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Cognitive and psychosocial functioning in bipolar disorder with and without psychosis during early remission from an acute mood episode: a comparative longitudinal study

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Abstract

Background—The current investigation aimed to extend previous findings, which linked psychosis in bipolar disorder (BD) to cognitive impairment during hospital discharge and readmission, by examining the recovery of patients with psychosis who were not re-hospitalized. The study compared mood, cognitive and functional outcomes in patients who had, versus had not, experienced psychosis during a recent psychiatric hospitalization. The hypothesis was that patients admitted to the hospital with psychosis would exhibit more residual symptoms, greater cognitive deficits, and lower psychosocial functioning than patients who presented to care without psychosis. Group differences were expected to emerge both at the time of hospital discharge and at a 3-month follow up.

Method—Fifty-five participants (ages 18-59, 25 women, 20 with psychosis) with BD I disorder completed both assessments, which included a clinical and diagnostic interview, functional evaluation, and the administration of mood measures and a neuropsychological battery.

Results—The groups were comparable with respect to illness history (e.g., number of previous hospitalizations, age of onset, employment). At discharge and follow-up, the group with psychosis exhibited more mood symptoms, obtained lower GAF scores, and performed more poorly on measures of memory and executive functioning. At follow-up, participants with psychosis exhibited poorer psychosocial adaptation.

Limitations—It is possible that some of the observed group differences in cognitive functioning emerged due to differences in medication efficacy or side effects.

Conclusion—The results of this study support the hypothesis that psychosis in BD predicts limited recovery during early remission from mood disturbance, regardless of illness history.

Keywords

bipolar disorder; psychosis; cognitive impairment; psychosocial functioning

1. Introduction

Psychosis in bipolar disorder (BD) is associated with greater cognitive impairment^{1,2}. Although some inconsistency has been noted in previous findings³, several studies have detected more severe cognitive impairment in BD patients with a history of psychotic episodes^{4,5}. In these patients, cognitive deficits emerged most consistently on neuropsychological measures of executive functioning^{6,7,1,8} and verbal memory².

In addition to cognitive impairment, psychosis is associated with lower psychosocial functioning in patients with BD^{9,10,11,12}. Studies suggest that psychosis is related to poorer adaptive functioning across the life span, including reduced family cohesion in youth^{10,11} limited employment during adulthood, and premature decline in activities of daily living (ADL) among the elderly⁹. Psychosis in BD is also associated with increased morbidity¹³, and reduced functional recovery¹². Taken together, these findings suggest that psychosis in BD correlates with both cognitive impairment and lower adaptive functioning.

Beyond their association with psychosis, cognitive and psychosocial functioning in BD are correlated with each other. Researchers have observed in multiple independent samples that patients with greater cognitive impairment exhibit lower functional outcome^{14,15,16,17,18,19}. Coupled with the findings mentioned above, these studies suggest that in BD various connections exist among psychosis, cognition and psychosocial functioning.

To date, most investigations examining linkages among these three variables have focused primarily on key questions relevant to the larger course of illness, and trait deficits (e.g. cognitive impairment with psychosocial correlates that cannot be attributed to mood symptoms) of BD that can only be explored during euthymic states²⁰. For these reasons, previous studies in this area excluded symptomatic patients²¹. Few studies have addressed symptomatic periods, such as early remission from a mood episode or discharge from inpatient care²².

Understanding the associations among psychosis, cognition and psychosocial functioning during early remission from mood disturbance may be important for clinical considerations. Specifically, a discrete episode of mood disturbance with psychosis may carry an impact on cognitive and psychosocial functioning that lingers into the recovery phase, beyond the initial resolution of symptoms. In other words, acute psychosis in BD may carry proximal deleterious effects on patients' functioning that are separate to some extent from the influences of distant clinical events (i.e. past illness severity), and therefore highly relevant for treatment and rehabilitation. Insight into these potential effects may be particularly helpful in developing effective treatment plans and supportive services that aim to facilitate the transition from inpatient care to less supervised environments.

