Author’s response to reviews

Title: Center of Pressure Characteristics from Quiet Standing Measures to Predict the Risk of Falling in Older Adults: A Protocol For A Systematic Review and Meta-Analysis

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Author’s response to reviews:

Reviewer reports:

We would really like to thank both reviewers for having read our text in depth and for their useful comments to improve the manuscript. We have done our best to follow their suggestions.

Associate Editor Comments:

Madam Larissa Shamseer,

Thank you for all of your helpful comments which have significantly improved the manuscript. We have done our best to modify the draft according to your remarks; we have explained our changes in the response below.

Yours sincerely,

Damien Ricard
Abstract:

- It would be helpful to please include the method of assessing risk of bias in the abstract

  Abstract page 3 line 15 has been changed to: “Two authors will independently assess the risk of bias for each included article using a 26-item checklist. Funnel plots will be drawn to attest of possible publication biases for each COP parameters.”

- How will funnel plots be used to assess risk of bias of included studies? Please describe this further in the methods section.

  Thank you for this comment. We added the analysis of the funnel plots in the Method section. Page 13 Line 16: “To visualize possible publication bias, funnel plots will be used to represent the estimated effect size of each article against the standard error mean plotted on the vertical axis. A symmetric inverted funnel shape suggests no publication bias. A funnel plot will be drawn for each COP parameter with respect to the type of study (retrospective or prospective)”

Methods:

- the authors have listed many variables for which data will be extracted. Are you able to clarify which variables are measuring/linked to specific review outcomes in table 2?

  To help clarify the list in the paragraph on Page 9 we have added the following table in the supplemental material.

Extracted data domain

General criteria

- Authors

- Title

- Year of publication

- Geographical location of the study

Type-of-study criteria

- Inclusion/Exclusion criteria

- Retrospective or Prospective evaluation of fall
- Consecutive or random inclusion
- Period that study was carried out
- Definition of the fall
- Evaluation of the fall

Participant criteria
- Mean age
- Weight
- Height
- Body Mass Index
- Cognitive test results (especially Mini Mental State Examination – MMSE –)
- Sex ratio
- Sample size
- Living arrangements (i.e. living independently, living in the community, regular medical establishment appointments, outpatient, nursing home, inpatient, group of patients with divers pathologies, mix of profiles, not specified)

Intervention criteria
- Patient condition (i.e. barefoot/with shoes, feet position, eyes open/closed)
- Type of surface (firm or foam)
- Simple or dual task
- Test duration
- Data collection method: measurement tool, sample frequency, resampling, type and cut-off frequency for the filter
- Time interval between the different tests

Comparison criteria
- Faller/Non-faller categorization: based on number of falls
- Test personnel: number, role, training and expertise
- Fall rate during follow-up
- Adverse events

Outcome criteria
- Measured COP features
- Type of modeling for prediction or classification
- Validation of model

Strategy for Data Synthesis:

- may you please state indicate how different study designs (i.e. experimental/observational, prospective/retrospective) will be addressed in the syntheses

  - We have emphasized the distinction between the data that will be used for prediction and prospective measurement of falls and data that will allow diagnostic retrospective classification of fallers and non-fallers.

    o Page 7 Line 1, the sentence has been changed for “Therefore, the main aim of this systematic review is to extract the best biomarkers from COP bipedal quiet stance displacement data in order to (retrospective study) distinguish fallers from non-fallers and so (prospective study) predict fall risk. The second aim is to evaluate the accuracy of currently available predictive and classification models using these biomarkers.”

  - For experimental studies, we propose to add on page 10 line 6, that

    “For experimental studies, the available COP data will be extracted from the baseline measurements that were taken before any intervention had been implemented as long as the history of fall is also available (retrospective classification). If the COP parameters before the intervention are not included, the article will not be analyzed. For observational studies with prospective evaluation of falls, data recorded before the follow-up assessment will used as in the analysis; if measurements were not performed before follow-up, the article will be excluded.”

