included. Cluster of SARS among medical students exposed to single patient,

Hong Kong. Emerg Infect Dis, 10 (2004), pp. 269-276

Teleman 2004: data in the Forest plot is correct. Teleman is included in A122. Our summary assessment was as follows: Risk of bias: low Notes: The authors conclude that 3 factors were associated with significant risks or protection:

- Wearing N95 respirator OR 0.1 (95% CI 0.02 to 0.86)
- Contact with respiratory secretions OR 21.8 (95% CI 1.7 to 274.8)
- Handwashing after each patient OR 0.07 (95% CI 0.008 to 0.66)

A well-reported study let down by the failure to indicate whether the assessment of risk factors had been carried out blindly to cases or control status.

Factors associated with transmission of severe acute respiratory syndrome among health-care workers in Singapore Epidemiol Infect, 132 (2004), pp. 797-803

Reynolds 2006: data is correct

Factors associated with nosocomial SARS-CoV transmission among healthcare workers in Hanoi, Vietnam, 2003 BMC Public Health, 6 (2006), p. 20

Olsen 2003: it is not clear where the data comes from. On flight 1 there were no cases detected (the numbers sitting near to the one index case can be based on the aircraft design); Flight 2: the 22 patients with SARS. 8 of the 23 passengers who were seated in

the same row as the patient or in the three rows in front of him, as compared with 10 of the 88 passengers who were seated elsewhere. Flight 3 of the 166 persons interviewed (67 percent), one reported fever and respiratory symptoms but never had a chest radiograph obtained and was not reported as having a probable case of SARS. None match the data for 139 subjects given in the meta-analysis.

There is also no distance given apart from the discussion which details the distance covered by three economy-class rows on a Boeing 737-300 is 2.3 m (90 in.), not 1.5m as reported in the review. Also, It is unsound methodology to combine the aeroplane result with health care settings and home settings given the vast difference in the settings. These results should be removed from the meta-analysis.

Transmission of the severe acute respiratory syndrome on aircraft N Engl J Med, 349 (2003), pp. 2416-2422

Loeb 2004: we could not find a distance measure reported in the paper but a distance of 2m is referred to in the meta-analysis. The analysis was limited to the 32 nurses who entered a SARS patient's room at least once. The 11 who did not enter the room were excluded yet these are seemingly reported in the meta-analysis as events further (0/11). The study only includes '43 nurses who worked in two Toronto critical care units with SARS patients' yet the denominator in the meta-analysis adds up to 51 – how is this possible -? There is no distance measure in the paper as all 32 nurses entered the room in the analysis; this is a non- comparative study and should be excluded.

SARS among critical care nurses, Toronto. Emerg Infect Dis, 10 (2004), pp. 251-255.

Yu 2005: reports no distance measure. The meta-analysis has estimated a measure but this is not compatible with the layout of the ward presented in Figure 1 of the original paper. The adjacent beds and possibly the direct opposite beds could be < 2 m (n=3) and the other beds (n =6) are clearly greater than 2 m. Yet all these are considered within 2m. The estimated distance is therefore invalid.

Temporal-spatial analysis of severe acute respiratory syndrome among hospital inpatients Clin Infect Dis, 40 (2005), pp. 1237-1243

Peck 2004: reports no events however the meta-analysis includes 41 people. It not clear where this number comes from as the study identified 102 (table 3) or 110 (cited in the abstract) healthcare workers with exposure within droplet range (i.e., 3 feet) to SARS-CoV–positive patients. The events further column in the meta-analysis should be 0/108 not 0/38. Just to reiterate the point, 40 had direct contact with the index case without gloves (table 3)

Lack of SARS transmission and U.S. SARS case-patient Emerg Infect Dis, 10 (2004), pp. 217-224.

On the 16th June, we received an email reply from the corresponding author (our response are appended at the end of the table)

Dear Carl and Tom,

Thank you for your email. We have done our best in responding to your queries quickly.

