Reviewer’s report

Title: A statistical model to assess the risk of communicable diseases associated with multiple exposures in healthcare settings

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Reviewer: Shuang Ji

Reviewer’s report:

This article is generally well written. By a statistical model the authors assessed the risk of communicable diseases with multiple exposures, including both observed exposures and unobserved (unobservable) ones. In addition, the effect of exposures to CD was broken down into the a delayed effect of the source person’s contagiousness and of lags. The statistical model appears to be sound. A study of influenza-like illness was illustrated. The proposed method can be applied to a variety of scenarios involving infectious diseases with multiple exposures.

Here follow some critiques that I hope will serve to help improve this work.

Minor Essential Revisions:

1. The authors should elaborate more on the background, especially on the literature review of such problems. The authors did mention the work of Barrett and Marshall (1969), however, neither its advantage/disadvantage nor its connection with the proposed method was discussed. Also, it is not clear whether there is other important work in this field - the authors should specify, and review if any.

2. The captions of the two figures are not clear (the caption of Figure 2 doesn't even seem to be complete). Also, more detailed explanations of the figures should be given. For example, the jump of the risk on the second day of symptoms seems to be interesting, despite the overall decreasing trend over time. Is there a known reason for this phenomenon?

3. The notation in the additional file 1 can be made more precise. More specifically, both the matrices W and beta are of dimension I*J, so the product should be written as W'*beta instead of W*beta, where W' denotes the transpose of W. Also, this product is a J*J matrix, rather than a scalar as intended in the manuscript. Though it is not hard to infer from the text what the expressions mean, it would be better to be mathematically strict.

Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Acceptable
**Statistical review:** Yes, and I have assessed the statistics in my report.

**Declaration of competing interests:**

I declare that I have no competing interests.