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Ecologically valid support for the link between cognitive and psychosocial functioning in bipolar disorder

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Abstract

Prior research into the link between cognitive and psychosocial functioning in bipolar disorder has examined primarily asymptomatic patients, has measured these domains concurrently, and has failed to establish convergent validity in the assessment of psychosocial dysfunction. The present study examines the relation between cognitive and psychosocial functioning at the time of discharge from hospitalization for acute mood disturbance. We obtained measures of psychosocial functioning that were both close and distant to the time of neuropsychological testing; the former from the discharging psychiatrists, and the latter from reports of formally recognized disability status, determined by persons wholly unrelated to the present research. Sixty-three patients with bipolar I disorder, hospitalized for acute mood disturbance, completed a neuropsychological test battery 24 to 48 hours prior to discharge. We compared patients with versus without formal disability status on the Global Assessment of Functioning (GAF) scale and on scores of neuropsychological tests. We also tested associations between GAF scores and cognitive test scores. Results supported the convergent validity in the measurement of psychosocial disability, underscored the robust connection between cognitive and psychosocial impairment, and highlighted the presence of this connection during an important clinical state – time of discharge from psychiatric hospitalization.

Keywords

Cognitive Impairment; Bipolar Disorder; Psychosocial Assessment

1. Introduction

Meta-analytic (Torres et al., 2007) and cross-sectional (Robinson et al., 2006) reviews of neuropsychological functioning in bipolar disorder indicate that patients often suffer from cognitive deficits during periods of euthymia. The presence of cognitive deficits in the absence of mood symptoms advanced speculations about the degree of brain dysfunction that inheres in bipolar disorder, challenged previous conceptions about the nature of this illness, and promoted discussions around the potential implications for clinical care and rehabilitation (Martinez-Aran et al., 2004a).

The evidence of chronic neurocognitive deficits may be particularly important in accounting for impaired psychosocial functioning in bipolar disorder. A decline in functioning since

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illness onset and poor post-hospital adjustment have been documented by multiple research groups (Harrow et al., 1990; Goldberg et al., 1995; Strakowski et al., 1998; Tohen et al., 2000; Zarate et al. 2000; MacQueen et al., 2001; Conus, et al., 2006), in both bipolar I and II disorders (Judd et al., 2005), and across cultures (Kebede et al., 2006). Since impairment in both cognitive and psychosocial functioning occurs in asymptomatic patients, current theorizing emphasizes the role cognitive dysfunction may play in exacerbating psychosocial disability (Martinez-Aran et al., 2004b, 2007), and reducing quality of life (Brissos et al., 2008a; Brissos et al. 2008b).

In a recent review of studies in this area, Torres et al. (2008) concluded that the balance of the data supports the existence of a strong association between cognitive and psychosocial functioning in bipolar disorder. In their critique, however, they point out several unresolved issues that deserve further investigation. First, studies have failed to establish convergent validity in the measurement of psychosocial disability; studies employing patients' self-reports of social functioning, as opposed to clinician-rated measures, find no association between cognitive and social status (Olley et al., 2005; Torres et al., 2008). Although the observed discrepancy may be attributed to diminished insight in patients with bipolar disorder (Amador et al., 1994; Ghaemi and Rosenquist, 2004; Varga et al., 2006), bias can occur in clinicians and researchers as well. Thus, further establishment of convergent validity in the measurement of psychosocial disability seems warranted.

Second, with few exceptions (i.e. Jaeger et al., 2007; Tabares-Seisdedos et al., 2008), studies showing a link between cognitive and psychosocial functioning generally obtained concurrent measurement of these variables, which increased the likelihood of detecting the hypothesized association. A temporal separation in measurement may help to clarify the extent to which the observed link between cognitive and social functioning represents a trait (i.e. versus state) characteristic of bipolar disorder.

Third, studies to date have primarily focused on euthymic patients, so little is known about the association between cognitive and social functioning during other clinical states. In particular, exploring the cognitive and social functioning of patients during the phase of early remission from acute mood disturbance may carry important implications for treatment and rehabilitation, especially at the time of discharge from inpatient care (Jaeger et al., 2007).