- Will risk of bias assessments be reflected in the meta-analyses, if done. And if so, how will this be done

  - Yes, the following information has been added regarding the use of the 26-item checklist:
Page 10 line 23 “The risk of bias will be assessed using the value of the percentage scores from the 26-item checklist: score distribution will also be studied to look for a Gaussian distribution or, on the contrary, a trend in favor of the studies included in the meta-analysis. The quality scores will also be used as a parameter of the COP heterogeneity level in the meta-analysis.”

(Page 11 line 8). On the other hand, “If data cannot be aggregated into a meta-analysis or if the results seem contradictory, the best evidence analysis will support articles with the highest score in the risk of bias assessment.”

Reviewer #1:

I read the current protocol for a systematic review and meta-analysis with great interest. The authors aim to address the question if and which COP parameters can best discriminate older people who have fallen and older people who have not fallen. Overall, the protocol is clearly written and the plan seems appropriate to address the aim. The authors have carefully followed the relevant guidelines and generally describe their analysis plan in sufficient detail. I have a few general comments for the authors to consider and some specific remarks listed below.

We thank reviewer 1 for his helpful comments which significantly improve the manuscript. We have done our best to modify the draft accordingly:

General Comments

1) A previous systematic review cited by the authors (Piirtola and Era, 2006) has addressed a very similar aim to the current protocol. I am aware that this review is much older and more studies are no doubt available today on the topic, but I would suggest that the authors outline what this previous review was able to conclude and specify what the current review aims to add in addition to what was already reported.

• Our protocol follows closely the objectives of Piirtola and Era, 2006 and we believe that our analysis will be able to refine the conclusions drawn by this review.

• New data have become available since 2006. The authors included 9 articles in their final analysis but results were contradictory since only half reported that the results related to falls were associated with certain measurements of the force platform whilst the other half did not find any association. Given these highly contradictory results, we hope to have a more comprehensive review on the subject.

In addition, we will enlarge our inclusion criteria to non-prospective studies. The inclusion of only prospective data limits the use of posturographic recording for the diagnosis of older people at high risk of falling. Retrospective data, which should still be analyzed separately from prospective data, could provide additional information to a simple history of falls during clinical
management. For example, it could be used to illustrate a reduction in balance between consecutive medical appointments, once the appropriate parameters are considered. The authors pointed out the limit of the absence of retrospective data as they stated, “thus subjects’ true balance before and during the falls remained unclear”.

In addition, the authors mixed different recording protocols, such as quiet stance or on a moving platform. We believe that strategies for maintaining balance differ between these two types of protocol. This is also why we decided to focus on bipedal quiet stance, which has already shown between-study variability.

Finally, our inclusion criteria differ; we will study older adults (≥ 60y; the cut-off agreed by the United Nations [United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision. New York: United Nations.] and most often used by the World Health Organization to refer to older people [World Health Organization. Global strategy and action plan on ageing and health. 2017.]. We believe that lowering the inclusion age threshold (from 65 to 60 years old) will include more study data without reducing the accuracy for older people. Indeed, the average ages may still be higher than 65 years.

As mentioned by Piirtola and Era, the balance measurement procedure should be described clearly enough to allow a correct analysis of the tests and result variables. In order to do the correct analysis, we list the exact extracted information and then propose a sensitivity analysis which was probably not possible for the authors due to the small number of articles on this topic. We hope that our literature search will allow data aggregation for each calculated parameter while reducing between-article heterogeneity through segmentation by study type (prospective/retrospective), narrow or comfortable stance base width and eye opening.

The work of Piirtola and Era, 2006 was a good approach to the problem that highlighted some parameters to allow the prediction of future falls. However, their study could not compare articles, which hindered the drawing of effective conclusions.

Therefore, our work aims at refining their analysis by proposing a more exhaustive literature search and a quantitative analysis: we hope to be able to highlight key parameters to use and discuss the impacts of recording conditions on COP measurements.

