Author’s response to reviews

Title: Item response analysis of the Geriatric Anxiety Inventory among the elderly in China: Dimensionality and differential item functioning test

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Version: 1 Date: 10 Aug 2019

Author’s response to reviews:

RESPONSES TO COMMENTS
We greatly appreciate the editors and reviewers for your help on the potential of improving the quality of the manuscript (BGTC-D-19-00037). The comments are very valuable. In accordance with the nice and constructive advice, we further revised the manuscript. The major revisions made in the revised manuscript were listed as follows:
1. Provided more details about participants and materials.
2. Added more information about statistical methods.
3. Reconstructed the Results section and the Discussion section
4. Clarified some inappropriate expressions.
5. Corrected some mistakes in writing, such as tense and grammar errors.
For detailed information about revision, please refer to the section of
RESPONSES TO REVIEWER

RESPONSES TO REVIEWER #1
We wish to express our appreciation to you for your insightful comments on our paper. The comments have helped us significantly improve the paper.

Comment 1:
Thank you for inviting me to review this paper. I found it interesting and easy to follow. The study further enhances our knowledge regarding the dimensionality and psychometric properties of the Geriatric Anxiety Inventory (GAI). In this respect it does well.
Response:
Your comments are highly appreciated.
Comment 2:
Major:
1. Language and use of past tense / present tense throughout the manuscript. This the editor may clarify, but several sections of the paper is written in past tense, while I was expecting present tense.
   Like on line 20 in the introduction “Though anxiety disorders were highly common among older adults, screening instruments for the aged left much to be desired [3].”
   and
   “Though anxiety disorders were highly common among older adults, screening instruments for the aged left much to be desired [3].” (line 53-54: Examining factor structure).
   So I wonder, have the manuscript been language edited before submission? If not, this should be done.
Response:
Thanks a lot for your nice suggestion. We have corrected the errors you mentioned, and have also carefully checked the whole text in the revised manuscript. Besides, we employed a professional editing service to improve the readability of the manuscript.

Comment 3:
In their tutorial paper (“A tutorial on how to do a Mokken scale analysis on your test and questionnaire data”), Sitsma and van der Ark (2017) warns about using automated item selection as a stand alone procedure, as AISP does not assess monotonicity. Gross violations will often be detected using AISP, but it is not always so (see page 147, section 2.4.2. in the tutorial). Also, local independence of the items should be evaluated separately (from AISP). Hence, this should also be reported.
Response:
Thank you very much for your suggestions. Following Sitsma and van der Ark (2017), we examined local independence and monotonicity to ensure that the data were adequately fit to the Mokken scale. The results indicated that no item expressed a significant violation of the monotonicity assumption, and no item violated the local independence assumption.
Moreover, local independence and monotonicity were examined to ensure the data were adequately fit to the Mokken scale. For local independence, no item pairs were flagged as locally dependent according to two indices (W1 and W2) calculated in the conditional association procedure [37]. That is, there is no evidence of local dependence. For monotonicity, the results showed that only item 12 violated the monotonicity assumption, but the violation was not significant (See Table 3). Mokken package also provides a simple index called crit for monotonicity seriousness evaluation of each item. It was calculated on the basis of item scalability coefficients Hi, choice frequency, and the magnitude and significance of monotonicity violation. According to a rule of thumb, an item with a crit value less than 40 indicates no serious violation [41]. Item 12 had a crit value of 31, and should not be discarded from the mokken scale. Graphical analysis indicated that all except Item 12 showed monotonical increases (see Figure 1). Item 12 showed a significant decrease in the middle, but the impact on its item response function was minimal.

Comment 4:
Some supplementary material should be provided like, graphs of monotonicity and scalability and item violations, like presented in Jan Stochl, Peter B Jones and Tim J Croudace. (2012) Mokken scale analysis of mental health and well-being questionnaire item responses: a non-parametric IRT method in empirical research for applied health researchers, BMC Medical Research Methodology. https://doi.org/10.1186/1471-2288-12-74
Response:
Thank you very much for your valuable comments. We have included supplementary material you suggested in the revised manuscript, such as the output of assessment of scalability and monotonicity.
We wish to thank you again for all the insightful comments. We now feel the manuscript is sharper and much improved as a result. We trust that the revised manuscript is suitable for publication.

RESPONSES TO REVIEWER #2
We wish to express our appreciation to you for your insightful comments on our paper. The comments have helped us significantly improve the paper.

Comment 1:
The topic of this manuscript is important. The factor structure of the GAI has been the subject of several studies and results are rather inconsistent. The dominant trend is a unidimensional structure although more complex structures have been identified. In this new study, the authors stand out from their predecessors by the use of a Mokken scale analysis. The results support the unidimensional structure of the GAI. In addition, the results of logistic regression analyses suggest measurement invariance of this inventory across individuals with different somatic diseases and sex.
Response:
Your comments are highly appreciated.

