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Recovery of cognitive functioning in patients with co-occurring bipolar disorder and alcohol dependence during early remission from an acute mood episode

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Abstract

Objective—The current study aimed to examine cognitive recovery in patients with cooccurring bipolar disorder (BD) and alcohol dependence (AD) during remission from an acute mood disturbance.

Method—Fifty-five adult inpatients with bipolar I disorder completed a neuropsychological battery, mood measures, and substance abuse measures upon discharge from the hospital and at a 3-month follow-up. Analyses provided group comparisons on these measures between patients who presented with co-occurring AD (n=21) in the year prior to hospital admission and patients without a substance use disorder (SUD; n=34).

Results—Multivariate analyses of variance detected group differences on measures of visual memory, verbal memory, and executive functioning, using previous number of psychiatric admissions and age of onset of BD as covariates. These differences occurred both at discharge and follow-up. Between discharge and follow-up, the group without SUD exhibited more substantial gains than the group of dually-diagnosed patients on free recall of verbal and visual materials and on a measure of cognitive flexibility.

Conclusions—Patients with co-occurring BD and AD may suffer from more severe cognitive dysfunction and less favorable recovery of cognitive deficits than patients without SUD over the course of remission from a mood episode.

Keywords

bipolar disorder; cognitive impairment; alcohol dependence; dually-diagnosed patients; inpatients

1. Introduction

The co-occurrence of bipolar disorder (BD) and substance use disorders (SUDs) represents a serious public health problem (1–4). Among all psychiatric disorders, BD has a particularly high prevalence of SUD in general (5) and alcohol abuse (AA) and dependence (AD) in particular (6). SUD may pose a major obstacle to the treatment of BD (7–11), as it typically predicts unfavorable rates of remission (7, 12–16), a more severe course of illness (17–20),

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and limited response to treatment (21–23). In addition, it may exacerbate psychosocial disability (8, 21–24), increase the cost of care (1,4,8), and reduce the quality of life of patients (21).

Several recent studies have advanced the hypothesis that cognitive impairment may contribute to illness severity and disability in dually-diagnosed BD patients (25–27). BD is associated with cognitive dysfunction that often persists into periods of euthymia (28). Similarly, patients with AD suffer from significant cognitive impairment, even after extended periods of abstinence (29–35). Moreover, in both BD and AD, deficits in executive functioning are particularly predictive of poor prognosis and psychosocial disability (36–44). It is therefore possible that people who suffer from both conditions may be at greater risk for developing debilitating cognitive impairment and a more severe course of illness (25–27).

Three of the studies that examined cognitive functioning in dually-diagnosed BD I patients recruited subjects in remitted states. The first study (27) reported additional decrements in executive functions in euthymic BD patients with a history of AD compared to BD patients without SUD. A more recent study (26) found poorer inhibitory control among euthymic BD patients with a history of a wide range of alcohol use disorders (AUDs) relative to patients without such a history. A third study (44) detected no association between cognitive functioning in BD and a history of alcohol abuse. These studies explored trait-related cognitive deficits in BD/AD, and their focus on euthymic patients aimed to avoid the confounding effects of mood symptoms on cognitive functioning.

Although the causes of cognitive deficits are more difficult to establish in a non-euthymic state, understanding the degree of impairment in symptomatic patients is critically important for practical considerations, related to treatment and post-hospital rehabilitation. For this reason, our group conducted a fourth study (25) with patients during early remission from a severe episode of mood disturbance. This study reported more severe memory and executive deficits in patients with co-occurring AD than similar patients without an SUD at the time of discharge from the hospital. Collectively, these studies are consistent with the hypothesis that cognitive deficits associated with both BD and AD converge to form more severe impairment in dually-diagnosed patients.

The current study aimed to examine the recovery of cognitive functions of dually-diagnosed BD/AD patients during remission from acute mood disturbance. Dually-diagnosed patients may be particularly vulnerable to the effects of cognitive deficits during this sensitive time. The temporal proximity to the peak of both mood disturbance and substance use, coupled with the use and titration of potentially sedating medications over the course of hospitalization may lead to compromised cognitive states. Negotiating the demanding transition from the minimally-stressful environment of the inpatient unit to less supervised settings after discharge, while at a cognitive ebb, may be highly challenging for patients. Understanding the cognitive state of dually-diagnosed patients when they leave the hospital, as well as the extent of cognitive recovery that occurs after discharge, may therefore be important for developing effective discharge plans, and for follow-up care.