From this clinical perspective, it is important to consider the possibility that the short-term effects of psychosis on cognitive functioning and functional adjustment are not specific to BD. However, the impact of psychosis on patients may differ across psychiatric conditions, due to variability in neurobiological factors and related patterns or severity of cognitive deficits. For this reason, the current investigation focuses on patients with BD, while

recognizing the value of comparative studies that may aim to examine more global effects of psychosis.

In the context of examining clinical factors that predict cognitive impairment in hospitalized BD patients, we reported in previous studies that a longer hospital stay²³ and psychosis²¹ predicted more severe cognitive deficits at discharge. In a different sample, all three variables, measured at hospital discharge, predicted re-hospitalization at a 3-month follow-up²⁴. These studies controlled for clinical factors related to illness severity, and thus provide some support to the hypothesis that acute psychosis in the context of mood disturbance negatively affects the immediate post-hospital recovery of patients with BD.

To further explore this hypothesis, the current investigation aimed to extend our previous study, which linked psychosis and cognitive impairment at discharge to re-hospitalization²⁴. Whereas the previous study employed a single assessment to predict relapse, the current study examined, in a longitudinal design that included two points of assessment, how psychosis was related to cognitive and psychosocial functioning in those patients who were not re-hospitalized. Excluding all re-hospitalized patients from the previous sample, the current study compared patients who experienced psychosis to those who did not during their last hospital stay. The study compared these newly formed groups on mood, cognitive and psychosocial measures both at hospital discharge and at a 3-month follow up. Our hypothesis was that patients presenting with psychosis would exhibit more residual symptoms, greater cognitive deficits, and lower psychosocial functioning than patients hospitalized for mood disturbance without psychosis. We expected these group differences to emerge independently of factors related to the larger course of illness such as age of onset and previous number of psychiatric admissions.

2. Method

2.1 Participants

Eighty-two inpatients (ages 18-59) with bipolar I disorder at McLean Hospital were recruited for this study, and completed the initial assessment shortly before discharge from the hospital. Participants had been admitted for acute mood disturbance; Thirty-nine met criteria for psychosis, defined by the presence of either delusions or hallucinations over the course of hospital stay. Twenty-nine participants met diagnostic criteria for substance abuse or dependence over the 6 months prior their hospital stay, as described in Levy et al., (in press); however, none required detoxification at the point of hospital admission. Of this original sample, 55 participants (25 women) completed the second assessment at the three-month follow up. Nine of these 55 participants had been hospitalized for depression, 12 in a mixed mood state, and 34 due to a manic episode. The presence of psychosis during hospitalization was observed in 20 of the 55 participants who completed the follow-up assessment. In the group remitting from psychosis (n=20), 7 participants experienced their first psychotic break in the context of their current hospitalization. In the group remitting from a mood episode without psychosis (n=35), 13 denied a history of psychotic episodes.

With respect to demographic variables, 30 participants were single, 14 were married and 11 were divorced. Only 9 participants identified an affiliation with an ethnic minority group. Of

the 27 participants who did not complete the study, 15 relapsed and were readmitted to the hospital for mood disturbance, 7 reported admission to a substance use disorder treatment program, and five maintained an outpatient status but declined to participate in the follow-up assessment. Fifteen of the readmitted patients presented to the initial hospitalization with psychosis. Follow up data was not available for the 22 readmitted patients, and the 5 patients who voluntarily discontinued their participation in the study.

2.2 Inclusion/Exclusion criteria

At the time of enrollment, all participants were adult hospital patients on an inpatient unit and met DSM-IV diagnostic criteria for bipolar I disorder. To control for the impact of mood symptoms on cognitive test performance, inclusion criteria required a Beck Depression Inventory (BDI) score < 15, a Beck Hopelessness Scale (BHS) score < 10, and a Young Mania Rating Scale (YMRS) score < 15. The presence or history of neurological illness or injury, determined from a review of the medical record and from the structured interview, excluded patients from participation.

