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Review Article

Montreal Cognitive Assessment (MoCA) Scale: Strengths, Limitations, and Implication for Clinical Practice

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Abstract

Objective: Mild Cognitive Impairment (MCI) is a transitional state between normal aging and dementia, with high risk of progression. Early detection is essential, and so the Montreal Cognitive Assessment (MoCA) has become a widely used screening tool. Despite its popularity, concerns remain about its psychometric limitations and cultural applicability.
This review aims to critically analyze the MoCA, focusing on the validity and limitations of its subtests, and to propose directions for refinement and clinical adaptation.
Method: We conducted a structured narrative review (2005–2024) using PubMed, Scopus, and Web of Science databases. Search terms included "Montreal Cognitive Assessment", "MoCA", "validity", "psychometrics", and "cultural adaptation". Studies evaluating psychometric performance, cultural adaptations, and clinical applications of the MoCA were included. Case reports and studies lacking psychometric evaluation were excluded. An item-by-item critical appraisal was performed.
Results: The MoCA shows superior sensitivity for MCI detection compared to the Mini-Mental State Examination (MMSE), with strengths in brevity, multidomain coverage, and accessibility. However, limitations include: superficial executive function (EF) assessment, cultural and educational bias, lack of recognition/cueing in memory testing, simplistic binary scoring, and risk of floor/ceiling effects. These may affect diagnostic accuracy across populations.
Conclusion: The MoCA remains a valuable tool but should not be used in isolation. Clinicians must consider the cultural/educational context when interpreting results. Refinements such as weighted scoring, cued recall, and culturally adapted items, alongside digital versions, could improve accuracy and fairness. Further empirical validation of these modifications is needed.

Key words: *Alzheimer Disease; Dementia; Mild Cognitive Impairment; Montreal Cognitive Assessment (MoCA)*

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Mild Cognitive Impairment (MCI) falls in the intermediate position on the continuum from normal aging through dementia, a transitional stage during which subjects exhibit a degree of cognitive deterioration that is higher than would be hypothesized for their age and education, but with a severity that is not steeply enough inclined to be deemed dementia (1). The importance of presenting on this topic stems from the significantly higher risk for patients with MCI to convert to Alzheimer's disease (AD) or dementia, as longitudinal clinical samples have estimated 10% to 15% annual rates of conversion. In addition, population-based research has found that the incidence of MCI in people over the age of 65 approximately ranges from 10% to 20%, with a significantly higher presence in older age groups (2, 3).

Risk factors in MCI are age, lower education, vascular comorbid conditions such as hypertension and diabetes, hereditary predisposition (such as APOE ε4 allele), and lifestyle aspects such as inactivity and loneliness (4-10). Importantly, not all cases of MCI progress to dementia; some remain stable and others revert to normal cognition, particularly if a treatable underlying etiology (such as depression or medication side effect) is addressed (11-14).

Conversion rates of MCI to dementia are highly variable and vary according to the subtype of MCI and the population being studied. In general, approximately 29% of MCI individuals develop dementia in a mean follow-up of three years (15). Amnestic MCI, for instance, has a conversion rate as high as 48.7% within 30 months (16). On the other hand, population-based studies report reduced rates, with an annual conversion rate of about 3% compared to 13% in clinical populations (17). A systematic review indicates that cumulative conversion risk is about 41.5% in clinical studies, and 27% in population-based studies. This disparity likely arises due to discrepancies in study environment, with clinical studies usually recruiting participants with greater cognitive impairment or self-reported memory complaints, leading to higher conversion rates. Population-based studies, on the other hand, have more extensive and less selected samples, with lower conversion rates (18, 19). Age, cognitive status, and comorbid illnesses all significantly influence these rates, so it is important to have age- and condition-stratified monitoring and intervention strategies for MCI patients. It is crucial to understand these patterns of conversion in order to timely detect and manage dementia.

Given the high prevalence and prognostic significance of MCI, detecting it early in its course is central to initiating interventions that could potentially halt cognitive deterioration, as well as to tailoring care plans to guide patients and their families through the process of adapting to cognitive change. To meet this clinical need, the Montreal Cognitive Assessment (MoCA) was created as a rapid, easy-to-administer cognitive screening tool designed to detect subtle cognitive impairments indicative of MCI. The MoCA, developed by Nasreddine *et al*. (2005), examines numerous areas of cognition including visuospatial/executive function (EF), naming, episodic memory, attention, language, abstraction, and orientation. It is scored on a scale of 30 with higher scores indicating higher performance. A frequently used cutoff score of 26 (out of 30) was first recommended, with 25 or lower indicating possible cognitive impairment and the need for further testing (20).

