Author's response to reviews

Title: Falls and Falls Efficacy: The Role of Sustained Attention in Older Adults.

Authors:

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Author's response to reviews: see over
7th November, 2011

RE: MS: 7265475605783961, entitled "Falls and Fear of Falling: The Role of Sustained Attention in Older Adults."

Dear Dr Arlene Pura,

Thank you very much for considering our manuscript for publication and for the very helpful and detailed comments from you and from the reviewers. We would very much like to accept your offer to resubmit a revised version of the manuscript.

We have revised the manuscript taking into full consideration all of the comments of the reviewers, and we include below an itemized, point-by-point response to their comments.

We hope that this revised version of the manuscript will be to your satisfaction and we look forward to hearing from you.

Best regards,
Dr Aisling O’Halloran.
**Editor Comments:**

**Editor: Arlene Pura**

**General comments**

In addition to the reviewers' comments, I would urge the authors to reconsider their use of the term "fear of falling". They used a falls efficacy measure and not a measure of fear of falling. The two constructs are distinct although they are often used interchangeably which is probably not correct. I would recommend that the authors see the following article for a more detailed discussion of this issue:


**Reply:**

We have reconsidered our use of the term “fear of falling” and have replaced it with “falls self efficacy” or “lower falls efficacy”, throughout the manuscript. Also, we take into account the recent discussion in the literature regarding the distinctions between these two constructs. This is outlined in the “Background” and “Discussion” sections of the paper.

See Page 4, Background, Paragraph 2. “Low falls-related self efficacy (loss of one’s confidence to perform activities of daily living without falling) and fear of falling are significant psychological consequences of having fallen [4]. While low falls efficacy and fear of falling were traditionally considered interchangeable concepts, more recent evidence indicates that they are correlated but distinct dimensions [3,5,6]. Both low falls efficacy and fear of falling are associated with previous and future falls [7-12], however falls efficacy is a stronger predictor of falls and can be considered a mediator between fear of falling and falls [12]. Interestingly, fear of falling has been reported in older people who have not fallen suggesting that factors other than falls history may influence the manifestation of fear of falling among older people [9,13].”.

See Page 17, Discussion, Paragraph 2. “…………..This is difficult to interpret but perhaps here lower falls efficacy may be mirroring fear of falling, which is reported by 20-85% of community-dwelling non-fallers [54]. Fear of falling is correlated with low falls efficacy, and factors other than a previous fall can induce both outcomes in older adults. The interaction between falls and lower falls efficacy, and the influence of gender and age, is in keeping with previous studies, suggesting that sustained attention and falls efficacy may be interacting to influence falls risk [7-9,55]”.


Reviewer Comments:
Reviewer #1
Reviewer: Jasmine Menant
Reviewer's report:

Minor essential revisions

Methods

1. Paragraph 1, page 7: Please specify what the inclusion and exclusion criteria for this study were. In the discussion, it is mentioned that none of the participants had a history of stroke or dementia (p 15), however this is not specified in the methods. Was there any cut-off score for the MMSE?

Reply:
We have specified the inclusion and exclusion criteria for this study in the “Methods” section under the subheading “Participants”. Included was an MMSE score cut-off of ≥ 23.

See Page 9, Methods – Participants:
“All 624 participants were ≥ 60 years old, community-dwelling, medically stable, without a history of stroke, or dementia (MMSE score ≥23), able to walk independently (with or without aids), and able to provide written informed consent. Participants were not asked to stop any of their usual medications, fast, or modify lifestyle habits before assessment. Of these, 500 individuals were offered additional cognitive tests including the Sustained Attention to Response Task SART [37], of which 458 successfully completed this task. The 42 participants who did not complete the task did so due to fatigue or a lack of understanding of the task instructions”.

2. Paragraph 1, page 7: For each instrument used (HADS, CES-D CFQ…), please specify the minimum and maximum score achievable as well as what a high / low score indicates. Where possible, also add references of studies that developed these scales.

Reply:
We have provided an explanation for each of the physical, psychosocial and cognitive tests measured and we indicated whether higher scores signify better or worse performance on the test. Minimum and maximum scores are provided for each of the scale tests, as well as the number of items on each of the scales. References for each test are also included in the Methods and Reference sections.