Hence, we added on Page 6 Line 20, the following paragraph:

“In 2006, Piirtola and Era (32) concluded that some COP parameters during bipedal quiet stance could help to predict risk of falls in the elderly. Unfortunately, the results of the nine articles included were contradictory and the measurement protocols used varied widely. Similarly, the narrative review by Pizzigalli et al. (31) reported some COP parameters as fall risk predictors. However, the contradictory results and the absence of quantitative analysis in these two articles limits the application of their conclusions in clinical practice. We hope that a more exhaustive literature search, and a quantitative study based on different recording protocols, will establish which parameters, and under what conditions, are associated with an increased risk of falling. We will seek to minimize protocol heterogeneity in order to draw conclusions that can be applied
in practice. A bipedal quiet stance is a simple test to study balance motor strategy in older adults (28,34) that, unlike unipedal or more complex tests, is more inclusive for an older population as it has a reduced incidence of participant exclusion due to falls during recording (35,36). Nevertheless, ways exist that make the test more challenging: one can add a double cognitive task (37), a soft support with a foam pad (38,39) or asking the participant to close their eyes (40).”

2) I think that it is problematic to combine studies with retrospective and prospective falls monitoring. Statements about prediction of falls using the COP parameters can only be made using the prospective falls monitoring studies. COP parameters may have been altered due to a history of falls in the retrospective studies and may be diagnostic rather than predictive. I encourage the authors to account for this in their plans in some way. There is also an issue with recall bias in retrospective versus prospective falls studies that may influence the results of a meta-analysis.

• We agree with this comment fully; COP parameters may have been altered due to a history of falls in the retrospective studies. In order to avoid any misunderstanding between predictive models and classification models based on retrospective data, precision will be provided in the text regarding the separation of prospective and retrospective data.

Since the analysis of the fall history is a determining factor for the personalized management of patients’ treatments, it is necessary to analyze the COP to decide what course of action to be taken. We plan to make a clear distinction between the types of studies by separating our results between retrospective and prospective studies. We will also highlight in the Discussion the limitations of retrospective studies, such as recall bias for instance. The sensitivity analysis will aim at analyzing the impact of the study methodologies regarding the relevant COP features.

○ PAGE 7 Line 1: a clear distinction between the predictive ability of COP parameters to determine future fallers and their diagnostic ability to distinguish retrospective fallers from non-fallers was added.

“Therefore, the main aim of this systematic review is to extract the best biomarkers from COP bipedal quiet stance displacement data in order to (retrospective study) distinguish fallers from non-fallers and so (prospective study) predict fall risk. The second aim is to evaluate the accuracy of currently available predictive and classification models using these biomarkers.”

○ PAGE 7 Line 10: we added information regarding classification model for retrospective history of fall.

“ - Which parameters should be included in a predictive or a classification model of fall risk assessment for an older population?”

○ PAGE 9 Line 26: A precision was added concerning the predictive model for future fall and the classification model for retrospective history of fall.
which “For predictive (in prospective studies) or classification (in retrospectives studies) models, their characteristics and level of accuracy will also be extracted, when a statistical model has been used.”

3) The introduction and rationale for the review may be strengthened by including discussion on specific mechanisms of balance control that may be better accounted for in specific COP parameters as opposed to the common clinical tests that the authors described.

See Hof (2007) and Maki and McIlroy (1997, 2006), for example:


• Thank you for these publications; they greatly strengthen our introduction. We agree the specific mechanisms of static balance should be discussed. It is particularly relevant to highlight the better description of the COP parameters to study these balance control mechanisms, especially in the context of complex, ageing related neuro-degradation. We therefore added the following precisions:

o PAGE 6 Line 3: we propose to add the following paragraph: “Posturography also provides additional information on specific balance control mechanisms (241.Hof, 2007) and thus constitutes a clinically useful tool to identify those at risk of falling (25). A better understanding of stabilization responses should therefore
allow a more targeted management of the causes of imbalance in older people (262. Maki and McIlroy 1997). COP analysis has been used to determine motor strategies for fall prevention (273. Maki and McIlroy 2006, 28), to reliably distinguish pathologies (29) and to link fear of falling with posturographic parameters (30).