The first part of the current study was designed to replicate with an independent sample the previous assessment of cognitive functioning we conducted with dually diagnosed patients before discharge from inpatient care (25). The second part extended this investigation in a longitudinal design, with a follow-up assessment of cognitive functioning 3 months after hospital discharge. Our hypothesis was that dually-diagnosed patients would show poorer performance than BD patients without AD at the time of discharge from the hospital. The

study further aimed to examine potential group differences in recovery of cognitive functioning at follow-up.

2. Method

2.1 Participants

A total of 82 inpatients (aged 18–59 years) with bipolar I disorder at McLean Hospital completed the initial assessment before discharge from the hospital. Fifty-five participants completed the second assessment at the three-month follow-up. Among the 27 participants who did not complete the study (11 with co-occurring AD), 15 were readmitted to the hospital for mood disturbance (3 with co-occurring AD), 7 reported admission to a substance abuse treatment unit, and 5 maintained an outpatient status (1 with co-occurring AD). A comparison of clinical and cognitive variables between participants who were re-hospitalized and those who completed the current study is summarized in a previous report (45). This analysis indicated a more severe mood episode leading to the hospitalization as well as greater cognitive deficits among patients who were readmitted to the hospital within 3 months of discharge. Among participants who discontinued the study, comparisons between patients with and without AD revealed no group differences in education, gender, age, mood symptoms at discharge, and the number or type of medications prescribed for BD. There were no group differences in attrition rate.

Among participants who completed the study, 21 met diagnostic criteria for AD in the past year. In this group, 13 participants reported past abuse or dependence on other drugs. Four of the 13 reported marijuana use, 2 reported cocaine use, and 2 reported opioid use during the month prior to hospital admission. All participants in the study were admitted for an acute mood disturbance, and none required detoxification upon admission to the hospital. From the 55 participants who completed the study, 34 did not report a history of SUD and served as a control group for dually-diagnosed patients. In the entire sample, 9 patients were admitted with depression, 12 in a mixed state, and 34 in a manic state. The sample consisted of 30 men and 25 women. Forty-six reported a Caucasian descent and 9 identified an affiliation with an ethnic minority group. Thirty were single, 14 married, and 11 divorced.

2.2 Inclusion/Exclusion criteria

All of the participants in the study were adults who met DSM-IV diagnostic criteria for bipolar I disorder. At the time of enrollment, all participants were hospitalized. Assignment to the dually-diagnosed group required a diagnosis of AD during the 12 months prior to admission. None of the other participants met diagnostic criteria for SUD in the past year. To control for the impact of mood symptoms on test performance, inclusion criteria required a Beck Depression Inventory, Second Edition (BDI-II) (46) score < 15, a Beck Hopelessness Scale (BHS) (47) score < 10, and a Young Mania Rating Scale (YMRS) (48) score < 15. Based on structured interviews and review of medical records, a clear history of neurological illness or injury excluded patients from participation.

2.3 Diagnosis and Procedure

After signing written informed consent, which had been reviewed and approved by the Institutional Review Board of McLean Hospital, participants underwent initial assessment to determine eligibility. This process included the review of records and verbal communication with the attending psychiatrist. Participants were approached for a diagnostic interview only after the information collected by the research team converged to indicate at least one current or past manic episode that could not be attributed to substance abuse, and provided no evidence for psychosis in the absence of mania. An independent confirmation of diagnostic status was attained through a Structured Clinical Interview for DSM-IV (49) by a

trained clinician. Once the treatment team indicated that a patient was sufficiently stable and approaching discharge, the patient was scheduled for neuropsychological testing 24 to 48 hours prior to discharge. On the day of testing, the examiner administered the mood and substance abuse measures, followed by the neuropsychological battery. The session typically ranged from 2.5 to 3.5 hours. After discharge, the treatment team remained in telephone contact with participants on a monthly basis. After approximately 3 months (88 to 102 days), participants returned for a follow-up evaluation, at which time all of the measures were re-administered. Before testing, participants gave urine for a drug screen and had a breath alcohol test. These procedures detected no recent use of alcohol, stimulants or opioids in any of the participants. Three of the participants tested positive for marijuana, but reported no use in the 5 days prior to testing.