Comment 2:
In my opinion, the manuscript's contribution to current knowledge should be better demonstrated. Admittedly, several important studies are cited but not that of Molde et al. (2019). Using data from 3,731 older adults from 10 national samples, their results, based on bifactor modeling, also support the
unidimensional structure of the GAI while acknowledging the presence of multidimensional factors. Moreover, the authors' argument in favor of their study is the superiority of a Mokken scale analysis compared to traditional methods such as exploratory factor analysis and principal component analysis. However, this superiority is not actually demonstrated by the authors whose conclusions are in fact identical to those of several other researchers. If the interest of their study lies in their analysis of the data, they should demonstrate how it sheds new light on the problem under study. It would be more convincing, for example, to apply a Mokken scale analysis to data from previous studies reporting multiple factors and to find a unidimensional structure. Finally, the authors do not elaborate on the relevance of examining the measurement invariance as a function of sex and health. This should be clarified.

Response:
Thanks a lot your constructive comments.

(1) We have incorporated this new and important article by Molde et al. (2019) into our literature review of the investigation on the dimensionality of the GAI.

(2) We used the same dataset as Guan (2016), but removed four records due to incomplete responses on the GAI-CV. Therefore, our data has 1314 records, while his data has 1318 records. Guan (2016) attempted to identify the factor structure of the GAI-CV using both principal components analysis and confirmatory factor analysis. He first conducted a principal components analysis and obtained a three-factor structure. Then, he conducted a confirmatory factor analysis, and the fit of the three-factor model to the data was acceptable (comparative fit index (CFI) = 0.891, root mean square error of approximation (RMSEA) = 0.084). In our study, we confirmed the unidimensional structure of the GAI-CV with mokken scale analysis, which is consistent with most updated studies, such as Molde et al. (2019).

Compared to traditional factorial analysis, MSA is a better fit for discrete data sets (Wismeijer, Sijtsma, van Assen, & Vingerhoets, 2008). It has advantages in conducting dimensionality investigation and model evaluation at the same time, avoiding “difficult factors” and distortions due to item-score distributions. It is capable of eliminating the effects of the difference in individual item score frequency distributions (Michielsen, De Vries, Van Heck, De Vijver, & Sijtsma, 2004). It also provides a clear view on the items’ scalability (Wismeijer, Sijtsma, Van Assen, & Vingerhoets, 2008).

(3) We have added some more explanations for the relevance of examining the measurement invariance as a function of sex and health. Researchers often want to make comparisons among groups with different sex, diseases, or culture. They should make sure that the instrument assesses the latent construct to the same extent for those groups. Otherwise, they could not tell whether the score difference is a reflection of substantial group variability or a reflection of differential item functions in the instrument.

Comment 3:
An important weakness is that the text, in its’ current form, does not provide a sufficiently clear and accessible explanation of the nature and interpretation of the analyses. In particular, I suspect that many readers interested in the GAI are not very familiar with Mokken scale analysis and will have difficulty judging the quality of the study and if conclusions are adequately supported by the data shown.

Response:
Thank you very much for the helpful suggestion.

We have provided more explanations about Mokken scale analysis in the Introduction section and the Results section, such as principals and advantages of mokken analysis, and some critical criterial for evaluating model, item and scale.

Comment 4:
The discussion is adequate but does not sufficiently emphasize the importance of this new study. For example, it would be important to interpret the disparities between the results of the different studies
and to explain why exactly Mokken scale analysis should be recommended in future studies. As a clinician, I would also appreciate that the authors discuss the implications of a unidimensional structure for our understanding of anxiety in older adults and what the GAI actually measures compared to other similar instruments.

Response:
Many thanks for your insightful comments.
We have discussed the importance of Mokken scale analysis and the implication of the unidimensional structure in the Discussion section.

The importance of mokken scale analysis: Mokken scale analysis is less restrictive than traditional methods concerning statistical assumptions, such as exploratory factor analysis and parametrical item response theory models. It eliminates effects of the difference in individual item score frequency distributions. It also provided a comprehensive output about the scalability of items and the structure of scales.

The implication of the unidimensional structure: Since results of Mokken scale analysis confirm a unidimensional structure, it is justified to use a simple sum score of the 20 items within the GAI-CV as a reliable index for anxiety among the elderly.

Comment 5:
Finally, in terms of form, several portions of the text are difficult to understand and I encourage the authors to revise grammar and verb tense. In addition, the style of citations in the text alternates between numbers in brackets (e.g., [17]) and the year of publication (e.g., Márquez-González et al. (2012)). It should be standardized according to the journal's requirements.