- In order to strengthen the interest in addressing the COP analysis in current practice, we also propose to add the following references to this paragraph:
  
  
  
  - Williams HG, McClenaghan BA, Dickerson J. Spectral characteristics of postural control in elderly individuals. Archives of physical medicine and rehabilitation. 1997;78(7):737-44.

4) Related to the previous point, the reasons for focusing specifically on parameters obtained during stance on two feet is not clearly outlined in the protocol. It is reasonable well established that specifically challenging balance tasks in training can reduce falls risk, so why not also assess COP parameters during single foot stance, for example? They may be more predictive. It would be useful if the authors could clarify their choice on this point.

- We recognize that more challenging tasks increase the ability of COP parameters to detect the risk of falling. One-legged stance-derived COP parameters have been shown to be predictive of the risk of falling [Oliveira MR, Vieira ER, Gil AWO, Fernandes KPB, Teixeira DC, Amorim CF, et al. One-legged stance sway of older adults with and without falls. Stoffregen TA, éditeur. PLoS ONE. 2018;13(9):e0203887.]. However, several authors have pointed out the difficulties associated with making older people undergo unipedal tests compared with only small benefits in favor of their discriminative capacities vs. bipedal tests [Lichtenstein MJ, Shields SL, Shiavi RG, Burger MC. Clinical determinants of biomechanics platform measures of balance in aged women. Journal of the American Geriatrics Society. 1988;36(11):996–1002.; Maki BE, Holliday PJ, Topper AK. Fear of falling and postural performance in the elderly. Journal of gerontology. 1991;46(4):M123-31.].

Furthermore, we would like to explore the value of a simple stabilometric test that can be easily replicated regardless of the available COP recording materials and that is applicable to a weak population so as to be clinically relevant. According to our preliminary research, our target population is predominantly independent and we believe that seeking unipedal tests would create a bias by excluding frailer and older people unable to perform the one-legged task [Michikawa T,
Nishiwaki Y, Takebayashi T, Toyama Y. One-leg standing test for elderly populations. Journal of Orthopaedic Science. 2009;14(5):675-85. Although we acknowledge the unfeasibility of conducting a sensitivity study based on the age or fragility of the patients, due to the current lack of individual data.

Finally, the motor strategies to maintain balance during a one-legged stance could be particularly different from those used for bipedal stance [Jonsson E, Seiger A, Hirschfeld H. One-leg stance in healthy young and elderly adults: a measure of postural steadiness? Clinical Biomechanics. 2004;19(7):688-94.] and, hence, be the topic of another, more specific, systematic review.

In summary, the difficulty of applying these different COP tests to fragile people, the diversity of recording methods, the heterogeneity of the results and the increased complexity of the analysis led us to select only static bipedal tests. We will update the core of this protocol to indicate why we adopted that choice, however, and acknowledge the need for more challenging balance tasks for older people, such as bipedal quiet stance. That is why we will include conditions that can be used to increase the difficulty, such as narrowing the stance base, using foam to decrease sensory information, adding a cognitive dual-task and/or closing the eyes.

• PAGE 6 Line 21: “A bipedal quiet stance is a simple test to study balance motor strategy in older adults (28,34) that, unlike unipedal or more complex tests, is more inclusive for an older population as it has a reduced incidence of participant exclusion due to falls during recording (35,36). Nevertheless, ways exist that make the test more challenging: one can add a double cognitive task (37), a soft support with a foam pad (38,39) or asking the participant to close their eyes (40).”

• The reasons why we only focused on bipedal test are also discussed Page 14 line 3: “We have purposefully chosen bipedal tests because of the applicability of these tests to all older people. Unipedal tests, which are more difficult to perform, tend to exclude frailer individuals who find themselves unable to stand on one leg (60). We do not think that conducting a sensitivity study based on this subgroup of people would be feasible due to a lack of individual data. We also chose to focus only on bipedal tests to reduce the diversity of recording methods used in the articles analyzed; including other methods for other tests would only further complicate the task of analyzing such already-heterogeneous data to obtain reliable results. Finally, we consider it possible that the motor strategies used to maintain balance during a one-legged stance are different from those used during bipedal stance (61) and, hence, a multivariate analysis of bipedal COP tests would be more suited as the topic of a separate, equally specific, systematic review.”

