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Criminal conviction, impulsivity, and course of illness in bipolar disorder

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Abstract

Objective—Criminal behavior in bipolar disorder may be related to substance use disorders, personality disorders, or other comorbidities potentially related to impulsivity. We investigated relationships among impulsivity, antisocial personality disorder (ASPD) or borderline personality disorder symptoms, substance use disorder, course of illness, and history of criminal behavior in bipolar disorder.

Methods—A total of 112 subjects with bipolar disorder were recruited from the community. Diagnosis was by Structured Clinical Interview for DSM-IV (SCID-I and SCID-II); psychiatric symptom assessment by the Change version of the Schedule for Affective Disorders and Schizophrenia (SADS-C); severity of Axis II symptoms by ASPD and borderline personality disorder SCID-II symptoms; and impulsivity by questionnaire and response inhibition measures.

Results—A total of 29 subjects self-reported histories of criminal conviction. Compared to other subjects, those with convictions had more ASPD symptoms, less education, more substance use disorder, more suicide attempt history, and a more recurrent course with propensity toward mania. They had increased impulsivity as reflected by impaired response inhibition, but did not differ in questionnaire-measured impulsivity. On logit analysis, impaired response inhibition and ASPD symptoms, but not substance use disorder, were significantly associated with criminal history. Subjects convicted for violent crimes were not more impulsive than those convicted for nonviolent crimes.

Conclusions—In this community sample, a self-reported history of criminal behavior is related to ASPD symptoms, a recurrent and predominately manic course of illness, and impaired response inhibition in bipolar disorder, independent of current clinical state.

Keywords

antisocial personality disorder; bipolar disorder; borderline personality disorder; comorbidity; crime; impulsive behavior; personality disorders; recurrence; substance-related disorders

Arrest and incarceration are potential complications of bipolar disorder (1–3), which has a higher prevalence among incarcerated individuals than in the community (4, 5). Relationships between psychiatric diagnoses and criminal behavior are complex and can be

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direct, or indirect, through comorbid conditions or environmental factors (6). Early onset of bipolar disorder is associated with juvenile antisocial behavior (7) and greater likelihood of arrest (8). A 13-year prospective study found that high hypomania scores predicted increased likelihood of subsequent arrest in a nonclinical sample of adolescents (9). Individuals with bipolar disorder who had been arrested had more hospitalizations than those who had not (10) and were more likely to be experiencing manic symptoms (11).

Increased risk for arrest or incarceration in subjects with severe bipolar disorder could reflect impulsivity or more severe mood instability, possible characteristics of cluster B personality disorders. Personality disorders or their clinical characteristics may reflect a more severe or unstable course of bipolar disorder (12–15), potentially due to increased impulsivity. Cluster B personality disorder characteristics may combine dimensionally with bipolar disorder. We reported a significant correlation between number of antisocial personality disorder (ASPD) symptoms and impulsive errors on a test of response inhibition (16). These characteristics may be related to impulsivity and to behavioral complications of combined bipolar and personality disorders (17). Risk for criminal behavior in bipolar disorder may be related to, or even dependent on, presence of a substance use disorder (2, 3, 18) which, in turn, is associated with increased impulsivity (19).

Impulsivity is multifactorial. Questionnaire-rated integrated impulsivity, measured by the Barratt Impulsiveness Scale (BIS-11) (20, 21), is elevated in bipolar disorder (22). More specific human behavioral-laboratory measures are based on response inhibition (23). Inability to adequately evaluate a stimulus before responding to it can be measured using continuous performance tasks. Inability to delay response for a larger reward can be measured by tasks requiring a choice between smaller-sooner and larger-later rewards, or by free-operant tasks. These aspects of impulsivity are increased in bipolar disorder (24), especially with recurrent or complicated course of illness (22, 24) and are also components of low self-control, a construct that is considered to be central to criminal behavior (25, 26). These aspects have not been investigated relative to history of criminal behavior in bipolar disorder.

Rationale and hypotheses

In subjects with bipolar disorder, we investigated relationships between self-reported history of a criminal conviction and severity of personality disorder characteristics [ASPD or borderline personality disorder Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II) (27) symptom counts], course of illness, and impulsivity. The purpose of the study was to compare subjects with bipolar disorder who had criminal conviction histories to those who did not. Our hypotheses were: (i) high impulsivity and substance use disorder would be associated with personality disorder symptoms and history of criminal conviction; and (ii) history of criminal conviction would be associated with early onset, recurrent course, and predominately manic presentation.

