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Concordance of the Montreal cognitive assessment with standard neuropsychological measures

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Abstract

Introduction: The concordance of the Montreal cognitive assessment (MoCA) with more comprehensive neuropsychological measures remains unclear. This study examined the individual MoCA domains with more comprehensive and commonly used neuropsychological measures to determine the degree of overlap.

Methods: Data included individuals seen in an outpatient neurology clinic specializing in neurodegenerative disease who were administered the MoCA and also underwent neuropsychological assessment (n = 471). A principal component analysis with varimax rotation was completed using the MoCA domain scores and comprehensive neuropsychological evaluation measures.

Results: Four factors emerged accounting for 55.6% of the variance: (1) visuospatial/executive functioning; (2) memory; (3) attention; and (4) language. The individual MoCA domain scores demonstrated high factor loadings with standard neuropsychological measures purported to measure similar cognitive constructs.

Discussion: These findings provide empirical validation for the MoCA domain classifications, lending further support for the use of the MoCA as a cognitive screen that reflects similar constructs as those measured by a comprehensive battery.

Keywords: Montreal cognitive assessment; Construct validity; Neuropsychology; Cognitive screening; Dementia

1. Introduction

The Montreal cognitive assessment (MoCA) [1] is a brief cognitive screening measure commonly used for both clinical and research purposes. It is often completed by primary care doctors and neurologists to screen for cognitive decline, including Alzheimer's disease. Given the large number of individuals with Alzheimer's disease, which is expanding exponentially, it is important to understand the relationship between this brief screening measure and the current gold standard of cognitive assessment: a full neuropsychological evaluation. Current validated use of the MoCA is restricted to interpretation of the total score, using a cutoff of less than 26 to signify impairment, which has demonstrated adequate sensitivity to cognitive impairment in a number of clinical populations, including mild cognitive impairment [1–4], Alzheimer's disease [1,2], stroke [5,6], Parkinson's disease [7,8], and Huntington's disease [9,10].

The extent to which performance on the MoCA relates to general cognitive functioning as assessed by more detailed neuropsychological tests has been explored, providing evidence of convergent validity for the overall total score [11,12]. Prior research has also compared the sensitivity and specificity of the MoCA to detecting cognitive

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impairment, as defined by impaired performance on standard neuropsychological measures, and again found adequate concurrent validity for the overall score [1,3,5–7,13,14]. Comparatively few studies, however, have examined the construct validity of the individual domain scores. The primary aim of the present study was to explore the construct validity of the individual MoCA domain scores in an effort to determine the extent to which those scores reflect similar cognitive constructs as those measured by more traditional and comprehensive neuropsychological measures.

Similar research conducted by Moafmashhadi and Koski (2013) examined the factor structure of commonly used neuropsychological measures and correlated the calculated factor scores with the individual items of the MoCA in a sample of geriatric clinical outpatients and found significant, albeit modest, correlations between their calculated factor scores and the MoCA items, suggesting construct overlap. In their examination of the sensitivity and specificity of the individual MoCA domain scores at predicting impaired cognitive performance on similar neuropsychological measures, the visuospatial/executive score demonstrated the best predictive accuracy; however, the MoCA domain scores were generally poor predictors of impairment on standard neuropsychological measures and the authors caution against clinical interpretation of domain scores [13]. Lam et al. (2013) found significant correlations among MoCA domain scores and respective neuropsychological domain scores in patients with mild Alzheimer's disease or mild cognitive impairment. They found significant cross-correlations among different domains with the highest correlation between memory domains and the lowest between language domains. For both the neuropsychological measures and the MoCA items, they grouped subtests/items based on the construct purportedly being measured, rather than using a statistical method of combining items based on shared variance.

The following study addresses a gap in our current understanding: how the MoCA domain scores relate to more comprehensive neuropsychological testing, without using an a priori categorization of the neuropsychological measures. Here, we examine the construct validity of the MoCA domain scores by using a factor analytic approach to objectively explore the construct validity. Our goal was to determine the extent to which the individual domain scores load onto similar factors with comparable indices of cognitive functioning taken from standard neuropsychological measures.

2. Methods

2.1. Participants

Data were drawn from a sample of individuals seen in a subspecialty outpatient memory disorders clinic, specializing in diagnosis and treatment of neurodegenerative disease (e.g., mild cognitive impairment, Alzheimer's disease, dementia with Lewy-bodies, frontotemporal dementia, Parkinson's disease). All patients were administered the MoCA during their intake appointment with neurology and were subsequently referred for neuropsychological assessment as part of routine clinical care. The analyzed sample consisted of 471 complete cases and was 49.9% women and predominantly Caucasian (91.3%) with an average age of 68.0 years (standard deviation [SD] = 9.3; range 25–92 years), average education of 14.7 years (SD = 2.8; range 7–20 years), and average MoCA score of 22.3 (SD = 4.0; range = 8–30). Neuropsychological testing was completed within 180 days of MoCA screening for all patients with an average interval of 47.8 days (SD = 45.8). This study was reviewed and approved by the Institutional Review Board at the Cleveland Clinic (14-565), and all patients gave written informed consent for the use of their data for research purposes.

2.2. Measures

2.2.1. Montreal cognitive assessment

The MoCA is a manually administered paper-and-pencil cognitive screening that takes approximately 10 minutes to administer and with appropriate training can be administered by multiple levels of health care providers (e.g., medical assistants, nursing staff, physician assistants, psychometrists, and so forth). It consists of 12 individual tasks, most of which are binary, that are scored and summed with a 6-item orientation screening and an educational correction (i.e., one point added for individuals with 12 years of education or less) to generate a total score representing global cognitive functioning. The individual MoCA items have been grouped into cognitive domains, including (1) visuospatial and executive functioning, (2) naming, (3) attention (e.g., simple attention, working memory, vigilance), (4) language (e.g., repetition, phonemic fluency), (5) abstraction, (6) delayed memory recall, and (7) orientation. Multiple domain classifications have been suggested [1,2], although none are currently validated for clinical interpretation. The current analysis uses the original domain organization established by the test authors.

2.2.2. Neuropsychological battery

All patients were evaluated using a comprehensive neuropsychological battery as part of routine clinical care. Measures included the brief visuospatial memory test, revised (BVMT-R) [15] delayed recall score and copy score, Hopkins verbal learning test, revised (HVLT-R) [16] delayed recall score, Wechsler memory scale, fourth edition (WMS-IV) [17] logical memory II, all five trails of the Delis-Kaplan executive function system (DKEFS) [18] trail making test (scanning, number sequencing, letter sequencing, switching,