Is the Prioritization of Postural Control Altered in Conditions of Postural Threat in Younger and Older Adults?

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Background. The purpose of this study was to determine if the prioritization of postural control over secondary task performance is altered in younger and older adults under different conditions of postural threat.

Methods. Fifteen healthy older adults (mean age = 69.53 ± 5.78) and 15 younger adults (mean age = 22.00 ± 2.17) performed Brooks’ Spatial Letter Task (BST) while standing in four conditions of postural threat. Galvanic skin conductance (GSC) was collected to measure changes in physiological arousal. BST task duration was used to measure changes in cognitive performance, and center of pressure (COP) area was used to determine changes in postural stability across each of the testing conditions. A prioritization index was calculated based on the relative change in BST and COP across testing conditions. This measure was used to quantify changes in the relationship between postural control and secondary task performance under conditions of postural threat.

Results. Measures of GSC increased in younger and older adults in response to conditions of increased postural threat. Prioritization index scores revealed that a greater number of older adults than younger adults prioritized postural control over secondary task performance under conditions of increased postural threat.

Conclusions. Environmental contexts that alter postural threat may lead to modifications in the prioritization between postural control and secondary task performance among older adults. This relationship may have implications for postural control under situations that do not afford deterioration in secondary task performance.
determined whether this apparent prioritization toward postural control is preserved during secondary cognitive task performance. Thus, the purpose of this study was to examine the relationship between secondary cognitive task performance and postural control under environmental conditions that altered postural threat. Furthermore, because differences exist in cognitive capacity (14) and fall risk (15) between YA and OA, a secondary purpose of this study was to investigate whether age-related differences existed in the propensity for a prioritization of postural control under conditions of postural threat.

**METHODS**

**Participants**

Fifteen OA (5 men, 10 women; age, 69.53 ± 5.78) and 15 YA (7 men and 8 women; age, 22.00 ± 2.17) participants in this study. All participants were free from neurological and orthopedic conditions that may affect cognitive function and/or postural control. In addition, participants had no reported or overt aversions to heights. OA were required to clear a comprehensive neurological screening comprised of standard sensorimotor tests of function, an electronystagmogram to exclude potential vestibular pathologies, and a complete Mini-Mental State Examination to confirm cognitive status. A neurologist performed all neurological screenings.

Before testing commenced, all participants voluntarily provided informed consent according to guidelines of the Human Research Ethics Committee of the University of Lethbridge. In addition, participants were asked to complete a Falls History form that assessed fear of falling (scale 1 [not afraid] to 10 [very afraid]), fear of heights (y or n), and time since last fall (months). Participants also completed both the Gait Efficacy Scale (GES) (16) and the Activities-Specific Balance Confidence (ABC) Scale (17). These questionnaires were designed to assess participants’ perceptions of their balance and their ability to perform daily activities. During testing, participants wore a tee-shirt or blouse, shorts, socked feet, and a safety harness over their clothes.

**Manipulation of Postural Threat**

An industrial hydraulic lift table (1.2 × 1.8 m; Pentalift, Guelph, ON) was used to alter the environmental context of the testing conditions. Participants were tested under two vertical height positions: Low (0.17 m) and high (1.4 m) from ground level and two position conditions on the lift table (middle and edge). Thus, four conditions of postural threat were included in this study: (i) low-mid (LM)—middle of the platform at ground level, (ii) low-edge (LE)—edge of the platform at ground level, (iii) high-mid (HM)—middle of the platform and elevated, and (iv) high-edge (HE)—edge of the platform and elevated. Middle and edge conditions were created to produce conditions of threat that did or did not permit an individual to step forward to recover his or her balance. The four different conditions modified the level of postural threat imposed upon the participants. Condition One (LM) was least threatening, and Condition Four (HE) provided the most postural threat. Fig-

![Figure 1. The experimental conditions for manipulating postural threat: A, low-mid (LM); B, low-edge (LE); C, high-mid (HM); D, high-edge (HE). Participants were required to wear a safety harness in all conditions.](https://academic.oup.com/biomedgerontology/article/57/12/M785/688551)
Figure 1 provides illustrations of the four testing conditions used in this study.