Methods

Subjects

The study was approved by the Committee for the Protection of Human Subjects, Institutional Review Board (IRB) at The University of Texas Health Science Center, Houston, TX. Potential participants, responding to advertisements or circulars approved by the IRB, were fully informed of the procedures, risks, and benefits of the study, and signed informed consent documents, before any study-related procedures. The purpose of this study was not to determine the rate of criminal behavior in bipolar disorder, or to compare it to community controls, but to determine what characteristics, among subjects with bipolar

disorder, were associated with history of criminal behavior as reflected by self-reported history of conviction for a crime. Advertisements used by the study included a part that was aimed at subjects with bipolar disorder in general, healthy controls, or subjects with antisocial behavior on probation or parole (the latter advertisements did not mention bipolar disorder). Subjects met DSM-IV-TR criteria for bipolar disorder according to the Structured Clinical Interview for DSM-IV (SCID) (28) and were required to have negative breath alcohol and urine screens for drugs of abuse when they were tested.

Course of illness—Course of illness was determined using a life chart based on the SCID. Median age of onset was 16 years (25th–75th percentile: 11–22 years). We categorized the number of episodes using median splits. A total of 44 subjects had too many manic/hypomanic episodes to recall, and 41 subjects had too many depressive episodes to recall. Fifteen subjects had too many depressive and too many manic episodes to recall. For the 86 subjects with comprehensive episode data, 32 had predominately manic episodes, 22 predominately depressive, and in 32 neither predominated. Of these subjects: 58 reported histories of substance use disorders and 27 reported no history; 51 had histories of alcohol use disorders and 35 reported no history; 43 had made suicide attempts and 46 reported no suicide attempts. Numbers varied according to availability of information.

Pharmacological treatments—Pharmacological treatments included: lithium (n = 7; none as monotherapy), an anticonvulsant (n = 60; 20 monotherapy), an antipsychotic (n = 36; 5 monotherapy), and an antidepressant (n = 29; 6 monotherapy). A total of 21 subjects were taking no medications; 35 were taking one class of medication, 36 two classes, 8 three classes, and 2 were taking four or more classes of medication. Pharmacological treatment was not significantly related to impulsivity measures or demographic features (22) or to conviction history [χ^2 (df = 4) = 7.3, p = 0.12 for number of medications].

Diagnosis and clinical state

Diagnoses were rendered by the SCID. Symptoms were rated using the Change version of the Schedule for Affective Disorders and Schizophrenia (SADS-C) (29) which is designed to measure depressive, manic, anxiety, and psychotic symptoms. We used the augmented version of the SADS-C (30), with all ten mania rating scale items from the full SADS (31), rather than the subset of five items in the conventional SADS-C. Raters were trained using standard materials and diagnoses and histories were confirmed by ACS, FGM, and JLS in consensus meetings.

Severity of cluster B personality disorder characteristics was assessed using the number of ASPD or borderline personality disorder lifetime symptoms endorsed (27) as structured interviews have been reported to provide more reliable measures of personality disorder severity than questionnaires (32). ASPD symptoms ranged from 0–14 and borderline personality disorder symptoms from 0–8.

Impulsivity

Barratt Impulsiveness Scale (BIS-11)—The BIS-11 is a 30-item self-rated scale with three oblique factors: *attentional/cognitive*, measuring toleration for cognitive complexity and persistence; *motor*, measuring the tendency to act on the spur of the moment; and *nonplanning impulsivity*, measuring the lack of sense of the future (33). Items are rated from 1 (absent) to 4 (most extreme). Scores range from 30–120, with nonpsychiatric controls generally scoring between 50–60 (21). Internal consistency was good across several different samples of subjects ($\alpha > 0.79$).

Rapid-response impulsivity: Immediate Memory Task (IMT) (34)—The IMT is a Continuous Performance Test developed to assess impulsivity and attention. A series of 5-digit numbers are displayed on a computer screen for 0.5 sec, with a 0.5-sec delay between each stimulus. Subjects are instructed to respond as quickly as possible when they see a number matching the previous number. Responses are recorded as: *correct detections* (CD), where the stimulus exactly matches the preceding stimulus; *commission errors* (CE), where 4 of 5 digits match (the position in the 5-digit sequence of the nonmatching digit is varied randomly); and *filler errors*, where no digits match. Reaction times to CD or CE are recorded and two signal detection parameters are calculated: *discriminability* (A'), from 0.5–1.0 (a higher value reflects ability to distinguish target from off-target stimuli); and *bias* (β), from –1.0 to 1.0 (a higher value reflects a conservative response bias with low rates of CE but also of CD) (35, 36).

