Author’s response to reviews

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

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Author’s response to reviews:

Dear Editor,

We have addressed the formatting changes highlighted by the Editorial Team below.
We have also re-attached the point-by-point response to reviewers for your reference.

Kind Regards,

Foteini Tseliou

Editor Comments:

1. Corresponding Author Email Address - The Corresponding Author is incorrect. Please correct so they are consistent with each other.

Response: The corresponding author is currently using the email: ftseliou01@qub.ac.uk. This email has been updated in the online Editorial Manager system for consistency purposes. It also has been checked for consistency between the affiliations and corresponding author’s sections.
2. Conclusion - Please include a Conclusions section after Discussion section. This should state clearly the main conclusions of the research and give a clear explanation of their importance and relevance. Summary illustrations may be included.

Response: A Conclusion section has been added at the end of the Discussion section. It reads as: “These analyses suggest benefits associated with engagement in pro-social activity (caregiving and/or volunteering): for caregivers the evidence proposes that, while there were increased risks of reporting mental ill-health, there was no evidence of increased suicide risk; for volunteers the risks of both reporting mental ill-health and suicide were reduced, though not significantly so in the more fully adjusted mortality models; and for persons engaging in both suicide risk was significantly reduced. However, while we stress these findings be approached with caution, it is important to further research the relationship between pro-social activity (especially caregiving) and health outcomes – if only because its societal role is predicted to grow.”

3. Figure legends - Please provide figure legends under a separate heading of 'Figure Legends' after the References. If legends are present within the figure files, please remove them. Figure files should contain only the image, as well as any associated keys/annotations.

Response: The figure has been moved to a separate file according to guidelines. A Figure Legends heading has been added below the References section as instructed by the Editorial Team.

Reviewer Comments:

Reviewer 1

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.

Response: In general we would agree with the reviewer that the analysis of cause-specific mortality should include a consideration of competing risks. However, we do not believe that this is required in this case or that it would make a substantial difference. It is now recognised that volunteering is associated with a significantly overall mortality risk: a meta-analysis of 14 studies by Okun et al. showed that organizational or formal volunteering reduced the mortality risk of people aged 55 or more by 47% [95% confidence interval (CI)¼38–55%] and by 24% (16–31%) after adjustment for mediating factors, and concluded that “it is no longer a question of whether volunteering is predictive of reduced mortality: rather. . . that the volunteering-mortality association is reliable and that the magnitude of the relationship is sizable” (Okun MA, Yeung EW, Brown S. Volunteering by older adults and risk of mortality: a meta-analysis. Psychol Aging 2013;28:564–77). Similarly, the consensus is that the deleterious effects of caregiving have been overstated and that most studies find that it is associated with significantly reduced all-cause mortality risk (Roth DL, Fredman L, Haley W. Informal caregiving and its impact on health: a reappraisal from population-based studies. Gerontologist 2015; 55: 309–19). Reductions all-cause mortality risk of this magnitude could not be due to reductions in suicide risk which is relatively rare. It is therefore difficult to see what competing causes would produce an apparent reduction in suicide and yet a reduction in overall mortality risk. However, we have added a section in the study’s Limitations sub-section to suggest that is something that future researchers might wish to pursue. It reads as (Discussion section, line 14 page 15): “Although the protective effect of engaging in both caregiving and volunteering activities in relation to suicide risk was highlighted, future researchers might wish to explore the potential influence of competing mortality risk on these effects.”

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.

Response: We thank the reviewer for the recommendation. We agree that it would be interesting to explore mental ill health across different levels of caregiving responsibilities, however, suicide
is “relatively rare” with only 528 completed suicides being identified in this population-wide study. The logistic regression analysis (Table 2) with relatively common chronic mental ill health as the outcome facilitated more disaggregated analysis, but this was not possible for suicide, which might also have raised confidentiality issues, especially among individuals who reported both caregiving and volunteering status.

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.

Response: We thank the reviewer for the comment. We have incorporated the recommendation in text within the Results section to clearly describe findings presented in Figure 1 in regard to the association of interest. The text now reads as (Results section, line 15 page 11): “The results of the analyses stratified according to chronic poor mental health are shown graphically in Figure 1: no mental health problems describing a direct effect of prosocial activity on suicide, while the presence of mental health problems presents an indirect effect through mental ill-health. Volunteers and caregivers with better mental health tend to have a lower risk of suicide but those with poor mental health tend to exhibit the same risk as those not engaging in either activity. This is confirmed in an analysis that considered all the helping activities together; for those with better mental health, prosocial activity is associated with a lower risk of suicide (HR= 0.66; 95% CIs 0.49, 0.88), for those with poor mental health the addition of helping activity does not improve models predicting suicide risk (P= 0.993) and the risk of suicide amongst helpers was the same as for non-helpers (HR=1.02: 95% CI=0.69, 1.51). Therefore, there is a decreasing direct effect of prosocial activity on suicide, though an opposing indirect effect was also observed in the presence of mental ill-health (as supported by the significant interaction coefficient), thus suggesting a complex link between prosocial activity, mental health and suicide risk.”
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.

Response: We thank the reviewer for their comment. We acknowledge that the discussion should be expanded upon to reflect on a broader scope of populations. We have added the recommended research studies and have amended the Limitations section of our discussion. It now reads as (Discussion section, line 21 page 15): “Finally, it is worth considering that our sample is of predominantly white ethnicity, with variation in the associations of interest to be expected in people from other cultures: for example, in Asian countries where government support for informal carers is limited [64-65] one study found that informal caregiving does not appear to be linked with all-cause mortality [66]; though this may not pertain when focusing on suicide risk.”

Reviewer 2

This manuscript is well-written and deals with important issues of suicide risk of volunteers and caregivers using longitudinal data. The topic addressed is novel and interesting.

I have one comment.

1. Recent previous studies suggest that caregivers' personality traits affect caregiver burden. For example, Kim et al. reported that neuroticism and extraversion influenced the mental health related QoL of caregivers. I think volunteering is strongly related with extraversion and the relationship between them might affect the risk of suicide. How about discussing it in your paper?

Response: We thank the reviewer for their positive feedback and their recommendation. We have amended our discussion section to provide a broader overview of our findings’ implications and the potential role of personality characteristics on the mental health related quality of life of caregivers. The discussion now reads as (Discussion section, line 17 page 14): “Personality traits might also be linked to caregiver burden, with neuroticism being negatively associated with mental health-related quality of life while extraversion has an opposite effect [61]. Volunteering
has also been strongly related with extraversion [62], suggesting that personality traits could affect the relationship between prosocial activities and suicide risk.”