Author’s response to reviews

Title: Psychometric Properties of Instrumented Postural Sway Measures Recorded in Community Settings in Independent Living Older Adults

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Author’s response to reviews:

Dear Editor,

We would like to thank the reviewers for the high quality and constructive reviews of our manuscript. Please consider our revised manuscript. In this revised version of the manuscript, we highlighted any change in response to comments raised by the reviewers. A detailed item-by-item response to each of the reviewers’ points follows. Our replies below are marked in italics.

Sincerely,

Bader Alqahtani, PhD
Reviewer reports:

A- Eling D. De Bruin, Ph.D. (Reviewer 1):

1- The numbering of the affiliations give the impression six different entities were involved. Is this correct?

That is because we included each authors’ email address. However, according to the BMC Geriatrics guidelines only the institutional affiliation is required so we have renumbered the affiliations. Please see P1

2- Abstract: Add quantitative data from the most important results to the abstract.

We added more details to the abstract. Please see P2, L17-21.

3- Page 3, lines 16-18: This is an important remark. It also hints to the fact that clinicians are mostly interested in individual patients. This requires that assessments are tested on their absolute and relative reliability.

We included results for both relative and absolute reliability. Please see P8, L22-23, P9, L1-5, P11, L10-16, P17, L11-22, and Table 3.

4- Page 5, lines 1-2: Given the aim of this study was to test the ecological validity of balance assessments in the own environment of the subjects it seems odd the participants were invited for their test retest in a standardised study test setting. This seems to be contradictory to the aim. Why were the researchers not actively going out to where the target audience is living and perform the tests in those intended environments?

All of the assessments were done at the participants’ residence facility (clarification has been added in the manuscript). Please see P5, L4 and L8.

5- Page 8, line 5: change "=" to "smaller or equal then"

Done, please see P8, L18
Page 9-10: When the intention is to measure people at their homes through mobile measurement systems the treating clinicians want obviously be able and say something about worsening or improving of an individual patient. This necessitates that we gain knowledge about smallest detectable change and similar measures. Hence, the analysis should be performed for both relative and absolute reliability and Bland-Altman plots should be added.

The absolute reliability of the balance accelerometry measurements for all balance conditions has been addressed using the standard error of the measurement and the minimal detectable change. Also, we have added a representative sample for the Bland-Altman plots. Please see P11, L10-16, Table 3, P17, L11-22, and Figure 1.

Page 15, lines 21-22: The authors express the hope that through technology interventions can be prescribed based on the individual's identified balance deficits. This, again, requires knowledge about the measurements on an individual's level and necessitates reporting both absolute and relative reliability results.

The absolute reliability of the balance accelerometry measurements for all balance conditions has been addressed using the standard error of the measurement and the minimal detectable change. Please see P11, L10-16, P17, L11-22, Table 3, and Figure 1.

B- Amal Wanigatunga (Reviewer 2): OVERALL

The paper examines the use of trunk-placed accelerometry to extract metrics related to postural sway measures. To verify these metrics, participants were instructed to perform various balance and performance tasks with the accelerometer on. The authors conducted reliability and validity statistical testing between accelerometer metrics for these various tasks and found that the trunk accelerometer data can be used to extract standing postural measures that were relatively reliability. I believe the paper is well written but the statistical approach lacked sensitivity analyses that were covariate adjusted. See my comments below. Also, a minor comment but the authors should replace the word "subject" with "participants".


The word “subjects” has been replaced by the word “participants” throughout the manuscript.
ABSTRACT
2-Well written
Thank you

INTRODUCTION
3-Well written
Thank you

METHODS
4- It is not clear how the participants completed the walking tests with eyes closed. Can the authors add this information?

The balance measurements included six standing conditions, and didn’t include any walking task. For the other measurements like the Gait Efficacy Scale, Figure of 8 Walk Test, Six-Minute Walk Test, and gait speed were performed with eyes open only. Please see P6, L1-6.