Response:
Thanks a lot for your detailed guide. We have corrected the errors you mentioned, and have also carefully checked the whole text in the revised manuscript for language issues. In addition, we employed a professional editing service to improve the readability of the manuscript.

We wish to thank you again for all the insightful comments. We now feel the manuscript is sharper and much improved as a result. We trust that the revised manuscript is suitable for publication.

RESPONSES TO REVIEWER #3
We wish to express our appreciation to you for your insightful comments on our paper. The comments have helped us significantly improve the paper.

Comment 1:
Overall, the study objective is clear. The literature review is comprehensive. However, the study design, survey sampling and statistical analyses are not well performed.
REQUESTED REVISIONS:
The authors need to address following issues:
1. The survey has two other surveys except the one that was used for this analysis. What other two surveys? What the main objective of this whole study? Was this study a secondary analysis? More sampling information is needed, such as what difference between this study and the paper already published used the same data. How was the survey conducted?
Response:
Thank you very much for the comments.
The data is drawn from a publicly available dataset, Chinese National Survey Data Archive (CNSD).
The aim of the project is to investigate mental health and its influencing factors of elderly adults in Beijing (Tang & Wang, 2004). The two other surveys are the activity of daily living scale (ADL) and the social interaction scale (SIS). The former measures self-care ability of daily living, while the latter assesses number and frequency of people they interact with. This study is a secondary data analysis. The aims are twofold: 1) To establish the factor structure of the GAI in a large Chinese sample using Mokken scale analysis; 2) to examine the measurement invariance of the instrument across different groups using DIF analysis. Tang and Wang (2004) mainly described the anxiety level of the elder and investigated which factors could predict the risk of anxiety disorder, such as age, education, ADL, and SIS. Guan (2016) attempted to identify the factor structure of the GAI-CV. He first conducted a principal components analysis and obtained a three-factor structure. Then, he conducted a confirmatory factor analysis, and the fit of the three-factor model to the data was acceptable (comparative fit index (CFI) = 0.891, root mean square error of approximation (RMSEA) = 0.084).

According to Tang and Wang (2014), the survey was conducted following the procedure: Forty-five communities were randomly selected in Beijing, China, including old communities, new communities, and large villages. Thirty elderly adults in each community were selected with a systematic sampling method. The investigators read the items in the survey one by one, and the participants provided answers corresponding to those items. Finally, a total of 1314 valid records were collected regarding the GAI-CV, 59.5% of which were from females.

We have also added the above information to the revised manuscript. In that case, readers will get a better understanding of the study design and survey sampling.

Comment 2:
2. The study stated that item response analysis is better than EFA and CFA. There are two concerns here:
(1) readers expect more solid evidences to the statement, such as theory adjustment, more literature citations.
(2) Since EFA and CFA are inferior to IRA, why the study stated that the results confirmed one dimensionality from EFA and CFA?
Response:
Thanks a lot for your comments. We have provided some explanations for the advantage of mokken scale analysis over EFA and CFA with more literature citations.
(1) Compared to traditional factorial analysis, MSA is a better fit for discrete data sets (Wismeijer, Sijtsma, van Assen, & Vingerhoets, 2008). It has advantages in conducting dimensionality investigation and model evaluation at the same time, avoiding “difficult factors” and distortions due to item-score distributions. It is capable of eliminating the effects of the difference in individual item score frequency distributions (Michielsen, De Vries, Van Heck, De Vijver, & Sijtsma, 2004). It also provides a clear view on the items’ scalability (Wismeijer, Sijtsma, Van Assen, & Vingerhoets, 2008).
(2) Most previous studies explored the dimensionality of the GAI using EFA and CFA. In the present study, we examined the dimensionality with Mokken scale analysis, and the results confirmed the unidimensionality of the GAI-CV. We have rephrased some expressions to make this point clearer.

Comment 3:
3. The study section did not cover descriptive analyses. The methods used in this study also need to be clear and full described.
Response:
Thanks a lot for your suggestion. We have added descriptive analyses in the Result section. We have also provided more information about the methods to make them clearer.
Comment 4:
4. The results and discussion are not well presented.
Response:
Thanks a lot for your comments. To make the results and discussion clearer and more logical, we have reconstructed the Result section and the Discussion section, and have provided more detailed information. Hope the revision meets your expectation.

Comment 4:
ADDITIONAL REQUESTS/SUGGESTIONS:
Authors need correct grammar errors. Some sentences are not complete.
Response:
Thank you very much for your nice suggestion. We have carefully checked the whole text in the revised manuscript for language issues. In addition, we employed a professional editing service to improve the readability of the manuscript.

We wish to thank you again for all the insightful comments. We now feel the manuscript is sharper and much improved as a result. We trust that the revised manuscript is suitable for publication.

References