The MoCA possesses numerous advantages over traditional cognitive screening tools, most importantly the Mini-Mental State Examination (MMSE). One of the best strengths of the MoCA lies in its sensitivity for detecting MCI, particularly in those with mild impairment not detectable by the MMSE (6, 20). While the MMSE is more focused on orientation, memory, and language, the MoCA evaluates more challenging EF and visuospatial performance and hence is more effective at identifying early changes in cognition seen with MCI. In addition, the emphasis of the MoCA on EF through tasks such as the trail-making test (which assesses inhibition control), clock drawing, and abstraction questions makes it better suited to assess cognitive flexibility and problem-solving, which are typically impaired in the early stages of dementia as well as in conditions like vascular cognitive impairment (21). The MoCA is also more sensitive across a broader range of educational levels than the MMSE, partly due to containing measures of abstraction and fluency in words. In addition, the relative brevity and ease of administration of the MoCA, typically taking about 10 minutes, make it a practical option for implementation in busy clinical settings, while still providing a multi-dimensional cognitive snapshot. Its free availability (compared with the MMSE, a copyrighted instrument) also contributes to its widespread use in research and practice (22-24). Together, these attributes make the MoCA an excellent tool when early detection of cognitive impairment, and indeed MCI, is the clinical concern. But these strengths must be weighed against the MoCA's own biases, specifically its educational and cultural biases, which must be taken into account with utmost care when applying it to different populations. Whereas various systematic reviews and studies have evaluated MoCA's psychometric properties and clinical usefulness, these tend to be more interested in its overall diagnostic validity rather than in a detailed, item-by-item analysis of its subtests. Furthermore, many previous reports do not adequately discuss MoCA’s cultural and educational biases, nor do they offer practical ways to mitigate them through structural and scoring modifications. Therefore, a more rigorous examination is needed to move beyond generalizability and evaluate the underlying cognitive constructs of every subscale. This contributes to existing literature and highlights the need for future refinement and adjustment of the MoCA across diverse clinical settings.

The objective of this review was to (1) critically evaluate the validity and limitations of each MoCA subtest on an item-by-item basis, (2) examine the cultural and educational effects on test performance, and (3) propose evidence-based recommendations for revision, score adjustments, and clinical adaptation to maximize its diagnostic accuracy across diverse populations.

Despite its widespread use and recognized advantages, MoCA exhibits notable deficits in the content and structure of its items, as well as in its scoring system, which can limit its diagnostic accuracy and clinical utility. One major concern is that several cognitive domains are underrepresented or insufficiently assessed. For example, EFs, which are crucial for detecting early cognitive impairment, are only superficially evaluated through the trail-making task and abstraction items, both of which are relatively simplistic and fail to capture the full complexity of executive processes such as planning, cognitive flexibility, and strategic problem-solving. Similarly, assessment of the visuospatial domain is limited to basic tasks like cube copying and clock drawing, which do not adequately assess higher-level spatial processing or visuospatial memory (25-27).

In the memory section, the MoCA relies primarily on a brief five-word delayed recall task, which is limited in its diagnostic resolution because it does not distinguish between different types of memory failure, particularly retrieval deficits and encoding/storage deficits. This distinction is crucial in differential diagnosis, especially when attempting to differentiate between AD and frontotemporal dementia (FTD)—two common causes of early-onset cognitive impairment with markedly different prognoses and management strategies (28-31).

In AD, memory impairment is typically the earliest and most prominent feature, characterized by deficits in memory encoding and consolidation due to the involvement of medial temporal lobe structures, particularly the hippocampus and entorhinal cortex. Individuals with AD are often unable to benefit from cueing or recognition aids, because the information was never adequately encoded or consolidated in the first place—a phenomenon known as amnestic syndrome of the hippocampal type (32).

