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The Expanded Brief Assessment of Cognition (BAC) for the Assessment of Cognitive Impairment in Mild Alzheimer's Disease

Poster #P113, THEME: Clinical Trials: Cognitive and functional endpoints.

Background

To support the development of new interventions targeting the preclinical and early stages of Alzheimer's Disease (AD), there is an urgent need for validated cognitive assessment tools with increased sensitivity to subtle cognitive decline.

The Brief Assessment of Cognition (BAC) is a battery of cognitive tasks that can be administered on a tablet, allowing for the standardization of administration and automatization of scoring (Keefe et al., 2008, Atkins et al., 2017).

The BAC has been used in multiple academic and industry-sponsored trials. An expanded version of the BAC (i.e, Expanded BAC; Figure 1) including additional subtests specifically targeting hippocampal-dependent cognitive functions has been developed to improve sensitivity to cognitive impairment observed at the earliest stages of AD. Here, we present results of a recent study assessing the sensitivity of the Expanded BAC to cognitive impairment in subjects with mild cognitive impairment (MCI) and early symptomatic AD.

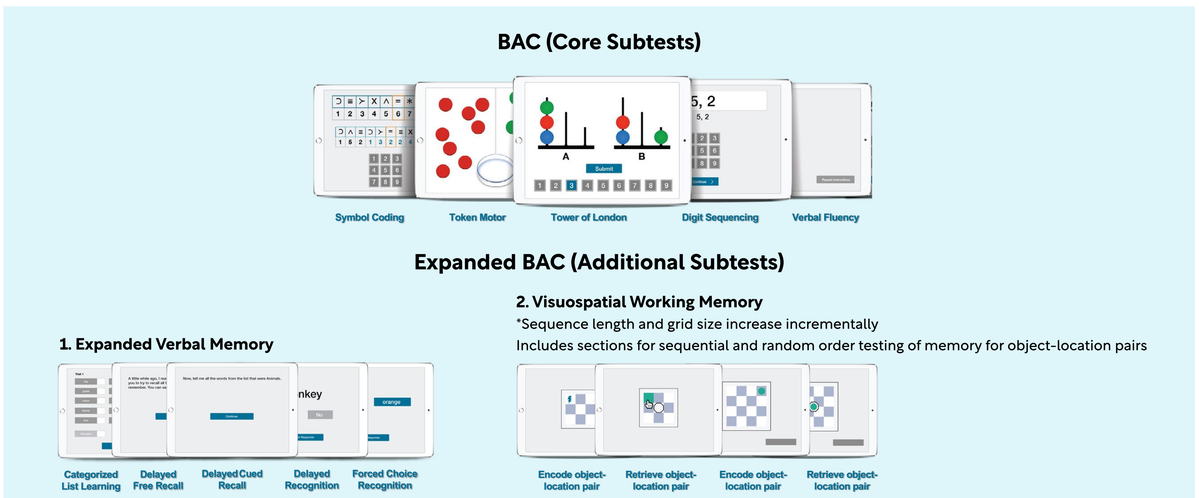

Figure 1: Illustration of subtests of the Expanded BAC

Methods

Participants included 78 adults with clinical diagnoses of MCI or mild-AD (NIA-AA criteria), 178 healthy adults aged less than 65 years (HA), 133 older adults aged 65 years or more with no subjective cognitive decline (healthy older adults, HOA), and 32 older adults with subjective cognitive decline (SCD) as identified based on a score ≥4 on the Mail-In Function Cognitive Screening Instrument (Table 1).

Participants from the HA, HOA, or SCD groups did not present cognitive impairment on standard cognitive screening tools.

Performance on the Expanded BAC individual subtests and composite score (i.e., mean of Z-scores from all completed subtests) was compared across groups using ANCOVAs, with age, gender, and education as additional covariates. Pairwise comparisons between groups were assessed using Tukey LSD tests.

In the MCI/mild-AD group, correlations were computed between the Expanded BAC composite score and well-established clinical outcome measures, the MMSE and CDR Sum-of-Boxes (CDR-SB).

