Author's response to reviews

Title: Exploratory factor analysis of self-reported symptoms in a large, population-based military cohort

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Author's response to reviews: see over
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Melissa Norton, MD
Editor-in-Chief
BMC Medical Research Methodology

Dear Editor Norton,

Enclosed please find our manuscript, “Exploratory Factor Analysis of Self-Reported Symptoms in a Large, Population-Based Military Cohort.”

The authors appreciate the opportunity to respond to the reviewers’ comments and all authors agree this revision has improved the clarity of objectives in the original manuscript. A revised version of the manuscript has been submitted. Our responses to each of the reviewers’ comments (in bold) follow below:

Reviewer 1:

1) Are the findings regarding mental health inherently biased because such factors were overrepresented in the survey? Also, are they biased because physical illnesses may have been overrepresented in the exclusion criteria? This is a potential weakness that should be addressed in the manuscript.

The reviewer raises some good questions. While there are approximately 400 items on the questionnaire, the intent of this study was to examine the covariance structure of self-reported symptoms. Therefore, we purposely excluded items that measured previous medical diagnoses, physical limitations, exercise, and other non-symptomatic items. We have more clearly defined in the methods why the 89 items were chosen for this study.

2) Why were 4-5 factor models uninterpretable?

We agree that this should be made more explicit. We have added a statement in the results section that identifies which of our factor solution criteria were violated by the 4 and 5 factor models.

3) Does the Kaiser-Guttman criterion apply to data sets that are as large as this one? What is the impact of such a large data set on the validity of the factor analysis?

To our knowledge, criticisms of the Kaiser-Guttman criterion have not depended on sample size but have focused, rather, on the perceived arbitrary eigenvalue threshold value of 1.0. These critiques notwithstanding, we chose a final factor model that agreed with this criterion primarily because this model also maximized interpretability and proportion of explained variance. We have modified
portions of the results section to highlight this.

To our knowledge, all published commentaries on factor analysis sample size refer to *minimum* sample size. We are not aware of any studies or theoretical work that investigates the influence of large sample size on factor analysis validity.

4) **Authors should provide more quantitative information on the results of their final factor analysis.**

We have added more quantitative information to the results section, including information about final model residuals, eigenvalues, and factor loadings.

5) **The issues of fatigue and lack of energy should be discussed with regard to potential or documented sleep loss of the population surveyed.**

Research conducted using data from the Millennium Cohort Study has found that Cohort members report an adjusted average sleep time of 6.5 hours per night (Seelig, 2010), which is slightly lower than most recommendations. Over a prolonged period of time such sleep restriction can have lasting effects on performance which could manifest in fatigue and lack of energy, among other symptoms. Furthermore, findings in the sleep article were mediated by mental health symptoms. This supports findings in the current study where overlap occurs between mental health and sleep/fatigue factors suggesting a strong comorbidity between these symptoms and conditions. Additional text has been added to the discussion.

Seelig AD; Jacobson IG, Smith B, Hooper TI, Boyko EJ, Gackstetter GD, Gehrman P, Macera CA, Smith TC, for the Millennium Cohort Study Team. Sleep patterns before, during, and after deployment to Iraq and Afghanistan. Sleep 2010;In press.

6) **Can the location of the participants (US, OCUNUS, In-theatre) be determined and accounted for in the model or by using some other statistical approach? This is a key with regard to data interpretation and appears to have been ignored.**

We appreciate this thoughtful comment from the reviewer. Since this is the first factor analysis performed using Millennium Cohort data we purposely aimed to examine the covariance structure of self-reported medical symptoms among the entire population. While we plan to do additional follow-up investigations examining how factor loadings may differ by deployment, demographic, and military characteristics, we respectfully feel that this is outside the scope of the current paper.

7) **Explain the term “polychoric.”**

Polychoric correlations estimate the correlation between categorical variables based on the assumption that the observed categorical values are functions of latent normal random variables. We have added this additional sentence to the methods section to elaborate on the meaning of this term.

**Reviewer 2:**

1) **The authors mention that the demographics for this sample are reported elsewhere. My own preference would be to actually have at least some rudimentary description of the sample**
available when I am reading a paper, rather than have to track down a different paper in a different journal just to see basic demographics. I will defer to the editor on this, but perhaps even a line or two just to describe the basics of the sample. Readers could still be referred elsewhere for more detailed information.

The reviewer raises a good point. We have added a sentence to the results that describes the basic demographics of the study population.

2) On page 7, the authors describe that they factor analyzed data from a variety of smaller scales imbedded in the survey. For some scales, all items were analyzed, while for others, only some items (e.g., “most items” line 7) were analyzed. How was the inclusion or exclusion of items determined?

We agree that this should be clarified and have added the following sentence to further elucidate why certain items from the embedded instruments were excluded: “Question items from these embedded instruments were excluded from the analysis if they were optional, fell under a skip pattern, or did not pertain to physical or mental health symptoms.”

3) The authors point out that “an important finding of this study was that the majority of the factors appeared to load strongly based on how symptoms were grouped according to location within the survey.” However, this conclusion cannot be demonstrated conclusively. First, location is confounded with content. It may be that subjects responded to the items similarly because they were in the same location of the survey, as suggested by the authors, but it may just be that it was because all of those items queried similar content. It is impossible to tease that apart. Secondly, item content and location are also confounded with response format. The various items for a particular scale (e.g., anxiety, PTSD, somatic symptoms) had a common format (e.g., dichotomous, 3-item, 4-item, 6-item responses). Thus, questions that asked about depression often had 4-item response formats, while questions that asked about disordered eating had a dichotomous response format, and items that asked about vitality had a 6-item format. Thus, the factor structure may have been partly reflecting response format as well as content or location. This limitation needs to be addressed in the discussion section.

We agree that the confounding of item location, content, and response format is important and have modified the abstract and conclusion section of the manuscript to better accentuate this.

4) The study seems to be entirely descriptive. There is no theoretical rationale or models put forth and it is not entirely clear what the ultimate utility of such an exploratory factor analysis would be. At this point, it shows that the current survey includes items measuring a variety of constructs and they appear to hold together relatively well. Is this the ultimate goal, or were there any theoretical bases for this analysis? Will the results of this analysis be used to modify the survey (i.e., dropping redundant items)?

The reviewer is correct in stating that this was mainly a descriptive, exploratory analysis. Our primary goals were to investigate the constructs of these symptoms and to examine any underlying patterns of the symptoms while determining if we were overburdening study participants. While we would have considered dropping redundant items on future questionnaires, the findings indicate that there is not considerable overlap of the constructs. In addition, our aim was to identify a number of symptom-based factors that may be used in future studies. We have included additional information to highlight these points in the introduction.
Thank you for the opportunity to submit our paper for review. We appreciate your consideration.

Very Sincerely,

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