2.4 Instruments

Mood measures—To assess residual mood symptoms at the time of testing, participants completed the BDI-I (46), a 21-item self-report instrument that assesses the severity of depressive symptoms as listed in the DSM-IV. Participants also filled out the Beck Hopelessness Scale (47), which measures negative attitudes about the future. The BHS consists of twenty 1-point aggregated items and offers a true/false response format. The severity of manic symptoms was assessed with the Young Mania Rating Scale (48). This is an 11-item scale with a 0–4 or 0–8 scoring system for each item, extensively used to assess the severity of mania in both clinical and research settings. Ratings were based on patients' self-reports, clinician observation, and verbal reports of the treatment team. The assessment period covered the 48 hours prior to testing at discharge, and 2 weeks prior to follow-up.

Substance Use Measures—Participants completed the drug and alcohol section of the Addiction Severity Index - 5th edition (ASI-5) (50) in the format of a semi- structured interview. This measure provides an assessment of both recent (past 30 days) and lifetime use of alcohol and a variety of other drugs (heroin, methadone, other opioids, barbiturates, other sedatives and tranquilizers, cocaine, amphetamines, cannabis, hallucinogens, and inhalants). To measure actual alcohol consumption and drug use 30 days prior to admission, we used the Timeline Followback method, using a calendar and key date anchors (51, 52). This method has been shown to have good psychometric properties with a variety of alcohol-using populations and cross-culturally (53, 54). Alcohol measures included the number of standard alcoholic drinks consumed in past 30 days, and the number of days in which alcohol was consumed over the same period. Participants also completed the Alcohol Use Disorder Identification Test (AUDIT) (55), a 10-item questionnaire (score range: 0 to 40) assessing potential problems that often result from excessive drinking (e.g. blackouts, accidents) occurring during the year prior to the assessment.

The neuropsychological battery—The neuropsychological assessment covered 5 domains of cognitive functioning - IQ, attention and working memory, verbal memory, processing of complex visual material and visual memory, and executive functioning - employing a battery with well-documented norms and satisfactory estimates of reliability and validity.

IQ—Participants completed the Wechsler Abbreviated Scale of Intelligence (WASI) (56), Vocabulary and Block Design subtests. Vocabulary (a measure of verbal intelligence) requires participants to provide definitions to words, and Block Design (a measure of non-verbal intelligence) requires the manipulation of colored blocks to copy designs that progress in gradual complexity.

Attention and Working Memory—To assess auditory attention and working memory, the battery included the Digit Span subtest from the Wechsler Adult Intelligence Scale - Third Edition (57). On this test, participants are asked to repeat a string of digits forward and then backwards. Visual scanning was assessed with the Letter and Symbol Cancellation Task (58), where participants are required to circle target symbols or letters, scattered amid distracters, with a pencil in maximum speed. Participants also completed the Trail Making Test parts A and B (59,60). On this test, participants are required to connect consecutive numbers on a page (Trail A) and alternate between ascending sequences of letter and numbers (Trail B) with maximum speed.

Verbal Memory—The acquisition of auditory verbal information was assessed with a list learning task (i.e. California Verbal Learning Test II - Short Form) (61), and memory of passages (Logical Memory from Wechsler Memory Scale-III)(62). The CVLT-II measures the number of word immediately recalled from the list of 9 words across 4 trials, and after a short and long (20-minute) delay. Logical Memory measures the number of details participants recall from two short stories with short and long (20-minute) delays.

Processing of complex visual material and visual memory was assessed with the Rey Complex Figure test (63). In this test, participants are required to copy a complex visual design and then reproduce it from memory after short and long delays.

Executive functioning—Inhibitory control was assessed with the Stroop Color-Word Interference Test (64). The test requires participants to inhibit the automatic urge to read the name of a color-word, and instead name the color of the ink in which the word is printed. The score is determined by speed and accuracy of execution. Phonemic and categorical fluency was assessed with the Controlled Oral Word Association Test (COWAT) - FAS letters format, and Animal Naming Task (65). In three separate trials, the test requires participants to retrieve as many words as they can that begin with F, A and S in 60 seconds. In a later trial, participants are asked to name as many animals as they can in 60 seconds. The battery also included the Wisconsin Card Sorting Test – 64 Card Version (66). This is a test of non-verbal concept formation, cognitive flexibility and ability to benefit from feedback. Participants are asked to match a target card to one of four alternatives. After each match, participants receive correct/incorrect feedback, and need to figure out the underlying principle that governs that matching rule (e.g. color, number, and shape of items that appear on the cards). After 10 consecutive correct matches, the rule shifts without announcement and participants need to adjust their strategy accordingly.