The current investigation addresses these issues. It offers a naturalistic observation of the ties between psychosocial and cognitive functioning in bipolar disorder at the time of discharge from the hospital. Specifically, the study examines interconnections between neuropsychological test scores and both temporally proximal psychosocial data (discharge GAF scores) and a temporally distant measure of psychosocial impairment (psychiatric disability status determined by Social Security). The use of psychiatric disability status data, generated by clinical and social agents whose function was wholly unrelated to any research group, provides an opportunity to assess the ecological validity of earlier findings, as well as to examine the convergent validity of psychosocial measures which were previously employed by research clinicians. The natural observation of clinical and community settings during early remission from acute mood disturbance may extend the generalization of previous findings and help consolidate conclusions about the link between cognitive and psychosocial functioning in bipolar disorder.

2. Methods

2.1. Subjects

A total of 63 inpatients, ages 18–59, at McLean Hospital who met DSM-IV diagnostic criteria for bipolar I disorder completed the study. These participants were recruited in the context of an investigation that explored the cognitive functioning of patients with bipolar disorder and co-occurring alcohol dependence (Levy et al., 2008). The sample included nine participants with alcohol dependence in full remission (12 months of abstinence), 13 participants who met diagnostic criteria for alcohol dependence at any point during the six months prior to admission, and 41 participants without a history of substance use disorders. Several instances of poly-substance abuse/dependence occurred in the sample (for full description, see Levy et al., 2008). All participants were admitted to the hospital for an acute mood disturbance, and none required detoxification upon admission. Forty-one participants presented with manic symptoms upon admission, 11 with depression and 11 in a mixed state. The sample included 35 men, and 28 women. Fifty-one participants identified as European American, and 12 reported an affiliation with an ethnic minority group. Thirty-two participants were single, 16 married and 15 divorced. For the purposes of this study, the patients were divided into 2 groups based on formally recognized disability status, as defined by eligibility for psychiatric disability benefits from the Social Security Administration. In the current sample, 41 participants met this criterion for disability, and the other 22 participants were classified as not disabled. Reported duration of disability status in the former group varied with a mean of 34 months and a standard deviation of 15.

2.2. Determination of eligibility for disability

In the state of Massachusetts, the Massachusetts Rehabilitation Commission (MRC) operates as a field office for the Social Security Administration (SSA) in determining eligibility for federal disability benefits, known as SSI and SSDI. The MRC employs Disability Examiners who are not medical professionals. The Disability Examiners review the treatment reports of applicants' medical providers and the reports of consultant examiners, who are medical professionals paid by MRC to perform an objective assessment. The decisions of the Disability Examiners can be overturned by their supervisors, as well as by senior medical consultants who are directly employed by MRC, and finally, by the Disability Quality Branch (DQB).

As detailed in the official website of the SSA, www.ssa.gov/disability/professionals/bluebook, the guidelines for determining eligibility for disability due to bipolar disorder include the psychiatric symptoms listed in the DSM-VI-TR and medical documentation of at least two of the following criteria (as quoted directly from the SSA website):

1. Marked restriction of activities of daily living
2. Marked difficulties in maintaining social functioning
3. Marked difficulties in maintaining concentration, persistence, or pace; or
4. Repeated episodes of decompensation, each of extended duration.

Long-term disability eligibility requires a medically-documented history of a chronic affective disorder of at least 2 years' duration that has caused more than a minimal limitation of ability to do basic work activities. Additional requirements are that symptoms or signs be currently attenuated by medication or psychosocial support, as well as one of the following:

1. Repeated episodes of decompensation, each of extended duration; or

2. A residual disease process that has resulted in such marginal adjustment that even a minimal increase in mental demands or change in the environment would be predicted to cause the individual to decompensate; or
3. Current history of 1 or more years' inability to function outside a highly supportive living arrangement, with an indication of continued need for such an arrangement.

2.3. Inclusion/exclusion criteria

Participants in this study were at least 18 years of age and carried a diagnosis of bipolar I disorder. Patients who had received ECT in the 12 months prior to evaluation, or presented with a history of neurological illness or injury were excluded. To diminish the impact of mood symptoms on test performance, inclusion criteria required a Beck Depression Inventory score < 15 (Dozois et al., 1998), a Beck Hopelessness Scale score < 10 (Beck et al., 1974) and a Young Mania Rating Scale < 15 (YMRS; Young et al., 1978). Thirty-eight patients who met the inclusion criteria declined participation in the study, most commonly because of reported scheduling conflicts.