See Page 7-8 : Methods – Physical, psychosocial and cognitive measures: “Physical measurements included age, gender, weight (kg) and height (cm). The timed up and go test (TUG): measured the length of time (seconds) taken to get up from a sitting position, walk 3 metres, turn around, walk back and resume a sitting position. It is a widely used measure of gait and balance in older people, with longer TUG times (>11 seconds) associated with a higher risk for falls [43]. The Berg balance scale (BBS): a 14-
item scale that measured balance among older people by assessing their performance on functional tasks. Higher scores indicated better balance with minimum and maximum scores of 0 to 56 [44]. The activities of daily living scale (ADL): an 8-item scale that measured the ability to perform daily self-care activities e.g. self-washing, dressing and feeding, as measure of functional status and/or disability. Higher scores indicated better functional activity with minimum and maximum scores of 0 to 24 [45]. The instrumental activities of daily living scale (IADL): a 9-item version of the scale was used which is not a measure of fundamental functioning, but of an individual’s ability to live independently in a community. Higher scores signify greater independence with minimum and maximum scores of 0 to 27 [46]. Polypharmacy was determined by the use of ≥ 4 medications daily. The Charlson co-morbidity Index (CCI) was used to classify and score the number of comorbid conditions and is a measure of disease burden. Higher scores indicate greater comorbidity and increased mortality risk with a range in this study sample of 0 – 12 [47].

Psychosocial measures included the anxiety section of the Hospital Anxiety and Depression Scale (HADS), which is a 7-item scale with higher scores reflective of greater levels of anxiety and with minimum and maximum scores of 0 to 21 [48]. A simplified 8-item version of the Center for Epidemiologic Studies Depression scale (CES-D) was used to measure depression. Higher scores reflected increasing levels of depression with minimum and maximum scores of 0 to 8 [49].

Measures of cognitive function included the mini-mental state examination (MMSE) as a measure of global cognition with higher scores to a maximum of 30 indicating better levels of cognition [50]. The cognitive failures questionnaire (CFQ) is a 25-item scale that measured self-reported absentmindedness or everyday lapses in perception, memory, and motor function. Higher scores reflect increasing levels of absentmindedness or cognitive lapses, with minimum and maximum scores of 0 to 100 [51].”

Also Page 20, References:


3. Paragraph 2, page 7: Given that the falls data were collected retrospectively, the classification of fallers into faller-12 months and faller-6 months might not be very accurate. This might need to be acknowledged in the limitations.

Reply:
We have refined the faller type category to include just non-fallers, single fallers and recurrent fallers in the past year. This is a more conventional definition of faller type and has been previously published in other studies of cognitive profiles in older adults.

Please See References:

See Page 11, Method – History of Falls:
“Participants who experienced one or more falls in the previous twelve months were classified as a faller (n = 197). Non-fallers had not experienced a fall in the last twelve months (n = 261). Participants were further categorised by faller type: non-faller (n =261, no falls in previous twelve months); single faller (n = 120, one fall in previous twelve months) and recurrent faller (n = 77, two or more falls in previous twelve months) [23,52].”

See Page13-14, Results – Faller Type and Figure 2:
“A comparison of the SART measures between non-fallers, single fallers and recurrent fallers is shown in Figure 2. One-way ANOVA testing revealed that mean RT differed significantly with faller type (F(2, 458) = 7.48, p = 0.001). Mean RT increased for both single (413 ms, p = 0.008) and recurrent fallers (420 ms, p = 0.006), compared to non-fallers (380 ms). A similar pattern was seen with respect to the RT variability measure SDRT (F(2, 458) = 4.73, p = 0.009). Once again variability was greater for single (174 ms, p = 0.046) and recurrent fallers (179 ms, p = 0.042), compared to non-fallers (150 ms). The FFV measure of variability also differed significantly with faller type (F(2, 384) = 6.99, p = 0.001). This time the greatest difference was between non-fallers and single fallers (p = 0.004) although there was also a significant difference between non-fallers and recurrent fallers (p = 0.024). Finally there was a global association between faller type and omission errors (F(2, 458) = 5.63, p = 0.004). Mean omission errors increased
from 12 (non-fallers), to 16 (single fallers, p = 0.184), to 21 (recurrent fallers, p = 0.005). There were no statistical differences in SLV or commission errors.”.

See Page16, Discussion, Paragraph 2:
“We next investigated faller type and found that mean and variability of reaction time, and omission errors, again differed markedly. The strongest differences were observed for recurrent fallers compared to non-fallers, although single fallers also differed significantly from non-fallers. In contrast, the strongest difference in the fast (moment to moment) component of variability were between single fallers and non-fallers, although significant differences between recurrent and non-fallers were also observed. These results are consistent with reports of other cognitive profiles in recurrent and single event fallers [18, 23]. The lengthening of reaction times, accompanied by increasing variability in reaction time and higher omission error rates may indicate that lapsing sustained attention may already have begun to manifest itself in those who have experienced just one fall. These results also suggest that insufficiencies of sustained attention are even more pronounced in recurrent fallers because recurrent falls are more likely to be indicative of neuropathology than a single fall [18]”

See Page19, Discussion, Paragraph 1:
“Falls history in the past twelve months was self reported and thus we must acknowledge that it may be subject to the recall bias inherent to retrospective falls data collection, whereby falls are underreported or forgotten. However, previous studies have shown that 12-month self-reported falls history had high specificity with respect to the gold standard of prospective falls assessment, especially for a cognitively intact sample of older adults without a history of dementia, which this study sample was [23,52,58]”.