Attached please find this relatively quick response. We have had multiple rounds of peer review both as part of journal submission and with colleagues from WHO and several of these issues were raised. We do not agree that there are grave errors. Furthermore, we think there may be some errors or unclear statements in your comments to us that you might want to check – we explain this in the attached.

As previously, we agree that there is lots of issues with these observational studies but we highlighted these concerns or potential biases and were careful in our interpretation of them. We also believe there is alternative ways of interpreting the studies and will check again for potential errors in data abstraction based on what you said. We would report these errors but we believe none of these would alter the results meaningfully. For now, we have provided a detailed response in the attached

Detailed response: (our responses are numbers in the text)

Heinzerling 2020: We don't understand this comment "Why are there no methods for continuity correction?" There are many ways to do continuity correction and we utilized a conservative one of 0.5 as the number of events which is the default in STATA. We used 0/4 versus 3/33 as the study reports "came within 6 ft". With different continuity corrections the results do not differ meaningfully[1] .

What does the comment "The low number …" mean?

Our goal was not to detect statistically significant differences among individual studies. Of course, we agree, as in previous correspondence on a different topic that used observational studies, that there are limitations and we described these limitations in the Lancet review on numerous occasions. We see nothing wrong with how we used this study for the distancing analysis [2] . This study was not included in the adjusted analysis.

Liu 2020: This reference should be: (both Liu Z 2020 and translated from Chinese). It should be: Investigation of a COVID⁻19 case with unknown cause and its close contacts. JOURNAL OF SHANDONG UNIVERSITY(HEALTH SCIENCES) . Vol 58. No 4. Apr 2020. DOI:10.6040/j.issn.1671⁻7554.2020⁻396

Our translation of this study reports on an index case being in close contact with 3 family members who lived with the index patient, of which 2 became infected. In contrast, 17 other potential exposures were not infected. China CDC defines these exposures as >1m or <1m [3] . This study was not included in the adjusted analysis.

Cheng 2020: The challenge is that the full text of each study needs to be reviewed very carefully because simply using the "Find" function can miss such details.

As stated above, in collaboration with our Chinese colleagues we used the description of the China CDC which defines different exposures according to different cutoffs such that household and family exposure mean closer vs further away. Though the healthcare exposures were stated, the report did not provide extractable information on how many were closer than two metres versus further than two metres[4] . Either way, this study was not included in the adjusted analysisA[5] .

Burke 2020: clearly reports distance in their tables (eg. Table 4) and text. In their text they also state that the two infected had direct contact with the index patients; both infected were spouses of the index patients. We are not clear what Heneghan and Jefferson are referring to because nowhere do we report that Burke 2020 used a distance of 1m[6] . This study was not included in the adjusted analysis.

Rea 2007: We stated in the methods we included probable and confirmed cases, and that this study had 61 probable cases which they did adjusted analyses on. Probable cases were verified by Health Canada and were in line with WHO definitions, including the use of laboratory assays and/or chest x-ray [7] .

Table 4 clearly lists the adjusted analysis for the relation of distance to infection. So we are not clear on exactly what the issue is here [8]. As noted in the article, the value was estimated as face to face being about 1 m, with the Pei study reporting similarly [9] .This study was not included in the adjusted analysis.

Lau 2004: We extracted data differently from what is suggested here. We used the comparison never vs (seldom, occasional or frequently) from the text as the data, accounting for footnote explaining missing data, and proportions reported in table 1 [10] .

We do not understand the concern although the article itself had an inconsistency in its reporting and we used the data from the table. We do not think there is an error here. Also provided an adjusted estimate that we utilized.

Pei 2006: It is true that there is a difference between the text and table of the original reported study by Pei. We do not think this is an error but open to interpretation. We used a different exposure measure "avoiding face to face contact with patients". We do not consider this an error.We believe using the other exposure measure would lead to similar results (we can do a sensitivity analysis to our meta-analysis if desired). The text of this article suggests avoid face to face and keeping a certain distance both equate to >1m (not the clearest description). For the study itself either value as 1m yields very similar results:"Face to face" RR = 0.36 [0.19, 0.70 [11]]

"keeping a certain distance" RR = 0.57 [0.40, 0.81] The pooled estimate but it is very very, very unlikely to change in any meaningful way if we used this alternative way of interpreting the data. Again, we provided the undadjusted data and analysis as a way to check if adjusted and unadjusted analysis differ. As to the comment "Pei 2006 is an example of why analysing unadjusted factors is unsound methodology". We did not focus on these results and do not disagree. We provided this data for completeness.