2.5 Statistical Analysis

Analyses of group differences in demographic and clinical data applied the Pearson's chi-square and t-tests for categorical and continuous variables, respectively. Cognitive data were analyzed with the Multivariate Analysis of Variance (MAVOVA), using the General Linear Model (GLM) in SPSS 18. This procedure was applied separately to the 5 different cognitive domains, and repeated across times of measurement (discharge and follow-up). Experimentwise type I error for multiple comparisons was controlled with Rom's (67) procedure. To compare the magnitude of change between groups over the recovery period, we applied the MANOVA procedure to change variables, which represent the difference in scale scores for each cognitive measure across measurements. All MANOVA and post-hoc analyses of between-subjects effects for individual measures applied previous number of hospitalizations and age of onset as covariates. Scores for cognitive measures included Standard Scores, based on normative data (mean = 50, SD = 10; California Verbal Learning Test - II immediate and delayed recall and recognition scores had a mean of 0 and SD of 1;

Digit Span scores had a mean of 10 and SD of 3). In all tests, lower values represented poorer performance.

3. Results

3.1 Demographic and Clinical Variables

Group comparisons of demographic and clinical variables appear in Table 1. As the table indicates, comparisons of demographic variables detected no group differences in age and education. Analysis further failed to detect differences in gender (24 women in the entire sample) and marital status. With respect to clinical variables, the group with AD reported almost twice as many previous psychiatric hospitalizations ($P<0.03$), and a trend toward a younger age of onset for BD ($P<0.06$) than the group without SUD. A significant difference ($P<0.01$) emerged in reported formal disability status between the dually-diagnosed group (19 out of 21 persons) and the group without SUD (22 out of 34 persons). No significant group differences emerged in mood measures at either discharge or follow-up. However, statistically significant improvement in all mood measures was noted within groups between discharge and follow-up. Analysis did not control for dose and medication type in the sample, although no group differences emerged in the number of psychotropic medications taken on the day of testing. This analysis compared the groups with and without AD on hospital discharge with respective frequencies of Lithium (62% versus 66%) Benzodiazepem (27% versus 23%), Neuroleptics (80% versus 83%), Anticonvulsant (47% versus 45%). Four patients in the AD group were prescribed Naltrexone. Insignificant changes in overall percentages of medication classes were noted from discharge to follow up.

3.2 Alcohol Measures

Analyses of alcohol measures indicated highly significant group differences in AUDIT scores for the 12-month period prior to admission. In keeping with the overall design of the study, the range of scores for the group with AD was consistent with a diagnosis of AD in past year, and the scores of the group without SUD ranged between abstinence and light social drinking (see Table 1). Quantity (i.e., number of standard alcoholic drinks) and frequency (i.e. number of days in which alcohol was consumed) of alcohol use 30 days prior to hospital admission were significantly higher in the group with AD. On the ASI-5, all participants in the AD group reported engagement in some form of active treatment for substance use disorders during the 3 months that preceded hospitalization. Seven participants reported abstinence during the month prior to admission, and none of the participants reported daily drinking. Eleven participants in the AD group reported averaging more than 10 drinks per drinking occasion. Group comparison of quantity and frequency of alcohol use 30 days prior to follow-up revealed no statistically significant differences; however the patterns of drinking were varied. In the AD group, 11 participants reported abstinence, whereas 10 participants reported a pattern of drinking 8 or more drinks per drinking occasion on few days (mostly 1 or 2 days) of the month. The group without SUD reported light social drinking ranging from 0 to 14 drinks per month, and a maximum of 5 drinks in one occasion. Drinking quantity and frequency decreased significantly in the AD group between the month before admission and follow-up.