2.4. Instruments/Measurement

2.4.1 Assessment of Psychosocial Functioning—We employed measures of psychosocial functioning both temporally-distant and proximal to the neuropsychological testing and discharge, in assessing the relation between cognitive and psychosocial status. As a temporally-distant assessment of psychosocial functioning, we used formal recognition of psychiatric disability status in the form of receipt of disability benefits from Social Security. Determination of disability status had been made prior to hospital admission, by persons entirely unrelated to the current study. Our review of medical records, patients' reports on structured interviews and other clinical information available to the treatment team yielded 41 participants with, and 22 participants without, formally-recognized disability status. The 41 participants had their disability status established at varying times prior to admission, with the most recent occurring about nine months prior to the current admission. To obtain a temporally-proximal assessment of psychosocial functioning, we relied on the GAF score determined by one of four of the discharging staff psychiatrists. In addition, given the context of this study, data regarding alcohol use were available from the Timeline Followback Method (Sobell and Sobell, 1995).

2.4.2 The Neuropsychological Battery—The neuropsychological battery measured five areas of cognitive functioning: intellectual ability (IQ), visual memory, verbal memory, attention/working memory, and executive functioning. Estimates of Verbal IQ, Performance IQ and Full scale IQ were obtained with the Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999). To assess **Visual Memory**, we employed the Rey Complex Figure test (RCF; Meyers and Meyers, 1995), and for Verbal Memory, we used the Logical Memory subtest from Wechsler's Memory Scale-Revised (Wechsler, 1987), as well as the California Verbal Learning Test II – Short Form (Delis et al., 1999).

Assessment of **Attention/Working Memory** encompassed both auditory and visual sensory channels. Tests included: the Digit Span subtest from the Wechsler Adult Intelligence Scale – Third Edition (Wechsler, 1997); the Trail Making Test, forms A and B (Spreen & Strauss, 1998); and the Symbol and Letter Cancellation Test (Spreen & Strauss, 1998). Measures tapping **Executive Functioning** included the Stroop Color-Word Interference Test (Golden and Freshwater, 2002), Controlled Oral Word Association Test (Tombaugh et al., 1999) - FAS letters format, the Animal Naming Task (Tombaugh et al., 1999), and the Wisconsin Card Sorting Test – 64 Card Version (Heaton et al., 2003).

2.5. Diagnosis and Procedure

After participants signed an informed consent form, researchers reviewed their medical charts and communicated with the treatment team to obtain all available clinical information. Next, a trained clinician conducted a diagnostic interview with the prospective participants, using the Structured Clinical Interview for DSM-IV (First et al., 1994) – Part I, and substance use measures. Participants who met inclusion criteria for the study completed the neuropsychological battery and mood measures between 24 to 48 hours before discharge. This assessment typically lasted between 2 and 3 hours.

2.6. Statistical Analysis

Differences in demographic and clinical data between the groups with and without formal disability status were analyzed with Pearson's chi-square and t-tests. To analyze group differences in neuropsychological data, we first grouped individual measures into larger cognitive domains according to what they measure, as described earlier in section 2.4. Attention and working memory included all measures tapping visual scanning, processing speed of visual material (i.e. Trail Making Test A and B, Cancellation Test), and auditory span for digits (Digit span). Visual Memory included the copy replication, as well as immediate and delayed recall of a complex figure (Rey Complex Figure). Verbal memory included the immediate, delayed recall and recognition of two short stories (Logical Memory) and a list of words (CVLT-II, short-form). Executive measures included phonemic (FAS) and semantic (Animals) fluency, ability to inhibit over-learned responses in favor of relevant task demands (Stroop), and cognitive flexibility, as indicated by effective responses to corrective feedback during non-verbal problem solving (Wisconsin Card Sorting Test). The IQ domain included composite scores of non-verbal, verbal and the combined scales. A Multivariate Analysis of Variance (MANOVA) procedure was repeated separately for each cognitive domain. This analysis applied previous number of hospitalizations, age of onset, and number of standard drinks consumed during the month prior to admission (derived from the Timeline Followback Method) as covariates. Data from neuropsychological measures reflect standardized scores with means in the normed population of 50, and standard deviations of 10. Exceptions to this are the California Verbal Learning Test II immediate recall, delayed recall and recognition scores with a population mean of 0 and a standard deviation of 1, and the Digit Span score with a population mean of 10 and a standard deviation of 3. For all neuropsychological measures, lower values denote poorer performance. Using Pearson's r , we also examined GAF scores in relation to performance on cognitive measures.