The abstract, SoF, other presentations focus on the adjusted estimates. We highlight the limitations. This is not an error but a different interpretation. This study was not included in the adjusted analysis.

Wong 2004: We do not think this is inaccurate.

We split the common comparator into two groups which is an established approach[12] . We inferred the two meter distance from the data as described in the first paragraph. There appears to be a clear difference in distance based on what is provided. An alternative interpretation is to use 4/16 versus 3/3 and not separate the two exposures. We do not think this represents an error but may be open to interpretation. This study is not included in the adjusted analysis.

Telemen 2004: We do not understand this comment fully and do not believe there is an error. This study is included in the adjusted analysis[13] .

Reynolds 2003: Fine.

Olsen 2003: We used the 2 row rule per WHO-guidance for risk of infection on flights (1.53 meters in this case as 3 rows are 2.3 m, then 2 rows are 1.53 m) as described in the text of the original report about this and diagram in the article to extract data and that provided the estimates and numbers [14]. No error. This study is not included in adjusted analysis.

Loeb 2004: As reported (in the table of our manuscript) this was inferred from the data based on "entered" the patient room.

We utilized the data including the 0 out of 11 nurses who did not enter the room. The authors excluded them from their analysis but they were still reported on. We probably made an error in assuming the total number of nurses as 40 in the exposed group [15] . The results do not change either by using the different effect estimate: 8/40 RR = 0.20 (0.01-3.24); 8/32 RR = 0.16 (0.01-2.59) or excluding this study. This study was not included in the adjusted analysis.

Yu 2005: We do not agree, as Heneghan and Jefferson may not realize this study is related to the Wong [16] 2004 study, which provides information to estimate distance. We considered 13 events in the group within 2 meters and the remaining (17) larger than 2 meters). We do not think it is invalid. The study was not included in the analysis of adjusted studies.

Peck 2004: The study defines close contact as 3 feet. Peck 2004 has only a single table in it that clearly shows the same numbers [17] that we report (38 within 3 feet, 3 not within 3 feet; 0 events in both groups). This study is not included in the adjusted analysis.

Our response

We are baffled by some of the distance assumptions made by the researchers in all papers except for two (Teleman and Reynolds) in which distances between cases and healthcare workers or other contacts were reported accurately and presumably measured.

[1] This continuity correction is not in in the methods

[2] At very low event rates adding in data to zero events make a big difference to the relative estimates

[3] Close contact is, therefore, an assumption – less than a metre in a family cluster

Yet, CDC defines close contact as: Close contacts are defined as persons within approximately 6 feet (2 meters) https://www.cdc.gov/flu/avianflu/novel-av-chemoprophylaxis-guidance.htm

[4] The distance was made up

[5] We are interested in Figure 2 and the precise distance estimates analysis the adjusted analysis is of no concern to us – it is not clear why this was highlighted throughout the response

[6] The table does not contain data broken down by COVID cases and controls it is a descriptive study. Burke uses 2 m and 0 metres in the meta-analysis.

Table 4: Exposures and Respiratory Sample Collection Among Actively Monitored Community Contacts Providing Additional Information on Exposure to 9 COVID-19 Patients (N = 78), United States, January – February 2020* There is no data for cases or controls given in this table just data on how many respiratory samples were collected for 78 participants

In the limitations section, the procedures used were heterogeneous across sites as different teams made different decisions regarding the definition of close contacts,

[7] Using clinical suspicion logic for research studies is naive

[8] The issue is they attributed a positive test where no such test is reported

[9] Estimates "about 1 mt" is therefore now equal to face to face

[10] Another assumption on distance frequency of close contact with the index patient, also removed 50 patients with missing data.