5-Were any of the statistical tests adjusted for covariates? If not, why not? The SD of age is quite large (7 years, give or take). Also a good proportion of the final analytic sample has 3 or more chronic conditions. I would also think body weight or some measure of it (e.g. BMI) would need to be adjusted because of confounding due to mechanical load on balance and adverse biological underpinnings (e.g., inflammation) that may affect the circulatory and skeletal muscular systems.

The statistical tests were not adjusted for covariates, as the purpose of establishing convergent validity was to examine the raw association, and not an association independent of confounders. However, on the reviewer’s suggestion, we examined the effect of confounding by BMI and age by performing a sensitivity analysis using partial correlations with and without the covariates Adjusting for BMI changed the number of significant correlations as shown in Table 4 by -1 out of 24 tests for the SPPB_b column, -6 out of 24 for the SPPB_t column, +2 out of 24 for the GES column, -1 out of 24 for the F8WT column, -5 out of 24 for the 6MWT column, and -3 out of 24 for the Gait speed column. The sensitivity analysis for the effect of age was similar. In our opinion, these results indicate that BMI and age may influence the relationship between sway and the total SPPB score and Six Minute Walk Test score, but do not affect the overall conclusions about convergent validity. We have included the conclusions from this sensitivity analysis in the text. Please see P14, L19-23.
RESULTS

6-Well written

Thank you

DISCUSSION

7-There is no limitations and strengths paragraph. Please add.

A limitation and strengths paragraph has been added. Please see P19, L10-23.

8-One limitation, somewhat indirectly mentioned in the first paragraph, is a practice effect of physical function measures. This should be mentioned. Better performance on the functional measures one week later may attenuate the ability to detect sway variability within the accelerometer metrics presented in the paper. Otherwise, do the authors have citations that state one week is enough to guard against practice effects?

A practice effect would typically be evident by a reduction in sway during the second testing visit. Since we did not generally find a reduction in sway during the second visit, as indicated in Table 2), it is not likely for this to have occurred. The time interval of one week between test and retest was chosen to make sure that no real change had happened, since most of our participants were participating in the parent study’s exercise intervention program. In addition, a number of previous studies, that have examined the psychometric properties, had used the same time interval which make it easier to compare our results with previous findings. An example for these studies are: Alsubaie et., 2019, Tjernström et al., 2014, Li Z et al., 2016, and Rafał S et al., 2011. Please see P5, L23-24.

9- I think the discussion needs more implications. The paper shows EO and EC results but little was discussed on the similarities and differences. Same goes for level versus foam flooring. Implications on these types of results are helpful, particularly when thinking about assessing balance in clinical settings but also perhaps in at-home settings in which certain scenarios of flooring and vision may occur independently but even jointly.

Details were added in the discussion. Please see P18, L1-6.
10- The audience is typically not aware of the utility of accelerometry. The authors could add a little more about how important ML and AP are. Give examples such as AP is particularly thought of as gait forward and backwards. ML may perhaps be more inline with "sway" when walking forward and backwards (e.g., wobble when walking). Providing context to the measures will help the readers.

Details were added in the introduction. Please see P3, L11-14.

11-Many studies use wrist accelerometry at a large scale. The authors could explain whether the results are translatable to wrist accelerometry or whether there is a need for further research for accelerometry on different body locations.

Our findings are limited only to trunk mounted accelerometers. The accelerometer in the current study was attached to the participants’ lower back at the level of the iliac crest, which approximates the level of the center of mass, as this position has been used by the majority of studies that examined standing balance. In addition, data from wrist-mounted accelerometers that assess static standing balance is limited and the relation between wrist position and the overall body posture is little. We have addressed this in the Introduction P3, L14-16.

TABLE 1

12-Is there information on weight and height? Could BMI be reported?

Information about BMI has been added, please see Table 1.

TABLE 2

13-No comments.

TABLE 3

14-No comments.

FIGURE 1

15-Were EO and EC tested for statistical differences?

Yes, we have already addressed that in the text, P14, L2-13. We also added labels in the figure to indicate significant differences. Please see Figure.