Psychometric Criteria for Identifying Cognitive Impairment in Older Adults on CNS Vital Signs

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Introduction

The purpose of this study was to develop evidence-based psychometric criteria for defining cognitive impairment on computerized cognitive testing with older adults.

Subjects

Participants were 390 healthy older adults between the ages of 55 and 96 (M = 68.9, SD = 8.8) from the Central Nervous System Vital Signs (CNS VS) standardization sample.

The sample was 52.9% male, 93.8% Caucasian, and their average education was 15.7 (SD = 2.6; Range = 9-20).

Table 1. Base rates of low domain scores on the CNS Vital Signs in healthy older adults.

		Age Groups				Gender		Race		Education (Years)			Computer Use		
Number of Domain Scores Below Cutoffs	**Total Sample N=390**	**55-59 N=63**	**60-69 N=159**	**70-79 N=115**	**80-96[1] N=53**	**Men N=189**	**Women N=168**	**Cauc N=360**	**A-A N=18**	**≤12 N=40**	**13-15 N=63**	**16+ N=151**	**Never N=54**	**Some N=112**	**Freq N=139**
<16th Percentile															
0 Domain Scores Below Cutoff	63.1	54.0	67.3	63.5	60.4	68.8	53.6	64.7	38.9	72.5	55.6	69.5	64.8	57.1	71.9
1 or More Domains Below Cutoff	36.9	46.0	32.7	36.5	39.6	31.2	46.4	35.3	61.1	27.5	44.4	30.5	35.2	42.9	28.1
2 or More Domains Below Cutoff	15.9	17.5	13.8	18.3	15.1	14.8	19.6	14.2	33.3	20.0	22.2	11.9	16.7	24.1	10.8
3 or More Domains Below Cutoff	8.5	9.5	8.2	9.6	5.7	7.4	11.3	6.9	27.8	17.5	14.3	4.6	13.0	14.3	3.6
4 or More Domains Below Cutoff	4.4	4.8	3.1	7.0	1.9	3.2	6.5	3.3	22.2	5.0	7.9	2.6	7.4	5.4	1.4
5 Domains Below Cutoff	1.3	--	--	3.5	1.9	1.1	1.8	0.8	11.1	--	1.6	1.3	1.9	0.9	0.7
<10th Percentile															
0 Domain Scores Below Cutoff	69.2	69.8	73.6	67.0	60.4	72.0	63.1	70.6	55.6	80.0	65.1	72.8	70.4	60.7	77.0
1 or More Domains Below Cutoff	30.8	30.2	26.4	33.0	39.6	28.0	36.9	29.4	44.4	20.0	34.9	27.2	29.6	39.3	23.0
2 or More Domains Below Cutoff	11.3	12.7	10.1	13.0	9.4	10.6	14.3	9.4	33.3	15.0	19.0	6.0	13.0	17.0	5.8
3 or More Domains Below Cutoff	5.9	6.3	5.0	7.0	5.7	5.8	7.1	4.7	22.2	12.5	6.3	4.6	9.3	8.0	2.9
4 or More Domains Below Cutoff	2.1	1.6	1.3	3.5	1.9	1.6	3.0	1.1	22.2	2.5	1.6	1.3	--	2.7	0.7
5 Domains Below Cutoff	0.8	--	--	2.6	--	1.1	0.6	0.3	11.1	--	--	0.7	--	--	0.7
≤ 5th Percentile															
0 Domain Scores Below Cutoff	79.0	74.6	82.4	79.1	73.6	81.0	74.4	80.8	55.6	82.5	76.2	85.4	77.8	71.4	88.5
1 or More Domains Below Cutoff	21.0	25.4	17.6	20.9	26.4	19.0	25.6	19.2	44.4	17.5	23.8	14.6	22.2	28.6	11.5
2 or More Domains Below Cutoff	7.9	11.1	6.9	7.8	7.5	7.4	10.1	5.8	33.3	15.0	9.5	4.0	7.4	11.6	4.3
3 or More Domains Below Cutoff	3.8	3.2	3.8	3.5	5.7	3.2	5.4	2.8	16.7	7.5	1.6	3.3	5.6	5.4	1.4
4 or More Domains Below Cutoff	1.5	--	1.3	3.5	--	1.6	1.8	0.8	16.7	--	1.6	0.7	--	0.9	0.7
5 Domains Below Cutoff	0.5	--	--	1.7	--	0.5	0.6	--	11.1	--	--	--	--	--	--
≤ 2nd Percentile															
0 Domain Scores Below Cutoff	90.3	87.3	91.2	90.4	90.6	91.0	87.5	92.5	66.7	85.0	93.7	93.4	90.7	89.3	95.0
1 or More Domains Below Cutoff	9.7	12.7	8.8	9.6	9.4	9.0	12.5	7.5	33.3	15.0	6.3	6.6	9.3	10.7	5.0
2 or More Domains Below Cutoff	2.6	4.8	3.1	0.9	1.9	3.7	1.8	2.2	5.6	5.0	3.2	2.0	--	4.5	2.2
3 or More Domains Below Cutoff	1.0	1.6	1.3	0.9	--	1.1	1.2	0.8	5.6	5.0	--	0.7	--	1.8	0.7
4 or More Domains Below Cutoff	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5 Domains Below Cutoff	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

[1] NB: There are only 8 subjects between the ages of 90 and 96.

Measures

CNS VS is comprised of seven tests that yield five primary domain scores (i.e., Memory, Psychomotor Speed, Reaction Time, Complex Attention, Cognitive Flexibility).

The base rates of low scores, when these five domain scores were examined simultaneously, were calculated for several cutoff scores.

Results

Having at least one (36.9%) or two (15.9%) domain scores <1SD from the mean is fairly common in healthy adults. In contrast, having two or more scores ≤5th percentile is uncommon, occurring in only 7.9% (see Table 1).

This cutoff stratified by education revealed the following prevalence rates: 12 or fewer years = 15%, 13-15 years = 9.5%, and 16+ years = 4%.

Two empirical criteria for cognitive impairment, and their associated false positive rates, are
provided below.

➢**First Criteria for Cognitive Impairment**: 4 scores below 1SD, OR 3 scores below 10th percentile, OR 2 scores below 5th percentile.

- False positives in the total *normative sample of older adults* (N = 390): 9.7%
- Men (N = 189) = 9.5% and Women (N = 168) = 11.9%
- Caucasians (N = 360) = 7.8%; African Americans (N = 18) = 33.3%
- Education: 12 years or less (N = 40) = 15.0%; 13-15 years (N = 63) = 15.9%; 16+ years (N = 151) = 5.3%

➢**Second Criterion for Cognitive Impairment**: 2 scores below 5th percentile.

- False positives in the *total older adult sample* (N = 390): 7.9%
- Men (N = 189) = 7.4% and Women (N = 168) = 10.1%
- Caucasians (N = 360) = 5.8%; African Americans (N = 18) = 33.3%
- Education: 12 years or less (N = 40) = 15.0%; 13-15 years (N = 63) = 9.5%; 16+ years (N = 151) = 4.0%

Conclusion

Having base rates of low domain scores in healthy older adults facilitates clinical interpretation of CNS VS.

The two criteria for identifying cognitive impairment on this screening battery have relatively low false positive rates.

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