**Presentation Order of Postural Threat**

A Latin-square design (18) was employed so that approximately the same number of participants could be randomly assigned to each of the four possible order combinations (i.e., 1 = LM, LE, HM, HE; 2 = LE, LM, HM, HE; 3 = HM, HE, LM, LE; 4 = HE, HM, LE, LM). This method was used to prevent carry-over effects from raising and lowering participants to different height conditions. Conditions One and Three were each completed by three YA and OA, Condition Two by four YA and three OA, and Condition Four by four YA and OA.

**Procedure**

Participants were seated in chairs on the ground to receive instructions regarding the testing procedure and protocol for Brooks’ Spatial Letter Task (BST) (19). Participants were presented with 16 different 20.32 cm × 27.94 cm cards showing one of eight large simple block letters (G, H, J, M, S, W, Y, or E) approximately 25.4 cm tall. Two cards were made for each letter so that each card had an asterisk printed on either the bottom-left or top-right corner of the letter to indicate the “starting point” for the initiation of the BST task (see Figure 2). Participants were allowed to view the letter until they felt they had a clear mental image of it. Upon participant consent, the letter was taken away, and participants were asked to start classifying the letter, according to the set criteria, out loud from one of two predetermined starting points, and moving in a clockwise direction. Each corner of the letter (indicated by gray dots, Figure 2) was to be classified with either a “yes” or a “no” according to set criteria. The criteria were either “top/bottom,” indicating that any corners on the extreme top or bottom of the letter received a “yes” answer, or “left/right” indicating that the corners on the extreme left or right edges of the letter received a “yes” answer (see Figure 2). Classification criteria and the presentation of letters were randomized so participants were unable to predict or memorize the answers for the task. A minimum of six practice trials were given to familiarize participants with the task, but testing did not proceed until the participants were comfortable and proficient at performing the task. Participant comfort was indicated by participant self-report, and task proficiency was dictated by a 90% minimum accuracy level on two consecutive practice trials.

Participants were also trained to perform a probe-reaction time (PRT) task. For the PRT task, participants were asked to verbally respond to the illumination of a red light located in the center of a light display unit (University of Lethbridge Technical Services Department) as quickly as possible, indicating starting points, and moving in a counterclockwise direction from the starting position. Panel A presents the extreme left/right condition, in which the correct series of responses, starting from the top/right corner would be Yes, Yes, No, Yes, Yes, Yes, Yes, Yes. Panel B presents the extreme top/bottom condition, in which the correct series of responses, starting from the bottom left corner would be Yes, Yes, No, No, No, No, No, No.

**Instrumentation**

Forceplates were used to obtain ground reaction force and moment of force data necessary to calculate center of pressure (COP) in each condition. A headset with a microphone was worn by the participant and was used to collect audio data for the BST and PRT tasks. Audio data from the headset microphone were collected on a separate collection computer through an AW35 Pro Audio soundcard (sampling frequency = 22 KHz). Finger cuffs with silver/silver-chloride electrodes from a BioDerm Skin conductance Level Meter (UFI, Morro Bay, CA) were attached to the middle phalanges of digits three and four to collect Galvanic Skin Conductance (GSC) data. Analog data were collected for 7 seconds during the PRT trials and for 15 seconds during the QS trials. Collection times for audio data in the BST trials varied depending upon the time required for the participant’s performance of the task (mean = 14.19 ± 2.21).
Measures of Interest

Results from the GES and ABC questionnaires were compiled to assess perceptions regarding the ability to perform daily activities in the home and within the community for YA and OA. In addition, results from the Falls History questionnaire were analyzed to determine if OA and YA significantly differed on perceptions of fear of falling, fear of heights, and time since last fall. GSC data for each trial were expressed as mean values for comparative analyses. Verbal responses from the BST task were monitored, and error rates and BST performance duration times were recorded.

Custom-written algorithms were used to process all analog data (Matlab, The MathWorks, Natick, MA). Forceplate data were filtered using a four-order zero-lag Butterworth low-pass digital filter at a cut-off frequency of 5 Hz. Coordinates for the anterior/posterior (x) and medial/lateral (y) positions of the COP, relative to the forceplate origin, were calculated for the assessment of postural sway as follows:

\[ \text{COPx} = \frac{M}{F} \]
\[ \text{COPy} = \frac{M}{F} \]
where \( M \) = moment of force and \( F \) = force.

