Author's response to reviews

Title: Dual-Tasking and Gait in People with Mild Cognitive Impairment. The effect of Working Memory

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Title: "Dual-Tasking and Gait in People with Mild Cognitive Impairment. The effect of Working Memory"

Response the reviewers comments

Editor, BMC Geriatrics

Dear Editor,

We are pleased to send you a revised version of our manuscript. The co-authors and I wish to thank you and reviewers for their perceptive, constructive and detailed review. We have carefully revised our manuscript to address the issues that you and the reviewers have noted. After following the reviewers’ suggestions, we believe that the result is a substantially improved manuscript, for which we thank the reviewers again. Below, you will find our answers point by point to the concerns and critiques raised. We hope that our responses will satisfy the reviewer comments.

Yours sincerely,

On behalf of the authors,

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Reviewer #1: Louise Waite

Reviewer's report:
This paper examines the association in subjects with MCI between cognitive measures and 3 gait speeds: normal and under two dual task paradigms (one with verbal fluency and the other with counting backwards). The study identified that gait velocity was reduced in all three gait tests in those with poorer performance on a task of working memory.

Major compulsory revisions:

1. Justification for TMT B-A should be provided and referenced.

   Response 1 The reviewer is correct in her consideration and we provided the justification and reference in “Methods” section of the revised version. We have used Trails B-A to isolate the executive functioning component since B-A minimizes visuoperceptual and working memory demands, providing a relatively pure indicator of executive control abilities.

2. LNS in WAIS 4 recommended to age 70. Please comment on its choice given mean age of 77.

   Response 2. The version of the LNS task that we used was from the WAIS-III, which is normed for older adults up to age 89. Thus, it was appropriate for use in our sample. WAIS IV was not available when we conducted the study.

3. The effects on gait velocity are very small for TMT B and TMT B-A are these clinically meaningful? For example in count gait velocity unadjusted TMT B-A is 0.000 +/- 0.000 with a p of 0.038. The authors need to comment on the clinical significance of this and what clinical utility such small differences are. In view of these small effects the conclusion that executive functioning is associated with declines in gait speed needs to be modified. The association with working memory is more consistent.

   Response 3. We do agree with the reviewer that the effects on executive function showed a small slope in the association and that the effect were more consistent in working memory. However, this effect was statically significant in our study. Additionally, the parameter estimate of -0.0004 of the negative correlation between executive function (TMT B) and the three GV (r=-0.47, p-value=0.038) means that for every 100 seconds of increment in the TMT
B performance, GV went down by 4 cm/s which is clinically relevant change on GV (1). In our sample the range of the TMT B was between 55 and 539 seconds. The upper quintile has a mean of 60 sec while the lowest quintile a mean of 400 sec. Therefore, the differences between performance in TMTB is in the range of 320 seconds which represent in change on GV of 13cm/s. A sentence clarifying this significance was added in Results of the revised version.

4. Ranges for variables in Table 1 would be beneficial in addition to means and SDs.

Response 4. We added the ranges of the variables in Table 1, as suggested.

5. Was diagnosis of MCI independent of the cognitive tests that gait was correlated with? If so this should be stated.

Response 5. The diagnosis of MCI was given prior to the gait testing and corroborated at baseline assessment. The cognitive tests presented in this manuscript were performed only for the purpose of this study.

6. From the memory definition of MCI, it is presumed that all with MCI had an amnestic component. Was there any attempt to define whether other domains were affected and then assessing the impact of this upon gait speed ie comparing amnestic vs amnestic/multi-domain MCI?

Response 6 The effect of grouping participants in amnestic and non-amnestic MCI was explored and no significant differences were found, although the study was not powered for this analysis

7. Was there any association between global cognitive scores eg the MoCA and MMSE with the different gait speeds? If so does this suggest that greater degrees of deficit are associated with slower gait speeds and poorer performance on dual task paradigms?

Response 7 Associations were explored as secondary analysis for the global MocA Score, global MMSE, and for the delay recall score of the MoCA and no significant differences were found. Although, our study was not powered for this analysis
8. The conclusion states that dual task paradigms may predict progression to dementia. There is no data from this cross-sectional study to support this but it certainly should be examined in this population longitudinally. The concluding statement should be modified to reflect this.

Response 8 We do agree with this comment and the concluding statement has been deleted in the revised version.

Minor compulsory revisions:
There are several grammatical errors that require correction including;
1. Page 2, Para 2: “while in engaging” should be “while engaging in”
4. The abbreviation GV is used in the abstract without defining it.

- The grammatical and spelling errors were corrected

5. It is unusual to reference figures and tables in the discussion. Please revise this.

- References were revised and we took out any reference to tables or figures in the “Discussion” section.

Level of interest: An article whose findings are important to those with closely related research interests
Quality of written English: Needs some language corrections before being published
Statistical review: No, the manuscript does not need to be seen by a statistician.

Reviewer #2: Nicola Lautenschlager

Reviewer’s report:
1. The main problem with this paper is that it does not use a control group. Whilst the topic and the research idea is of interest to the field the lack of control group makes a meaningful interpretation of the results difficult. Without the control group it is unclear whether the results reported represent a general ageing effect or whether they are specific for MCI, but not seen in healthy people. From this point of view the main finding that people with MCI who have to do multi-tasking will do less well than concentrating just at one task at a time is hardly surprising or new.
Response 1. We do completely agree that a limitation in our study is the lack of control group. A sentence has been added in this regard in limitations of the “Discussion” of the revised version. However, our main objective was to look for intra-group differences in a MCI population. A similar design without control group has been used also in previous cross-sectional studies evaluating gait and dual-tasking performance in community dwelling older adults and in frail older adults (2,3).