In contrast, patients with FTD, especially in its behavioral variant (bvFTD) or dysexecutive subtype, may perform poorly on free recall tasks due to retrieval failure, linked to frontal lobe dysfunction. However, they often demonstrate improved performance with cues or recognition formats, indicating that the memory trace was encoded but cannot be efficiently accessed—a classic retrieval deficit. This pattern reflects the executive dysfunction typical of FTD, rather than true amnesia (33, 34).

The MoCA's current structure does not include recognition or cueing components, which are essential for making this diagnostic distinction. Without these elements, clinicians cannot determine whether a poor delayed recall score reflects a failure to encode and store (as in AD) or a failure to retrieve (as in FTD or depression). This limits the MoCA's ability to serve as a standalone diagnostic tool in complex neurodegenerative presentations. To improve its utility, future revisions or supplementary protocols could incorporate recognition or cued-recall tasks, allowing for a more refined analysis of memory impairment profiles and improving the accuracy of syndromic classification in early dementia assessment (35, 36).

The scoring system of the MoCA also reflects a lack of granularity, as all items are typically weighted equally, regardless of their cognitive complexity or diagnostic value. For instance, drawing a simple clock circle is scored the same as the correct placement of the clock hands, despite the latter being far more dependent on executive functioning, working memory, and abstract reasoning. This flat scoring system reduces the test's sensitivity to subtle cognitive deficits in higher-functioning individuals, contributing to a ceiling effect in well-educated populations. Moreover, the MoCA's binary scoring (correct/incorrect) for several items fails to capture the qualitative aspects of performance, such as types of errors made, which could offer richer diagnostic insight. Addressing these deficits through more comprehensive item development, domain-specific weighting, and refined scoring rubrics could significantly enhance the MoCA's diagnostic precision, particularly for detecting early-stage cognitive decline across diverse populations and educational backgrounds.

We will also present and discuss several critiques of the MoCA in this article.

Sensitivity and Specificity

Some studies have raised concerns about the sensitivity and specificity of the MoCA in different populations. While it is generally effective for detecting MCI and early stages of dementia, its performance may vary based on demographic factors such as age, education level, and cultural background (37-39).

The sensitivity and specificity of MoCA can vary across different populations, but this should not be interpreted solely as a limitation of the tool itself. Rather, this variability is a common feature shared by most neuropsychological assessments when applied across culturally, linguistically, and educationally diverse groups. Cognitive tests are inherently influenced by language, culture, education level, and test-taking familiarity, meaning that their cut-off scores, normative data, and diagnostic accuracy must be tailored to the specific population being assessed. For instance, in a UK memory clinic, the MoCA showed a sensitivity of 83% for MCI and 94% for dementia, but its specificity was lower (50%), indicating a higher false-positive rate in that context (40). In contrast, studies conducted in African American and South African populations found higher sensitivity (up to 95% for MCI) but lower specificity, particularly when the standard cutoff of 26 was applied without adaptation (41). These findings do not necessarily indicate that the MoCA is flawed; rather,

they underscore the essential need for culturally appropriate validation studies in every society where the test is used.

These variations highlight the influence of demographic factors such as cultural background, age, and education level on the MoCA's performance. Adjustments in cut-off scores and test modifications may be necessary to improve its diagnostic accuracy in diverse populations.

Educational and Cultural Bias

The MoCA was originally developed in a specific cultural context, which may not be translated well across different populations. Critics argue that certain items may be culturally biased, potentially leading to underdiagnosis or misdiagnosis in individuals from diverse backgrounds (38, 42).

Studies have shown that the MoCA requires cultural adaptation beyond simple translation to ensure its effectiveness in different cultural contexts. For example: the abstraction task, which asks individuals to explain relationships between a train and a bicycle, assumes familiarity with both forms of transportation, which may not apply equally across cultures or socioeconomic groups. In communities where bicycles or trains are uncommon, the test may inadvertently penalize individuals for cultural unfamiliarity rather than cognitive dysfunction. Our observations suggest that only highly educated subjects can respond properly to this item and many cognitively healthy subjects may refer to the concrete and observable similarities of these two means of transport, such as having wheels, which is a correct response. One suggestion would be to specify 2 scores for this subscale: score 1 for those subjects who cite “wheels”, and score 2 for those who identify both as “vehicles”; since, “wheels” is not incorrect and should not be scored zero.