To normalize for differences in foot length and stance width, COP measures were expressed as a percentage of measured base-of-support for each subject (i.e., foot length for COPx and stance width for COPy). COP area was calculated for each condition as follows:

\[ \text{COParea} = \left( \frac{\text{COPx range}}{\text{BOS}} \right) \times \left( \frac{\text{COPy range}}{\text{BOS}} \right) \]

Data were cropped according to the length of the shortest BST response duration to ensure that the duration of sway analysis was constant between subjects and to ensure that the analysis of COP area occurred during periods of verbal response for all subjects.

Data Analysis

Separate independent \( t \) tests were used to determine differences in the mean total score of the combined GES and ABC scores, fear of falling, and time since last fall scores between YA and OA. A chi-square test was used to determine statistical differences in the number of YA and OA who reported a fear of heights.

Due to technical limitations, data from five out of 15 OA and 11 out of 15 YA were suitable for the analysis of GSC. Independent \( t \)-test comparisons indicated that these samples were not significantly different in mean GSC values \( (p > .05) \). Thus, to control for the disproportionate sample sizes, GSC means were combined across age groups and were entered into a three-way (Height [Low vs High] \( \times \) Position [Middle vs Edge] \( \times \) Task [QS vs BST]) repeated-measures (RM) analysis of variance (ANOVA) using the combined subject sample of 16 participants. Data from BST trials were not analyzed for two female OAs because they were unable to perform the task. Mean durations from the BST task and error rates were analyzed in three-way (Age [YA vs OA] \( \times \) Height [Low vs High] \( \times \) Position [Middle vs Edge]) RM ANOVA of covariance (ANCOVA) using BST values and error rates from the sitting LM condition as a co-variate, to control for differences in response times and memory performance (18,20). Mean COP area data from the same subject sample (15 YA and 13 OA) were entered into a four-way (Age [YA vs OA] \( \times \) Height [Low vs High] \( \times \) Position [Middle vs Edge] \( \times \) Task [QS vs BST]) RM ANOVA. Task was included as a variable to determine the effects of presentation of the BST task on measures of COP.

A prioritization index was calculated to quantify changes in the relationship between postural control and secondary task performance. The prioritization index was obtained by comparing the percentage change in postural performance and secondary task performance across the testing conditions. Change in postural performance was assessed using COP area by calculating the percentage change from the LM condition while performing the BST in the LE, HM, and HE conditions (e.g., \( \frac{LM – LE}{LM} * 100 \)). Change in secondary task performance was calculated by the percentage change in the LE, HM, and HE conditions from the duration of the LM condition (e.g., \( \frac{LM – LE}{LM} * 100 \)). For the prioritization index, a score was assigned for each participant according to the following criteria: (i) posture prioritization = reduced area and longer duration on BST and (ii) no prioritization = all other possible combinations. The number of participants who revealed postural prioritization versus the number of participants who did not prioritize posture first was assessed by chi-square analysis to determine significant differences in frequencies. Findings for all statistical tests were considered to be significant at \( \alpha = 0.05 \), and Bonferroni adjusted post hoc comparison of means \( (t \) tests) were used when appropriate.

RESULTS

Statistical results for tests of arousal, postural control, and cognitive performance are summarized in Table 1. Table 2 provides a summary of descriptive statistics for main effects from these statistical tests.

Participant Data

Results from independent \( t \) tests revealed that scores on the GES and ABC questionnaires did not significantly differ

Table 1. Summary of Statistical Findings

<table>
<thead>
<tr>
<th>Measure</th>
<th>A</th>
<th>H</th>
<th>P</th>
<th>T</th>
<th>A ( \times ) H</th>
<th>A ( \times ) P</th>
<th>A ( \times ) T</th>
<th>H ( \times ) P</th>
<th>H ( \times ) T</th>
<th>P ( \times ) T</th>
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<th>H ( \times ) P ( \times ) T</th>
<th>A ( \times ) H ( \times ) P ( \times ) T</th>
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<tbody>
<tr>
<td>Error</td>
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<td>COP Area</td>
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</tbody>
</table>

Note: A = age; H = height; P = position; T = task; GSC = galvanic skin conductance; BST = Brooks’ Spatial Letter Task; COP = center of pressure.