4. Statistical analysis, pages 9 and 10: It is not clear from this paragraph what the dependent variables in the logistic and linear regressions are.

Reply:
We have stated more clearly that the dependent variable for the multivariate logistic regressions was the binary variable of Non-Faller versus Faller.

See Page 12, Statistical Analysis, Paragraph 1:
“Multivariate logistic regression analyses with non-faller versus faller as the binary dependent variable were performed. Each SART variable was included as an independent variable in separate regression models along with age and gender to allow for the contribution of these factors. For independent variables which remained in the model as significant factors associated with falling, p-values, odds ratios (OR) with 95% confidence intervals (CI) were provided”.
Results
5. Given that according to table 1 the two groups differ significantly in age and men/women ratio, I wonder why the statistical analyses of the SART-related variables were not adjusted for these two major confounders. The authors could add asterisks to the data on table 2 to indicate where the significant differences remain after controlling for age and gender in an analysis of covariance.
Similarly, asterisks should be added to table 3 to illustrate whether the correlations remain after controlling for age (partial correlations).

Reply:
We adjusted for the major confounders of gender and age which were indicated as highly associated with fallers in table 1. We did this by performing logistic regression analyses. The results of the regression modelling adjusting for age and gender are summarised in a new version of table 2 on Page 33 with asterisks indicating the SART variables significantly associated with Fallers.
To illustrate whether the correlations between MFES score and SART measures in fallers and non-fallers remain after controlling for age and gender we performed partial correlations as suggested by the reviewer. Instead of summarising these results in table 3 using asterisks to indicate the significant partial correlations, we have instead included the significant partial correlations in the Results section. Table 3 has been removed.

See Page 12, Statistical Analysis, Paragraph 1 and 2:
“Multivariate logistic regression analyses with non-faller versus faller as the binary dependent variable were performed. Each SART variable was included as an independent variable in separate regression models along with age and gender to allow for the contribution of these factors. For independent variables which remained in the model as significant factors associated with falling, p-values, odds ratios (OR) with 95% confidence intervals (CI) were provided”……

……………….. Spearman rho (rs) correlations were computed between MFES score and the SART measures. Partial correlations between MFES score and the SART measures with age and gender partialled out were also performed”.

See Page 13, Results – Fallers versus Non-fallers, Paragraph 2:
“There were significantly more female fallers compared to male fallers (58.4% versus 34.6% respectively; $\chi^2(1) = 21.73$, p < 0.001). Also, fallers were significantly older (t(458) = 7.26, p < 0.001) compared to non-fallers as can be seen from Table 1. The results from binary logistic regression models between non-fallers and fallers including each of the SART variables adjusting for age and gender are shown in Table 2. Only mean RT ($p = 0.038$, OR = 1.00, 95% CI: 1.00 – 1.01) and FFV ($p = 0.009$, OR = 1.14, 95% CI: 1.03 – 1.26) were significant factors associated with falls in the past year along with age and gender”

See Page 33, Table 2:
The regression modelling adjusting for age and gender are summarised in a new version of table 2.
See Page 14-15, Results – Falls Efficacy, Paragraph 2:
“Fallers had lower mean MFES scores compared to non-fallers (8.85 versus 9.56, p < 0.001) and females had lower MFES scores compared to males, (p < 0.001). MFES score was also significantly correlated with age (rs(566) = -0.300, p < 0.001). Partial correlations were performed between MFES score and the SART measures in fallers and non-fallers, with age and gender partialled out. Only mean RT (r(261) = -0.159, p = 0.012) and FFV (r(261) = -0.122, p = 0.073) remained weakly correlated with MFES score and only in the non-faller group”.

6. Paragraph 2 page 11: “falling and female gender [...] female versus male group”: this sentence is unclear.

Reply:
This sentence has been replaced to clarify the meaning.

See Page 13, Results – Fallers versus Non-fallers, Paragraph 2:
“There were significantly more female fallers compared to male fallers (58.4% versus 34.6% respectively; χ²(1) = 21.73, p < 0.001). Also, fallers were significantly older (t(458) = 7.26, p < 0.001) compared to non-fallers as can be seen from Table 1”.

7. Paragraph 2 page 12: “Increasing SDRT; p=0.002 [...]”: this is unclear. In addition, according to Table 3, the correlations between SDRT and MFES for non-fallers and fallers (p=0.03 and p=0.012) are both below 0.05, thus presumably significant. In fact, none of the p-values given in Table 2 appear to correspond with those written in this paragraph of the results. Please clarify.

Reply:
This paragraph has been rewritten to clarify the meaning. None of the results in this section now refer to a table.