2.3 Diagnosis and Procedure

Following a substantiation of a bipolar I disorder diagnosis by the unit treatment team, participants were recruited for a diagnostic session, which was preceded by an informed consent procedure approved by the hospital review board. The diagnostic procedure included verbal communication with the unit treatment team, and a review of records from the current and available previous hospitalizations. Participants were enrolled in the study only after information collected by the treatment 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 mood disturbance. An independent confirmation of diagnostic status was attained through the Structured Clinical Interview for DSM-IV²⁵, administered by a trained clinician. The training process for this procedure included 12 supervised administrations with actual hospital patients, which yielded an inter-rater reliability estimate of 0.91 between the principal investigator and the training clinician. Consistent with prior research, psychosis was defined as having delusions or hallucination. This information was gleaned from the medical chart and verbal reports of the treatment team. Global Assessment of Functioning (GAF) scores were obtained from the medical record discharge note. Information regarding employment and school enrollment was obtained from both the medical record and the clinical interview.

Once the treatment team indicated that patients were sufficiently stable and approaching discharge, neuropsychological testing was scheduled 24 to 48 hours prior to discharge. On the day of testing, the examiner conducted a clinical interview to verify the absence of lingering symptoms of psychosis, and then administered mood and substance abuse measures, which were followed by the neuropsychological battery. The session typically ranged from two and a half to three and a half hours. After discharge, the treatment team remained in phone contact with participants on a monthly basis.

After approximately three months (88 to 112 days), participants returned for a follow-up evaluation, wherein all neurocognitive and mood measures were re-administered, follow-up

GAF scores were determined, and information concerning adaptive functioning (i.e. employment and school enrollment) was obtained. Before testing, participants gave a urine sample and were tested with a breathalyzer for recent alcohol use. The urine sample was sent for a lab toxicology screen. These procedures detected no recent use of alcohol, stimulants, and opiates. Three of the participants tested positive for marijuana, but reported no use in the five days prior to testing.

2.4 Measures

Mood measures—The Beck Depression Inventory – Second Edition (BDI-II)²⁶ was used to assess residual mood symptoms at the time of testing. This 21-item self-report instrument measures severity of depressive symptoms as identified by the DSM-IV, and was created to evaluate symptoms of severe depression, which would require hospitalization. The Beck Hopelessness Scale (BHS)²⁷ was also administered at time of testing. This instrument measures negative attitudes about the future, and consists of twenty 1-point aggregated items with a True/False response format. Manic symptom severity was assessed with the Young Mania Rating Scale²⁸, an 11-item scale widely used in clinical and research settings to determine the severity of mania. Ratings were based on patient self-reports, clinician observation, and verbal reports of the treatment team. At discharge, these sources reported on mood in the last 48 hours; at three-month follow-up, the time frame for mood assessment encompassed the prior two weeks.

The neuropsychological battery—Five domains of cognitive functioning were evaluated: IQ, attention, verbal memory, processing of complex visual material and visual memory, and executive functioning. Tests included in the battery possessed well-documented norms and satisfactory estimates of reliability and validity.

IQ and attention: To obtain an estimate of IQ, the battery included the Wechsler Abbreviated Scale of Intelligence (WASI)²⁹, Vocabulary and Block Design subtests. These two-subtests correlate well with the Wechsler global composite IQ³⁰. For Vocabulary (a measure of verbal intelligence) participants provide definitions to words; for Block Design (a measure of non-verbal intelligence) participants manipulate blocks to copy designs that progress in gradual complexity.

Tasks measuring attention included the Digit Span subtest from the Wechsler Adult Intelligence Scale – Third Edition³¹. For this test, participants repeat strings of digits of increasing length, both forward and backwards. To evaluate visual attention, the battery contained the Cancellation Test³². On this task, participants use a pencil to circle target symbols or letters, scattered amid distracters, as quickly as they can. The battery also contained the Trail Making Test A³⁰, which requires participants to draw a line connecting consecutive numbers scattered on a page as fast as possible.

Verbal memory: The ability to acquire auditory verbal information was assessed with a list learning task (i.e. California Verbal Learning Test II [CVLT-II]– Short Form)³³, and memory for passages (Logical Memory from Wechsler Memory Scale-III)³⁴. The CVLT-II records the number of word immediately recalled from the list of nine words across four

trials, and after short and long (20 minutes) delays. Logical Memory records the number of details participants recall from two short stories after short and long (20 minutes) delays.