Reward-delay impulsivity: Two-choice Impulsivity Paradigm (TCIP)—The subject chooses between a small reward after a 5-sec delay or a larger reward after a 15-sec delay (23) and a counter displays the results on the screen. Short-delay responses are taken as impulsive responses. This procedure has been widely used by our group (23) and by others (37, 38) in studies of potentially impulsive populations.

Reward-delay impulsivity: Single-key Impulsivity Paradigm (SKIP)—This free-operant test measures ability to delay response for a larger reward (23, 39). Money received for a response is directly proportionate to time since the previous response. Unlike two-choice tests, the duration of the task does not depend on responses by the subject. The amount obtained (cumulative and for each response) is displayed on the computer screen. The total number of responses, average delay, shortest delay, and longest delay are recorded.

Statistics

For normally distributed variables, we used general linear model analysis of variance or linear multiple regression analyses. If criteria for normality were not met (Shapiro–Wilk test) we used logarithmic transformation, or appropriate nonparametric statistics if transformation did not improve normality of distribution (40, see pp. 84–86). Kendall tau was used for nonparametric correlational analyses due to advantages in balancing type I and type II error (41). The Tukey Honestly Significant Difference (HSD) test correction for unequal n was used for post-hoc comparisons when appropriate analysis of variance was significant (42). Effect sizes (Cohen's d) were calculated as the difference divided by the pooled standard deviation, weighted by sample size (43). For prediction of continuous dependent variables, e.g., BIS-11 scores, by categorical and continuous independent variables, we used general linear models analysis. For prediction of dichotomous variables, e.g., history of conviction, by categorical and continuous predictor variables, we used logit analysis (40, see pp. 270–273).

Results

Demographic and clinical characteristics

A total of 29 subjects with bipolar disorder reported having been convicted for a crime. Subjects with history of conviction had less education than other subjects [12.5 ± 2.6 years ($n = 29$) versus 14.1 ± 2.0 years ($n = 77$), $t = 3.4$, $p < 0.005$, effect size (Cohen's d) = 0.7]; but did not differ in current age [36.7 ± 8.2 ($n = 29$) versus 37.7 ± 11.1 ($n = 86$), $t = 0.4$, $d = 0.1$], age at onset of bipolar disorder [17.7 ± 9.5 ($n = 25$) versus 17.1 ± 8.4 ($n = 83$), $t = 0.3$, $d = 0.07$], gender (16 of 52 men and 13 of 59 women, Fisher Exact test (FET) $p = 0.39$), or ethnicity [χ^2 ($df = 2$) = 3.5, $p = 0.2$]. Neither gender nor ethnicity significantly affected any results of this report, except as specifically noted.

Convictions were for nonviolent crimes: fraud, drug possession or selling ($n = 13$), burglary or crimes against property ($n = 7$); or violent crimes against persons: assault, robbery ($n = 8$). There were no significant differences in impulsivity-related or clinical characteristics across these categories, except as noted below.

Current clinical state included 32 interepisode subjects (not meeting criteria for depression, mania, or hypomania), 20 manic/hypomanic, 37 depressed, and 25 with combined depression and mania/hypomania. Past conviction was not related to current clinical state [χ^2 ($df = 3$) = 2.2, $p = 0.5$], mania, depression, anxiety, or psychosis scores on SADS-C ($|t| < 1.0$, $p > 0.4$), or pharmacological treatments (FET $p > 0.2$).

Cluster B symptoms, course of illness, and self-reported history of criminal behavior

Subjects who reported criminal conviction had higher ASPD scores than those who had no criminal conviction (7.1 ± 3.9 versus 2.6 ± 1.7 , Mann–Whitney, $z = 3.5$, $p < 0.0005$); borderline personality disorder scores did not differ (4.8 ± 1.7 versus 4.7 ± 2.9 , $z = 0.7$). Table 1 summarizes course of illness in subjects with or without histories of convictions. Subjects who had been convicted were more likely to have many manic and total episodes. Course was predominately manic in 8 subjects with convictions versus 9 without, predominately depressive in 5 versus 19, and without predominate episode type in one versus 19 [χ^2 ($df = 2$) = 8.5, $p = 0.015$]. Subjects with convictions were more likely to have histories of a substance use disorder and of a suicide attempt. BIS-11 scores did not differ ($p > 0.2$).