2. Introduction: MCI should be discussed more in its complexity that is that not all patients with MCI progress to dementia (as opposed to the 2nd sentence of the introduction).

Response 2. MCI concept has been further discussed and the “Introduction” has been changed, accordingly.

3. Methods: details should be given on the power analysis. How was it done and what sample size was calculated?

Response 3. “Power and sample size calculations were conducted using the PROC POWER procedure, MULTREG option for multiple linear regression. A sample size of 60 subjects was estimated to provide > 70% to detect a moderate to large effect of the predictors of interest. This calculation was based on an R-square difference of > 0.1 between the model with adjustment variables (age, gender and falls) and the model including the test predictor.” We have attached the actual calculations with this rebuttal letter and a sentence clarifying power and sample size calculations was added to “Methods” of the revised version.

4. Discussion: the discussion should address the fact that there is no control group and therefore interpret the findings carefully. Is there any literature to show changes like this in normal older people without MCI?

Response 4 In limitations of the “Discussion” section of the revised version we have further address this issue. However, our main objective was to look for intra-group differences and for the relations with specific performance on gait and cognition, as described in previous cross-sectional studies evaluating gait and dual-tasking performance in community dwelling older adults and in frail older adults(2,3). Previous studies comparing younger subjects and normal older subjects have shown changes and dual tasking costs but to a lesser degree(4). No associations with working memory were reported(4).
- Minor Essential Revisions
In the abstract the abbreviation “GV” should be explained.

Abbreviation was explained

Level of interest: An article whose findings are important to those with closely related research interests
Quality of written English: Acceptable
Statistical review: No, the manuscript does not need to be seen by a statistician.

Reviewer #3: Keith Hill
Reviewer’s report:
This is a well written paper in an emerging area of research interest. The research aims are well described, and a sound method has been utilised to address these. In particular, the detailed series of cognitive and executive function assessments are well selected. The method of testing, with practice trials, and counterbalancing of order of trials is good.
A limitation of the paper (though relatively minor) is that the thoroughness utilised in determining the suite of cognitive and executive function assessments is not matched with the assessments of the other key domain of assessment - that being gait. Gait velocity is certainly a widely used indicator of mobility, and the two dual task conditions are well justified in the paper. However, there are a range of other temporal-distance measures of gait that can be derived, some of which may provide as good or better discrimination of gait performance changes in MCI, with and without dual task conditions. Several computerised systems (eg GaitRite) are available that provide quick quantification of a range of temporal and distance gait parameters. In particular, measures of double support duration and step width as indicators of stability during gait may be as good or better indicators. This is a limitation of the study and direction for future research, that should be included in the discussion.

Response. We thank to the reviewer for his constructive and positive review. We added in discussion a paragraph concerning the limitation of clinical quantitative gait analysis vs high tech quantitative gait analysis, as suggested.

Major compulsory revisions:
Nil
Minor essential revisions:
1. don’t use abbreviations that have not been defined in the abstract - spell out GV (Methods, line 2)
2. Abstract - Method - add sample profile (mean age, gender) to the abstract.
3. Abstract - Results - first sentence - reword - change text to read "Participants experienced a reduction in GV while ENGAGING IN dual-task challenges ..."
4. Abstract - Conclusion - last sentence - change text from "...that cortical control of gait is affected by decline ..." to "that cortical control of gait is associated with decline ..."
5. Throughout the paper: referencing throughout needs to be corrected to have a space consistently before the square brackets.

The grammar and spelling mistakes outlined above were corrected in the revised version

6. Method, page 7, gait assessment section, line 4 - change "centiseconds" to "milliseconds".

   Our chronometer has a discrimination equal to one hundredth of a second, thus, centiseconds was kept.

7. Method - Describe how falls data was collected.
   **Response 7.** Falls were retrieved by self report.

8. Results section, page 8, line 4 - describe how the speeds were selected for the three walking speed groups - were these based on other reported literature, if not, what was their basis? The slow group only had n=4, which limits the usefulness of this grouping in any analyses.

   **Response 8.** The rationale for grouping our subjects according to their baseline usual gait velocity was done based on previous studies which determined that GV equal above 1m/s are normal and below 0.8 are slow (5-7). This was done only for descriptive purposes and not included as a variable for in the analysis.

9. Results section, pages 8-9 - Comment is made about the scores on various cognitive / executive function tasks relative to normal scores, but this comparison is not made for gait velocity. Make a comment about how the single task gait velocity for this sample relates to gait velocity for a healthy older sample.

   **Response 9.** We added a comment and references about the distribution of the gait velocity in this sample in the results section of the revised version.
10. Discussion: Include a comment under the limitations section of the discussion that gait velocity is only one of a range of temporal-distance gait measures that could be investigated using this study design, and that future research could evaluate whether other temporal-distance gait measures might be as discriminative or more discriminative in early MCI of gait changes associated with dual task.

Response 10. We added a sentence in limitations stating that gait velocity was assessed using a stopwatch and without using an electronic walkway; therefore, other quantitative gait variables beyond velocity were not available for analysis.

11. Table 1 - the proportion of the sample reporting falls is low relative to the general population aged greater than 65, suggesting self report of this measure is likely to be poor in this group. Given that this measure is used in the linear regression, there should be mention in the discussion as this being a potential limitation, with future studies considering prospective recording of falls with falls diaries, with career validation of falls data, to overcome this.

Response 11. This issue has been addressed in limitations of the “Discussion” section in our revised version.

Discretionary revisions:
1. Abstract - conclusion - change the term "elderly" to "older people" (also elsewhere in the paper where the term "elderly" is used.
2. Methods, page 5, 4th last line - consider adding "and cognitive impairment" to the statement that depression may affect gait performance.

We have done the discretionary changes in our revised version.

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.

Reference List