Visual memory: We examined the ability to process and recall a complex visual stimulus with the Rey Complex Figure test³⁵. For this test, participants copy a complex visual design and then reproduce it from memory after short and long (20 minutes) delays.

Executive functioning: Participants completed tasks which assess several aspects of executive functions, including inhibitory control, ideational fluency, and shifting between mental sets. Inhibitory control was assessed with the Stroop Color-Word Interference Test³⁶. This test requires participants to inhibit the impulse 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. Verbal fluency was assessed with the Controlled Oral Word Association Test (COWAT)³⁷ - FAS letters format and Animal Naming Task. In three separate trials, the test requires participants to generate as many words as they can that begin with F, A and S in 60 sec. In a later trial, participants are asked to name as many animals as they can in 60 sec. The ability to shift between mental sets was examined using the Wisconsin Card Sorting Test – 64 Card Version (WCST)³⁸ and the Trail Making Part B³⁰. The WCST also measures non-verbal concept formation and ability to benefit from feedback. The WCST requires participants to match a target card to 1 of 4 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 are required to adjust their strategy accordingly. The Trail Making Part B task requires participants to draw a line as quickly as possible connecting letters and numbers scattered in circles on a page, in an alternating and ascending sequence (i.e. 1-A-2-B etc).

2.5 Statistical Analysis

Pearson chi-square, t, and z-tests were used to evaluate demographic, clinical, and adaptive functioning data. Because multiple measures were used to assess five distinct cognitive domains, we employed multivariate analyses of variance to examine group differences in neuropsychological performance. We repeated this procedure five times, once for each cognitive domain, with n= 82 and n=55 for data collected at discharge and follow up, respectively. To control for the influence of residual mood symptoms and medication, covariates included number of medications and mood measures (i.e., BDI-II and YMRS). The same covariates were applied in post hoc analyses of between-subjects effects for individual measures. Analyses did not control for dose and type of medication use in the sample due to insufficient statistical power. Scores for cognitive measures reflect Standard Scores, based on normative data (mean = 50, SD = 10; California Verbal Learning Test II, immediate and delayed recall and recognition scores all had means of 0 and a SD of 1; Digit Span scores had a mean of 10 and a SD of 3). In all tests, lower values reflected poorer performance.

3.0 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 revealed no group differences in age and education. Analysis further failed to detect differences in gender and marital status. With respect to clinical variables, no significant group differences emerged in age of illness onset or previous number of psychiatric admissions. Forty percent of patients (14/35) in the group without psychosis met diagnostic criteria for alcohol dependence in the year prior to admission, compared to 35% (7/20) in the group with psychosis.

Significant group differences were noted in residual mood symptoms. Both at discharge and follow-up, the group with psychosis exhibited more symptoms on the YMRS, BDI-II and BHS than the group without psychosis. Both groups, however, showed a reduction in scores on all three measures between discharge and follow-up. Analyses further detected a longer duration of hospital stay, lower GAF scores and higher number of psychotropic medications on the day of testing for the group with psychosis. The same difference in number of medications was noted at the follow-up assessment; however, no group differences emerged in classes of medications. The group difference in GAF scores increased from discharge to follow-up.

3.2 Adaptive Functioning

As noted, patients experiencing psychosis during their most recent hospitalization obtained lower GAF scores at discharge ($t=-2.6, p<.01$), and group differences in GAF scores increased at follow-up ($t=-4.6, p<.001$). With respect to employment, at the time of discharge, both groups exhibited similar ratios of unemployment, partial employment and employment. The group without psychosis reported 40% unemployment ($n=14$), 38% ($n=13$) partial employment (i.e., more than 10 hours per week for compensated work or school) and 22% full employment ($n=8$). The group with psychosis reported 35% unemployed ($n=7$), 30% partially employed ($n=6$), and 35% fully employed ($n=7$).

At 3-month follow-up group differences emerged in employment status. Sixty-seven percent of subjects (14/21) in the group without psychosis, who reported partial or full employment at discharge, regained the same work or school capacity at the 3 month follow up. In the group with psychosis, this percentage was substantially lower (20%, 3/13). Z-tests for two proportions showed that whereas the groups did not significantly differ at discharge, the proportions maintaining their work/schooling differed significantly at follow-up ($z=2.12, p=.04$).