Increased history of suicide attempts in subjects with conviction histories may have been related to more episodes of illness. Further, we have shown that subjects with bipolar disorder and medically severe suicide attempts had increased IMT commission errors and faster reaction times (44). We investigated these relationships using logit analysis, with suicide attempt history as dependent variable, total episodes, IMT commission errors, and IMT reaction time as independent variables, and history of conviction as a categorical independent variable. Independent variables were those that differed between subjects with or without conviction history and suicide attempt in univariate analyses. The only variable significantly associated with suicide attempt was total episodes of illness (Wald statistic = 7.3, $p = 0.007$; for all other independent variables, Wald statistic < 1.0 , $p > 0.4$).

Laboratory-measured impulsivity and history of criminal behavior

Table 2 shows that conviction history in bipolar disorder was associated with impaired response inhibition, including increased commission errors and accelerated reaction times. Reward-delay impulsivity did not differ between subjects who had been convicted and those who had not (TCIP and SKIP, $|t| < 1.0$). Logit analysis was conducted with conviction history as dependent variable, and variables significantly associated with criminal conviction in univariate analyses as independent variables. Decreased education was not included because of its potentially circular relationship as both a cause and an effect of antisocial behavior and impulsivity (45, 46). Table 3 shows that number of ASPD symptoms, increased commission errors, and accelerated reaction time, but not number of manic episodes or substance use disorder, were significantly associated with history of conviction. There was a potential interaction whereby history of conviction appeared more likely in subjects with both many manic episodes and substance use disorder than with either alone, but it did not reach significance ($p = 0.076$).

We conducted further analyses to determine whether the variation in symptoms and affective state across subjects could have influenced apparent relationships between impulsivity measures and history of conviction. When depression, mania, anxiety, and

psychosis factor scores were added to the model, significant effects of ASPD symptoms (Wald statistic 4.7), commission errors (Wald statistic 3.9), and reaction times (Wald statistic 3.8) persisted (all $p < 0.05$); symptom factor scores had no significant effects (Wald statistic < 1.7 , $p > 0.25$). An analogous analysis with affective state (euthymic, depressed, manic, mixed) in the model revealed persistence of nearly identical contributions of ASPD symptoms, commission errors, and reaction times, with no effect of affective state (Wald statistic < 0.67 , $p > 0.6$).

Relationships to history of violent crime

A total of 8 of the 29 convicted subjects had been convicted for a violent crime. They did not differ from those only convicted for nonviolent crimes with respect to numbers of ASPD or borderline symptoms. In terms of impulsivity, subjects convicted for violent crimes differed only by having lower BIS-11 motor scores than those with nonviolent crimes: 28.9 ± 5.6 in subjects not reporting conviction ($n = 91$), 30.6 ± 4.9 in those reporting conviction for nonviolent crimes ($n = 19$), and 24.7 ± 6.0 in subjects reporting conviction for violent crimes ($n = 8$); $F(2,115) = 3.2$, $p = 0.04$; violent versus nonviolent difference, $p < 0.05$, Tukey HSD; BIS-11 total, attentional, and non-planning scores did not differ across groups. Performance on human laboratory measures of impulsivity, including IMT ($|t| < 1.4$, $p > 0.2$), TCIP ($|t| < 0.6$, $p > 0.5$), and SKIP ($|t| < 1.0$, $p > 0.3$), also did not differ. History of substance use disorder did not predict conviction for violent crime, but only five subjects convicted for any type of crime did not meet criteria for a substance use disorder. Unlike criminal history in general, there was a possible relationship to gender (nonviolent: 9 men and 10 women; violent: 7 men and 1 woman, $FET = 0.06$). On logit analysis with BIS-11 motor score and gender as independent variables, BIS-11 motor score contributed significantly (Wald statistic = 4.3, $p = 0.037$), but gender did not (Wald statistic = 2.4, $p = 0.13$).

Discussion

Relative to our hypotheses, *Hypothesis 1*: (i) ASPD symptoms, impairment of response inhibition, and substance use disorder were associated with conviction history, confirming the hypothesis; (ii) questionnaire-measured trait impulsivity was not related to conviction history; and (iii) on logit analysis accounting for ASPD symptoms and response inhibition, substance use disorder no longer contributed significantly. For *Hypothesis 2*: (i) self-reported criminal history was related to a recurrent course of illness with predominately manic episodes, as hypothesized, however, this relationship was accounted for by increased ASPD symptoms and impaired response-inhibition.