Specific Comments:

1) Title and throughout - I would encourage the authors to use "older adults" instead of "elderly" as the former is generally more acceptable.

• Thank you; we have adopted that terminology throughout the text.
2) Abstract Background: "Currently-available clinical tests are insufficiently sensitive…". I would recommend that the authors adjust this phrase to reflect the fact that they did not discuss all existing tests in their main background text, only selected, common tests.

- We fully agree with the lack of exhaustiveness regarding the clinical tests and we changed the sentences for “Commonly-used clinical tests have limitations when it comes to reliably detecting the risk of falling but existing laboratory tests, such as force platform measurements, represent one method of overcoming this lack of a test.” (Page 3 Line 4)

3) Abstract Background: The specific focus on bipedal stance is not mentioned here, which could lead readers to believe that COP measures from many different standing balance tests will be of interest. I suggest mentioning this.

- We agree and we changed it. PAGE 3 Line 20: we add “Our objective is to identify, through a systematic review and meta-analysis, the COP characteristics of older adults (≥ 60 years old) during quiet bipedal stance which will allow fallers to be distinguished from non-fallers” and Lines 35 and 55 the mention “bipedal” is also added.

4) Abstract Method line 40: Change "synhetized" to "synthesized".

- Thank you for the correction.

5) Abstract Discussion: computerised posturography is mentioned for the first time here. I suggest keeping terminology consistent with the previous sections of the abstract to avoid confusion.

- The term “computerized” has been removed to avoid misunderstanding.

6) Background paragraph 1 line 8: I suggest including a reference to support this statement.

- We added the following references for this statement:

7) Background paragraph 1 lines 15-25: The tests included in this description should be specified at the outset. It should be clear for readers to which tests precisely these limitations apply.
These specifications have been added Page 5 line 7:

“At the time of writing, most commonly used clinical screening tools, such as the Timed Up and Go test (TUG), STRATIFY, Performance Oriented Mobility Assessment (POMA) and the Berg Balance scale (BBS) are retrospectively correlated to a patient’s fall history from previous months (6) but they have been repeatedly shown to lack both sensitivity and accuracy in order to be used prospectively to identify the fall-prone older adults (7–11).”

8) Page 6 line 5: I suggest not making a new paragraph here as the information directly follows from the previous sentence.

• Thank you for this comment. The two paragraphs have been merged.

9) Page 6 line 10: change "stances" to "stance"

• Thank you for the correction.

10) Page 6 lines 20-23: As mentioned above, the study of Piirtola and Era (2006) appears to have addressed this question before. Perhaps the authors can be more specific about the differences between the previous review and the current one.

• As written in the General comments, the difference between their conclusion and our objectives have been added in the following paragraph:

“In 2006, Piirtola and Era (32) concluded that some COP parameters during bipedal quiet stance could help to predict risk of falls in the elderly. Unfortunately, the results of the nine articles included were contradictory and the measurement protocols used varied widely. Similarly, the narrative review by Pizzigalli et al. (31) reported some COP parameters as fall risk predictors. However, the contradictory results and the absence of quantitative analysis in these two articles limits the application of their conclusions in clinical practice. We hope that a more exhaustive literature search, and a quantitative study based on different recording protocols, will establish which parameters, and under what conditions, are associated with an increased risk of falling. We will seek to minimize protocol heterogeneity in order to draw conclusions that can be applied in practice. A bipedal quiet stance is a simple test to study balance motor strategy in older adults (28,34) that, unlike unipedal or more complex tests, is more inclusive for an older population as it has a reduced incidence of participant exclusion due to falls during recording (35,36). Nevertheless, ways exist that make the test more challenging: one can add a double cognitive task (37), a soft support with a foam pad (38,39) or asking the participant to close their eyes (40).”