\( * p < .05; ** p < .01; *** p < .001; --, not tested. \)
in YA and OA \((p = .85)\). YA had a mean score of 93.82% compared to 94.26% in OA on the 26 questions asked on the questionnaire. This finding indicated that both groups perceived that they could adequately perform daily activities and function well within the community. Participant history data revealed no significant differences between YA and OA in perceived fear of falling \((p = .76)\) and fear of heights \((p = .26)\). However, when participants were asked to recall how long it has been since they last fell, YA were found to have fallen significantly more recently than OA \((0.77 \text{ months vs } 36.46 \text{ months}; p = .034)\).

**Measures of Arousal**

A significant main effect for task \((F[1,15] = 9.1, p = .009)\) indicated that performing the BST task significantly increased arousal. Significant main effects also emerged for height \((F[1,15] = 19.45, p = .000)\) and position \((F[1,15] = 5.04, p = .041)\) and revealed that arousal increased from the non-elevated to the elevated positions and from the middle to the edge positions. Comparison of means revealed that GSC values increased by approximately 43% from the LM to the HE conditions in no task (QS) trials and by approximately 35% in task (BST) trials. Interestingly, a 51% increase in GSC values emerged between the LMQS and the HEBST trials. These changes are illustrated in Figure 3.

**Measures of Cognitive Performance**

There were no significant main or interaction effects for the measure of error rates. However, a significant main effect for height indicated that BST task performance was reduced in the elevated conditions \((F[1,25] = 9.73, p = .005)\), and a main effect for position revealed that performance of the BST task slowed when participants were asked to stand at the edge compared to the middle of the platform \((F[1,25] = 14.32, p = .001)\). A significant Height \(\times\) Position interaction indicated that for all participants, BST performance in the elevated conditions was dependent on position \((F[1,25] = 5.06, p = .034)\) (Figure 4).

In the analysis of BST duration, a significant between-groups effect indicated that OA were slower in performing the BST task than YA \((F[1,25] = 15.84, p = .001)\), regardless of condition of postural threat. Interactions between Age \(\times\) Height \((F[1,25] = 7.65, p = .011)\) and between Age \(\times\) Position \((F[1,25] = 13.64, p = .001)\) revealed that YA

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**Table 2. Summary of Descriptive Statistics (Mean ± SE) for Main Effects**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Age</th>
<th>Height</th>
<th>Position</th>
<th>Task</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>YA</td>
<td>OA</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>GSC (µS)</td>
<td>—</td>
<td>—</td>
<td>11.63 (0.976)</td>
<td>14.08 (1.23)</td>
</tr>
<tr>
<td>Error (%)</td>
<td>1.9 (0.02)</td>
<td>9.72 (0.02)</td>
<td>5.53 (0.01)</td>
<td>6.11 (0.01)</td>
</tr>
<tr>
<td>BST Duration (s)</td>
<td>12.32 (0.61)</td>
<td>16.07 (0.66)</td>
<td>14.04 (0.37)</td>
<td>14.33 (0.54)</td>
</tr>
<tr>
<td>COP Area (%BOS²)</td>
<td>1.13 (0.14)</td>
<td>0.44 (0.13)</td>
<td>0.96 (0.14)</td>
<td>0.61 (0.06)</td>
</tr>
</tbody>
</table>

Note: YA = young adults; OA = older adults; QS = Quiet Standing; BST = Brooks’ Spatial Letter Task; GSC = galvanic skin conductance; COP = center of pressure; BOS = base of support.
performed the BST task significantly faster in the elevated compared to the non-elevated conditions \( (p = .003; 12.82 \text{ seconds non-elevated vs 11.79 seconds elevated}), \) whereas OA performance on the BST task slowed with increased height \( (p = .141; 15.23 \text{ seconds non-elevated vs 16.88 seconds elevated}). \) A similar finding was noted in follow-up tests for Age × Position and revealed that task performance significantly improved among YA from the middle to the edge conditions \( (p = .008; 12.92 \text{ seconds in middle vs 11.63 seconds in edge}), \) whereas OA performance was slowed by the change in position \( (p = .049; 15.38 \text{ seconds middle vs 16.77 seconds edge}). \) Results from the three-way RM ANCOVA on the mean duration to complete the BST task revealed that the Age × Height × Position interaction was not significant \( (F[1,25] = .049, p = .05). \) Separate two-way RM ANCOVA within OA and YA revealed that performance of the BST task was affected by height and position among OA only \( (F[1,11] = 6.73, p = .025; 14.89 \text{ seconds in LM vs 17.48 seconds in HE}; \) see Figure 4).