3. Results

3.1 Clinical and Demographic Variables

Table 1 presents means, standard deviations, and test statistics of key clinical and demographic variables. Significant group differences emerged in previous number of psychiatric admissions ($p < 0.02$) and GAF scores ($p < 0.01$); patients with disability reported roughly twice as many hospitalizations, and received lower GAF scores upon discharge, compared with the group without disability. Group comparison of illness onset (age of first psychiatric hospitalization) approached statistical significance ($p < 0.06$), suggesting a younger onset for the group with disability. No group differences emerged in the number of psychiatric medications taken on the day of testing, nor in diagnostic subtype upon admission. Moreover, results showed no group differences for either depressive or manic symptoms on the day of testing. No differences emerged in the reported average number of standard drinks participants consumed during the month prior to admission. With respect to demographic variables, no differences emerged in age or years of education, nor did Chi-square analyses reveal differences in gender or marital status.

3.2 Cognitive Measures

Intellectual Ability and Memory—No significant group differences emerged in IQ measures (Wilks' lambda; $F(3,56)=1.72$, $p<0.17$). The MANOVA procedure detected significant group differences in visual memory (Wilks' lambda, $F(4,55)=5.77$, $p<0.01$). The group with disability performed more poorly across all conditions of the visual memory task (Immediate Recall, Delayed Recall, and Recognition of the figure's parts), except the Copy. Correlational analyses indicated significant associations of 0.29, 0.20 and 0.33 for the Copy, Immediate Recall, and Recognition of the figure's parts, respectively.

Verbal memory was also poorer for the group with versus without disability (Wilks' lambda, $F(6,53)=3.62$, $p<0.01$). However, analysis of between subject effects revealed significant differences only on the list learning task (CVLT-II) during the Acquisition phase, Short Delay and Long Delayed Recall. No group differences emerged for the recognition of the words (Yes/No format), nor for performance on Logical Memory, a task tapping memory for prose. Moreover, no connections were detected between GAF scores from the hospital discharge note and any of the verbal memory tasks.

Attention/Working Memory and Executive Functioning—Table 3 presents results from the MANOVA analyses, revealing significant group differences in measures of executive functioning (Wilks' lambda, $F(6,53)=3.11$, $p<0.01$). With the exception of perseverative errors on the WCST, all measures indicated superior performance for the group without disability. At the same time, none of these measures was significantly associated with GAF scores.

Results further revealed group differences on measures of attention (Wilks' lambda, $F(7,52)=2.62$, $p<0.02$). More compromised performance for the group with versus without disability was noted on Digit Span as well as the Trails Making Tests (both A and B). In addition, Digit Span and Trails A were significantly correlated with GAF scores (see Table 3).

4. Discussion

Several goals guided this study. First, the study aimed to further establish convergent validity for non-self-reported assessments of psychosocial functioning. Along these lines, we gathered information about psychiatric disability status in the sample, determined many months prior to the current hospital admission, as well as GAF scores generated by discharging psychiatrists one to two days following neuropsychological testing. The data showed that participants with earlier-established psychiatric disability status achieved lower GAF scores, thus strengthening the convergent validity for non-self-reported measurements of psychosocial functioning.

Second, the current study examined more closely the link between cognitive and psychosocial status. Prior research has established a connection between cognitive and (clinician-rated) psychosocial functioning. However, this association disappears when relying on patients' ratings. We observed differences in cognitive functioning between participants with versus without previously established (i.e. established by agents unrelated to the research group) psychiatric disability status. Moreover, we detected associations between psychiatrist-generated GAF scores and performance on some neuropsychological measures. Thus, results suggest that the previous inability to detect a link between cognitive and psychosocial functioning when relying on patient ratings may be because persons with bipolar disorder have difficulty accurately assessing their own level of psychosocial functioning. In other words, the previous inconsistency probably emerged from bias in

patients' as opposed to researchers' reports. This conclusion makes sense in light of the chronic cognitive deficits that characterize more severe manifestations of bipolar disorder.