See Page 14, Results – Falls Efficacy:, Paragraph 1
“Lower MFES scores were correlated with longer mean RT in both fallers (rs(197) = -0.195, p = 0.007) and non-fallers (rs(261) = -0.203, p = 0.001). RT variability (SDRT) was also significantly and negatively correlated with lower MFES scores in fallers (rs(197) = -0.182, p = 0.012) and non-fallers (rs(261) = -0.137, p = 0.030). Similarly, higher values of FFV were correlated with lower MFES scores in both fallers (rs(197) = -0.173, p = 0.034) and non-fallers (rs(261) = -0.196, p = 0.004). SLV was correlated with MFES score in non-fallers only (rs(261) = -0.162, p = 0.016). Higher numbers of omission errors, were also significantly correlated with lower MFES scores in both fallers (rs(197) = -0.190, p = 0.009) and non-fallers (rs(261) = -0.143, p = 0.023). Commission errors were not associated with MFES score in fallers or non-fallers”.

8
Discussion
8. The limitations of the study involve the recall bias inherent to retrospective falls data collection and which the authors should acknowledge, especially as the fallers were further divided in groups.

Reply:
We have highlighted the subjective recall bias inherent to retrospective falls data collection whereby falls may be forgotten and thus underreported and we acknowledge this in the limitations paragraph of the discussion. We also note that our study population were cognitively intact and we now only include non faller, single faller and recurrent faller over the last twelve months. We have removed the faller 6-months classification from our analysis as it is more subject to recall bias. We also cite the reference of Cummings SR, Nevitt MC, Kidd S. Forgetting falls. The limited accuracy of recall of falls in the elderly. J Am Geriatr Soc 1988; 36:613-6.

See Page 19, Discussion – Paragraph 1
“……………Falls history in the past twelve months was self reported and thus we must acknowledge that it may be subject to the recall bias inherent to retrospective falls data collection, whereby falls are underreported or forgotten. However, previous studies have shown that 12-month self-reported falls history had high specificity with respect to the gold standard of prospective falls assessment, especially for a cognitively intact sample of older adults without a history of dementia, which this study sample was [23,52,58]”.

Tables and Figures
9. Table 2 and Figure 1 present the same data and therefore are redundant; use either one to display the results.

Reply:
We have kept figure 1 which presents the SART measures in fallers and non-fallers. We have replaced table 2 with a new summary table of the age and gender adjusted logistic regression analyses of the SART variables in fallers versus non-fallers.

See Page 33, Table 2:

Discretionary revisions
Abstract:
1. The first two sentences of the abstract could be taken out as the facts presented are well documented; the abstract could start with “Previous evidence [...]”.

Reply:
We have removed the first two sentences of the abstract as suggested.

See Page 2, Abstract – Background:
“Previous evidence indicates that older people allocate more of their attentional resources toward their gait and that the attention-related changes that occur during aging increase the risk of falls. The aim of this study was to investigate whether performance and
variability in sustained attention is associated with falls and fear of falling in older adults.”.

**Introduction:**
2. *The introduction could be more concise, going straight to the background relative to attention and falls followed by the rationale for the study and aims, i.e. the 1st and 2nd paragraphs could be cut down to a sentence each.*

**Reply:**
The first two paragraphs have been abbreviated to a short first paragraph.

See Page 4, Background – Paragraph 1

“One-third of people over the age of 65 have at least one fall each year and almost half of these experience more than one fall [1,2]. Falls are a major cost to healthcare systems worldwide and have significant adverse impacts both physically and psychologically on the older person. Following a fall, older people often voluntarily restrict their activity fearing a reoccurrence. This reduction in exercise leads to further weakness that in turn increases the risk of another fall — a vicious cycle [3]. Currently, intervention strategies targeted to known risk factors only result in a 30-40% reduction in the reoccurrence of falls after one year [4-6]. This highlights the need to identify additional risk factors which contribute to falls and provide novel interventions to lower falls risk more effectively”.

**References**
3. *There is more recent major work on fear of falling that could be cited, see papers from Delbaere et al.*

**Reply:**
We have included more recent work which highlights the distinctions between falls efficacy and fear of falling which had been previously lacking in our paper.

See Page 4, Background – Paragraph 2:

“Low falls-related self efficacy (loss of one’s confidence to perform activities of daily living without falling) and fear of falling are significant psychological consequences of having fallen [7]. While low falls efficacy and fear of falling were traditionally considered interchangeable concepts, more recent evidence indicates that they are correlated but distinct dimensions [3,8,9]. Both low falls efficacy and fear of falling are associated with previous and future falls [10-15], however falls efficacy is a stronger predictor of falls and can be considered a mediator between fear of falling and falls [15]. Interestingly, fear of falling has been reported in older people who have not fallen suggesting that factors other than falls history may influence the manifestation of fear of falling among older people [12,16]”.

