Psychometric Properties of the Verbal Series Attention Test: Preliminary Findings

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Introduction

The Verbal Series Attention Test (VSAT)[1] was created as a screening measure for attention difficulties in geriatric patients suspected of having dementia. Psychometric properties have been reported including interscorer reliability, test-retest reliability, sensitivity to impairments in dementia, and low-level correlations between the VSAT total score and WAIS-R indices minimally demonstrating construct validity. While principal components analysis (PCA) revealed a two-factor structure, the structure of the VSAT has not been investigated cross-validated or investigated across the spectrum of cognitive impairments with exploratory factor analysis (EFA) to determine the latent factor structure. Therefore, it is critical to assess the measurement invariance of the VSAT to assure that the same construct is being measured across different patient groups.

[1] Mahurin, RK & Cooke, N. (1996) Verbal series attention test: Clinical utility in the assessment of dementia, The Clinical Neuropsychologist, 10:1, 43-53.

Methods

Participants included a consecutive series of clinical patients presenting with a primary memory complaint. Each patient underwent a comprehensive neuropsychological assessment and provided informed consent for research. Groups formed included:

1) No Neurocognitive Disorder
2) Mild Neurocognitive Disorder, and
3) Major Neurocognitive Disorder with etiologies including suspected Alzheimer's disease and/or vascular pathology.

Scores on the 8 VSAT timed items underwent EFA using squared multiple correlations as prior communality estimates. The principal factor method was used to extract factors followed by a *promax* (oblique) rotation. The scree test and other indicators suggested two meaningful factors. Significant loadings were set at ≥ 0.36 (based on sample sizes).

		No Cognitive Disorder	Mild Neurocognitive Disorder	Major Neurocognitive Disorder
N		262	337	524
Age, yrs.	Median	70.8	72.4	77.3
	Mean	68.9 (11.7)	72.3 (8.9)	76.5 (8.3)
	Range	21-89	39-93	31-96
Education, yrs.	Median	16	16	14
	Mean	16.2 (2.5)	15.4 (2.7)	14.5 (3.1)
	Range	8-20	8-20	1-22
Sex, Female, %		53.8	51.0	57.6
Race/Ethnicity, %				
	White	81.7	78.0	71.4
	Hispanic	8.0	5.9	7.4
	Black	5.3	13.7	18.5
	Asian	5.0	2.1	2.5
	Pacific Islander	0.0	0.0	0.2
	Native American	0.0	0.3	0.0
MMSE, spelling		28.8 (1.5)	26.3 (2.4)	20.3 (5.0)
MMSE, serial 7s		28.3 (1.6)	25.5 (2.9)	19.0 (5.1)
VSAT, seconds		82.9 (28.6)	126.7 (52.8)	210.5 (87.4)

VSAT Timed Items

1. Reciting the alphabet
2. Counting backward from 20 to 1
3. Counting backward by 3's from 100 to 70
4. Reciting the days of the week forward
5. Reciting the days of the week backward
6. Reciting the months of the year forward
7. Reciting the months of the year backward
8. Alternately sequencing numbers and letters from 1 to 10 (oral adaptation of the Trail Making Test - Part B)

No Cognitive Disorder Coefficient α = 0.84 (total)	Rotated Factor Pattern (Standardized Regression Coefficients)	
	Complex Attention	**Simple Attention**
Coefficient α	0.79	0.81
Variance Explained	80.4%	19.6%
Dec_Nov	**80**	-5
100_97	**72**	-8
1A_2B	**61**	0
Sun_Sat	**60**	23
Mon_Tue	-16	**91**
Jan_Feb	18	**72**
20_19	30	**59**
ABC	-6	**51**

Mild ND Coefficient α = 0.81 (total)	Rotated Factor Pattern (Standardized Regression Coefficients)	
	Complex Attention	**Simple Attention**
Coefficient α	0.80	0.72
Variance Explained	75.7%	24.3%
1A_2B	**86**	-2
Dec_Nov	**71**	3
100_97	**64**	6
Sun_Sat	**44**	17
20_19	**37**	**36**
Mon_Tue	-4	**92**
Jan_Feb	8	**62**
ABC	11	**36**

Major ND Coefficient α = 0.83 (total)	Rotated Factor Pattern (Standardized Regression Coefficients)	
	Complex Attention	**Simple Attention**
Coefficient α	0.81	0.78
Variance Explained	81.0%	19.0%
1A_2B	**78**	-4
100_97	**77**	-8
Dec_Nov	**73**	6
Sun_Sat	**44**	**36**
Jan_Feb	-4	**75**
Mon_Tue	-10	**70**
Jan_Feb	5	**60**
20_19	27	**59**

Construct Validity

To investigate construct validity, the 8 VSAT timed items were entered into an EFA with measures of attention and executive function (i.e., WAIS Digit Span [forward, backward, sequence], Trail Making Test A & B, semantic fluency (animals), and Controlled Oral Word Association Test [COWAT, FAS]).

- The three patient groups were combined (N=950) given the VSAT's consistent factor structure.
- Using the same factor analytic procedure as before, two main factors emerged with the VSAT Complex Attention variables loading on a general complex attention/working memory factor (Trails B, semantic fluency, and Digit Span subtests).
- The VSAT Simple Attention items loaded on a general attention factor (VSAT Simple Attention variables and Trails A).
- COWAT did not load significantly on either factor.

All Groups Combined [N=950]	Rotated Factor Pattern (Standardized Regression Coefficients)	
	Attention/Working Memory	**General Attention**
Variance Explained	91%	11.8%
Trails B	**87**	-2
1A_2B	**84**	-1
100_97	**81**	-3
Dec_Nov	**75**	9
Digits Forward	**-48**	-11
Digits Backward	**-64**	-13
Semantic Fluency	**-67**	-6
Digits Sequence	**-80**	0
Jan_Feb	-4	**71**
Mon_Tue	-8	**67**
20_19	23	**62**
ABC	9	**55**
Sun_Sat	31	**49**
Trails A	36	**42**

Summary

- Negative factor loadings reflect properties of non-timed vs. timed tests.
- The latent factor structure of the VSAT was consistent across patient populations.
- Excellent internal consistency was found in each clinical group for the total VSAT score (α = 0.81-0.84) and the factor scores (α = 0.72-0.81).
- The VSAT Complex and Simple Attention factor items loaded on factors with similar variables revealing the anticipated latent structure and construct validity of the VSAT.
- These results support the use of the VSAT in patients across a wide range of neurocognitive integrity and age.
- Future studies will further explore additional psychometric properties of this instrument with a larger sample and more sophisticated analyses.

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