Finally, we were interested in determining whether prior neuropsychological correlates of bipolar disorder, identified during patients' euthymic states, could also be detected in another important clinical state: time of discharge from inpatient care. Consistent with prior research, we found associations between assessments of psychosocial functioning and measures of visual and verbal memory, attention/working memory, and executive functioning. Notably, temporally-distant assessments of psychosocial functioning such as SSA disability status appeared more sensitive to cognitive dysfunction than more temporally proximal psychosocial measures like the GAF score given at the time of discharge. Specifically, whereas psychiatric disability status was related to poorer scores on measures of verbal memory and executive functions, no such correlations were detected between these measures and GAF scores. This may be due to the custodial nature of inpatient care. By design, the inpatient unit poses minimal functional demands on the brain, so the impact of higher-order cognitive deficits (i.e. impairment in verbal memory and executive dysfunction) on functioning is not readily apparent in the hospital. In the absence of objective feedback from neuropsychological testing, inpatients with higher-order cognitive deficits may appear more highly functioning than they really are. After discharge, however, patients are required to negotiate less supportive environments where their deficits can disable them. This may be the reason that formal disability status predicted higher cognitive deficits better than GAF scores. In addition, it is also possible that the dimensions on which patients are evaluated at discharge are less influenced by poor verbal memory and executive functions. Alternatively, the observed differences between GAF scores and formal disability status may be due to the limited reliability of GAF assessment in the context of a natural observation.

These findings suggest that in discharge planning, earlier-established psychiatric disability status, as well as current GAF score, should be considered when determining the extent to which patients are able to comply with recommendations for their care. It may be that psychiatric disability status is a marker for more disturbances in cognitive functions, which may interfere with post-hospitalization adjustment problems and increase vulnerability to relapse. This information may aid in discharge planning by identifying patients more in need of support.

The current results support convergent validity among psychosocial measures and replicate correlations among psychosocial and neurocognitive assessments during an understudied clinical state (time of hospital discharge). Thus, study findings enhance the external validity of the connection between cognitive and psychosocial functioning in bipolar disorder. However, a number of limitations deserve mention. First, given our interest in addressing the relation between cognitive and psychosocial functioning in an ecologically valid context, we did not control for medication type and doses, which varied both within and between groups. It is likely that medications influence task performance; however, there were no group differences with respect to the number of psychiatric medications on the day of testing. A second limitation has to do with the fact that roughly a third of the sample had a history of substance dependence. However, groups did not differ in terms of average number of drinks consumed in the month prior to admission. As previously indicated, concerns regarding the reliability of the discharge GAF scores also limit conclusions. We did not establish inter-rater reliability among the four staff psychiatrists. Low inter-rater reliability may have accounted for the paucity of links between GAF scores and cognitive deficits. Despite this concern, it is notable that the groups differed on GAF scores in the expected direction. That is, that the disabled group received significantly lower GAF scores than the non-disabled group points to the convergent validity of non-self-reported assessments of

psychosocial functioning – whether this psychosocial assessment was made shortly after the cognitive testing session (GAF score) or several months earlier (SSA disability status). Finally, our sample size was relatively small. A larger sample size would increase the power of the analysis, thus increasing the likelihood of detecting more subtle neurocognitive deficits between groups with and without psychosocial disability. With respect to sampling bias, roughly a third of potential participants declined involvement in the study. Information regarding non-participants was not available, but it is possible that bias of an unknown nature influenced the present findings.

Results from this investigation underscore the robust association between cognitive and psychosocial impairment and add to previous findings by highlighting the presence of this connection during a sensitive clinical period. These results suggest that patients with more compromised neuropsychological functions may be in greater need of post-hospitalization support. Future research should continue to assess patients' cognitive and psychosocial functioning following discharge to establish prospectively whether those with greater neuropsychological deficits have higher relapse rates.

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Table 1

Clinical and demographic variables

Measures	With Disability (n=41)		Without Disability (n=22)		t	Sig.
	Mean	SD	Mean	SD		
Education	14.1	2.2	15.1	2.1	-1.6	.11
Age	35.4	12.8	41.3	12.0	-1.8	.08
Onset	25.6	10.8	31.1	10.5	-1.9	.06
GAF	56.5	4.61	61.8	5.4	-3.9	.001
Admissions	7.3	7.2	3.5	2.5	2.4	.02
Drinks	11.8	23.7	12.9	24.9	-1.7	0.8
YMRS	7.1	4.1	5.9	4.0	1.0	.27
BDI – II	8.3	3.6	8.0	3.1	.28	.78
BHS	3.6	3.9	5.4	4.0	-1.4	.16

Note: BDI=Beck Depression Inventory, BHS=Beck Hopelessness Scale, YMRS=Young Mania Rating Scale, Admissions=previous number of psychiatric admissions, Onset=age of first psychiatric admission for mood disturbance, Drinks=number of standard drinks consumed in the month prior to hospitalization.