The naming task—requiring identification of a lion, rhinoceros, and camel—may pose challenges in regions where these animals are unfamiliar. In certain rural or indigenous populations, substituting these animals with locally relevant species, such as water buffalo, sheep, or native birds, could enhance relevance and fairness. Additionally, research indicates that the MoCA's cut-off scores may need adjustment for less Westernized populations to improve diagnostic accuracy.

These findings highlight the importance of developing education-neutral cognitive assessment tools to ensure accurate diagnosis across diverse populations.

Ceiling Effect

One of the key advantages of the MoCA over the MMSE lies in its ability to detect cognitive impairment in high-functioning individuals, including those with higher education levels or greater cognitive reserve (43). The MMSE has long been criticized for its ceiling effect, meaning that many individuals with early-stage MCI still achieve near-perfect scores, masking subtle cognitive deficits. This limits its usefulness in detecting MCI in well-educated individuals or those with naturally higher baseline cognitive abilities. In contrast, the MoCA incorporates more challenging cognitive tasks, particularly within EF, abstraction, and visuospatial domains, thereby, providing a broader range of item difficulty and reducing the risk of ceiling effects.

However, it is important to recognize that the MoCA’s primary psychometric vulnerability is the opposite phenomenon, that is the floor effect, particularly when applied in populations with lower educational attainment, limited test-taking experience, or cultural backgrounds that diverge from the original sample on which the test was developed. Individuals with less formal education may struggle disproportionately with tasks such as the Serial 7s subtraction, backward digit span, or abstraction questions, not necessarily due to pathological cognitive decline, but because these tasks depend heavily on educational exposure and familiarity with formal problem-solving tasks. This educational bias can lead to artificially low MoCA scores (a floor effect), increasing the risk of false-positive results where cognitively healthy individuals are misclassified as impaired simply because they were less equipped to handle test-specific cognitive demands.

This duality of superior sensitivity for high-functioning individuals but increased risk of floor effects in lower-education populations highlights the complex interpretive demands that come with using the MoCA across diverse populations. To mitigate these risks, researchers have emphasized the importance of adjusting cutoff scores according to educational background, and in some cases, using alternative tasks or culturally adapted items to ensure fairness. Some validation studies have recommended lowering the cutoff score for individuals with lower educational attainment, while others have suggested offering educationally stratified norms, so that performance is interpreted relative to educational peers, rather than to a one-size-fits-all threshold.

In summary, the MoCA’s design offers a clear advantage in detecting early cognitive impairment in high-functioning individuals, making it a preferred tool in specialized memory clinics and research focusing on early-stage cognitive decline. At the same time, its educational sensitivity requires careful consideration when applied in low-education populations to avoid over-pathologizing normal variation in cognitive performance. This reinforces the need for locally validated norms, cultural adaptation, and clinician awareness of population-specific performance patterns, ensuring that the MoCA fulfills its potential as a globally useful screening tool while minimizing unintended bias.

Length and Administration

The MoCA is often described as a relatively brief cognitive screening tool, typically taking around 10 to 15 minutes to administer. While some clinicians working in high-volume settings have argued that even this timeframe can be challenging, it is important to recognize that brevity should not come at the expense of diagnostic accuracy, especially when evaluating

complex cognitive domains such as EF. In fact, a more critical issue is that the MoCA does not contain enough in-depth items specifically targeting EF, rather than being "too long" overall. Executive dysfunction is often one of the earliest cognitive changes in conditions such as vascular cognitive impairment and neurodegenerative disorders; yet, the MoCA's coverage of planning, cognitive flexibility, and problem-solving is superficial, leaving room for improvement in its item pool not in its length.

The notion that cognitive screening tools should be as short as possible reflects a misunderstanding of the purpose of such tools. Cognitive screening is not merely a tick-box exercise, but a clinical gateway that informs further diagnostic steps and care planning. An overly brief test risks missing subtle but clinically significant impairments, particularly in higher-functioning or early-stage patients, defeating the purpose of early detection. Instead of simply shortening cognitive assessments, efforts should focus on improving the content validity of tools like the MoCA by expanding the depth and range of cognitive domains assessed — especially in areas like EFs, working memory, and contextual memory, all of which are critical in differentiating normal aging from pathological cognitive decline.