3.3 Cognitive Measures

IQ and attention—With respect to IQ measures, an ANCOVA procedure revealed no group differences on a measure of vocabulary at hospital discharge ($SS=590.2, MS=147.5, F_{(4,77)}=1.6, p=.017$). Similarly, no group differences emerged on a non-verbal measure of IQ (i.e., Block Design, $SS=415.8, MS=103.9, F_{(4,77)}=0.87, p=.48$). In addition, a MANOVA procedure revealed no group differences on measures of attention at discharge

(Wilks' Lambda=0.94; $F_{(5,73)} = 0.8, p = 0.55$) and follow up (Wilks' Lambda=0.97; $F_{(6,47)} = 0.72, p = 0.51$). The analysis thus suggests that the groups did not differ in speed and accuracy of visual scanning (i.e., Boston Cancellation Test), ability to follow basic numerical sequences of numbers and letters (i.e., Trail Making Test A), and auditory span (i.e., Digit Span: number of digits that can be repeated in forward and reverse order).

Memory—The MANOVA procedure for measures of verbal memory was significant at discharge (Wilks' Lambda=0.66; $F_{(6,72)} = 6.1, p = 0.001$) and follow up (Wilks' Lambda=0.75; $F_{(6,47)} = 2.5, p = 0.02$). The between-group comparisons for each of the measures revealed a different pattern for logical (i.e., memory for prose) and rote memory (CVLT-II, i.e., list-learning-task). As Table 2 indicates, the analysis of the list-learning-task revealed significant group differences in the acquisition as well as the immediate and delayed recall of the words; however, the same procedure applied to logical memory indicated that group differences were not probable. Poorer performance was noted for the group with psychosis.

On measures of visual processing and memory, assessed by the Rey-Osterrieth Complex Figure test, the MANOVA procedure detected significant group differences both at discharge (Wilks' Lambda=0.81; $F_{(4,74)} = 4.1, p < 0.004$) and follow-up (Wilks' Lambda=0.23; $F_{(4,49)} = 3.8, p < 0.001$). As Table 3 indicates, between-group comparisons of the different phases of this test were significant across time measurement. Patients with psychosis exhibited more difficulty replicating and later recalling the complex design than patients without psychosis.

Executive functioning—Analysis indicated significant group differences in measures of executive functioning at discharge (Wilks' Lambda=0.45; $F_{(7,46)} = 2.33, p = 0.04$) and follow-up (Wilks' Lambda=0.74; $F_{(7,46)} = 2.2, p < 0.05$). As Table 4 indicates, with the exception of the semantic part of the verbal fluency task (i.e., Animals), and perseverative errors on the WCST, comparisons of specific measures yielded significant results at both measurement times, where superior performance was noted for the group without psychosis.

A reanalysis of the data collected at the time of hospital discharge, limited to the subjects who were assessed at follow up (n=55), detected significant differences in the same cognitive domains that emerged in the analysis of the full sample (n=82).

4. Discussion

In the previous study, we reported that psychosis predicted higher rates of readmission within 3 months of hospital discharge²¹. The results of this study, obtained in a longitudinal design that included two assessments, suggested that psychosis was also associated with more limited recovery in patients who were not readmitted during this period. In these patients, psychosis was associated with an increase in residual symptoms, more severe cognitive impairment, and lower adaptive functioning. It is important to note that in the current study, these functional and clinical differences emerged between groups equivalent in age of onset, previous number of hospitalizations, and employment status prior to hospital admission. In the context of a longitudinal design, this overall pattern of result is consistent

with the hypothesis that a discrete psychotic episode in BD may carry proximal deleterious effects on patients' post-hospital recovery, and that these effects may be independent to a certain degree from other factors related to the course of illness.