Table 2
Group Comparison of Scaled Scores of Visual Memory, Verbal Memory, and IQ Measures

Test of Between-Subjects Effects				Means and Standard Deviations of Measures			
Measures	MD	MS	df	F	r	With Disability (n=41) Mean	Without Disability (n=22) Mean
Visual Memory							
Rey-C	4.0	95.8	3.0	3.24*	.30*	28.5	32.5
Rey-I	10.9	840.2	3.0	6.8***	.33**	28.6	39.5
Rey-D	9.1	581.8	3.0	5.8***	.20	24.9	34.0
Rey-R	11.4	1097	3.0	9.8***	.29*	35.0	47.6
Verbal Memory							
LM-I	5.2	133.8	3.0	1.2	.15	43.4	48.6
LM-D	3.0	157.3	3.0	1.5	-.19	43.4	46.4
CVLT-A	9.9	481.6	3.0	4.8***	.10	34.3	44.2
CVLT-SD	-1.4	11.1	3.0	8.1***	.02	-1.4	-0.06
CVLT-LD	1.1	6.7	3.0	6.5***	-.10	-1.7	-0.6
CVLT-R	0.3	1.1	3.0	.5	-.12	-1.3	-1.0

Note: MD = Mean Difference (short-long), MS = Mean Square, SD = Standard Deviation, df = degrees of freedom, LM-I = Logical Memory Immediate Recall, LM-D = Logical Memory Delayed Recall, CVLT = California Learning Test, (A= Acquisition, SD = Short Delay Recall, LD = Long Delay Recall, R = Recognition), r=correlation between measure and GAF,

* =P<0.05,
** = P<0.01=
*** =P<0.001.

Table 3
Group Comparisons of Scaled Scores of Attention, Executive Functioning and IQ Measures.

Test of Between-Subjects Effects				Means and Standard Deviations of Measures					
Measures	MD	MS	df	F	r	Mean	SD	Mean	SD
Executive Functioning									
FAS	9.4	555.7	3.0	4.3***	.21	51.1	12.4	60.5	9.1
Animals	6.0	310.2	3.0	3.8**	.12	42.1	9.3	48.1	9.1
Stroop-cw	5.9	424.9	3.0	4.3***	.10	38.8	10.3	44.7	10.5
WCST-C	1.5	10.8	3.0	7.1***	.21	1.2	1.0	2.7	1.6
WCST-N	8.3	422.0	3.0	3.5*	.15	31.8	9.2	41.1	13.2
WCST-P	2.2	174.7	3.0	2.1	.03	38.5	8.9	40.7	10.2
Attention									
Digit Span	2.3	28.8	3.0	4.6***	.42**	7.7	2.0	10.0	3.3
Trails A	10.9	572.6	3.0	3.8**	.28*	33.8	13.6	44.7	8.6
Trails B	13.1	970.8	3.0	5.6**	.20	30.1	11.2	43.2	15.3
CT-SU	4.7	100.5	3.0	.49	.10	37.9	14.5	41.6	13.4
CT-SS	1.4	36.7	3.0	.19	-.02	41.4	14.0	42.8	12.8
CT-LU	2.2	55.4	3	.32	.16	40.8	13.1	43.0	12.2
CT-LS	3.6	78.0	3.0	.49	.17	38.3	12.3	41.9	12.8
IQ									
VIQ	4.3	170.3	3.0	.91	.03	102.3	14.2	106.7	12.1
PIQ	7.8	380.6	3.0	3.24*	.10	96.1	10.9	103.9	10.8
FSIQ	3.1	172.9	3.0	1.0	.09	100.3	12.1	104.4	14.5

Note. MD = Mean Difference (short-long), MS = Mean Square, SD = Standard Deviation, df = degrees of freedom, FAS = Controlled Oral Association Test, Stroop - CW = Color-Word Condition, WCST = Wisconsin Card Sorting Test (C = number of categories completed, N = non-perseverative errors, P = perseverative errors, CT = Symbol and Letter Cancellation Test, (SU=Symbol Unstructured, SS=Symbol Structured, LU=Letter Unstructured, LS=Symbol Structured), VIQ = Verbal IQ, PIQ = Performance IQ, FSIQ = Full Scale IQ, r=correlation between measure and GAF,

* =p<0.05,

** = p<0.01=

*** =p<0.001.