In summary, while the administration time of the MoCA is reasonable for a comprehensive screening tool, the focus of future revisions should be its content gaps, particularly in EF, rather than calls to shorten the test. Shorter does not necessarily mean better when the goal is clinically meaningful cognitive screening, and this principle should guide future test development and refinement.

Lack of Comprehensive Assessment

The MoCA focuses on a limited range of cognitive domains (e.g., attention, memory, language, visuospatial skills) and does not provide a comprehensive assessment of all cognitive functions. Critics suggest that it should be used in conjunction with other assessments for a more thorough evaluation (43-45).

Consequently, integrating the MoCA with additional neuropsychological tests can provide a more complete picture of an individual's cognitive abilities, particularly in clinical settings where a detailed cognitive profile is necessary. This approach ensures that clinicians can identify and address a broader range of cognitive issues.

Training and Interpretation

Proper administration and interpretation of the MoCA require training. Misinterpretation of scores or failure to consider contextual factors can lead to inappropriate clinical decisions:

Like every assessment scale, proper administration and interpretation of the MoCA indeed requires adequate training to ensure accurate results. Misinterpreting scores or neglecting contextual factors, such as cultural background and education level, can lead to inappropriate clinical decisions. Studies emphasize the importance of training healthcare professionals to correctly administer the MoCA and interpret its results, as errors in these areas can affect diagnostic accuracy (46, 47). Additionally, the MoCA's sensitivity to educational and cultural differences necessitates careful consideration of these factors during interpretation to avoid misdiagnosis or underdiagnosis. Training programs and guidelines are recommended to enhance the reliability and validity of the MoCA in diverse clinical settings, ensuring that practitioners can make informed decisions based on the assessment outcomes (48-50).

In this study, we conducted a more in-depth examination of each individual item within the MoCA, aiming to explore their underlying cognitive domains. Our objective was to critically analyze the structure and content of the test components to assess their specificity, sensitivity, and clinical relevance.

1. Visuospatial/Executive (Trail Making, Cube Copying, Clock Drawing)

Trail Making Task (Alternating Numbers & Letters)

This task assesses EF, but only in a limited manner. It requires cognitive flexibility and working memory, yet does not fully capture problem-solving or strategic planning, which are key components of EF.

Linguistic and cultural adaptations are necessary for individuals who are unfamiliar with the Latin alphabet, particularly in populations where education does not emphasize letter-number pairing. These adaptations ensure the task remains accessible and accurately assesses cognitive flexibility across diverse linguistic backgrounds without the language being a limitation.

Cube Copying Task (Visuospatial Ability)

The cube copying task is a simple yet effective way to test visuospatial skills, but does not capture the full spectrum of spatial processing abilities. Moreover, performance in this task is specifically dependent on educational background and schooling effects. Individuals with limited formal education may struggle with this task, not due to cognitive impairment, but because of insufficient exposure to geometric and spatial concepts.

Clock Drawing Task (EF & Spatial Awareness)

This task is frequently used in dementia screening, though performance on it is influenced by cultural and educational factors.

Errors in clock drawing could be either due to visual-perceptual deficits or cognitive impairments resulting from an EF deficit, leading to misinterpretation by clinicians. Research suggests that in highly educated individuals, the MoCA clock test may not differentiate between normal aging and early cognitive decline.

Overall, the clock drawing test within the MoCA serves as an important measure of visuospatial abilities and EF (specifically planning, sequencing and motor control). However, the scoring system does not adequately differentiate between the distinct cognitive and motor demands required for drawing the clock's circle versus its hands. While drawing a simple circle primarily

assesses basic motor coordination and visuospatial construction, the accurate placement of the clock hands demands more complex cognitive abilities, specifically EFs such as working memory and the conceptualization of time.

Given the greater cognitive burden associated with drawing the hands—requiring an understanding of proportionality, spatial organization, and temporal representation—it is arguable that this aspect of the task should be weighted more heavily in scoring. Current scoring systems, which often allocate equal points for both components, may not sufficiently capture subtle deficits in EF that emerge specifically during hand placement. A revised scoring system that assigns greater weight to the clock hands could enhance the sensitivity of the MoCA in detecting early cognitive decline, particularly in conditions such as fronto-temporal dementia and other dementias where executive dysfunction is an early symptom.