Only limited causal inferences concerning pathways among psychosis, cognition and psychosocial functioning can be drawn from the current data. However, the data do suggest new hypotheses regarding relations among these constructs. The first hypothesis focuses on psychosis as the major destabilizing factor, which either creates or accompanies a mood disturbance that is difficult to treat effectively in the limited time allotted to inpatient care. This notion is consistent with the links we observed between psychosis and longer hospital stay, higher number of prescribed medications, and elevated residual symptoms upon discharge²¹. These findings suggest that patients who were admitted with psychosis may leave the hospital in a more vulnerable psychiatric state than patients who presented to care without psychosis.

A vulnerable discharge may compromise the recovery of patients remitting from psychosis. The elevation in residual symptoms at hospital discharge may decrease their cognitive and psychosocial functioning during a particularly vulnerable period, in which they are required to negotiate a difficult transition to less supervised environments. The widening gap between functional limitations and demands upon discharge from inpatient care may destabilize patients in remission from psychosis, and result in hospital readmission, or more limited recovery.

This account is highly consistent with previous findings, which demonstrated the direct negative effects of acute mood symptoms on cognitive functioning in BD¹⁷. At the same time, the current data do not exclude the effects of additional factors on cognitive functioning. In fact, the group differences in cognitive test scores remained significant with mood symptoms as covariates, suggesting that residual symptoms did not fully account for the observed link between psychosis and cognitive impairment in this sample. These findings raise the possibility that at least some of the effects a psychotic episode has on cognitive functioning may linger beyond the resolution of acute symptoms. Support for this hypothesis may require future studies to control for baseline cognitive functioning before hospital admission, and the onset of psychosis. The current study did not control for baseline cognitive functioning in this manner, so the data should be interpreted with caution.

The general notion, however, that psychosis leads to lingering cognitive impairment has been raised in previous studies conducted with euthymic patients. These studies show that a more severe course of illness in general, and a history of psychosis in particular, are associated with cognitive impairment even in the absence of mood symptoms^{8,39,40}. Current theorizing around these findings emphasizes the potential neurotoxic effects of repeated exposure to symptoms¹⁵. The absence of neurological data in this study limits conclusions about the relevance of neurotoxic models to the proximal effects of a single psychotic episode on cognitive functioning in BD. However, the idea that psychosis-related effects linger beyond the presence of symptoms remains viable. This hypothesis may be investigated in designs that focus on repeated as well as single exposure to psychosis. Future research may explore neurobiological differences between patients remitting from mood

disturbance with versus without psychosis, and the extent to which they account for variance in cognitive functioning during this sensitive period.

The observed group differences in adaptive functioning may be easier to explain. As documented by multiple studies, the presence of residual mood symptoms^{41,42,43} and cognitive impairment^{44,45} interfere with psychosocial functioning in BD. In the current study, the group remitting from psychosis suffered from both. Given the functional equivalence between the groups prior to hospital admission, the combination of more intense symptoms and greater cognitive deficits may explain the difficulties these patients experienced in regaining employment or academic pursuits at the 3-month follow-up. This conclusion is consistent with evidence from previous research that greater cognitive impairment at hospital discharge is related to poorer psychosocial functioning at a one-year follow-up²².

Several limitations of the current study are notable. First, the naturalistic nature of this study did not allow us to control for the effects of medication on cognitive test performance. The groups did not differ in medication types, but the group with psychosis was prescribed more medications. The statistical control we employed for the number of medications taken on the day of testing did not fully rule out medication-related bias. Thus, the pharmacological treatment of psychosis rather than psychosis itself may have contributed to the differences in cognitive performance between the groups. In addition to the possible pre-existing group differences in cognitive functioning and history of psychosis, the differences in prescribed medication weaken the validity of causal inferences regarding the relationship between recent psychosis and cognitive impairment. Another limitation is related to the self-reported history of the illness, which complemented the data available from the medical chart. Although participants did not exhibit psychotic symptoms during the interview, cognitive impairment may have affected the accuracy of their report. To the extent that memory problems led to underreporting of previous episodes, the observed group differences in cognitive and psychosocial functioning may have reflected a more severe disease process rather than the deleterious impact of a discrete episode. With respect to sample attrition, 33% readmission rate from discharge to follow up is significant. Conclusions are therefore limited to BD patients who have been able to maintain their recovery from psychosis with outpatient treatment. Other sampling biases that may limit the generalizability of results may include the successful enrollment of patients who potentially showed better response to treatment (i.e., as indicated by relatively high GAF scores at discharge) than others. Furthermore, the sample consisted primarily of patients recovering from mania rather than depression. Finally, our sample of participants included only a few participants from ethnic minority groups. This may limit the generalization of results.