Course of illness and self-reported criminal behavior

Subjects reporting histories of convictions had a recurrent course of illness with predominately manic episodes, with increased probability of substance use disorders and suicide attempts.

A spurious association between substance use disorder and history of conviction could arise if a large enough proportion of convictions were for offenses directly related to drug use. However, it is conversely possible to be convicted for drug-related crimes without having a substance use disorder. Most of the convictions in this group were not directly drug-related. Most importantly, Table 3 shows that when ASPD symptoms, manic episodes, and response inhibition measures significantly differing between subjects with and without conviction histories were taken into account, substance use disorder no longer contributed significantly.

On average most episodes of bipolar disorder, including the first, are depressive episodes (47), though there may be predominately depression-and mania-prone forms of illness (48). The data presented here suggest that patients with mania-prone illness are more likely to be convicted than are those with depression-prone illness or no dominant episode type. This confirms results of a large community-based study where predominately manic course tripled the prevalence of conviction history (49), and of a crime-registry study of subjects who had been discharged from hospitalization for an affective disorder, where propensity toward mania was associated with subsequent conviction (3). Table 3 suggests, however, that increased manic episodes per se may not account for this relationship, since number of manic episodes did not contribute significantly to conviction history when ASPD symptoms and measures of response inhibition were taken into account.

Despite their propensity toward manic episodes, subjects reporting conviction history had increased likelihood of a suicide attempt. The combination of increased incidence of suicide attempts, increased ASPD symptoms, and history of conviction may be related to the correlation between impulsivity and hostility reported in patients with bipolar disorder who had made suicide attempts (50). However, logit analysis showed that increased history of suicide attempts was accounted for largely by increased total episodes of illness.

In future studies it will be useful to determine whether manic (or depressive) episodes in these individuals are more likely to be mixed, which are associated with recurrent course of illness (51, 52), substance use disorder (53) and suicide attempts (54).

Cluster B symptoms, impulsivity, and self-reported criminal behavior

Patients with bipolar disorder have higher rates of arrest and incarceration than community controls (1), and bipolar disorder has a higher prevalence in correctional institutions than in the community (4, 5). BIS-11 scores were not higher but response inhibition was more severe in subjects with conviction histories, resembling results from offenders with schizophrenia (55). This suggests that, in some clinical populations, self-reported impulsiveness may not accurately reflect the propensity for impulsive behavior (23) and underscores the importance of functional measures related to impulsivity (25).

In the current study, criminal behavior in bipolar disorder was related to ASPD symptoms and to impaired response inhibition, especially rapid-response impulsivity. Laboratory measures of impulsivity did not correlate significantly with ASPD symptoms in these subjects, so a combination of impulsivity and some other factor represented by ASPD symptoms may be necessary for risk of criminal behavior, as confirmed by logit analysis, where each contributed independently (Table 3). Further, subjects who had been convicted for violent crimes were not more impulsive, by any measure, than those whose convictions were for crimes that were not violent; in fact, their BIS-11 motor scores were lower than in subjects convicted for nonviolent crimes.

We have reported that measures of impulsivity can vary with clinical state (19, 56, 57). In general, we did not have information about subjects' clinical state when they committed the crimes for which they were convicted. Similarly, we did not have direct information about the extent to which the acts resulting in conviction were themselves impulsive acts. Impulsivity can interact with situational and other individual characteristics to influence behavior. For example, highly impulsive subjects may be more likely to carry out suicidal or aggressive acts that do not appear impulsive (25, 44). Logit analysis showed that neither psychiatric symptoms nor clinical state at the time of testing were significantly related to history of conviction; clinical state did not alter relationships between ASPD symptoms, commission errors, or reaction times and history of criminal conviction.

It may appear tautological that ASPD symptoms were related to criminal behavior. However, most SCID-II ASPD symptoms are not directly related to illegal behavior: of the 15 items, five require a potentially illegal act, and for two more an illegal act is likely (27). Perhaps most important, ASPD symptoms and laboratory-measured impulsivity contributed independently to conviction history (Table 3).

The lack of gender effect on conviction history in bipolar disorder resembles reports of gender and alcohol abuse (58) or suicide (59, 60): compared to the general population, the normal preponderance of men is reduced with increased additional risk for women. Increased risks for criminal behavior and substance use disorders may interact in women with bipolar disorder (61, 62). Violent crime appeared more prevalent in men, though logit analysis showed that lower BIS-11 motor scores, but not gender, were associated with violent crime history (see Results).