In support of this approach, several established clock drawing scoring systems have been developed to better capture the executive and visuospatial complexity of this task. For instance, the Shulman scoring system provides a graded scale from 1 to 6 based on overall accuracy, layout, and presence of errors. The Mendez system offers a more detailed evaluation of planning, sequencing, and spatial organization, assigning points for specific elements like clock symmetry, number placement, and hand direction. Similarly, the Freedman scoring method emphasizes error patterns and executive strategy, identifying conceptual errors that often signal frontal lobe dysfunction. These alternative systems recognize that not all aspects of clock drawing are diagnostically equivalent and that errors in hand placement carry more diagnostic weight than minor distortions in circle drawing or number placement.

Adapting the MoCA's scoring system to incorporate principles from these more sensitive and detailed scoring rubrics or offering a supplementary clock interpretation scale could significantly improve its ability to detect subtle executive dysfunction in early dementia, ultimately enhancing its clinical diagnostic value in real-world settings. Empirical validation of such a modified scoring approach is warranted to determine its diagnostic efficacy and reliability across diverse populations.

2. Naming (Lion, Rhinoceros, Camel)

Animal Naming Test

This test requires visual recognition and lexical retrieval, which can be challenging in cases of aphasia or visual agnosia. The selection of animals is based on Western familiarity. Some populations may not easily identify a rhinoceros or camel if these animals are not native to their region.

Possible Modification:

When adapting the MoCA for different cultural and linguistic contexts, it is essential to consider both the familiarity and the cognitive rationale behind the selection of specific test items, including the animal-naming task. The inclusion of "rhinoceros" in the original MoCA appears to be intentional, as it represents a low-frequency and less commonly encountered word in many languages. This design choice likely serves a specific neuropsychological purpose: low-frequency nouns are generally more vulnerable to anomia and are harder to retrieve than high-frequency ones, making them useful in identifying subtle language deficits, such as those seen in amnestic Mild Cognitive Impairment (aMCI) and early AD.

Replacing "rhinoceros" with a more culturally relevant animal should therefore not simply be a matter of familiarity, but must also consider lexical frequency and semantic distinctiveness in the target culture. For example, in some Asian or African contexts, an elephant, water buffalo, or crocodile may be more culturally recognizable, while still maintaining relatively low frequency in daily speech, thereby preserving the diagnostic challenge of the item. Importantly, any such substitution should undergo formal validation to ensure that it maintains the test's sensitivity and specificity to naming and language impairment. Blindly replacing items with more familiar terms could weaken the discriminative power of the test and reduce its clinical utility.

Ultimately, test adaptation must strike a balance between cultural relevance and cognitive load equivalency, ensuring that modifications align with the neuropsychological principles underlying the original item selection.

3. Memory (Word Recall)

The word recall task in the MoCA is one of its most valuable components, as it provides a more informative assessment of memory function compared to the MMSE, which only requires recall of three words. By using five words instead, the MoCA enhances its sensitivity to detecting mild memory impairments. This increased cognitive load allows for better differentiation between normal aging, MCI, and early stages of dementia. The inclusion of additional words makes the test more effective in assessing encoding and retrieval processes, offering a more comprehensive evaluation of verbal memory than the MMSE.

4. Attention (Digit Span, Serial 7s)

Digit Span Task (Forward & Backward)

This task measures working memory, but does not capture complex attention processing. Individuals with lower education may struggle with serial 7 and the backward span despite intact cognitive function.

Serial 7s (Subtracting from 100)

This task evaluates concentration and working memory, but has significant educational bias. Individuals with limited formal education or dyscalculia (math disabilities) may score poorly, even without cognitive impairment. Some studies suggest using Serial 3s instead, as it reduces educational bias while still assessing cognitive functions.

5. Language (Sentence Repetition & Verbal Fluency)

Sentence Repetition Task

It evaluates syntax processing and verbal working memory. The sentence repetition task in the MoCA assesses syntactic processing and verbal working memory, making it particularly useful for identifying impairments in conditions such as primary progressive aphasia (PPA), specifically the non-fluent/agrammatic variant. To maintain the validity of this subscale, it is essential to clarify the rationale behind the selection of sentences used in the test.

When adapting the MoCA for different languages, researchers must carefully consider linguistic elements that influence performance. Key factors include articulation demands, sentence length, and syntactic complexity. Additionally, preserving the number of prepositions and conjunctions is crucial for distinguishing between language impairments, such as differentiating agrammatism in PPA from other forms of cognitive decline.