Although these limitations warrant attention, the results of this study are relevant from a clinical perspective. Psychosis during an acute mood episode indicates greater difficulties for patients post-hospitalization. Remission from acute psychosis in BD may be accompanied by the presence of more intense residual symptoms, cognitive impairment, compromised adaptive functioning, and greater likelihood for relapse. Regardless of the causes, these findings suggest implications for patient care, emphasizing the need for expanding post-hospital supports and assessment procedures, in addition to the development

of rehabilitation programs that can effectively replace the protective environment of the hospital for symptomatic patients.

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Table 1

Means, Standard Deviations, and Group Comparisons of Demographic and Clinical Variables.

Measures	Bipolar Patients with psychosis (n=20)		Bipolar Patients Without psychosis (n=35)		Between groups		Within groups (Discharge-follow-up)	
	Mean	SD	Mean	SD	t	P Value	t	P Value
Demographic								
Education (years)	14.3	2.4	14.8	1.9	-0.8	0.4		
Age	37.3	12.1	38.5	12.0	-0.3	0.7		
Clinical Features								
Illness Onset	24.0	8.2	27.7	9.7	-1.4	0.15		
Hospitalizations	7.0	6.3	5.1	6.4	1.0	0.3		
Mood Symptoms								
YMRS (D)	7.9	3.7	5.3	3.4	2.6	0.01**	3.9	0.001*** ^a
YMRS (f)	5.3	1.8	3.7	1.7	3.2	0.002**	3.3	0.002*** ^b
BDI - II (D)	9.2	2.6	7.2	3.1	2.3	0.02*	3.8	0.001*** ^a
BDI - II (f)	7.1	2.0	5.7	2.4	2.2	0.03*	3.6	0.001*** ^b
BHS (D)	5.7	3.8	3.4	3.1	2.4	0.01**	4.0	0.001*** ^a
BHS (F)	4.0	2.5	2.5	2.7	2.0	0.05*	7.3	0.001*** ^b
Hospital Stay								
Duration (days)	12.6	2.5	9.8	2.6	3.9	0.001***		
GAF (D)	57.5	4.1	61.4	5.8	-2.6	0.01**	-2.3	0.03* ^a
GAF (f)	59.5	5.5	66.8	5.7	-4.6	0.001***	-15.3	0.001*** ^b
Medications (D)	3.2	1.1	2.7	0.7	2.7	0.009***	1.4	0.16 ^a
Medications (F)	3.0	1.2	2.4	0.8	2.4	0.02*	1.5	0.13 ^b

Note: (D)=Discharge, (F)=Follow-up, BDI=Beck Depression Inventory, BHS=Beck Hopelessness Scale, YMRS=Young Mania Rating Scale, Hospitalizations =Previous number of psychiatric admissions, Illness Onset=Age of first psychiatric admission for mood disturbance, GAF=Global Assessment of Functioning, Duration=Number of days in hospital, Medications=Number of medications taken on day of testing.

* P <0.05,

** P <0.01

*** P <0.001.

^a change from discharge to follow-up in participants without psychosis.

^b change from discharge to follow-up in participants with psychosis.