11) Page 6 lines 23-27 "the main purpose of this systematic review is to extract the best biomarkers from a person's COP displacement results to quantify their future risk of falling". As described in the general comments, if the aim is looking at future risk of falls, I am not sure it is appropriate to include studies with retrospective falls assessment in the meta-analysis.
We believe that determining which COP parameters are disrupted by balance impairment may be of interest to the readers especially since, as highlighted, falls can disrupt balance strategies. Identifying the COP parameters altered by falls would eventually make it possible to offer personalized therapies and that is why we wish to maintain the inclusion of retrospective studies. We fully agree with your point however and we have modified our objectives for this review accordingly (Page 6 Line 7) and have clearly separated the results of the retrospective and prospective studies.

Page 8 Lines 35-40: Will the authors also consider the reliability of the various COP measures reported in the literature? E.g. Lin et al. 2008 Gait Posture 28(2):337-42. Doi: 10.1016/j.gaitpost.2008.01.005

Thank you for this comment. We will assess the external quality of the included studies which contain an item related to the validation of the COP. Also, we will discuss about the variability of the various COP measures as well as the reliability of the different COP parameters. The following sentences have been added on PAGE 13 line 1 in the “Confidence regarding the cumulative evidence” to underline the impact of potential variability on the meta-analysis results:

“Sensitivity analyses will explore the impact of recording settings on the COP results during the quiet standing measurement such as if patients had open or closed eyes, their foot position, standing surface firmness as well as whether the study was prospective or retrospective. The impact of COP measurement variability, due to factors like recording duration or sampling frequency (55), will also be discussed. Inter and intra-participant reliability for the different COP parameters will also be discussed in order to assess their usefulness in clinical practice (56–58). If the data are detailed enough, the causes of falls will be investigated further to determine whether external factors independent of balance disorders were involved in the fall/non-fall status; such external factors could weaken the overall ability of COP measures to predict falls.”

Page 10 lines 34-48: The authors may also consider using software to extract values from graphs when raw data is not available. See, for example: https://automeris.io/WebPlotDigitizer/

This option has been considered but we found that using software, like Plot Digitizer for example, has several flaws concerning its limited reliability. Although this technique could be promising in the future, to date the software allows only a limited percentage of agreement between both raters (about 50%) and original data (about 70% for trained raters) [Jelicic Kadic A, Vucic K, Dosenovic S, Sapunar D, Puljak L. Extracting data from figures with software was faster, with higher interrater reliability than manual extraction. Journal of Clinical Epidemiology. June 2016;74:119-23.]. To the best of our knowledge, there is no guidance for this kind of extraction so far [Vucic K, Jelicic Kadic A, Puljak L. Survey of Cochrane protocols found methods for data extraction from figures not mentioned or unclear. Journal of Clinical Epidemiology. oct 2015;68(10):1161-4.]. After few attempts on the preliminary screened articles, we were not satisfied by the results we obtained from the graph (primarily due to the graphical
quality of the figures) and the excessively time-consuming nature of these processes. We would also rather not extract the data into graphs to avoid introducing new biases.

- In order to discuss the suggestion of the reviewer, these points are now summarized in the text as follow:

  - Page 10 Line 12: “Using software (like Plot Digitizer) to obtain data from figures was not considered as an option to extract data since this technique has been shown to be flawed concerning inter-rater reliability, with only a 50% agreement between both raters and an agreement of 70% with the original data even for trained raters (48). In addition to the time consumption of extracting data by two authors independently, there is no guidance for this kind of extraction so far (49). Therefore, we had rather not extracting the data on graphs to avoid introducing new biases.”

14) General comments on the discussion: The authors may consider the reliability of various COP measures as mentioned above. Additionally, a potential limitation could be a lack of information about the situation that led to the falls in the included studies. Not all falls will be related to insufficient balance control or may have mechanisms unrelated to COP during standing, which will weaken the overall ability of COP measures to predict falls in general. When data is available, a sub analysis of type of fall may be of use.