A well-defined manual should guide researchers in selecting equivalent sentences during translation. This ensures that the adapted versions retain their diagnostic sensitivity while accounting for language-specific grammatical structures. By maintaining these linguistic principles, the MoCA can provide a reliable assessment of syntactic deficits across diverse populations.

Verbal Fluency Task (Words Starting with F)

The verbal fluency task in the MoCA requires individuals to generate as many words as possible beginning with the letter "F" within a given time frame, usually one minute. This task assesses lexical access, semantic retrieval, and executive functioning, particularly cognitive flexibility and self-monitoring. However, its validity across languages and cultures depends heavily on linguistic properties, especially the frequency and distribution of words beginning with the selected letter in the target language.

The choice of the letter "F" in the English version of the MoCA appears to reflect its moderate word-initial frequency, ensuring that the task is challenging but not prohibitive. However, this frequency characteristic does not translate uniformly across languages. For example, in some languages, "F" may be a high-frequency letter, while in others, it may have a low frequency or be nearly absent. Therefore, using "F" indiscriminately across translations can introduce linguistic bias, potentially skewing results and reducing the test's fairness.

To preserve the cognitive demands and difficulty level of the original task, researchers adapting the MoCA should first analyze letter frequency distributions in their respective languages and then select a letter that mirrors the lexical accessibility of "F" in English. This ensures that the verbal fluency task maintains equivalent psychometric properties across cultures and avoids unfair penalization or artificial inflation of scores based on linguistic structure rather than cognitive ability. Letters with too few or too many common words can distort test difficulty, leading to misinterpretation of verbal fluency performance.

In summary, while the verbal fluency task is a valuable measure of language and executive functioning, careful linguistic calibration is essential in cross-cultural adaptation. The guiding principle should be to select a letter with comparable word-initial frequency in the target language to preserve both the validity and diagnostic sensitivity of the original task.

6. Abstraction (Similarities Task)

The task asks patients to explain relationships (e.g., "train and bicycle" → both are modes of transport). In some cultures, functional rather than categorical reasoning is preferred. Based on our observations, many cognitively healthy subjects would say: Both have wheels! While we must give a score of zero to this response, it seems that it may not be fair. Hence, it might be better to adopt a more nuanced scoring system of 0, 1 and 2.

7. Delayed Recall

The Memory and Delayed Recall components of the MoCA are critical for evaluating episodic memory, which is particularly vulnerable in conditions such as MCI and AD. The current MoCA structure requires individuals to register a set of words and later recall them after a delay period, during which they complete other cognitive tasks. While this approach aligns with conventional neuropsychological assessments, there is growing concern that the inclusion of intrusive tasks between registration and recall may inadvertently impact performance and reduce the test's specificity for memory impairments.

Intrusive cognitive tasks such as visuospatial exercises, attention assessments, and language-based activities introduce additional cognitive load that may interfere with an individual's ability to encode and consolidate the target words. This interference can disproportionately affect individuals with executive dysfunction or working memory deficits, leading to difficulties in retrieval that may not solely reflect impairments in episodic memory. Instead, these challenges could stem from divided attention, executive control limitations, or susceptibility to proactive interference, thereby confounding the interpretation of memory performance.

To improve the validity of the MoCA's memory assessment, it may be beneficial to minimize or eliminate non-memory-related tasks during the delay interval. A cleaner assessment structure, in which the recall phase follows a passive delay rather than an active interference period, may provide a more accurate measure of true episodic memory function. This modification could enhance the sensitivity of the MoCA in differentiating between memory storage deficits, as seen in AD, and retrieval difficulties associated with executive dysfunction, as seen in frontal lobe impairments.

Future research should explore the impact of intrusive cognitive tasks on recall accuracy and investigate

whether alternative task sequencing could improve diagnostic precision. Implementing such refinements may contribute to a more reliable and specific assessment of memory function in clinical and research settings, specifically in terms of scoring.