**Measure of Postural Control**

All participants showed significantly reduced COP area in the elevated compared to the non-elevated conditions \( (F[1,26] = 11.64, p = .002). \) A significant main effect did not emerge for position \( (p > .05), \) although mean values indicated that COP area was reduced in the edge compared to the middle positions.

OA showed a significantly greater magnitude of sway area than YA \( (F[1,26] = 12.40, p = .002). \) A Height × Age interaction revealed that the effect of height differed between YA and OA \( (F[1,26] = 11.73, p = .002). \) Follow-up comparison of means indicated that OA showed a significant reduction in COP area from the non-elevated to the elevated conditions \( (p = .001), \) while COP area remained unchanged among YA \( (p > .05); \) OA\text{Non-elevated} = 1.45 \%B\text{OS}^2; OA\text{Elevated} = .802 \%B\text{OS}^2; YA\text{Non-elevated} = .459 \%B\text{OS}^2 \text{ vs } YA\text{Elevated} = .416 \%B\text{OS}^2).

**Effects of Secondary Task on Postural Control**

The main effect for task was nonsignificant \( (p > .05), \) although COP area increased by approximately 50% when the secondary task was introduced (see Table 2). A Task × Height interaction, however, indicated that the effect of task differed between heights \( (F[1,26] = 4.91, p = .036). \) Post hoc comparisons confirmed that performing the BST task significantly increased COP area in the non-elevated testing conditions \( (p = .014). \)

Despite this effect for the BST task in the non-elevated conditions, a significant Task × Height × Age interaction \( (F[1,26] = 4.53, p = .043) \) indicated that OA showed a significant reduction in COP area when performing the BST task in the elevated conditions compared to the non-elevated conditions \( (p = .001); \) OA\text{Non-elevated} = 1.95 \%B\text{OS}^2; OA\text{Elevated} = 0.834 \%B\text{OS}^2; YA\text{Non-elevated} = 0.505 \%B\text{OS}^2; YA\text{Elevated} = 0.450 \%B\text{OS}^2); \text{see Figure 5). \) This effect did not emerge among YA \( (p > .05; \) Figure 5).

**Prioritization of Postural Control**

The prioritization index revealed that more OA prioritized postural control than YA when in the HE condition.

The percentage of YA and OA who prioritized postural control did not dramatically change in the LE (30.77% of OA vs 40.00% of YA) and HM (23.08% of OA vs 20.00% of YA) conditions. However, more OA were found to prioritize postural control in the HE condition compared to YA (53.84% of OA vs 20.00% of YA; see Figure 6). Frequency scores of OA and YA who prioritized postural control achieved near significance in the HE \( (X^2[1] = 3.47, p = .063); \) however, frequencies in the LE and HM conditions did not approach the 0.05 \( \alpha \) level.

**DISCUSSION**

The purpose of this study was to examine the relationship between performance of a postural task and the concurrent performance of a secondary task in YA and OA in conditions of increasing postural threat. YA and OA participants were asked to perform Brooks’ Spatial Letter Task (19) while maintaining static equilibrium under four conditions of increasing postural threat. Changes in BST task performance and postural control were monitored in each trial and were used for the calculation of the prioritization index. Results revealed that the relationship between postural control and BST task performance was altered by postural threat. In particular, as postural threat increased, postural stability improved, and performance on the secondary task deteriorated. This finding, however, was exclusive to OA. Results from YA indicated that postural stability and secondary task performance improved in conditions of increased postural threat. These findings confirm our hypothesis that among OA, postural control is maintained at the expense of secondary task performance when the potential consequences of instability are increased.

Measures of arousal confirmed that the manipulation of environmental context was successful in increasing arousal. In addition, arousal was found to increase when participants performed the BST task. This finding confirms results from
However, a variety of internal or external factors can deter-
mance of the primary task, the secondary task, or both. 
hibited performance of a secondary task can affect perfor-
capacity of attention (23), interference from the concur-
cognitive capacities (14). According to the model for lim-
perform multiple tasks because of age-related declines in 
cognitive tasks exceeded the cognitive resources available 
resources involved in postural control (8,22), we propose 
BST task has been shown to compete for the same cognitive 
secondary task performance must deteriorate. Because the 
known that, as the consequences of postural instability increased, 
relationship between secondary task performance and postural control was altered such that balance was prioritized at the expense of cognitive task performance.