See Page , References:


Reviewer Comments:
Reviewer #2
Reviewer: Kim Delbaere
Reviewer's report:

1. My main issue is related to the population sample.
- Could you please provide detail on the recruitment strategy of the people attending the TRIL clinic?

Reply:
We have revised the Methods section to more clearly explain how participants were recruited to the study.
See Page 7, Methods – Setting, paragraph 1:
“A convenience sample of 624 men and women aged ≥ 60 years underwent a comprehensive multidisciplinary geriatric assessment at the Technology Research for Independent Living (TRIL) Clinic, St James’s Hospital, Dublin, Ireland, between August 2007 and May 2009. The majority of participants (66.8%) were self-referrals for ‘‘health check’’ attracted by the TRIL Centre website (http://www.trilcentre.org) or articles in the local media. The remainder (33.2%) were referred from medical and health professionals for further assessment of participants with a history of falls. Participants did not have familiarization visits, but prior to attendance they had a telephone conversation with the clinical nurse specialist explaining the content of the scheduled visit”.

- It is unclear what the representativeness of this ‘convenience’ sample is towards the general population. Looking at Table 1, it seems that the proportion of female participants is quite high (>70%) and the physical characteristics imply that the sample comprises relatively fit, healthy older adults.

Reply:
We have attempted to clarify inclusion/exclusion criteria and to provide a better description of the participants in the Methods section:

See Pages 9, Methods – Participants, Paragraph 1:
“All 624 participants were ≥ 60 years old, community-dwelling, medically stable, without a history of stroke, or dementia (MMSE score ≥23), able to walk independently (with or without aids), and able to provide written informed consent. Participants were not asked to stop any of their usual medications, fast, or modify lifestyle habits before assessment. Of these, 500 individuals were offered additional cognitive tests including the Sustained Attention to Response Task SART [37], of which 458 successfully completed this task. The 42 participants who did not complete the task did so due to fatigue or a lack of understanding of the task instructions”.

Also please refer to Table 1 on Page 32.
In addition we treat the representativeness of the study population and the higher percentage of females in the sample among the limitations of the study in the Discussion section.

See Pages 18-19, Discussion, Paragraph 3:
“This study was a convenience sample of medically stable, community-dwelling older adults who were able to walk independently (with or without aids), and may be a potential design limitation. It may be considered more representative of a relatively well sample of older adults rather than representative of the general population over 60 years which would include non-mobile, medically unwell and non-community-dwelling individuals. There were also a high percentage of females in the sample, which can be explained for two reasons. Firstly, this convenience sample was two-thirds self-referred and older females are more likely to engage in volunteered participation than older males. Secondly, one-third of the sample was medically referred with a history of falls and females are more likely to fall and require medical treatment than males”.

- Could you provide a rationale as to why the 168 people who could not complete the SART were excluded from the paper? Considering the size of this subsample, this seems like a waste of valuable data. (Btw, 624 minus 458 is 166, please check whether your numbers are correct.) Then, in a second instance, another 74 participants were excluded from the variability analyses because of a large amount of zero answers. There are different ways of dealing with ‘unable’ scores (e.g. use mean +/-3SD) rather than simple deleting these cases.

Reply
A rationale to explain the loss of 166 participants is provided in the Participants subsection of the Methods section.
The loss of 74 individuals due to consecutive zero answers results in non-continuous data. Only continuous data is appropriate for application of the Fast Fourier Transform (FFT) procedure. The interpolated of consecutive zero responses using averaging methods would lead to misrepresentation of the data and would not be accurate or appropriate in this context. This is included in the Methods section under the subheading Data Pre-Processing for FFT Analysis.
Incorrect numbers have been corrected.

See Page 9, Methods – Participants:
“All 624 participants were ≥ 60 years old, community-dwelling, medically stable, without a history of stroke, or dementia (MMSE score ≥23), able to walk independently (with or without aids), and able to provide written informed consent. Participants were not asked to stop any of their usual medications, fast, or modify lifestyle habits before assessment. Of these, 500 individuals were offered additional cognitive tests including the Sustained Attention to Response Task SART [37], of which 458 successfully completed this task. The 42 participants who did not complete the task did so due to fatigue or a lack of understanding of the task instructions. The group of 166 individuals who were either not offered or did not complete the SART were significantly older (77.2 versus 71.6 years),
with lower mean MMSE scores (25.8 versus 27.8), and had a higher percentage of fallers (65.6% versus 43.3%) compared to those who completed the SART”.

See Pages 10, Methods - Data Pre-Processing for FFT Analysis:
“The FFT procedure can only be applied to continuous, non-zero data, and so pre-processing of the SART reaction time data prior to the FFT analysis was necessary. Therefore, we interpolated zero values (corresponding to omission errors and correct nogo responses on digit 3) using the two reaction times before and after the zero values. Participants that exhibited gaps too large to be considered continuous for the application of the FFT procedure, could not be adequately interpolated using averaging methods. In this context, 74 participants with more than 6 consecutive zero answers were removed from the analysis reducing the number of participants with FFT data to 384”.