- We fully agree with this comment and have added a sentence concerning a sub analysis of the type of fall when the data are sufficiently available

- Page 12 Line 20: “If the data are detailed enough, the causes of falls will be investigated further to determine whether external factors independent of balance disorders were involved in the fall/non-fall status; such external factors could weaken the overall ability of COP measures to predict falls. If the heterogeneity for a given COP parameter within the meta-analysis is too great (as measured by $I^2 >50\%$), the decrease of this heterogeneity will be tested by the deletion of studies that use a particular COP recording configurations (with a different material than the other studies included for this parameter for example); the heterogeneity decrease will then be discussed in relation to the study(s) deleted.”

In the discussion, Page 14 line 20, this particular point is now underlined:

“One conceivable, and potentially major, limitation of this systematic review would be a lack of this participant and test protocol information in the included articles. In particular, fall circumstances can be key confounding variables: some COP measures might be associated with falls only under particular circumstances and not others. For parameters where the data are available, we will carry out a sub-analysis stratified by fall circumstances. We will also try to reduce these risks of bias by taking into account the quality of each study and by extracting information regarding the definition and evaluation of ‘a fall’, as well as data about adverse events gathered during the follow-up after from each acquisition protocol.”
Table 1: Population: "Older Adult", Intervention: "Stance", Comparison: "posturography" are terms that I would have expected in the search terms. Are these covered by the current search strategy?

- We added this search terms to the list. Thanks to the reviewer our research is now more exhaustive.

Table 2: Participants criteria: "without neurological disease": Should this be determined by self-report or by a diagnostic assessment?

- We add the statement “Older patients (aged ≥60 years of age) considered to be otherwise healthy / without neurological disease as determined by a diagnostic assessment (or any specification from the authors)” in the table 2.

Table 3: As mentioned above, justification of the intervention criteria would be helpful in the background of the main text.

- Thank you for your comment. We have added two paragraphs to justify our choice of taking into account bipedal quiet stance only:

  o PAGE 6 Line 21: “A bipedal quiet stance is a simple test to study balance motor strategy in older adults (28,34) that, unlike unipedal or more complex tests, is more inclusive for an older population as it has a reduced incidence of participant exclusion due to falls during recording (35,36). Nevertheless, ways exist that make the test more challenging: one can add a double cognitive task (37), a soft support with a foam pad (38,39) or asking the participant to close their eyes (40).”

  o Page 14 line 3: “We have purposefully chosen bipedal tests because of the applicability of these tests to all older people. Unipedal tests, which are more difficult to perform, tend to exclude frailer individuals who find themselves unable to stand on one leg (60). We do not think that conducting a sensitivity study based on this subgroup of people would be feasible due to a lack of individual data. We also chose to focus only on bipedal tests to reduce the diversity of recording methods used in the articles analyzed; including other methods for other tests would only further complicate the task of analyzing such already-heterogeneous data to obtain reliable results. Finally, we consider it possible that the motor strategies used to maintain balance during a one-legged stance are different from those used during bipedal stance (61) and, hence, a multivariate analysis of bipedal COP tests would be more suited as the topic of a separate, equally specific, systematic review.”

Table 3: Equipment criteria: One could expect very different levels of data quality/reliability between, for example, force plates and pressure insoles. Perhaps the authors wish to mention how they would deal with or analyse the results from studies using such different methodology?
• We will add studies that extract COP trajectory using pressure insoles. In fact, if any new technology that allows COP measurement and parameter recording is discovered in the literature, we agree we should include these data in the meta-analysis. If the heterogeneity for any given COP parameter in the meta-analysis is too high, we will re-assess the impact of removing studies using particular COP recording setups.

• This statement has been added on Page 14 Line 1: “If the heterogeneity for a given COP parameter within the meta-analysis is too great (as measured by $I^2 >50\%$), the decrease of this heterogeneity will be tested by the deletion of studies that use a particular COP recording configurations (with a different material than the other studies included for this parameter for example); the heterogeneity decrease will then be discussed in relation to the study(s) deleted.”