These data are consistent with other results suggesting that impaired response inhibition may be necessary but not sufficient for increasing risk for criminal behavior; an additional factor more related to voluntary behavior may be required (63). Possibilities include: (i) psychopathy (64), which would account for the fact that ASPD, but not borderline, symptom scores were increased with conviction history; (ii) childhood trauma, reported to increase the risk for subsequent criminal behavior in bipolar disorder (65); and (iii) substance abuse, which appears to predispose to violent behavior in severe psychiatric illnesses—in fact, in the absence of a substance use disorder, large community-based studies show that violent behavior is not increased in bipolar disorder or schizophrenia (18). A study using population-based registries of psychiatric hospital discharges and criminal behavior found that risk for violent crime associated with diagnosis of bipolar disorder ($n = 3,743$) versus controls ($n = 37,429$) was increased only in subjects who also had a substance use diagnosis (2). In the current study, prevalence of substance use disorder was increased in subjects reporting convictions (Table 2) but did not predict history of nonviolent or violent conviction when other variables were taken into account (Table 3), perhaps in part because the rate of substance use disorder across all subjects was high (67%).

Limitations

Potential limitations include: (i) retrospective determination of the course of illness, including self-reported conviction history; (ii) there was no information about potentially criminal acts that did not result in conviction as in the community-based studies cited in this paper; (iii) symptom counts, while clearly related to severity, are not truly quantitative; (iv) subjects varied in symptoms and clinical state, though this did not differ between groups with and without conviction history; (v) there was no information about clinical state or context of the subjects' crimes; (vi) the recruitment may have biased toward selecting subjects with criminal convictions, although recruitment was directly from the community, and the aim of our study was not to determine the proportion of subjects with bipolar disorder who have been convicted but rather to compare them to otherwise comparable subjects who had not; and (vii) the number of subjects with histories of violent crime was small, so those analyses must be considered preliminary.

Conclusions

Subjects with bipolar disorder and self-reported histories of criminal convictions had impaired response inhibition, a recurrent course of illness with predominately manic episodes, and higher ASPD symptom counts than those without conviction histories. ASPD symptoms and impaired response inhibition contributed independently.

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Table 1

Course of illness and history of criminal behavior

Course variable	No conviction history	Conviction history	Fisher's Exact Test
Many manic episodes			0.004
No	32	4	
Yes	15	12	
Many depressive episodes			0.077
No	30	6	
Yes	16	10	
Many total episodes			0.005
No	27	2	
Yes	18	12	
Age at first episode			0.90
< 16	47	9	
≥ 16	33	7	
Gender			0.39
Men	36	16	
Women	46	13	
Substance use disorder			0.013
No	33	5	
Yes	43	24	
Suicide attempt			0.045
No	40	9	
Yes	42	19	

Histories of 'many episodes' are defined as described in the Methods.

Table 2

Immediate Memory Task performance and criminal history

Measure	Never convicted (n = 76)	Convicted (n = 26)	<i>t</i> (df = 100) (p-value)	Effect size
Correct detections	76.2 ± 15.2	75.3 ± 14.8	0.3 (0.8)	0.06
Commission errors	27.3 ± 14.1	34.4 ± 15.3	2.2 (0.032)	0.48
CE/CD	0.368 ± 0.178	0.463 ± 0.186	2.3 (0.022)	0.52
Reaction time to CD, msec	538 ± 78	485 ± 71	3.1 (0.003)	0.63
Reaction time to CE, msec	541 ± 88	493 ± 95	2.4 (0.019)	0.5
Discriminability	0.825 ± 0.081	0.789 ± 0.085	1.9 (0.055)	0.46
Bias	-0.080 ± 0.510	-0.212 ± 0.470	1.2 (0.25)	0.26

Values are presented as mean ± SD. Correct detections (CD) and commission errors (CE) are expressed as percent of the appropriate trials.

Table 3

Contributors to history of criminal conviction in bipolar disorder

Variable	Wald statistic	Significance
ASPD symptoms	6.09	0.013
IMT commission errors	5.46	0.019
IMT accelerated reaction time	3.82	0.05
Many manic episodes	0.03	0.87
Substance use disorder	0.75	0.39
Substance use $\times$ many manic	3.14	0.076

Wald statistics were obtained from logit analysis with presence/absence of conviction history as dependent variable. Antisocial personality disorder (ASPD) symptom counts were log transformed. IMT = Immediate Memory Task.