2. Your definition of faller types is somewhat unconventional and warrants a rationale. What is the additional value of using these faller types – why not just stick to fallers versus non-fallers?

Reply
Please See References:

See Page 11, Method – History of Falls:
“Participants who experienced one or more falls in the previous twelve months were classified as a faller (n = 197). Non-fallers had not experienced a fall in the last twelve months (n = 261). Participants were further categorised by faller type: non-faller (n = 261, no falls in previous twelve months); single faller (n = 120, one fall in previous twelve months) and recurrent faller (n = 77, two or more falls in previous twelve months) [23,52]”.

See Page13-14, Results – Faller Type and Figure 2:
“A comparison of the SART measures between non-fallers, single fallers and recurrent fallers is shown in Figure 2. One-way ANOVA testing revealed that mean RT differed significantly with faller type (F(2, 458) = 7.48, p = 0.001). Mean RT increased for both single (413 ms, p = 0.008) and recurrent fallers (420 ms, p = 0.006), compared to non-fallers (380 ms). A similar pattern was seen with respect to the RT variability measure SDRT (F(2, 458) = 4.73, p = 0.009). Once again variability was greater for single (174 ms, p = 0.046) and recurrent fallers (179 ms, p = 0.042), compared to non-fallers (150 ms). The FFV measure of variability also differed significantly with faller type (F(2, 384) = 6.99, p = 0.001). This time the greatest difference was between non-fallers and single
fallers (p = 0.004) although there was also a significant difference between non-fallers and recurrent fallers (p = 0.024). Finally there was a global association between faller type and omission errors (F(2, 458) = 5.63, p = 0.004). Mean omission errors increased from 12 (non-fallers), to 16 (single fallers, p = 0.184), to 21 (recurrent fallers, p = 0.005). There were no statistical differences in SLV or commission errors.”.

See Page 16, Discussion, Paragraph 2:
“We next investigated faller type and found that mean and variability of reaction time, and omission errors, again differed markedly. The strongest differences were observed for recurrent fallers compared to non-fallers, although single fallers also differed significantly from non-fallers. In contrast, the strongest difference in the fast (moment to moment) component of variability were between single fallers and non-fallers, although significant differences between recurrent and non-fallers were also observed. These results are consistent with reports of other cognitive profiles in recurrent and single event fallers [18, 23]. The lengthening of reaction times, accompanied by increasing variability in reaction time and higher omission error rates may indicate that lapsing sustained attention may already have begun to manifest itself in those who have experienced just one fall. These results also suggest that insufficiencies of sustained attention are even more pronounced in recurrent fallers because recurrent falls are more likely to be indicative of neuropathology than a single fall [18].”

See Page 19, Discussion, Paragraph 1:
“Since falls history in the past twelve months was self reported we must acknowledge that it may be subject to the recall bias inherent to retrospective falls data collection, whereby falls are underreported or forgotten. However, previous studies have shown that 12-month self-reported falls history had high specificity with respect to the gold standard of prospective falls assessment, especially for a cognitively intact sample of older adults without a history of dementia, which this study sample was [23,52,58].”

3. Some minor points/suggestions:
- Provide a clear rationale for choosing only the 458 participants who were able to perform the SART, in the introduction or at the very start of the Methods. (or use the entire sample instead, see previous comment)

Reply
We have clarified the rationale for using the subset of 458 individuals as only these participants completed the SART task providing data for analysis. The rationale for why this occurred is now included in the Methods section, as mentioned previously above.

See Page 9, Methods – Participants:
“All 624 participants were ≥ 60 years old, community-dwelling, medically stable, without a history of stroke, or dementia (MMSE score ≥ 23), able to walk independently (with or without aids), and able to provide written informed consent. Participants were not asked to stop any of their usual medications, fast, or modify lifestyle habits before assessment. Of these, 500 individuals were offered additional cognitive tests including the Sustained
Attention to Response Task SART [37], of which 458 successfully completed this task. The 42 participants who did not complete the task did so due to fatigue or a lack of understanding of the task instructions. The group of 166 individuals who were either not offered or did not complete the SART were significantly older (77.2 versus 71.6 years), with lower mean MMSE scores (25.8 versus 27.8), and had a higher percentage of fallers (65.6% versus 43.3%) compared to those who completed the SART.”.

See Page , Methods - Sustained Attention to Response Task (SART), Paragraph 1: “……During a pilot, we noticed that some participants had difficulties performing the SART for the whole length of the task. In order to minimize data attrition, we reduced the number of trials from 225 in the original SART to 207 trials. The task lasted approximately 4 minutes”.

- Provide more detail regarding the physical and psychosocial measures used. I.e. brief explanation of the tests (incl. references), explanation of the score (high score good or bad?), etc.

