Author's response to reviews

Title: Mental health and wellbeing in spouses of persons with dementia: the Nord-Trondelag health study

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Author's response to reviews: see over
Dear Editor,

Thank you for your positive response and constructive comments on the manuscript, "Mental health and wellbeing in spouses of persons with dementia: the Nord-Trøndelag health study". We have incorporated revisions suggested by you and the reviewers, mainly in the introduction and discussion section. As suggested, we have used a professional language editing service to improve the style of the written English, and we have included the full institutional name of the ethics committee that approved the study (page 6, line 12-14).

Due to the language editing, there are small changes in the language throughout the manuscript. These changes are not indicated in the text.

Attached is a list of responses to the comments made by the reviewers.

We look forward to hearing from you!

With best regards,
Helga Ask
Response to Reviewer #1 Karlijn J Joling:
Thank you for thorough and helpful reviewing of the manuscript "Mental health and wellbeing in spouses of persons with dementia: the Nord-Trøndelag health study". We have prepared a revision on the manuscript, and we hope we have made the aim and contribution of our study more clear.

1. Introduction: Although the limitations in caregiver research are described pretty extensively, it is not totally clear how the main aim of this study relates to these shortcomings. The background of the study could be described more structured and to the point. I would recommend to focus the introduction more on the gap that this study is trying to fill in particular and to describe more in detail what previous studies have found with regard to the prevalence (and development) of depression and anxiety in dementia caregivers whether or not in comparison with other or non-caregivers.

Response: I agree that the relevance of our study and how it relates to earlier research could be more to the point. We have tried to restructure the introduction accordingly, especially the first section of the introduction and from page 4 line 23 to page 5 line 30.

Several key studies are left out and most of the references are from more than 10 years ago. I would like to call attention to the following previous studies on this topic: (Ballard et al., 1996; Joling et al., 2010; Joling et al., 2012; Mahoney et al., 2005; Neundorfer et al., 2006; Whitlatch et al., 1996).

Response: Thank you for providing these references. We have updated the reference list, and included them in the introduction and throughout the text.

2. Methods: Treatment of missing values: the approach used to handle missing values seems a bit ‘messy’: several strategies are used, e.g. for educational level and functional impairment were replaced by the lowest possible value, while in other cases EM imputation or LOCF is used if I understand it correctly. I would suggest to handle all missing values in the same way and use more precise imputation methods to estimate these values, e.g. multiple imputation or EM imputation.

Response: I can understand that our strategies for handling missing values may seem a bit messy. The text in the re-submitted manuscript has been revised to hopefully better explain the strategies used to handle missing values. Our main strategy performed for all scales consisting of several items was to use EM imputation (see table below). This was done for all outcome variables, which we regard as the most important variables, and to predictor variables containing several items. Regarding education, it was only 15 out of the total sample with missing values. We did not think that we had variables suitable to predict education in EM analyses. Previous experience has shown that for most purposes replacing unknown education with a low score is more appropriate than replacing it with a high score, but with this low number of missing it hardly matters exactly which value that substitute missing values. Regarding responses on functional impairment, it is natural to assume that if a person did not respond to these questions they most likely did not have any functional impairment. These questions were only answered by respondents having responded to an entry question that they had some type of impairments. To avoid shrinkage of the dementia group due to missing predictor variables, we found it necessary to go some additional steps
in the case group. Missing values were estimated for between 2 and 11 individuals for each variable, using EM were we found it most suitable. We have rewritten the section to try to give a clearer picture of the strategies and why we found these strategies to be the best alternative for our analyses.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Missing value handling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total sample</strong></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>EM</td>
</tr>
<tr>
<td>Depression</td>
<td>EM</td>
</tr>
<tr>
<td>Extraversion</td>
<td>EM</td>
</tr>
<tr>
<td>Religion</td>
<td>EM</td>
</tr>
<tr>
<td>Education (Missing =15)</td>
<td>EM</td>
</tr>
<tr>
<td>Functional impairment (Missing= 122)</td>
<td>No impairment</td>
</tr>
<tr>
<td><strong>Dementia case group only</strong></td>
<td></td>
</tr>
<tr>
<td>Subjective health</td>
<td>EM</td>
</tr>
<tr>
<td>Extraversion</td>
<td>EM</td>
</tr>
<tr>
<td>Religion</td>
<td>EM</td>
</tr>
<tr>
<td>Meaning</td>
<td>EM</td>
</tr>
<tr>
<td>Cultural activity</td>
<td>Median value</td>
</tr>
</tbody>
</table>

3. Discussion: The comparison with previous findings can be discussed more in detail. How do the ‘rather low estimates’ relate to the rates found in earlier studies using control groups (e.g. Joling et al 2010, Ory et al. 1999) and how can differences be explained?

Response: A more detailed comparison with previous findings is provided in the discussion, page 15 line 7-12, and line 19-23. However, I find it quite difficult to compare estimates of incidence based on diagnostic information with our estimates of differences in symptom levels on a very detailed level.

- It would be interesting if the authors could discuss whether significant differences that were found are clinically relevant or not.

Response: This is a fair comment. Some sentences on clinical relevance are included in the conclusion section in the revised manuscript, page 18, from line 7.

Minor points

- 1. It seems not appropriate to speak about the ‘effects’ of dementia on the outcomes. Because it involves a cross-sectional analysis, authors can only speak about the association between being a spouse of a person with dementia and presence of mental health symptoms.
Response: The wording is changed to association in most places in the revised manuscript. However in some cases the word effect is still used. Since the statistical model used in our analyses is a causal model, it is natural to use the word “effect” when describing the results of our analyses. As mentioned in the discussion, we are fully aware that one in a cross-sectional study never can be sure about the causal direction. However, in interpreting the primary association, it is more likely that dementia causes caregiver burden than vice versa, to say the least.

- 2. I assume that Q1 and Q2 were administered at the same time, but this is not specified.
Response: There were two questionnaires included in the study. The first (Q1) was returned at the health examination site and completed by practically all participants. The second (Q2) was handed out at the examination site and returned by mail. For most of the sample, the time lag between the two questionnaires was only a few days. This information is now included in the manuscript on page 6, line 6.

- 3. A flow chart that visualizes the composition of the study sample described at page 6 and 7 might be helpful.
Response: We have made a flow chart (Figure 1) to visualize the study sample. I hope this is the type of figure that you requested.

- 4. At the end of the conclusions paragraph, some sentences are written in Norse?
Response: Thank you for noticing that! The sentence has now been translated to English.
Response to Reviewer #2 Kathryn Adams:

Thank you for the positive reviewing of the manuscript "Mental health and wellbeing in spouses of persons with dementia: the Nord-Trøndelag health study". We have translated the paragraph in the final page from Norwegian into English. Thank you for noticing that!