Table 2

Group Comparison of Scaled Scores of Verbal Memory Measures

Test of Between-Subjects Effects						Means and standard Deviations of Measures			
						Bipolar patients with psychosis		Bipolar patients without psychosis	
Measure	Time	SS	MS	F	PES	Mean	SD	Mean	SD
Logical Memory	DIS.	607.3	151.8	1.6	0.05	39.0	9.6	43.2	9.13
immediate recall	FU	355.6	177.8	1.8	0.06	41.0	8.4	46.2	10.5
Logical memory	DIS.	422.9	105.7	1.5	0.05	36.7	6.4	42.4	11.9
delayed recall	FU	465.0	232.5	2.5	0.09	42.0	6.9	48.0	11.3
CVLT	DIS.	2385.9	596.7	9.0***	0.25	34.4	8.2	45.6	7.9
acquisition	FU	822.9	411.4	5.4***	0.17	38.5	6.5	46.5	9.5
CVLT	DIS.	17.5	4.3	3.5*	0.16	-1.4	0.8	-0.52	1.6
immediate recall	FU	11.9	5.9	4.9**	0.16	-0.9	1.2	0.01	1.2
CVLT	DIS.	16.8	4.2	4.4**	0.21	-1.6	0.9	-0.8	1.1
delayed recall	FU	14.1	7.0	8.8***	0.25	-1.0	1.0	-0.1	0.8
CVLT	DIS.	18.4	4.6	3.4*	0.15	-1.5	1.2	-0.61	1.1
recognition	FU	4.8	2.4	1.9	0.07	-0.9	1.3	-0.2	1.1

Note. Time=time of measurement (DIS.=time of discharge, n=82; FU=3 months after discharge, n=55), 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 Visual Memory Measures

Test of Between-Subjects Effects						Means and standard Deviations of Measures			
Measure	Time	SS	MS	F	PES	Bipolar patients with psychosis		Bipolar patients without psychosis	
						Mean	SD	Mean	SD
Rey Copy	DIS.	317.6	79.4	3.7**	0.12	28.5	5.8	31.0	3.4
	FU	132.2	66.1	4.4**	0.14	29.9	4.9	33.1	3.0
Rey Immediate Recall	DIS.	1392.7	348.19	3.8*	0.12	32.7	10.3	39.9	8.8
	FU	991.9	495.9	6.3***	0.19	33.6	9.3	41.5	8.7
Rey Delayed Recall	DIS.	1650.1	412.5	3.7*	0.12	27.6	9.2	35.1	11.5
	FU	858.4	429.2	3.9*	0.13	29.1	8.4	37.3	11.3
Rey Recognition	DIS.	1267.9	316.9	1.2	0.04	37.2	11.4	38.7	9.4
	FU	651.2	325.6	3.0*	0.10	37.9	11.9	45.5	9.2

Note. Time=time of measurement (DIS.=time of discharge, n=82; FU=3 months after discharge, n=55), 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			
Measure	Time	SS	MS	F	PES	Bipolar patients with psychosis		Bipolar patients without psychosis	
						Mean	SD	Mean	SD
Trails B	DIS.	2176.0	544.0	5.0***	0.16	32.7	10.0	43.0	10.2
	FU	1374.5	687.2	5.2***	0.17	33.2	11.6	43.5	11.1
COWAT-FAS	DIS.	1759.2	439.8	3.4**	0.07	40.7	9.6	47.1	9.4
	FU	428.3	241.1	3.7*	0.08	44.0	9.1	49.6	6.5
COWAT Animals	DIS.	384.2	96.0	1.2	0.04	41.2	7.9	45.4	9.1
	FU	668.3	334.1	2.4	0.08	48.7	13.7	54.4	10.5
Stroop Interference	DIS.	1717.0	429.2	5.2***	0.17	38.3	6.9	46.9	10.7
	FU	559.8	279.9	3.7**	0.12	45.0	6.7	50.3	9.7
WCST- Categories completed	DIS.	48.3	12.0	6.9***	0.23	1.35	1.0	2.8	1.5
	FU	14.3	7.1	4.6**	0.15	1.95	1.46	3.0	1.0
WCST Non Perseverative Errors	DIS.	997.0	249.2	2.5*	0.09	35.8	10.9	42.7	9.1
	FU	624.3	312.1	4.7**	0.15	39.7	8.5	46.1	8.0
WCST Perseverative Errors	DIS.	106.1	26.5	0.33	0.02	39.2	8.4	40.8	8.2
	FU	185.8	92.9	1.6	0.06	43.6	6.5	46.0	6.7

Note. Time=time of measurement (DIS.=time of discharge, n=82; FU=3 months after discharge, n=55), PES=Partial Eta Squared, SS=Sum of Square, MS=mean Sum of Square,

* $P < 0.05$,

** $P < 0.01$

*** $P < 0.001$.