	HA	HOA	SCD	MCI/AD
N	178	133	32	78
Age (mean [SD])	48 [12.8]	73.8 [6.2]	72.8 [9.3]	73.4 [7.7]
Female (n [%])	96 [54%]	77 [57%]	21 [65%]	32 [41%]
Years of Education (mean [SD])	14.3 [2.4]	15 [2.5]	14.6 [2.5]	16.5 [2.8]

Table 1: Sample demographics

Results

Group differences in performance across all Expanded BAC subtests are presented in Table 2.

There was no difference in the Expanded BAC composite score between HA and HOA ($p>0.05$), after adjusting for age, education, and sex. The MCI/mild-AD group performed worse on the Expanded BAC composite score compared to the HA ($p< 0.001$), HOA ($p< 0.001$), and SCD ($p< 0.001$) group. Finally, individuals from the SCD group had reduced performance compared to HOA ($p=0.003$) – Figure 2.

When looking at associations with well-established clinical outcome measures, the Expanded BAC composite score was significantly associated with the MMSE score ($r=0.31$, $p=0.01$; Figure 3 A) and CDR-SB ($r=-0.51$, $p<0.001$; Figure 3 B).

	HA	HOA	SCD	MCI/AD	ANCOVA results	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	F value (sig)	Pairwise Comparisons
Symbol Coding	47.2 (12.6)	34.3 (9.27)	29.2 (11.7)	27.8 (9.61)	106.1 (p<0.001)	YA>MCI/AD*; HOA>SCD*; HOA>MCI/AD***
Token Motor	85.3 (31.5)	55.3 (19.8)	52.3 (27.4)	54.7 (24.2)	50.24 (p<0.001)	-
Verbal Fluency	55.7 (13.4)	52.5 (12.8)	48.1 (12.0)	45.8 (12.4)	12.65 (p<0.001)	HOA>MCI/AD***, YA>MCI/AD***
Digit Sequencing	21.0 (4.05)	20.7 (3.7)	18.4 (4.09)	18.8 (4.38)	9.00 (p<0.001)	YA>SCD*; YA>MCI/AD**; HOA>SCD*; HOA>MCI/AD***
Tower of London	17.1 (3.39)	16.3 (3.11)	15.0 (4.02)	14.7 (3.77)	9.91 (p<0.001)	HOA>MCI/AD***
Categorized List (CL) Learning	38.6 (7.43)	35.3 (6.93)	32.5 (8.21)	26.0 (7.47)	63.74 (p<0.001)	YA>MCI/AD***; HOA>MCI/AD***; SCD>MCI/AD***
CL Delayed Free Recall	10.2 (3.26)	9.56 (2.99)	8.69 (3.33)	5.03 (4.13)	48.54 (p<0.001)	YA>MCI/AD***; HOA>MCI/AD***; SCD>MCI/AD***
CL Delayed Cued Recall	11.6 (2.47)	11.3 (2.31)	9.94 (2.79)	7.97 (3.71)	37.90 (p<0.001)	YA>MCI/AD***; HOA>MCI/AD***; HOA>SCD*; SCD>MCI/AD**
CL Delayed Recognition	29.1 (1.35)	29.0 (1.37)	28.5 (1.68)	26 (3.60)	50.98 (p<0.001)	YA>MCI/AD***; HOA>MCI/AD***; SCD>MCI/AD***
CL Delayed Forced Choice Recognition	15.0 (0.18)	15.0 (0.19)	14.8 (0.37)	14.3 (1.18)	31.15 (p<0.001)	YA>MCI/AD***; HOA>MCI/AD***; SCD>MCI/AD***
Visuospatial Working Memory	18.5 (6.44)	14.6 (4.63)	11.7 (4.31)	10.6 (4.52)	50.54 (p<0.001)	YA>MCI/AD***; HOA>MCI/AD***; HOA>SCD*

Table 2: Expanded BAC Subtests Performance Across Groups

Figure 2: Expanded BAC Composite Score Across Groups

Figure 3: Correlations between the Expanded BAC Composite and Other Clinical Measures in Participants with Mild AD

Conclusions

Performance on the Expanded BAC is sensitive to cognitive impairment in subjects with SCD and MCI/mild-AD. Additionally, performance on the Expanded BAC is significantly correlated with clinical and cognitive staging instruments commonly used in AD clinical trials.

These findings suggest that the Expanded BAC could be a valuable tool to assess and track cognitive impairment associated with the early stages of AD.

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