Subject: Manuscript revision AOAS1608-032

Dear Dr. Griffin,

We would like to thank you, the associate editor and the anonymous reviewer for reviewing the manuscript entitled “Efficient estimation of age-specific social contact rates between men and women” (reference AOAS1608-032) for publication in the Annals of Applied Statistics (AOAS).

We have resolved the issue regarding the symmetry of the Q matrix and revised the manuscript accordingly. We would like to resubmit this revised manuscript for publication AOAS. The comments are addressed below in detail.

Thank you again for your consideration.

Sincerely,

Dr. J. van de Kassteele

National Institute for Public Health and the Environment - RIVM

PO Box 1

3720 BA Bilthoven

The Netherlands

E: jan.van.de.kassteele@rivm.nl

T: +31-30-274-3690

**Anonymous reviewer's comments**

I have reviewed the revised paper along with the responses. It is my opinion that the paper is now significantly clearer and that the authors have addressed my comments. I would like however to obtain further clarification about my original comment below:

Original comment:

I am not convinced that all non-symmetric dependent triplets are currently reflected in the precision matrix. For instance, in Figure 1, for the Female-Male and Male-Female matrices, the total number of dependent triplets is 18 (i.e. 12 + 6). I would expect a total of 30 dependent triplets, or 2n(n − 2), for the FM and MF combined, where n is the number of age categories. This could impact the difference matrix, and ultimately, the precision matrix.

Original response:

*We are not entirely sure that we understand the reviewer's comments. More specifically, why there should be 2n(n – 2) triplets. We can explain why there are 12 (FM) and 6 (MF) triplets. First, we have to recognize that the entire matrix (that is MM, FM, MF and FF together) should be symmetric in the main diagonal from bottom-left (M1, M1) to top-right (F5, F5) as indicated by the colors. It is easy to see that the MM and FF matrices are symmetric. The FM matrix and MF matrix are symmetric too. This means that nodes 16, 21, 25, 28 and 30 in the FM matrix should return in the MF matrix, or else the entire matrix will not be symmetric. This explains why the number of triplets in the MF matrix is 12 and the number of triplets in the FM matrix is 6: in the MF matrix we do not need the diagonal. This is explained in section 2.3 in the manuscript.*

Follow up comment:

I understand that one of the main goal of the methodology is to ensure that the Q matrix imposes smoothness and symmetry of the estimated contact rates. However, I am still unclear about the construction of Q for the off-diagonal blocks (i.e. MF and FM). Why can’t the differences between nodes 22-25-38 in Figure 1, for instance, be smoothed (or any triplets crossing the diagonal of that block)? The upper triangle of MF (and FM) does not have to be symmetric to its lower triangle.

Assuming I am missing something and that those triplets don’t have to be considered, maybe it is just a matter of clarifying further Section 2.3 by explaining why they don’t have to be considered. The sentence “Because FM and MF matrix share one diagonal, the difference operator matrix for MF contacts can be reduced to a 6 × 10 matrix.” is unclear to me.

Follow up response:

*We thank the reviewer for these additional comments. We now understand what the concern was about. The reviewer was right all the time. The FM matrix should contain 30 triplets instead of 12.*

*Explanation. Let us consider a female participant in age class 3. The contact rate between this female and males in age class 1 should be similar to the contact rate between this female and males in age class 2, which in turn is similar to male in age class 3, 4, etc. So indeed, there should be edges (three triplets in total) between these 5 age classes in the vertical direction, crossing the diagonal of the FM matrix. Similarly, there should be edges between the 5 female age classes in the horizontal direction.*

*As the reviewer correctly points out, the upper triangle of FM (and MF) does not have to be symmetric to its lower triangle. In total there should be 5 x 3 + 5 x 3 = 30 triplets in the FM matrix. The MF matrix contains none because of the imposed symmetry. This resolves all the issues with the Q-matrix. The MM and FF matrices remain unchanged.*

*We have revised Figure 1 and section 2.3 accordingly and updated the results and discussion sections. The revision has a very small impact on the results; near the diagonal of the FM and FM matrices the contacts rates are a bit more smoothed, as they should. We have included the revised R scripts in the Supplementary Material.*

Minor comment:

Under equation (2.5), it should read log(*cijMF*) as opposed to *cijMF*.

*This is correct.*