Reviewer's report

Title: A simple ratio-based approach for power and sample size determination for Rasch analysis

Version: 1
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Reviewer: Tolulope Sajobi

Reviewer's report:

General Description
This manuscript addresses an important and relevant topic on power calculation in patient-reported outcomes research. The authors have proposed a ratio-based approach for power and sample size determination for patient reported outcome studies via the item-response theory using Rasch modelling. Given that the classical method for sample size calculation may under-estimate the expected number of patients needed to detect a given power (say 100[1-#]%), Raschpower method, which was previously developed by authors that the required sample size for Rasch modelling is a product of the classical sample size for normally distributed manifest variable and a correction factor. In this study, the authors propose a ratio-based approach for estimating the required sample size for Rasch modelling. Using Monte Carlo methods, the authors showed that this ratio is primarily a function of the variance of the latent trait and number of items. They showed that expected sample size based on this ratio-based approach is within the 5% error margin for the sample size Rasch power.

MAJOR COMPULSORY REVISIONS
The authors only investigated number of items that ranged between 3 and 20. These results may be applied in powering studies that aim to adopt brief versions of health-related quality of life (HRQOL) instruments such as SF-12 and EQ5D. The authors should report results about simulation conditions when J > 20. Given that most of the commonly adopted HRQOL instruments have J > 20 items (e.g., SF-36, inflammatory bowel disease questionnaire), simulation results for J > 20 will be useful for powering studies that adopt such instruments.

MINOR ESSENTIAL REVISIONS
Avoid using mathematical notations in the abstract.
The sentence under the conclusion of the abstract is incomplete.
The method section of the abstract should indicate that a Monte Carlo methodology is used to generate the results for linear regression
I don’t think the discussion of the simulation results is complete. The authors should discuss the impact of other simulation parameters on RATIO. Also, the authors should include a discussion of how the full linear regression model with
all the simulation parameter differs from the final model. I wonder if there is substantial difference in model R2 for the full model and the final model.

One major item that is missing in the discussion section is the implications of adopting the ratio-based approach for the Raschpower method. It will be great if the author can provide recommendations for clinical researchers and analysis on the choice between ratio-based approach over the Raschpower and vice versa for the simulation conditions investigated.

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

**Quality of written English:** Acceptable

**Statistical review:** Yes, and I have assessed the statistics in my report.

**Declaration of competing interests:**

I declare that I have no competing interests