Reply
We have provided an explanation for each of the physical, psychosocial and cognitive tests measured and we indicated whether higher scores signify better or worse performance on the test. Minimum and maximum scores are provided for each of the scale tests, as well as the number of items on each of the scales. References for each test are also included in the Methods and Reference sections.

See Page 7-8: Methods – Physical, psychosocial and cognitive measures: “Physical measurements included age, gender, weight (kg) and height (cm). The timed up and go test (TUG): measured the length of time (seconds) taken to get up from a sitting position, walk 3 metres, turn around, walk back and resume a sitting position. It is a widely used measure of gait and balance in older people, with longer TUG times (>11 seconds) associated with a higher risk for falls [43]. The Berg balance scale (BBS): a 14-item scale that measured balance among older people by assessing their performance on functional tasks. Higher scores indicated better balance with minimum and maximum scores of 0 to 56 [44]. The activities of daily living scale (ADL): an 8-item scale that measured the ability to perform daily self-care activities e.g. self-washing, dressing and feeding, as measure of functional status and/or disability. Higher scores indicated better functional activity with minimum and maximum scores of 0 to 24 [45]. The instrumental activities of daily living scale (IADL): a 9-item version of the scale was used which is not a measure of fundamental functioning, but of an individual’s ability to live independently in a community. Higher scores signify greater independence with minimum and maximum scores of 0 to 27 [46]. Polypharmacy was determined by the use of ≥ 4 medications daily. The Charlson co-morbidity Index (CCI) was used to classify and score the number of comorbid conditions and is a measure of disease burden. Higher scores indicate greater comorbidity and increased mortality risk with a range in this study sample of 0 – 12 [47].
Psychosocial measures included the anxiety section of the Hospital Anxiety and Depression Scale (HADS), which is a 7-item scale with higher scores reflective of greater levels of anxiety and with minimum and maximum scores of 0 to 21 [48]. A simplified 8-item version of the Center for Epidemiologic Studies Depression scale (CES-D) was used to measure depression. Higher scores reflected increasing levels of depression with minimum and maximum scores of 0 to 8 [49]. Measures of cognitive function included the mini-mental state examination (MMSE) as a measure of global cognition with higher scores to a maximum of 30 indicating better levels of cognition [50]. The cognitive failures questionnaire (CFQ) is a 25-item scale that measured self-reported absentmindedness or everyday lapses in perception, memory, and motor function. Higher scores reflect increasing levels of absentmindedness or cognitive lapses, with minimum and maximum scores of 0 to 100 [51]”.

Also Page 20, References:

- Use parametric statistics with normalized data rather than non-parametric statistics where possible.

Reply
We wee careful to use parametric statistical tests in relation to the SART measures which have a normal distribution. However distribution of MFES scores in our sample was highly skewed with there is a high degree of skewness in the MFES score with the top 70% scoring ≥9 on a 0-10 scale. Also, when the statistical measure of skewness is more than twice the standard error, this indicates that MFES score is not normally distributed.
For this reason we use non-parametric Mann Whitney U and Spearman correlation when dealing with the MFES score in our study population.

See Page 12, Statistical Analysis, Paragraph 2:
“MFES scores did not conform to a normal distribution with 70% of participants scoring 9.0 or more on the 0-10 scale. This resulted in skewing of the MFES scores. A statistical measure of skewness (G1) = -2.43, which is larger than twice its standard error (SE) = +/- 0.10, confirmed that the distribution of the MFES scores differed significantly from a normal distribution. For this reason non-parametric tests were employed including Mann Whitney (U) tests to compare MFES scores between non-fallers and fallers or males and females. Similarly, Spearman rho (rs) correlations were computed between MFES score and the SART measures.”.

- What is the purpose of Table 3? It is not mentioned in the text and is actually showing some very unimpressive correlations.

Reply:
We have removed Table 3 from the paper and instead include the data in this table in the text of the results section.

See Page 12, Results, Falls Efficacy, Paragraph 1 and 2:
“Lower MFES scores were correlated with longer mean RT in both fallers (rs(197) = -0.195, p = 0.007) and non-fallers (rs(261) = -0.203, p = 0.001). RT variability (SDRT) was also significantly and negatively correlated with lower MFES scores in fallers (rs(197) = -0.182, p = 0.012) and non-fallers (rs(261) = -0.137, p = 0.030). Similarly, higher values of FFV were correlated with lower MFES scores in both fallers (rs(197) = -0.173, p = 0.034) and non-fallers (rs(261) = -0.196, p = 0.004). SLV was correlated with MFES score in non-fallers only (rs(261) = -0.162, p = 0.016). Higher numbers of omission errors, were also significantly correlated with lower MFES scores in both fallers (rs(197) = -0.190, p = 0.009) and non-fallers (rs(261) = -0.143, p = 0.023). Commission errors were not associated with MFES score in fallers or non-fallers.
Fallers had lower mean MFES scores compared to non-fallers (8.85 versus 9.56, p < 0.001) and females had lower MFES scores compared to males, (p < 0.001). MFES score was also significantly correlated with age (rs(566) = -0.300, p < 0.001). Partial correlations were performed between MFES score and the SART measures in fallers and non-fallers, with age and gender partialled out. Only mean RT (τ(261) = -0.159, p = 0.012) and FFV (τ(261) = -0.122, p = 0.073) remained weakly correlated with MFES score and only in the non-faller group”.
- The relation between executive functioning and falls is a lot better established than implied in this paper. Both the introduction and discussion need an update of the literature in this regard.