3.4 Cognitive measures

3.4.1 Attention and Working Memory—The MANOVA procedure revealed no group differences on measures of attention and working memory upon discharge (Wilks' Lambda; $F(5,47)=1.32$, $P<0.26$), and at follow-up (Wilks' Lambda; $F(6,46)=1.18$, $P<0.33$). This analysis suggests that the groups did not differ in speed and accuracy of visual scanning,

speed of basic numerical sequencing, and auditory span. However, these measures improved in the entire sample between discharge and follow-up (F=3.1, P<0.04).

3.4.2 Visual Memory—The MANOVA procedure detected significant differences in visual memory, as measured by the Rey-Osterrieth Complex Figure test, at discharge (Wilks' Lambda; F(4,48)=4.12, P<0.006, Partial Eta Squared (PES)=0.25), follow-up (Wilks' Lambda; F(4,48)=5.35, P<0.001, PES=0.3), and degree of change during recovery (Wilks' Lambda; F(4,48)=3.7, P<0.01). As Table 2 indicates, post-hoc analysis of between-subjects effects for individual measures revealed significant group differences on all parts of the test, both at discharge and follow-up, at which time the extent of gains in the free delayed recall of the figure was significantly larger in the group without SUD.

3.4.3 Verbal Memory—The MANOVA procedure detected significant differences in verbal memory at discharge (Wilks' Lambda; F(6,46)=2.48, P<0.05, PES=0.24), and larger differences at follow-up (Wilks' Lambda; F(6,46)=8.0, P<0.001, PES=0.51). The degree of change from discharge to follow-up was also different between the groups (Wilks' Lambda; F(6,46)=3.0, P<0.05, PES=0.28). As Table 3 indicates, post-hoc analysis of between-subjects effects for individual measures revealed superior performance for the group without SUD on most parts of the list learning task, but no significant group differences emerged for story memory. This pattern was consistent between discharge and follow-up. More substantial gains during recovery were noted for the group without SUD on delayed free recall of the stories, delayed free recall of the list learning task, and recognition of the word list.

3.4.4 Executive Functioning—Analysis indicated significant differences in measures of executive functioning. The MANOVA procedure was highly significant at discharge (Wilks' Lambda; F(6,48)=5.1, P<0.0001, PES=0.41) and follow-up (Wilks' Lambda; F(6,48)=6.9, P<0.0001, PES=0.47). The degree of change over the course of recovery was approaching significance (Wilks' Lambda; F(6,48)=2.1, P<0.07, PES=0.2.1). As Table 4 indicates, poorer performance was noted for the group with AD on semantic/phonemic fluency, Stroop test, and overall number of errors on the WCST, both at discharge and follow-up. More substantial recovery was noted for the group without SUD on Trail Making Test B, which measures cognitive flexibility and ability to shift cognitive set.

3.4.5 IQ—Analysis applying the Univariate General Linear Model revealed no group differences on a test of vocabulary (F=0.8, MS=79.2, P<0.48). However, poorer performance was found for the group with AD on Block Design (F=4.1, MS=378.2, P<0.01), which is a timed pressured task that measures visuo-spatial reasoning and abstract non-verbal problem solving. The difference in group means was approximately 10 scale points (54 versus 44, population mean=50), which is the equivalent of 1 standard deviation in the normative sample.

4.0 Discussion

The current study examined the cognitive functioning of patients with co-occurring BD and AD over the course of early remission from an acute mood disturbance. Consistent with previous findings (25), at the time of discharge from inpatient care, analysis indicated that dually-diagnosed patients performed more poorly on measures of memory (both verbal and nonverbal) and executive functioning than patients without a history of SUD. At 3-month follow-up, similar discrepancies emerged between the groups. Although cognitive recovery over the course of remission was noted in both groups, the group without SUD exhibited more significant gains than the dually-diagnosed group on delayed free recall of the word-

list, stories and complex figure. More significant gains for the group without SUD were also noted on the Trail Making Test – Part B, which assesses complex attention and cognitive flexibility. These results remained significant after controlling for group differences in clinical variables relating to illness severity. Thus, in this sample, dually-diagnosed patients exhibited more compromised cognitive functioning and, to a certain extent, more limited cognitive recovery than patients without SUD, over the course of mood remission. The data, however, do not elucidate the causes that account for the observed group differences on cognitive measures.