Interestingly, among YA, secondary task performance and measures of postural stability appeared to benefit from conditions of increased arousal. In particular, data from performance of the BST task revealed that performance on the BST task became significantly faster in the edge and in the elevated conditions. We propose that the concurrent performance of the postural and secondary tasks did not exceed the cognitive capacities of YA as it did in OA. It is possible, therefore, that the effects of arousal may have had beneficial effects on secondary task performance in YA. The Yerkes-Dodson law dictates that task performance is improved with increased arousal (24,25). Thus, according to this theory, YA may have improved performance on the secondary task because of increased arousal. Furthermore, although not significant, our results indicated that postural control was improved in conditions of increased postural threat in YA. Improved postural performance under conditions of threat has been well demonstrated in previous investigations (11,12). Thus, we believe that the regulation of postural control in response to postural threat is not age-dependent; however, under dual-task conditions, OA may need to sacrifice secondary task performance to modulate postural stability.

The present study has examined the effects of performing a secondary task on postural control in YA and OA when in conditions that increase the consequences of instability. Results indicated that among OA, postural control was significantly improved at the expense of secondary task performance (7,8). It is possible that, as forwarded by "the posture first hypothesis" (7), secondary task performance in our study was prioritized in low threat conditions at the expense of postural control because balance was not perceived to be threatened. However, the unique finding in our study was that, as the consequences of postural instability increased, the relationship between secondary task performance and postural control was altered such that balance was prioritized at the expense of cognitive task performance.

Our results suggest that a reciprocal relationship exists between secondary task performance and postural control among OA; in order for OA to improve postural stability, secondary task performance must deteriorate. Because the BST task has been shown to compete for the same cognitive resources involved in postural control (8,22), we propose that the concurrent performance of both the postural and cognitive tasks exceeded the cognitive resources available for postural control in OA in the most threatening condition. Indeed, OA have been shown to have a reduced ability to perform multiple tasks because of age-related declines in cognitive capacities (14). According to the model for limited capacity of attention (23), interference from the concurrent performance of a secondary task can affect performance of the primary task, the secondary task, or both. However, a variety of internal or external factors can deter-
mine which task is affected. As has been shown in previous studies that employ a dual-task methodology, our results indicated that secondary task performance was maintained at the expense of postural control in nonthreatening conditions (7,8). It is possible that, as forwarded by "the posture first hypothesis" (7), secondary task performance in our study was prioritized in low threat conditions at the expense of postural control because balance was not perceived to be threatened. However, the unique finding in our study was that, as the consequences of postural instability increased, the relationship between secondary task performance and postural control was altered such that balance was prioritized at the expense of cognitive task performance.

Understanding how postural control is prioritized may lead to insights regarding how to reduce falls in older adults. Based on our findings, fall risk may increase in OA who are unable, or unwilling, to compromise secondary task performance in conditions of increased postural threat. This finding could have implications for rehabilitation practitioners who often instruct patients while they are performing pos-
tural tasks (26). Although our findings contribute to the growing body of knowledge regarding cognition and pos-
tural control, it remains unknown how postural control may be altered in individuals with an existing fear of falling. Perhaps individuals with an intense fear of falling may not be able to perform a secondary task in conditions of increased postural threat. Therefore, although the present

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findings are important in deciphering the relationship between secondary task performance and postural control in different environmental contexts, further research is warranted to determine what actions should be taken to prevent falls in individuals who may be at the greatest risk of falling.

Indeed, the asymmetric gender composition of the YA and OA subject samples may threaten the internal validity of our findings. We believe, however, that the gender composition of the subject samples presented in this study does provide a generalizable representation of demographic trends and, thus, strengthens the external validity of our findings. On a similar note, the loss of participant data in the analysis of GSC results eliminated the possibility for an age comparison regarding GSC effects. An age-related difference in GSC results would strengthen the age-dependent differences regarding the effects of the secondary task on postural control; however, this interpretation cannot be made from our work.

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References


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