

## Assessed and distressed: White-coat effects on clinical balance performance

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### Abstract

**Objectives:** While balance in young and older adults is known to change with the threat of standing on elevated surfaces, the potential for social anxiety to influence emotional states and balance performance during a clinical assessment is currently unknown. **Methods:** Nineteen young and 19 older healthy female adults volunteered for the study. The effects of age and clinical assessment on balance performance were examined using a 2×2 between- and within-subjects factorial design. Balance performance measures were derived from forceplate recordings of three different postural tasks. Psychological measures included fear of negative evaluation, state anxiety, and fear related to the completed balance tasks. **Results:** There was a significant increase in state anxiety and fear when participants performed balance tasks while being assessed by an evaluator. Compared to the control condition, both age groups

leaned significantly further forward during the functional reach task when being assessed. While being assessed, older adults had significantly larger amplitudes and frequencies of center of pressure (COP) displacement during two-legged stance with eyes closed (EC) and significantly less stance time during one-legged standing compared to the control condition. In contrast, balance performance in young adults during one-legged or two-legged stance tasks was unchanged by clinical assessment. **Conclusions:** Social anxiety associated with the clinical assessment of balance can have a negative influence on both emotional states and balance control. As a result, clinicians need to recognize and account or control for potential social anxiety effects on clinical balance performance in young and older adults in particular.

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### Introduction

Balance tests are commonly used in clinical settings to screen for balance deficits or track changes in balance function over the course of a disease or treatment intervention. In most cases, subjective assessments are used to determine whether the patient appears unstable or falls during the performance of the clinical balance task [1]. However, in cases where more objective measures of balance are required, posturography can be used to measure center of pressure (COP) from ground reaction forces and moments recorded from a forceplate or body kinematics recorded from

a motion analysis system to detect more subtle changes in balance which may not be discernable even by the trained clinician [2]. The common assumption is that abnormal performance on such clinical balance tests is indicative of altered neurophysiological, muscular, or biomechanical function due to age or disease.

Recent evidence suggests that psychological factors such as fear of falling may precipitate an increased likelihood of falling and in some cases fear has been shown to directly influence changes in balance control. For example, studies have shown that when participants stood quietly in conditions of “high” compared to “low” postural threat, the frequency of COP displacements used to control postural sway is increased [3,4]. Likewise, the amplitude of the COP displacements is also influenced by postural threat, although the direction of change appears dependent upon the degree of fear reported by the participant. For example, participants who experience anxiety and low levels of fear when standing

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on elevated surfaces responded with a decrease in COP displacements, while those with a high level of fear and anxiety responded with an increase in COP displacements [4]. Similar effects of increased postural threat on the control of quiet stance have been observed in older adults [5,6]. Furthermore, young subjects standing in conditions of increased postural threat had altered performance on other commonly used clinical balance tasks, including decreased time standing on one foot and decreased displacements during maximum functional reach tasks [3]. Although these findings provide support for the hypothesis that balance control can be influenced by anxiety-inducing stimuli, the manipulation of surface height employed in this body of research may have limited ecological validity. Thus, the overall purpose of this study was to examine the extent to which postural control is affected when participants are subjected to an anxiety-invoking scenario commensurate with typical patient-assessment procedures used within a clinical setting. Of particular clinical relevance is whether anxiety related to performing in front of a clinician can significantly influence a patient's performance on a clinical balance test. For example, an individual may be anxious about their performance during a clinical balance assessment because he or she has a desire to "do well" or impress the clinician, whose assessment may have a direct implication for the patient's ability to maintain independence and a normal lifestyle. Social anxiety, defined as a fear of performance in situations in which a person is exposed to unfamiliar people or to possible scrutiny by other people [7], involves changes in the autonomic nervous system (including heart rate, respiration), but also influences critical cognitive processing [8]. Specifically, social anxiety decreases a person's attention to environmental cues, affects how information is encoded and interpreted, and increases the probability of detrimental cognitions and emotions such as dwelling on negative aspects of themselves and having aversive feelings [9].

In this study, we sought to examine the influence of social anxiety, as it relates to clinical assessment, on the performance of static and dynamic balance tasks and on emotional states in both young and older healthy female adults. Based on evidence from elevated height studies, we hypothesized that the assessment by an evaluator/clinician would cause concomitant changes in balance control and emotional states in healthy young and healthy older female adults. Specifically, we expected (a) a change in the amplitude and frequency of COP displacements during quiet stance, (b) a decrease in one-legged stance time, (c) a decrease in forward displacement during a maximum functional reach task, and (d) an increase in state anxiety and fear when subjects performed in the presence of an evaluator compared to a control condition. Since young healthy adults are more posturally stable and thus have fewer reasons to worry about their ability to perform well in a balance task, we expected that a situation of clinical assessment would have a greater impact on the older healthy

adults. Thus, we hypothesized that during assessment by an evaluator, older female adults would display greater changes in balance performance, as well as elevated state anxiety and fear scores for each of the balance tasks compared to young female adults.

## Methods

### *Participants*

Nineteen healthy young female adults (mean±S.D.: age 22.23±3.25 years; height 166.02±6.81 cm; and weight 59.68±8.53 kg) and 19 older female adults (mean±S.D.: age 72.89±8.65 years; height 163.05±5.32 cm; and weight 63.57±6.12 kg) volunteered to participate in this study. Young adults consisted of undergraduate and graduate student volunteers recruited from the University of British Columbia (UBC). Older adults were all independently living women who were recruited from the local community via advertisements posted at a local hospital, swimming pool, and university outreach physical activity program, as well as community centers, social clubs for the elderly, and independent living seniors' buildings in the surrounding area. Participants were excluded from the study if they reported any known neurological, vestibular, or orthopedic deficits that interfered with their balance, if they required orthoses or other walking assistive devices to stand or walk normally, or if they were on prescription medication that might affect balance control at the time of testing. Each participant provided witnessed informed consent and all experimental procedures were approved by the UBC clinical research ethics board.

### *Experimental procedure*

The current study was a 2 (Age)×2 (Assessment) factorial design with repeated measures on the second factor. The assessment factor consisted of an experimental and control condition, and was counterbalanced across subjects. In the experimental condition, participants were required to complete eight balance tasks that corresponded to the different elements of the Berg Balance Scale [10]. Participants were told that their performance on these tasks would be carefully observed and evaluated by an expert on balance and that it was important that they performed to the best of their ability on each of the tasks. In the control condition, participants performed the same series of balance tasks without an evaluator present. In order to try and minimize the number of comparisons in our study, we limited our analysis to the three balance tasks in the Berg Balance Scale [two-legged standing for 60 s with eyes closed (EC), one-legged stance for 20 s, and maximum functional forward reach], which have been the focus of prior postural threat studies [3] and are considered to examine different elements of postural control [i.e., spontaneous sway under static (two-legged stance) and dynamic

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