The current study reported more extensive cognitive deficits in dually-diagnosed patients than studies that focused on cognitive functioning during strictly-defined periods of euthymia and abstinence (27); or studies that focused on a wider range of alcohol use disorders (26). Whereas these studies found deficits primarily in executive functioning, the current study also found impairment in learning and memory. The larger scope of cognitive impairment detected in the current study is consistent with findings indicating that cognitive deficits tend to be more pronounced in patients with AD than in patients with milder forms of alcohol use disorders (68–71). Current findings also agree with studies showing greater cognitive deficits in the early phases of remission from prolonged intoxication in AD (72, 73) or mood disturbance in BD (74,75). In this respect, the current study reaffirms the previously established connection between cognitive functioning and clinical state, and more specifically examines cognitive functioning in dually-diagnosed patients in a particular clinical state that is under-researched: non-euthymic BD patients in partial recovery from AD.

Whereas previous research with dually-diagnosed patients excluded symptomatic participants due to methodological considerations, the current study focused on these patients for clinical concerns. Specifically, it examined the cognitive challenges of a distinct group of patients during a critical time in their illness. The results suggest that dually-diagnosed patients who suffer an acute mood disturbance during early or partial remission from AD may suffer more significant cognitive impairment than asymptomatic patients or BD patients without SUD in the same affective state. These findings may be important for clinical care.

Psychiatric care of dually-diagnosed patients may benefit from future research that explores the clinical effects of cognitive impairment during recovery from acute mood episodes. Specifically, the destabilizing shift between the symptomatic phases of BD and AD may be compounded by debilitating cognitive impairment. For example, early remission from AD is typically accompanied by mood instability (76–78). With co-occurring BD, increasing mood symptoms and stress can lead to an acute mood episode that requires hospitalization (79–83). When patients arrive to the hospital with either depression or mania, they are stabilized with psychiatric medications. On discharge, patients face the challenge of transitioning from the protective environment of the inpatient unit to a less supervised setting (74, 84) at a neurocognitive low point. In this state, the task of negotiating the demands of everyday life can be overwhelming (81–83), as indicated by the robust links among cognitive impairment, prognosis, and psychosocial disability in both BD (85–89) and AD (90). Suboptimal post-discharge support may therefore lead to a vicious cycle of stress, relapse to either disorder, greater psychosocial disability, and further compromise of quality of life.

Several limitations of the study deserve mention. The sample size was fairly small and may limit conclusions in the absence of larger independent replications. Results may not generalize to minority groups, which were not represented in this sample in a way that allowed for informative analysis of differences in cognitive functioning, related to ethnicity, and culture. In addition, the current sample was too small to control for the effects of

medication, with the exception of number of medications taken on days of testing. The cognitive measures were repeated across discharge and follow-up, so some of the observed gains may have resulted from practice effects, and may not reflect brain changes related to affective recovery. Finally, significant attrition between discharge and follow-up, mostly due to relapse and readmission, rendered a selective sample of those who managed to maintain their outpatient status. As noted in our previous report (45), further investigation into the differences between patients who relapsed and those who recovered may help to illuminate the connections between cognitive functioning at discharge and post-hospital adjustment in BD patients both with and without AD or other SUD.

Finally, this study does not illuminate the causes for the observed difference between the groups. The study did not determine baseline differences between the groups prior to hospitalization, or during euthymia. The symptomatic recovery of patients with AD may have been less favorable during the interval between discharge and follow up. It is also possible that patients with AD have slower recovery, and therefore may continue to improve beyond the 3-month follow up period. Differences in treatment, stress and social support may also play a role in accounting for the cognitive disparities between the groups.

Despite these limitations, the current study provides further evidence that the co-occurrence of BD and AD is associated with increased impairment of cognitive functioning. The results of this study suggest that, over the course of remission from an acute mood disturbance, dually-diagnosed patients in partial remission from AD exhibit more severe deficits and poorer recovery of memory and executive functioning than BD patients without SUD. The unique set of circumstances, complex clinical picture, and level of disability of dually-diagnosed patients may require additional measures for their care. Careful neurocognitive evaluation before hospital discharge may inform discharge planning in a manner that increases supports for the early phases of rehabilitation and recovery. Understanding the extent of cognitive impairment at discharge, and the expected degree of functional recovery over the course of early remission, may help to decrease relapse, disability, cost, and suffering.

