

The Brief International Cognitive Assessment for Multiple Sclerosis (BICAMS): First Consensus Steps Towards a Brief Universal Cognitive Assessment for MS

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ABSTRACT

Objective: To recommend a brief cognitive assessment for multiple sclerosis (MS) that is optimized for centers with one or few staff members who may not have neuropsychological training. The recommended assessment will be constructed to maximize international use, although, in the first instance, suitability may only be established for certain areas of the world.

Background: Cognitive impairment in MS has a negative impact on many patients at all disease stages and in all subtypes. Full cognitive assessment in clinical settings is expensive, requiring expert staff and special equipment. Test versions and normative data are not available for all languages and cultures.

Design/Methods: An expert committee of twelve members representing the main cultural groups that have contributed data about cognitive dysfunction in MS was convened. 80 scientific papers were reviewed from peer-reviewed journals, investigating cognitive dysfunction in MS. Papers were selected to cover a broad spectrum of cultures and scales that targeted cognitive domains vulnerable to MS. Each was read by two committee members and each scale rated on psychometric qualities (reliability, validity, and sensitivity), international application, ease of administration, feasibility in the specified context, and acceptability to patients. The ratings of the other scales were collated and presented to the committee for discussion.

Results: The committee recommended the Symbol Digit Modalities Test, if only 5 minutes was available, with the addition of the California Verbal Learning Test – Second Edition (first five recall trials) and the Brief Visuospatial Memory Test – Revised (first recall trials), if a further 10 minutes could be allocated for testing.

Conclusions: A brief cognitive assessment for MS has been recommended. A validation protocol is in preparation for language groups and it is anticipated that validation studies will follow.

Potential Benefits

- Identifying a very brief measurement battery with adequate reliability, validity, sensitivity, and specificity would allow for more widespread, accurate, cognitive evaluations, with baseline ratings and regular observations at later follow up, optimizing patient management.
- The information delivered by this cognitive monitoring tool could be used to assist clinicians in therapeutic decision making in determining how best to support patients' involvement in disease management.
- Information and counseling could be offered to enhance adjustment at work and in the home.
- The effect of a start or shift in disease-modifying drug treatment on cognition could be easily monitored, and also the use of cognition enhancers (provided that sufficient evidence of efficacy is achieved; see Christodolou *et al*, 2008¹²).
- The brief cognitive tool could also be integrated into more detailed, specialist cognitive assessments and used to indicate which patients require expert evaluation, targeting this resource more efficiently and equitably.

Methods

- A committee of neurologists and neuropsychologists was convened, selected for their expertise in research and clinical aspects of MS cognition.
- A list of 80 scientific articles from peer-review journals was assembled. These were chosen to represent a broad international spectrum of cognitive scales and their psychometric properties.
- Each article was rated independently by two committee members on three psychometric standards (reliability, validity, and sensitivity) and four pragmatic standards (international applicability, ease of administration, feasibility in the specified context, and acceptability to patients). All ratings were 1–3 (1 = excellent, 2 = satisfactory, 3 = unsatisfactory). The mean rating for each scale and each standard was calculated, and then the mean overall rating for psychometric and pragmatic qualities was calculated separately.

Recommended Monitoring Tests

Attention and processing speed

- There are two widely-used tests of attention and processing speed in MS: the Paced Auditory Serial Addition Task (PASAT)¹³ and the Symbol Digit Modalities Test (SDMT, oral form).¹⁴ Both are included in the Brief Repeatable Battery of Neuropsychological tests (BRB-N) and the Minimal Assessment of Cognitive Function in MS (MACFIMS).¹⁵ Discussion acknowledged that the SDMT is more congenial for both patient and assessor, takes less time to complete, requires less expertise and experience of the assessor, and unlike the PASAT, it does not require special equipment for auditory presentation of stimuli. It has equal psychometric validity to the PASAT.¹⁶
- The SDMT¹⁴ had the highest rating and was recommended as the test of attention and processing speed (Figure 1).
- The test consists of a key at the top of the page, with each single digit between one and nine paired with a specific abstract graphic symbol. Below are rows of the nine graphic symbols, in pseudorandom arrangement. The patients must say the number that corresponds with each symbol. There are a few practice items, to familiarize the patient with the task. Then the patient must say as many numbers correctly paired with the symbols as they can in 90 seconds. The SDMT can be completed within 5 minutes, including instructions, practice, and testing. The good psychometric properties of the SDMT are well described elsewhere.¹¹

Verbal Memory - Immediate Recall

- Again, two candidate scales emerged: The California Verbal Learning Test-II (CVLT-II)¹⁷ and the Selective Reminding Test (SRT).¹⁸ It was noted that the SRT formal required more expertise in administration and scoring, compared with the simple list recall format of the CVLT-II. The committee decided that the first five recall trials of the CVLT-II (CVLT-II T1–5) had sufficient psychometric rigor, in particular, sensitivity to MS impairment,^{19,20} to be suitable for inclusion in the Brief International Assessment of Cognition for MS (BICAMS). CVLT-II T1–5 has been previously recommended as part of a brief MS cognitive assessment.²¹
- The recommended verbal memory scale is the CVLT-II T1–5,¹⁷ which had the highest rating (Figure 2).
- This comprises a 16-item “shopping list,” with four items belonging to each of four categories, arranged randomly. The list is read aloud five times in the same order to the patient, at a slightly slower rate than one item per second. Patients are required to recall as many items as possible, in any order, after each reading of the list. The CVLT-II T1–5 can be completed in 5 minutes, including instructions, testing and responses.