8. Orientation (Time & Place)

MoCA's orientation section is simple and effective for moderate-to-severe dementia, but may fail to detect subtle cognitive impairments. On the other hand, the retired elderly might have problems remembering the day and week without having a cognitive impairment

Final Considerations:

These findings highlight the necessity of re-examining the MoCA beyond its overall diagnostic performance. While the tool is already widely implemented in both research and clinical practice, the limitations observed at the subtest level remain relatively under-discussed. Such gaps carry important clinical consequences: for instance, a lack of recognition or cueing in the recall task may lead to misinterpretation of memory profiles in AD versus FTD, and the strong educational bias in tasks such as Serial 7s may increase the risk of misclassification in low-education populations. Similarly, in the clock drawing test, the current equal weighting of circle drawing versus correct hand placement does not reflect the much higher executive and conceptual demands of hand placement. This limitation risks overlooking subtle but clinically meaningful executive dysfunction, particularly in early dementia. Therefore, a structured critique that addresses these overlooked aspects is timely and necessary, even though several general reviews of the MoCA already exist. By focusing on item-level analysis, including tasks such as memory recall and clock drawing and their practical implications, the present study provides a perspective that is distinct from previous literature and directly relevant to improving clinical decision-making.

How to Address These Issues?

1. Improving Sensitivity & Specificity

Enhancing the sensitivity and specificity of the MoCA across different populations requires more than simply adjusting cutoff scores or translating the test into various languages. A fundamental step is ensuring that both the original test developers and the researchers responsible for cultural adaptations deeply understand the cognitive principles underlying the test's design. Each item, whether it is a word in a naming task, a sentence in a repetition exercise, or a task evaluating EF, has been intentionally selected based on neuropsychological theory, with specific attention to factors like lexical frequency, semantic category, syntactic complexity, or task difficulty. Therefore, the official test manual and adaptation guidelines must emphasize not only administrative instructions, but also the rationale behind item selection, including the psycholinguistic and neurocognitive purpose each element serves. This knowledge is critical when adapting or validating the MoCA for different linguistic and cultural settings. Without a thorough understanding of these underlying principles, there is a risk that culturally adapted versions may inadvertently dilute the cognitive load or misrepresent the intended construct, resulting in versions that appear to lack the sensitivity and specificity demonstrated by the original test. Researchers must approach cultural adaptation as more than a translation exercise. It is a process of psychometric and conceptual alignment. Ideally, adapted versions should undergo rigorous pilot testing, item analysis, and normative validation within the target population to ensure that they preserve the diagnostic utility and construct validity of the original scale. This approach ensures that the adapted MoCA remains a valid, sensitive, and specific tool for identifying cognitive impairment across diverse populations.

2. Addressing Cultural Bias

Modifying test items (e.g., alternative animal naming for different cultures) and validating MoCA translations beyond simple linguistic conversion.

3. Reducing Ceiling Effects

Adding more challenging EF tests, including contextual memory tasks for high-functioning individuals.

4. Enhancing Administration Feasibility

Developing shorter, digitized versions with automated scoring, as well as implementing adaptive testing, where item difficulty is adjusted based on patient performance.

Research Directions

1. Modifications to the MoCA

Ongoing research is focused on adapting the MoCA for different cultural and linguistic populations to enhance its applicability. For instance, the MoCA has been culturally adapted for the Portuguese population, ensuring its psychometric properties and clinical utility are equivalent to the original version. Similarly, adaptations have been made for the Filipino population, demonstrating high reliability and validity. These efforts highlight the importance of contextual adaptation rather than direct translation to maintain the test's effectiveness across diverse settings (51-53).

2. Integration of Technology

Studies are exploring digital versions of the MoCA to improve administration and scoring accuracy. For example, the electronic version of the MoCA-Thai has shown high concurrent validity with the traditional paper version, indicating its potential to enhance workflow and accessibility in clinical settings. The integration of digital tools in cognitive assessments can reduce the burden on healthcare providers and increase the test's utility, especially in regions with limited medical staff (54-56).

Limitation

Our study is conceptual and critical in nature, without new patient data. Future studies are required to test the proposed modifications and validate them in clinical samples.

Conclusion

Although the MoCA is a useful screening measure of cognitive impairment, clinicians need to recognize the logic behind its subscales and the patient's educational, occupational, and social background. This allows them to better pinpoint the nature of a deficit, understand the test's limitations and use it as part of a complementary assessment approach. This involves applying culturally modified versions and incorporating computer technologies to enhance their relevance and sensitivity in different populations and environments.

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Conflict of Interest

None.

Author's Contributions

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