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Table 1

Means, Standard Deviations, and Group Comparisons ofDemographic Variables, Clinical Variables, Mood measures, and Alcohol AbuseMeasures

Measures	Bipolar Patients with AD (n=21)		Bipolar Patients without SUD (n=34)		Between groups		Within groups (paired sample)	
Demographic	**Mean**	**SD**	**Mean**	**SD**	**t**	**P Value**	**t**	**P Value**
Education	15.1	1.61	14.4	2.38	0.9	0.37		
Age	40.7	11.3	36.4	12.2	1.3	0.19		
Clinical								
Onset	23.4	7.7	28.1	9.8	−1.8	0.06		
Admissions	8.1	7.4	4.3	5.2	2.2	0.03*		
Mood								
YMRS (D)	6.5	3.6	6.1	3.7	0.4	0.68	5.4	0.001***
YMRS (F)	4.7	2.1	4.0	1.7	1.4	0.15		
BDI – II (D)	7.9	2.7	8.0	3.2	−0.05	0.95	11.6	0.001***
BDI – II (F)	6.4	2.0	6.1	2.5	0.42	0.67		
BHS (D)	4.7	3.6	3.8	3.4	0.89	0.37	6.6	0.001***
BHS (F)	3.2	2.2	2.9	2.9	0.39	0.70		
Alcohol								
AUDIT (D)	30.3	4.4	4.5	2.9	26.1	0.001***		
Quantity (D)	44.8	57.9	5.9	5.4	3.9	0.001***	2.9	0.006***
Quantity (F)	23.0	44.4	6.0	4.3	2.2	0.03*		
Frequency (D)	3.6	4.1	3.4	2.7	0.2	0.83	4.2	0.001***
Frequency (F)	1.4	2.3	2.7	2.3	−0.7	0.51		

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. Quantity=number of standard drinks consume in past 30 days, Frequency=number of days in past 30 days participant consumed alcohol.

P<0.01

* P<0.05

*** P<0.001.

Table 2

Group Comparison of Scaled Scores of Visual Memory Measures

Test of Between-Subjects Effects						**Means and standard Deviations of Measures**			
						Bipolar with AD		**Bipolar without SUD**	
Measure	**Time**	**SS**	**MS**	**F**	**PES**	**Mean**	**SD**	**Mean**	**SD**
Rey Copy	DIS.	144.5	48.2	3.2*	0.16	28.9	4.5	31.9	3.4
	FU	160.5	53.5	3.6*	0.18	30.1	5.1	33.1	2.8
	DIF.	2.3	0.78	0.5	0.03	1.1	1.2	1.2	1.3
Rey Immediate Recall	DIS.	915.7	305.2	3.4*	0.17	32.8	8.1	39.2	10.4
	FU	918.9	306.3	3.8*	0.18	34.3	8.7	41.3	9.3
	DIF	16.2	5.4	1.8	0.10	1.5	1.7	2.0	1.8
Rey Delayed Recall	DIS.	1160.1	386.1	4.0**	0.19	26.8	7.4	34.8	11.1
	FU	1519.1	506.6	5.0***	0.23	28.2	8.8	38.1	10.6
	DIF	51.5	17.2	3.9**	0.12	1.4	2.1	3.3	2.0
Rey Recognition	DIS.	861.0	287.0	2.4(.07)	0.13	36.1	10.6	43.5	10.8
	FU	966.6	322.2	3.0*	0.15	37.3	10.1	45.5	10.1
	DIF	17.2	5.7	1.7	0.09	1.2	1.5	2.0	1.9

Note. Time=time of measurement (DIS.=time of discharge; FU=3 months after discharge; DIF=Difference in scores between follow up and discharge), PES=Partial Eta Squared, SS=Sum of Square, MS=mean Sum of Square

