

The Specificity and Diagnostic Utility of Neuropsychological Impairment in Schizophrenia, Schizoaffective Disorder, and Bipolar Disorder

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Abstract

Background: The extent to which schizophrenia (SZ), schizoaffective disorder (SA), and bipolar disorder (BD) represent discrete diagnostic entities with clearly demarcated boundaries and distinct etiologies is unclear. Comparing neuropsychological function between the disorders may illuminate their similarities and differences in cerebral dysfunction and determine the accuracy of neuropsychological impairment at discriminating between them

Methods: 278 outpatients with SZ, SA, or BD were administered a battery of neuropsychological tests and rated on positive and negative symptoms. Analyses were undertaken to compare neuropsychological functioning between groups, examine the relative impact of diagnosis and clinical symptoms on test performance, and determine the accuracy of neuropsychological functioning at classifying patients.

Results: SZ patients performed worse than both SA and BD patients on most neuropsychological tests, especially measures of verbal memory and executive function. No differences were observed between SA and BD groups. The profile of impairment was very similar across groups and neuropsychological test performance was a poor predictor of diagnosis. Moreover, clinical symptoms accounted for more variance in performance on most neuropsychological variables than diagnosis.

Discussion: SZ is associated with greater cognitive impairment, especially in verbal memory and executive function, than SA and BD, which do not differ from one another. Continuous measures of clinical symptoms account for more variance in cognition than categorical diagnoses and the accuracy of neuropsychological functioning at classifying patients according to diagnosis is poor. The findings suggest that neuropsychological dysfunction may be best conceptualized as a continuous dimension that varies in severity across the three disorders rather than a dichotomous variable that distinguishes between them.

Methods

• 278 outpatients with SZ, SA, and BD were administered a battery of neuropsychological tests (Table 1). Test scores corrected for age and education using published normative data.

Table 1. Neuropsychological tests and dependent variables

Name	Abbreviation	Dependent Variable	Normative Data
Auditory Consonant Trigrams Test	ACTT	Number of letters correctly recalled (range: 0-60)	Shuss et al., 1982;
Category Instance Generation Test	CIGT	Number of animals named in 60 s (range: 0-4)	Boone et al., 1990
Controlled Oral Word Association Test	COWAT	Number of words named in 60 s beginning with F, A, and S (range: 0-4)	Tombaugh et al., 1999
Rey Auditory Verbal Learning Test	RAVLT	Total words recalled over 5 learning trials (range: 0-75)	Geffen et al., 1995
Spatial Working Memory Test	SWMT 5 s	Total words recalled from list after 20 minute delay (range: 0-15)	NA
Test	SWMT 15 s	Number of correct trials with 5 s delay (range: 0-32)	NA
WAIS-R Digit Symbol sub-test	WAIS-R DSST	Number of correct trials with 15 s delay (range: 0-32)	Wechsler, 1981
WAIS-R Mazes sub-test	WISC-R Mazes	Number of items completed in 90 s (range: 0-93)	NA
WISC-R Mazes sub-test	WISC-R Mazes	Sub-test raw score (range: 0-28)	NA
Wisconsin Card Sorting Test	WCST Cat.	Number of categories correctly sorted (range: 0-6)	Heaton et al., 1993
Test	WCST % PEs	Percent of responses classified as perseverative errors (range: 0-100)	NA=Not Available

• Analyses were undertaken to: 1) Identify group differences in neuropsychological functioning; 2) determine if neuropsychological test scores can classify patients according to diagnosis; and 3) examine the proportion of variance in test scores accounted for by diagnosis and clinical symptoms.

Results

Table 2. Demographic Characteristics and Neuropsychological Test Scores in Schizophrenia, Schizoaffective, and Bipolar Disorder

Variable	SZ (n=114)		SA (n=71)		BD (n=93)		Statistic ^a	p<	Pairwise Contrasts
	Mean	SD	Mean	SD	Mean	SD			
Sex (Male:Female)	75:39		35:36		25:68		$\chi^2(2)=31.06$.001	SZ<SA<BD ^b
Ethnicity (w.b.h.a.o)	65:46:0:1:2		48:19:1:2:1		65:24:1:0:3		$\chi^2(2)=10.98$.204	--
Age	39.2 10.9		42.1 11.1		42.1 10.1		F(2,275)=2.62	.076	--
Education ^c	3.9 1.4		3.7 1.3		3.5 1.2		F(2,275)=1.71	.184	--
Age at Onset	21.1 11.5		23.7 13.0		23.2 11.3		F(2,260)=1.29	.278	--
Illness Duration	18.0 14.0		18.2 14.6		19.4 12.6		F(2,260)=0.28	.757	--
SAPS (total)	6.2 3.4		5.3 3.3		3.4 2.8		F(2,275)=20.56	.001	BD<SZ, SA
SANS (total) ^d	7.7 4.3		6.6 3.4		5.4 3.4		F(2,175.4)=9.07	.001	BD<SZ