Reply:
We have improved our review of the literature with respect to the relationship between executive function and falls. We have introduced new paragraphs addressing this in the background and the discussion sections.

See Page 4-5, Background, Paragraph 3
“Several studies have suggested that aspects of cognition, particularly declining executive function, are correlated with and predictive of falls risk in older adults without dementia or overt cognitive impairment [17,18,19]. Since deficits in executive function increase with age, this may impair the ability of the older person to compensate for age-related changes in gait and balance. This in turn, may compromise the ability of the older person to negotiate and cope with the complexities of their day to day surroundings [20,21,22]. This is supported by evidence from gait and balance studies, particularly dual tasks, indicating that gait performance and falls are related to executive function, and that falls have been associated with primary ageing of the prefrontal cortex [23,24]. Attention is a specific component of executive functioning. Low scores on tests of attention have been correlated with postural instability and increasing gait variability, both of which are related to falls [25,26]. Additional findings revealed that older people allocate more of their attentional resources toward their gait and that the attention-related changes that occur during aging increase the risk of falls [27,28].”

See Page 16, Discussion, Paragraph 7:
“…………Previous studies have reported significant associations between declining executive function and falls [17-19,23], or low scores/longer reaction times on tests of attention and increasing gait variability or postural instability, both of which are related to falls However reports looking specifically at attention have tended to focus on divided or selective attention during dual tasking or have selected older adults with cognitive impairment, dementia, stroke and Parkinson’s disease (PD)., [25-28,53]. This paper directly associates reduced levels of sustained attention (and particularly vigilant attention) as measured by the SART) and falls in older community dwelling adults without a history of overt cognitive impairment, dementia, stroke or PD”.

- Considering the submission of this paper to a general geriatrics journal, I suggest to rewrite certain sections for a more general medicine audience – at times it is very technical – and to elaborate further on the clinical relevance of the results.

Reply:
We have attempted to reduce some of the technical language as far as possible and to explain some of the more technical issues more clearly e.g. in relation to the Fast Fourier Transform (FFT) analysis.
In addition, we have tried to more clearly outline the potential clinical implications of our finding by highlighting the less than expected efficacy of current falls prevention and intervention strategies and the need to identify new assessment and intervention targets of which sustained attention may be one. We address this in the introduction and discussion sections.

See Page 4, Background, Paragraph 1:
“One-third of people over the age of 65 have at least one fall each year and almost half of these experience more than one fall [1,2]. Falls are a major cost to healthcare systems worldwide and have significant adverse impacts both physically and psychologically on the older person. Following a fall, older people often voluntarily restrict their activity fearing a reoccurrence. This reduction in exercise leads to further weakness that in turn increases the risk of another fall — a vicious cycle [3]. Currently, intervention strategies targeted to known risk factors only result in a 30-40% reduction in the reoccurrence of falls after one year [4-6]. This highlights the need to identify additional risk factors which contribute to falls and provide novel interventions to lower falls risk more effectively”.

See Page 19-20, Discussion, Paragraph 2:
“Falls prevention is a major issue in promoting successful ageing and fostering independence among the older population. Current intervention strategies targeted to known risk factors only result in a 30-40% reduction in the reoccurrence of falls [4-6] This highlights the need to identify additional risk factors which contribute to falls and provide novel interventions to lower falls risk more effectively. The recent “Clinical Practice Guidelines: Prevention of Falls in Older Persons” as set out by the AGS and BGS do not incorporate a measure or assessment of sustained attention under “Neurological function” [59]. The SART is a 4 minute test and was successfully completed by 91.6% of older adults who were offered the task. Thus, replication of the findings presented here could confirm the potential use of this test in the clinical setting. The SART is a short, inexpensive, easily administered test of sustained attention that could provide an objective, cognitive biomarker of falls risk and reduced falls efficacy. This was also a relatively well sample of older adults indicating that the test may be capable of detecting sub-clinical differences in sustained attention allowing for early detection and intervention. Many aspects of attention are amenable to interventions such as attentional training, therefore the opportunity exists to implement such strategies to improve levels of attention and decrease the risk and prevalence of falls in older adults [60,61]”.