* P<0.05

** P<0.01

*** P<0.001.

Table 3

Group Comparison of Scaled Scores of Verbal Memory Measures

Test of Between-Subjects Effects						**Means and standard Deviations of Measures**			
						Bipolar with AD		**Bipolar without SUD**	
Measure	**Time**	**SS**	**MS**	**F**	**PES**	**Mean**	**SD**	**Mean**	**SD**
Logical Memory immediate recall	DIS.	21.9	7.3	0.07	0.004	43.0	8.5	43.4	10.5
	FU	25.9	8.6	0.08	0.005	44.5	9.3	44.2	10.6
	DIF.	7.5	2.5	1.0	0.05	1.5	1.9	0.8	1.2
Logical memory delayed recall	DIS.	72.7	24.2	0.23	0.01	42.2	9.0	43.7	10.7
	FU	361.2	120.4	1.24	0.06	43.0	8.0	47.6	10.6
	DIF	136.2	45.4	3.3*	0.16	0.7	3.0	3.9	4.0
CVLT acquisition	DIS.	958.8	319.6	3.2*	0.16	36.0	10.4	43.5	9.7
	FU	1000.5	: 333.5	4.5***	0.21	38.8	7.4	46.5	9.3
	DIF	18.8	6.2	0.4	0.02	2.8	5.6	3.0	2.3
CVLT immediate recall	DIS.	16.1	5.3	3.3*	0.16	−1.3	0.9	−0.4	1.4
	FU	14.4	4.8	4.0**	0.19	−0.9	0.8	−0.02	1.2
	DIF	1.0	0.3	2.2	1.12	0.3	0.3	0.4	0.5
CVLT delayed recall	DIS.	11.7	3.9	4.6***	0.21	−1.5	0.9	−0.7	0.8
	FU	16.9	5.6	8.5***	0.33	−1.1	0.8	0.0	0.8
	DIF	1.4	0.5	3.6**	0.17	0.4	0.4	0.7	0.3
CVLT recognition	DIS.	15.0	5.0	3.4	0.17	−1.5	1.3	−0.6	1.1
	FU	16.2	5.4	5.6***	0.25	−1.2	1.0	−0.08	0.9
	DIF	0.8	0.3	0.9	0.05	0.4	0.4	0.6	0.6

Note. Time=time of measurement (DIS.=time of discharge; FU=3 months after discharge; DIF=Difference in scores between follow up and discharge), PES=Partial Eta Squared, SS=Sum of Square, MS=mean Sum of Square

*P<0.05

**P<0.01

***P<0.001.

Table 4

Group Comparison of Scaled Scores of Executive Measures

Test of Between-Subjects Effects						**Means and standard Deviations of Measures**			
						Bipolar with AD		**Bipolar without SUD**	
Measure	**Time**	**SS**	**MS**	**F**	**PES**	**Mean**	**SD**	**Mean**	**SD**
Trails B	DIS.	1145.4	381.8	2.4	0.12	31.4	11.4	40.7	12.6
	FU	1691.6	563.8	4.4***	0.20	32.7	10.6	44.1	12.2
	DIF.	72.3	24.1	3.1*	0.16	1.3	1.8	3.4	3.1
COWAT-FAS	DIS.	599.0	199.6	2.9*	0.14	40.6	7.6	47.3	8.3
	FU	525.1	175.0	3.0*	0.15	43.7	7.4	50.0	7.4
	DIF	12.1	4.0	0.45	0.02	3.1	3.4	2.6	2.6
COWAT Animals	DIS.	1923.0	641.0	4.5**	0.21	45.8	11.4	55.4	12.7
	FU	1739.7	579.9	4 9***	0.22	46.0	10.6	56.2	11.2
	DIF	73.3	24.4	2.1	0.10	0.14	2.9	0.8	3.8
Stroop Interference	DIS.	888.7	296.2	3.6**	0.17	41.1	6.3	49.3	10.0
	FU	902.0	300.6	4.3***	0.20	43.3	6.2	51.5	9.1
	DIF	1.39	0.46	0.51	0.003	2.1	2.1	2.2	2.9
WCST Non Perseverative Errors	DIS.	1015.6	338.5	4.2**	0.19	34.7	8.8	42.1	9.2
	FU	1410.6	470.2	8.9***	0.34	37.8	6.8	47.5	7.7
	DIF	104.3	34.7	2.2	0.11	3.1	3.2	5.4	4.3
WCST Perseverative Errors	DIS.	247.8	82.6	1.3	0.07	42.1	7.0	41.4	8.4
	FU	277.8	92.6	1.6	0.08	43.6	6.5	45.3	8.3
	DIF	101.2	33.7	1.5	0.08	1.4	2.5	3.9	5.5

Note. Time=time of measurement (DIS.=time of discharge; FU=3 months after discharge; DIF=Difference in scores between follow up and discharge), PES=Partial Eta Squared, SS=Sum of Square, MS=mean Sum of Square

*P<0.05

**P<0.01

***P<0.001.