



Review

Psychometric properties of dual-task balance assessments for older adults: A systematic review



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ARTICLE INFO

Article history:

Received 26 September 2014

Received in revised form

22 December 2014

Accepted 1 January 2015

Keywords:

Systematic review

Dual-task

Psychometrics

Balance

Older adults

ABSTRACT

Background: The ability to maintain balance while simultaneously performing a cognitive task is essential for daily living and has been implicated as a risk factor of falls in older adults.

Aims: To evaluate the evidence related to the psychometric properties of dual-task balance assessments in older adults.

Methods: An extensive literature search of electronic databases was conducted. Articles were included if they evaluated the psychometric properties of dual-task balance assessment tools in older adults. The data were extracted by two independent researchers and confirmed with the principal investigator. The methodology quality of each study was rated by using the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) checklist.

Results: Twenty-six articles were included in this systematic review. For dual-task static standing balance assessments, the center of pressure-related parameters (displacement, velocity) and reaction time measurements were reliable but not useful for prediction of falls. For walking balance assessments, the gait outcomes derived generally demonstrated good to excellent reliability (intraclass correlation coefficient >0.75), but their ability to predict falls varied. Outcomes derived from the cognitive tasks and the dual-task cost (dual-task performance minus single-task performance) mostly demonstrated low to fair reliability. The methodological quality of majority of studies was poor to fair, mainly due to small sample size.

Conclusions: Among the dual-task balance assessments examined, the reliability and validity varied. The findings of this review should be useful in guiding the selection of dual-task balance measures in future research.

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1. Introduction

Deficits in balance and mobility are among the major health concerns in the elderly population [1–3]. Functional community ambulation not only necessitates a critical level of balance skills, but also the ability to engage in cognitive tasks while simultaneously performing the walking task (i.e., dual-tasking) in constantly changing environments [4]. Increasing research has examined the dual-task balance and mobility performance in older adults and its clinical correlates.

Different assessment tools have been developed to evaluate dual-task balance and mobility performance [5–13]. There is evidence that dual-task balance performance declines with aging, particularly when the task is more challenging in nature [14–16]. Impaired dual-task performance has also been associated with increased risk of falls in the elderly [17–19]. While various dual-task balance assessment tools are available, studying their psychometric properties is essential. For example, good reliability and validity are required for accurate evaluation of patient performance. Adequate responsiveness of a measurement tool is important for detecting change in dual-task performance over time and assessing treatment effectiveness [20].

Previous reviews have only evaluated the ability of various dual-task assessments to predict falls (i.e., predictive validity) [17–19] without addressing other important aspects of psychometric properties (reliability, convergent validity, etc.). Moreover, none of the reviews used a systematic review approach. To date, no systematic review has examined the psychometric properties of different dual-task balance assessment tools in older adults. The current systematic review was undertaken to address this knowledge gap.

2. Methods

2.1. Search strategy

An extensive literature search of electronic databases was conducted, including PubMed, CINAHL (1982–9 December 2013), MEDLINE (1950–9 December 2013), PsycINFO (1806+), SCOPUS, Web of Science, and Cochrane Library. The specific search strategy for the MEDLINE is described in Supplementary Appendix 1.

Two independent researchers (L.Y., L.R.L.) were involved in the article screening and selection. After elimination of irrelevant articles by screening of the title and abstract, the remaining articles were reviewed in full text to determine their eligibility. The reference lists of the eligible articles were also examined to find other potentially relevant articles. The Science Citation Index was used for an additional search to identify all relevant articles that referenced the eligible articles. The last search was done on 20 January 2014. The agreement between the two independent researchers in article selection was evaluated by Kappa statistic.

2.2. Selection criteria

The inclusion criteria were: the study utilized dual-task balance performance as an outcome measurement; a clear description of the methods used to assess dual-task performance was provided; psychometric properties of a specific dual-task test were evaluated and reported; the study sample involved older adults; published in English. The exclusion criteria were: the study involved only individuals with a specific primary diagnosis (e.g., stroke); dissertation theses, review articles or conference abstracts.

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