Global Neuropsychological Assessment (GNA): Preliminary Evidence of Clinical Utility for Depression

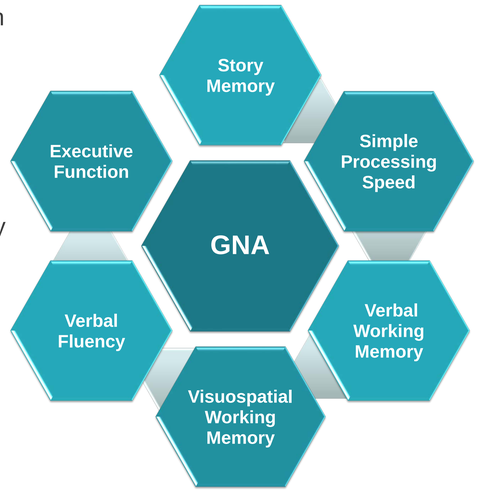
John-Christopher Finley,[1] Angela G. Carroll,[1] Jeremy M. Raines,[2] Lindsay F. Morra,[1] Christina M. Figueroa,[3] Ralph H.B. Benedict,[4] & David J. Schretlen[1]

[1]Johns Hopkins University, [2]University of North Dakota, [3]Arizona Neurology Associates, [4]University of Buffalo

Introduction

Global Neuropsychology, Inc. is a nonprofit organization whose mission is to develop global, regression-based norms for a brief cognitive test battery that will be made freely available to colleagues who help collect normative and clinical data. The Global Neuropsychological Assessment (GNA) test battery:

- Consists of five core cognitive subtests, one optional subtest, and the PHQ-4 screener for depression/anxiety
- Yields multiple measures plus global composite
- Takes 18–20 minutes to administer & 5 to score
- Can be used for persons who are 5 to 90+ years old
- Screens for impaired hearing and vision
- Does not require literacy or use of a pencil
- Being translated into as many languages as possible
- Being normed in as many countries as possible



GNA Subtest	Function	Stimuli & Task Demands	Time
Perceptual Comparison	Processing speed	Compare as many of 48 design pairs as possible in 45 seconds, and state whether the designs in each pair are the same or different.	1 min
Story Memory	Episodic memory	Listen to a brief story that is read aloud and recall as many of 14 target words as possible. Includes two learning and one delayed recall trial.	3 min
Digit Span	Auditory-verbal Working memory	Using adaptive approach, repeat as many digits forward and backward (from 1 to 9) as possible. One trial of each tested string length.	4 min
Spatial Span	Visuospatial Working memory	Using adaptive approach, correctly remember the location and order of numbered boxes on a grid, then draw a line in an empty grid through the same boxes in the same order, forward and backward.	5 min
Animal Naming	Verbal fluency	Name as many animals as possible in 60 seconds.	1.5 min
Category Switching	Executive: set-switching	Switch back and forth between naming as many body parts and foods as possible in 60 seconds.	1.5 min
PHQ-4	Self-rated anxiety and depression	4 question Likert-type instrument for participants to rate current mood.	1 min

Study Aims & Method

Study Aim: Test whether GNA subtests discriminate patients with depression from healthy adults.

Participants: 65 adults admitted to the Johns Hopkins Hospital mood disorders service as part of routine clinical workup.

63 healthy adults completed GNA as part of validation study

Presented at 2020 INS Conference in Denver, CO. **Correspondence: David Schretlen, PhD dschret@jhmi.edu**

Method – Demographics

GNA Subtests		Patient	Control	Statistic Value	*p*-value	Effect Size
N		65	63	--	--	--
Sex (men: women)		29: 36	20: 43	X^2 = 2.243	.134	V = .13
Handedness (right: left: other)		52: 6: 0	55: 7: 1	X^2 = .956	.620	V = .62
Age		48.1 (16.3)	59.3 (13.7)	t(123) = 4.18	<.001	*d* = .74
Education years		16.1 (2.7)	15.4 (2.3)	t(122) = -1.44	.151	*d* = -.28
Difficulty concentrating (yes: no)		24: 34	58: 5	X^2 = 35.516	<.001	V = .54
Overall health (1 = very good; 5 = very poor)		2.7 (1.1)	1.8 (0.8)	t(126) = -5.427	<.001	*d* = -.94
GNA Form						
	Form 1	17	12	X^2 = 2.353	.671	V = .67
	Form 2	14	17			
	Form 3	13	10			
	Form 4	8	12			
	Form 5	13	12			

Method - Analysis

We conducted multivariate analysis of covariance, covarying for age, to test whether healthy adults outperformed patients with severe mood (unipolar and bipolar) and anxiety disorders on seven GNA subscales. Separate analyses of covariance (covarying for age) were conducted to determine if there were differences in overall performance on GNA scores. Furthermore, an ANCOVA was conducted to determine if the GNA anxiety/depression screener (PHQ-4) could differentiate patients and controls.

Results

There was a significant difference between patients and controls when considered jointly on the variables, Wilks' Lamba = .710; $F(7, 110) = 6.41$, $p < .00001$, partial $\eta^2 = .290$.

GNA Subtests	Patient	Control	Statistic	*p*-value	Partial η^2
Processing Speed (Correct Comparisons in 45 seconds)	30.4 (8.5)	34.3 (8.0)	$F(1, 118) = 23.59$	**<.0001**	.169
Story Memory Learning (Sum Learning Trials 1 & 2)	17.4 (4.8)	17.4 (5.0)	$F(1, 119) = 0.24$	.629	.002
Story Memory Delayed Recall (Trial 3)	7.8 (3.7)	8.6 (3.0)	$F(1, 119) = 5.62$	**.019**	.047
Digit Span (Sum Max Forward & Max Backward)	10.5 (2.7)	11.5 (2.4)	$F(1, 119) = 6.17$	**.014**	.051
Spatial Span (Sum Max Forward & Max Backward)	11.1 (3.5)	11.8 (3.1)	$F(1, 119) = 8.52$	**.004**	.068
Verbal Fluency (Sum Animal Naming & Food/Body Parts)	37.8 (12.2)	45.5 (8.9)	$F(1, 119) = 20.23$	**<.0001**	.149
Category Switching (Correct switches between Food/Body Parts)	17.0 (6.6)	21.0 (4.8)	$F(1, 119) = 15.46$	**<.001**	.118
GNA Total Score	131.9 (31.8)	150.1 (23.5)	$F(1, 119) = 24.52$	**<.0001**	.227
PHQ-4 (Sum Items 1 – 4)	8.0 (3.9)	1.9 (2.0)	$F(1, 119) = 97.81$	**<.0001**	.451

Conclusions

- Six of the seven GNA cognitive subtests and GNA total scores discriminated patients with depression from healthy adults. The largest group differences were found for GNA total scores and for the processing speed, semantic verbal fluency, and category switching (executive functioning) subtests. Smaller but still significant group differences were found by the story memory delayed recall and verbal and spatial working memory subtests.
- The largest group difference of all emerged on the ultra-brief, PHQ-4 depression and anxiety screening test.
- These findings strongly support the criterion validity of the GNA and its subtests for distinguishing psychiatric inpatients with severe mood and anxiety disorder from healthy adults. The results are highly consistent with prior research.