Reviewer's report

Title: Lighting and Perceptual Cues: Effects on Gait Measures

Version: 1 Date: 8 July 2011

Reviewer: Alex Black

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This study addresses an important area of research, as it examines a potentially modifiable environmental factor (lighting) which may be linked to risk of falls among older adults. Strengths of the study include a suitable sample size, well written manuscript and excellent data collection methodology. However, there are some sections which need further clarification, as outlined below.

Major compulsory revisions:

Introduction
1. 1st para: Statements regarding “gait patterns in dim lighting” (1st para) and “older adults tend to look down when walking” (3rd para) should be supported with references.
2. 4th para: “with and without falls risk” – vague statement, see comment 6 below.
3. 4th para: Statements regarding use of Gaitrite outcomes measures associated with risk of falls should be supported with references.
4. 4th para: Please clarify the term STDEV. Perhaps the term “variability” should be used, to be consistent with previous literature.

Methods
5. 2nd para: What was the timeframe in which participants reported “history of falls”?
6. 2nd para: The use of terms “fallers” and “non-fallers” in the manuscript is confusing, as “non-fallers” may have experienced one fall in the past six months. It may be better to use terms which reflect adults deemed to be at low-risk of falling (low-risk) vs. those likely to be at high-risk of falling (high-risk).
7. 3rd para: Can the authors clarify whether participants self-reported any other ocular conditions, such as glaucoma? In addition, was visual acuity ascertained binocularly with participants wearing their habitual optical correction (spectacles or contact lenses) and were these used spectacles during testing?

Statistical considerations:
8. Age may be an important confounding factor, as “Fallers” were around 8 years older than “Non-fallers” (82 vs. 74.5 yrs). Is this a significant difference? Are the significant findings for the group comparisons simply due to age-related differences, or are they independent of age?
9. It is also unclear if any correction was applied for the multiple testing conducted for the numerous post-hoc t-tests, i.e. are some significant results occurring due to chance?

10. The authors consistently report additional analyses (t-tests) relating to the group vs. lighting interactions, which were not significant in the ANOVA models (p-values not reported). They state that fallers' gait patterns are “much more affected by the lighting conditions than non-fallers”, but there doesn’t appear to be large interaction effects. For example, step length reduced about the same magnitude for fallers (3 to 4 cm; 48cm vs. 44cm and 45cm) as non-fallers (2 to 3 cm, 70cm vs. 67cm and 68cm) in the dim light. This is an important issue that needs to be clarified, as the authors make comments in the discussion that “dim illumination had a larger negative effect on older adults with falls risk”, without supporting evidence in their results.

Results:

11. As the key finding of the research is that dim lighting conditions affect various gait parameters, the authors should present these findings prior to the other main effects.

Discussion:

12. The argument in the 1st paragraph is vague. The fact that older adults slow their walking in dim lighting indicates more cautious gait patterns, as a protective strategy (increased time in double support). Dim lighting means fewer visual cues for postural control (hence greater postural instability), so people slow down as a result. As was demonstrated in the study, the laser lines provide more visual cues for balance, better postural stability, and adults walk faster as they are more stable and more confident. Therefore, slow walking would reflect reduced postural stability. Do the authors suggest that slow walking itself compromises dynamic walking stability and increases the risk of falls? If so, please provide some supporting references to strengthen the argument.

13. 2nd para: While people with slower gait are more prone to falls (as shown by Verghese et al; Ref #16), these findings relate to between-subjects, rather than within-subject. A person who walks slower than another person probably has some underlying impairment in balance or gait biomechanics, which increases their risk of falls. The use of Verghese’s value of 10cm/sec drop in velocity is therefore unrelated to the present study. If a person slows their walking in challenging environments compared non-challenging conditions, it is unclear why they are more likely to fall?

14. 3rd para: The study by Brach (Ref #20) used step length variability, based on coefficient of variation (SD/mean X 100%). The authors have not outlined their method of calculating STDEV, so it is unclear whether the measures in this study are directly comparable to Brach’s study.

15. Other limitations are the use of participants with normal vision. The prevalence of visual impairment is high in older populations, particularly in nursing homes (See Owsley et al, Arch Ophthalmol. 2007 Jul;125(7):925-30.), so the effects of dim lighting may be even greater in visually impaired older adults.
Tables:
16. Table 1: The sample sizes for each group is only partially presented – only “n=8” for females is presented. Do the two groups differ significantly for any of these measures?
17. Table 2: STDEV Velocity appears to be missing the “Trial” Variable.

Minor essential revisions:
18. Suggest including “wavelength” in “Methods/Lighting conditions” to specify the 650nm wavelength light.
19. Are the authors able to comment on whether the “0.015 lux at the cornea” conditions represent mesopic or scotopic luminance levels? Were luminance values measured?
20. Table 1: Please confirm journal requirements regarding units – imperial or metric? Some variables may be easier read with fewer decimal points – particularly age (suggest one decimal) and blood pressure (one or none). It is also worth considering removing MDS-ADL, considering all participants scored zero. Also, please confirm the SD value for “Fallers/Male” Berg Balance score – stated as “0.00”.
21. Use of p-value symbols across graphs is inconsistent. Suggest using the same symbols across all graphs, for the following values: p<0.05, p<0.01 and p<0.001.

Discretionary revisions:
22. Inconsistent terminology for “elderly” and “seniors”. Suggest the use of “older adults”, which is more consistently used in the literature.
23. Avoid referencing papers which have not been accepted for publication (Ref #23).

Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Acceptable

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

Declaration of competing interests:
I declare that I have no competing interests.