Reviewer’s report

Title: Are volunteering and caregiving associated with suicide risk? A Census-based longitudinal study

Version: 1 Date: 02 Apr 2019

Reviewer: Atsushi Miyawaki

Reviewer's report:

Thank you for giving an opportunity to review this insightful paper. This study investigated the association between prosocial activities such as informal caregiving or volunteer and suicide mortality using Northern Ireland Census data and revealed that doing both informal caregiving and volunteer are associated with decreased suicide mortality. Also, their findings did not suggest increased suicide risk among informal caregivers. The suicide risk among informal caregivers are often mentioned as a serious problem by the mass media, but the authors tried to reveal whether or not the suicide risk among informal caregivers are actually high. In this sense, this paper will be valuable for international readers and the public. However, the current version has some concerns over analyses and interpretations, and there seems to be still room for further improvement.

1. In the paragraph "analysis strategy," the authors state "suicide is relatively rare." In this situation, however, the analyses considering competing risk may be strongly recommended in this study. The model they use in the current version looks like the cause-specific proportional hazard (CSPH) model, but the CSPH model would be biased when the competing risks are not independent. For example, please see https://www.mailman.columbia.edu/research/population-health-methods/competing-risk-analysis.

2. In Table 2, mental health deterioration among intensive caregivers are suggested by cross-sectional analyses. However, in Table 3, caregivers are not stratified by intensiveness of caregiving. Why didn't the authors show the HR of intensive/non-intensive caregivers for suicide mortality? The reviewer is wondering if intensive caregivers might show increased suicide mortality.

3. The reviewer thinks the mental status at baseline can be one of the mediators between caregiving/volunteer status at baseline and suicide mortality. From this viewpoint, the stratified analyses by mental status at baseline is a kind of mediation analysis. Thus, attention should be paid to the interpretation of Figure 1. First, Let me define the effect of caregiving/volunteer on suicide via mental health as "indirect effect" and the effect of caregiving/volunteer on suicide not via mental health as "direct effect." Then, under some
assumptions (see Vanderweele, 2015), the left panel of Fig. 1 suggest that the indirect effect of caregiving on suicide is significantly a decreasing effect. On the other hand, the right panel suggests that the indirect effect + direct effect of caregiving on suicide is null. These results indicate that the indirect effect of caregiving via mental deterioration might be an increasing effect. They reported that the coefficient of interaction terms between caregiving and mental status are significant, which is supporting this interpretation. Thus, the analyses in Figure 1 show the balance between the positive effect of informal caregiving and the negative effect son informal caregiving. The authors can add these discussions.

4. In the limitation section, the author should refer to the fact that this study's result is based on one European country's data. The association between informal caregiving and increased suicide risk may still be observed in other countries including Asian countries, because in many Confucian cultures, it is considered that the family will take care of aging relatives, and consequently, formal resources for assisting informal caregivers remain under-developed (Bambra, 2007; Liu and Dupre, 2016). The studies about the relationship between informal caregiving and mortality in Asian countries are very scarce, but one recent study (https://doi.org/10.1016/j.socscimed.2019.01.034) did not find reduced all-cause mortality among informal caregivers, in contrast to the studies in the US or European countries.

Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.

No

Does the work include the necessary controls?
If not, please specify which controls are required in your comments to the authors.

Yes

Are the conclusions drawn adequately supported by the data shown?
If not, please explain in your comments to the authors.

Yes

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If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.

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