Neuropsychological test raw scores

Variable	n	Mean	SD	n	Mean	SD	n	Mean	SD	Statistic	p<	Pairwise Contrasts
ACTT	111	37.5	10.8	71	38.3	10.3	92	39.4	9.1	F(2,268)=1.09	.340	--
CIGT	113	15.1	5.9	70	16.7	5.8	91	17.1	5.0	F(2,268)=3.30	.039	SZ<SA, BD
COWAT	111	28.0	11.8	71	30.8	11.1	91	31.1	11.6	F(2,267)=1.78	.171	--
RAVLT Total	109	35.4	11.7	71	39.9	10.9	91	42.5	10.8	F(2,265)=9.42	.001**	SZ<SA, BD
RAVLT DR	106	6.3	3.3	69	7.3	3.7	90	7.7	3.4	F(2,259)=4.01	.020	SZ<SA, BD
SWMT 5 s	79	22.1	3.0	55	22.2	2.9	85	22.4	2.4	F(2,213)=1.05	.352	--
SWMT 15 s	81	16.2	5.7	57	17.7	4.8	85	18.0	5.0	F(2,217)=3.10	.048	SZ<SA, BD
WAIS-R DSST	110	38.0	14.1	70	40.8	13.4	92	44.4	14.4	F(2,266)=3.32	.039	SZ<BD
WCST Cat.	108	2.6	2.2	68	3.1	2.3	89	3.3	2.1	F(2,259)=2.69	.070	--
WCST % PEs	109	26.7	18.8	68	20.1	11.1	90	19.4	9.3	F(2,261)=7.31	.002**	SZ<SA, BD
WISC-R Mazes	103	16.7	6.0	68	18.3	5.2	92	18.1	5.6	F(2,257)=5.01	.007	SZ<SA, BD

Abbreviations: a-Asian, b-black, BD=Bipolar Disorder, h-Hispanic, o=other, SA=Schizoaffective Disorder, SZ=Schizophrenia.

^b For analyses of neuropsychological test data, statistic represents diagnosis term in univariate ANCOVA with age, education, and sex entered as covariates

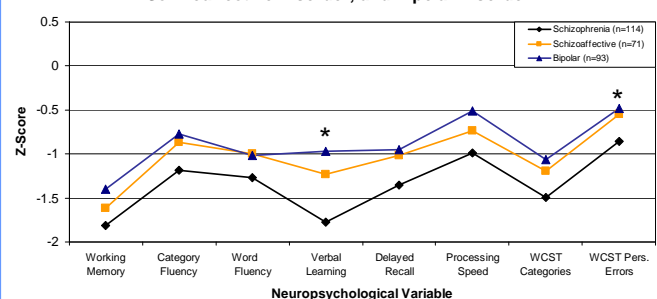
^c Education rated on a 1-7 scale where 1=graduate/professional training, 4=high school graduate, and 7=less than Grade 7

^d Groups compared using Welch's variant of the F-Test due to inhomogeneity of within-group variance

* Proportion of men in SZ group greater than SA group which, in turn, consisted of more men than the BD group.

** Significant main effect of group at after Bonferroni correction (p<.005)

Figure 1. Neuropsychological Functioning in Schizophrenia, Schizoaffective Disorder, and Bipolar Disorder



• SZ patients demonstrated greater cognitive impairment than both SA and BD on tests of verbal learning and executive functioning

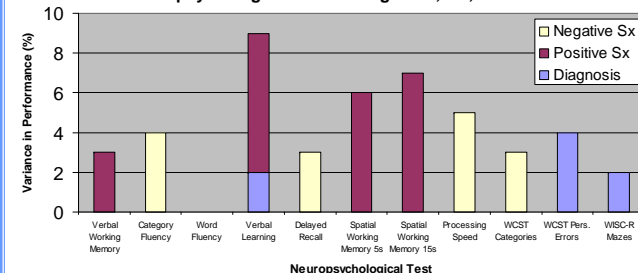
Table 3. Accuracy of Neuropsychological Test Scores at Classifying Patients*

Observed	Predicted			Percent Correct
	Schizophrenia	Bipolar	Schizoaffective	
Schizophrenia	53	30	4	60.9%
Bipolar	24	58	1	69.9%
Schizoaffective	29	30	2	3.3%
Overall Percentage				48.9%

*Classification analysis based on subset of 231 patients with complete data

• Collectively, neuropsychological test scores did not accurately classify patients according to diagnosis (multinomial logistic regression: $\chi^2(18)=28.05$, $p=.061$)

Figure 2. Impact of Diagnosis and Clinical Symptoms on Neuropsychological Functioning in SZ, SA, and BD



• Clinical symptoms accounted for more variance in neuropsychological functioning than diagnosis

Conclusions

• Cognitive impairment is greater in schizophrenia compared to schizoaffective and bipolar disorder
 • Verbal learning and executive functioning are significantly more impaired in schizophrenia compared to the other two diagnostic groups

• There were no differences in impairment in any cognitive domain between schizoaffective and bipolar disorder

• The pattern of deficits is strikingly similar across the three diagnostic groups suggesting that there is little specificity in the profile of impairment

• The fact that clinical symptoms accounted for more variance in performance than diagnosis further underscores the lack of specificity of cognitive impairment

• The similarity in cognitive impairment across the three disorders is further evidence of the limitations of the Kraepelinian model of two major psychoses

• Neuropsychological impairment may be best conceptualized as a continuous variable that varies quantitatively, but not qualitatively across the three disorders

• Schizophrenia, schizoaffective disorder, and bipolar disorder may represent points on a continuum of psychotic disorders that vary in severity, rather than discrete diagnostic entities with clearly demarcated boundaries

Author Disclosure

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