"Frequency of close contact with IP (within 1 m)" the footer states: Information on 13 cases and 37 controls missing. 50 patients with missing data which gives 2098 still different to 2089 reported in the meta-analysis. TRANSPOSED DIGITS.

[11]They assumed that face to face equals 1 m

[12] Assumption that bed position equals distance. Discarded data because they wanted to use 1 vs 2-metre distance

[13] Teleman one of 2 studies reporting distance

[14] WHO guidance to assume distance. 84 people in the further distance group only used when there was a whole plane full of folk omitted from the analysis

[15] They made an error

[16] In Wong they report the bed's difference as 1mt and 2mt where here they now report 2 meters alone for the estimated bed difference.

[17]   The very complex Lancet review which contains 172 studies also has some features which are confusing. For example, text reference number 60 is reported as "Peck AJ, Newbern EC, Feikin DR, et al. Lack of SARS transmission and U.S. SARS case-patient. Emerg Infect Dis 2004; 10: 217–24".

Is it Peck or it Park? Both have the same reference and both have 6 tables (not one table as in the response)

Lack of SARS transmission and U.S. SARS case-patient.

Peck AJ, Newbern EC, Feikin DR, Issakbaeva ET, Park BJ, Fehr J, LaMonte AC, Le TP, Burger TL, Rhodes LV 3rd, Weltman A, Erdman D, Ksiazek TG, Lingappa JR, SARS Pennsylvania Case Investigation Team

Author information ▸

Emerging Infectious Diseases, 01 Feb 2004, 10(2):217-224
DOI: 10.3201/eid1002.030746   PMID: 15030686   PMCID: PMC3322937

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Emerg Infect Dis. 2004 Feb; 10(2): 217–224.   PMCID: PMC3322937
doi: 10.3201/eid1002.030793   PMID: 15030686

Lack of SARS Transmission among Healthcare Workers, United States

Benjamin J. Park,[*] Angela J. Peck,[*] Matthew J. Kuehnert,[*] Claire Newbern,[*†] Chad Smelser,[*‡] James A. Comer,[*] Daniel Jernigan,[*] and L. Clifford McDonald[⊠*]

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Concerns about the figure

Comment from Mark Jones, University of Queensland

Chu et al Figure 3

Figure 3 (A) shows that at a distance of 0m the log relative risk on average is approximately -1.9 which equates to a relative risk of 0.15 (85% reduction in risk) whereas at a distance of 1m the log relative risk on average is approximately -1.2 which equates to a relative risk of 0.30 (70% reduction in risk), and at a distance of 2m the log relative risk on average is approximately -0.5 which equates to a relative risk of 0.61 (39% reduction in risk).

Hence the Figure shows relative risk decreases with increasing distance and consequently this analysis suggests protection decreases with increasing distance.

Another way to interpret this finding is that studies with exposure based on the distance of 2m reported smaller relative risks than studies with exposure based on the distance of 1m. However, the interpretation provided in the abstract is that "protection was increased when the distance was lengthened". This interpretation is at odds with Figure 3 (A).

Another way to check the interpretation is to conduct subgroup analysis by distance. Extracting data from Figure 2 of the paper and conducting subgroup analysis shows that for distance = 0m: RR = 0.16; for distance = 1m: RR = 0.31; and for distance = 2m: RR = 0.48, i.e. as distance increases, relative risks decrease implying protection diminishes.

Summary:

As experienced reviewers, we looked at the evidence and could not replicate the distance estimates reported in the Lancet paper. We now invite others to check the papers – most are open access – and share their assessments. we look forward to your comments

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Tom Jefferson is a senior associate tutor and honorary research fellow, Centre for Evidence-Based Medicine, University of Oxford. Disclosure statement is here

Carl Heneghan is Professor of Evidence-Based Medicine, Director of the Centre for Evidence-Based Medicine and Director of Studies for the Evidence-Based Health Care Programme. (Full bio and disclosure statement here)