Reviewer's report

Title: Dimensionality and predictive validity of the HAM-Nat, a test of natural sciences for medical school admission

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Reviewer: Manjula Marella

Reviewer's report:

This is a well-written manuscript. The authors developed HAM-Nat scale and validated it to assess the students applying for admission in Hamburg Medical School for their knowledge in natural sciences. They developed 52 items for biology, physics and chemistry subjects and tested their validity as a single unidimensional model and a scale composed of three subject specific domains. For further validation, the scales were tested for their predictability of academic success after two years. The sample of 334 subjects was randomly divided into two groups for development and validation phases. Of the two proposed models for the scale, a model with three subject specific domains had better psychometric properties and had good predictability of academic success. It was shown that by selecting the upper quartile of subjects using the HAM-Nat scale, there could be a significant rise in the expected success rate.

The manuscript needs some minor corrections before it can be accepted for publication. See comments below:

Introduction:
- Well-written addressing the need and significance of the study.
- Page 3, line 4 from below: expand SAT2 AND ACT.
- Page 4, lines 14 and 15: maths was mentioned as one of the subject domains of 52 multiple-choice questions. This domain was not reported anywhere later in the manuscript.

Methods:
- This is a well-designed study and clearly presented. However, convenient sampling was a drawback that was mentioned by the authors in the discussion section.
- How many items were included in each subject domain to start-with?
- Page 8, paragraph 2, line 2: space between “split” and “the”

Results:
- How many items were there in each subject domain of the 33-item HAM-Nat uni scale?
- The scale’s internal consistency was reported as 0.84 in the text, while it was 0.86 in Table 2.
- It is not clear how did the authors end up with a total of 38 items in the
3-dimensional scale. After removal of 4 items in Factor analysis and 6 items later in Rasch analysis, there should be a total of 42 items.

- Is Rasch analysis performed for the combined scale “HAM-Nat-BPC”? Specify the fit statistics for this scale.

- Are 33 items selected for HAM-Nat-Corrmax same as the previously mentioned 33 items for HAM-Nat uni scale?

- It is not clear whether there was an equal distribution of items in the three subject domains of HAM-Nat uni and HAM-Nat-Corrmax scales.

Discussion:

- There is no significant difference in the prediction of success using HAM-Nat-BPC scores and GPA. Why do authors think HAM-Nat scale should be used as opposed to GPA alone for the selection of candidates into medical school?

**Level of interest:** An article of importance in its field

**Quality of written English:** Acceptable

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**

I declare that I have no competing interests.