Visual Memory - Immediate Recall

- Once again, two major candidate scales emerged: the Brief Visuospatial Memory Test-revised (BVMT-r)²² and the 10/36.²³ The committee's decision highlighted the reliability of the BVMT-r, the special equipment needed for the 10/36, and the possible ceiling effect on the 10/36.^{11,24} As in the deliberations about the verbal memory scale, the conclusion was reached that the first three recall trials of the BVMT-r (BVMT-r T1–3) would be the scale recommended for BICAMS, with similar advantages and caveats to those stated above in connection with the CVLT-II T1–5.
- The BVMT-r T1–3²² had the highest rating and is recommended (Figure 3).
- The BVMT-r T1–3 requires the patient to inspect a 2 × 3 stimulus array of abstract geometric figures. In each of the three learning trials, the patient views the same array for 10 seconds. Then the array is removed and the patient is required to draw the stimulus array from memory, with the correct shapes in the correct position. The psychometric properties of the BVMT-r T1–3 are good.²²

Confounds and Limitations

- Neuropsychological test performance, including measures such as the SDMT, CVLT-II, or BVMT-r, are influenced by physical symptoms of MS, demographic factors, the presence of concurrent neurological disorders other than MS, concurrent medications, and symptoms of depression and fatigue. Each of these factors varies in the extent of their influence on performance and whether there are available mechanisms to control for their effects.
- For those health professionals with little experience of cognitive assessment it may be necessary, before the first administration, to practice and review the instructions carefully.

Future Work

- The BICAMS committee is developing an international validation protocol and some national validation projects are planned to start within a year. The BICAMS Web site (www.BICAMS.net) will provide a source of information, updates, and normative data.

Summary and Conclusions

- An expert consensus committee of neurologists and neuropsychologists, with extensive research and clinical experience of MS cognition, have recommended BICAMS. The battery can be completed in 15 minutes, requires no specialist equipment and no specialist expertise in cognitive assessment. BICAMS comprises:
 - The Symbol Digit Modalities Test
 - The California Verbal Learning Test-II, first five recall trials
 - The Brief Visuospatial Memory Test-revised, first three recall trials.

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Introduction and Rationale

- MS is an inflammatory central nervous system disease which damages myelin and axons.¹ A wide range of impairments can occur in both the physical and cognitive domains.
- Cognitive impairment is probably the most important determinant of employment status and associated societal costs, and also adversely affects driving safety, household task completion, social activity, physical independence, rehabilitation progress, coping, treatment adherence, and mental health.²
- Cognitive impairments are common in MS, with reported prevalence rates between 43% and 70%.³ They occur in all stages of the disease, including Clinically Isolated Syndrome (CIS) and early relapsing-remitting MS (RRMS).
- Cognition is only loosely related to disease duration⁴ and physical disability (in some instances clearly dissociated)⁵ and more strongly related to brain MRI parameters, especially atrophy.⁶
- Patients may not be fully aware of their deficits, or may not report them reliably, depression results in over-reporting,⁷ while metamemory impairment and loss of insight lead to underestimation in up to a third of patients.^{8,9}
- Information processing speed and memory are typically the most severely affected cognitive domains, with language usually largely intact. Cognitive deficits are often undetected at consultation.¹⁰
- Assessment of cognitive status, although psychometrically robust,¹¹ requires time consuming expert evaluation with specialist materials.
- There is a clear need for a short, well-validated, and widely accepted tool, which captures the performance of the most important cognitive skills for MS patients and can be used in everyday practice by clinical neurologists or administered by local healthcare workers.

Objective

- To recommend a clinical tool for the neurologist and healthcare professionals seeing MS patients, which:
 - Is not designed to be a cognitive screen, as it would only address a few key cognitive domains.
 - Is not designed to be a full cognitive assessment, which can only be completed by a neuropsychologist and is necessary for detailed rehabilitation and vocational interventions, and determination of disability.
 - Will be a brief monitoring instrument.
 - Will be optimized for centers with one or few staff members who may not have neuropsychological training.
 - Requires only paper, pen, and stopwatch.
 - Can be completed in 15 minutes.
 - Is for those health professionals with little experience of cognitive assessment.

Figure 1. Stimuli of the Symbol Digit Modalities Test type

≥	±	«	Π	Ж	ψ	Δ	ο	↑
1	2	3	4	5	6	7	8	9

ψ	±	Π	ψ	±	ο	≥	Δ	↑	Ж	±	«	±	≥	Δ
6	2	4												
Ж	Δ	↑	ο	Π	«	Δ	↑	Ж	±	«	«	«	Ж	ψ
ο	±	«	Π	Ж	ψ	≥	ο	±	≥	±	«	«	ψ	ο
≥	Π	«	ψ	Ж	±	Δ	ο	↑	ο	±	«	Π	Ж	«
±	±	«	Π	Ж	ψ	ο	±	ο	≥	±	«	Π	ο	ψ
«	Π	«	Δ	«	Π	Δ	ο	↑	Δ	«	«	Δ	Ж	ψ
≥	±	«	±	Ж	«	±	ο	«	≥	±	±	Π	Δ	ψ

Figure 2. Stimuli of the CVLT-II type

Carrot
Sweater
Hammer
Baseball
Football
Chisel
Pants
Beans
Shoes
Screwdriver
Basketball
Corn
Saw
Golf
Dress
Lettuce

Figure 3. Stimuli of the BVMT-r type