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Interactions between bipolar disorder and antisocial personality disorder in trait impulsivity and severity of illness

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Abstract

Objective—We investigated trait impulsivity in bipolar disorder and antisocial personality disorder (ASPD) with respect to severity and course of illness.

Method—Subjects included 78 controls, 34 ASPD, 61 bipolar disorder without Axis II disorder, and 24 bipolar disorder with ASPD, by Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (SCID-I and -II). Data were analyzed using general linear model and probit analysis.

Results—Barratt Impulsiveness Scale (BIS-11) scores were higher in ASPD (effect sizes 0.5–0.8) or bipolar disorder (effect size 1.45) than in controls. Subjects with both had more suicide attempts and previous episodes than bipolar disorder alone, and more substance-use disorders and suicide attempts than ASPD alone. BIS-11 scores were not related to severity of crimes.

Conclusion—Impulsivity was higher in bipolar disorder with or without ASPD than in ASPD alone, and higher in ASPD than in controls. Adverse effects of bipolar disorder in ASPD, but not of ASPD in bipolar disorder, were accounted for by increased impulsivity.

Keywords

bipolar disorder; personality disorders; antisocial personality disorder; impulsive behaviour; substance-related disorders; recurrence; suicide attempted

Introduction

Cluster B personality disorders and bipolar disorder overlap clinically and share impulsivity as a core feature (1,2). Yet, there is surprisingly little information comparing impulsivity and its consequences in bipolar disorder with personality disorders, either as single diagnoses or in combination (2). Cluster B disorders could be part of a bipolar spectrum (3), representing an attenuated form of bipolar disorder, or they could combine with a severe and complicated form of bipolar disorder (1,4,5). Conversely, presence of bipolar disorder could worsen the course of a personality disorder. We focus on relationships between bipolar disorder and antisocial personality disorder (ASPD), a potentially destructive and poorly understood condition that may overlap with bipolar disorder in impulsivity and clinical presentation.

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Declaration of interests
None.

Impulsivity in bipolar and cluster B disorders

The high comorbidity of bipolar disorder and cluster B personality disorders (6,7) [recently reviewed (2)] may involve impulsivity. Impulsivity can be defined as a tendency to respond to stimuli without reflection or full assessment, resulting in inability to conform behaviour to contextual demands (8), and contributing to problems including aggression, substance use, and suicide. Impulsivity can be characterized as a trait-like characteristic whose expression can also vary in a state-dependent manner (9). For example, response inhibition is impaired by noradrenergic stimulation in controls (9) and during mania in bipolar disorder (10). Trait impulsivity is increased, and response inhibition is impaired, in ASPD (11) and in bipolar disorder, even after correcting for effects of medicines and clinical state (5,12,13). Impulsivity is related similarly to antisocial and borderline personality disorders, while the two entities are differentiated by aggressive traits (14). One study found mutually increased trait impulsivity in bipolar disorder and borderline personality disorder compared with individuals with either diagnosis alone (15). Impulsivity-related complications of bipolar disorder, including addictive disorders (10,16) and suicidal behaviour (17,18), may be more likely if a concurrent personality disorder is present.

Bipolar disorder and ASPD share important clinical features that may be related to impulsivity. Bipolar disorder is associated with higher rates of arrest and incarceration (19), and higher prevalence among incarcerated individuals, than community controls (20). Individuals with bipolar disorder who had been arrested had more hospitalizations than those who had not (21). Early onset of bipolar disorder correlates with juvenile antisocial behaviour (22) and greater likelihood of arrest (23). A 13-year prospective study found increased subsequent arrest in a non-clinical sample of adolescents with high hypomania scores (24).

Personality disorders, possibly including ASPD, may worsen the course of bipolar disorder (1,4,16,17). There is less information on effects of concurrent bipolar disorder on severity of ASPD (2). Potential clinical overlap between bipolar disorder and ASPD (7) could reflect i) impulsivity predisposing jointly to bipolar disorder and ASPD or ii) severe bipolar disorder or ASPD predisposing to comorbid disorders. Our rationale for focusing on ASPD included i) to reduce heterogeneity among subjects with cluster B personality disorders, ii) ASPD can be more readily distinguished from bipolar disorder than borderline personality disorder can, since affective disturbances resembling bipolar disorder are less prominent in ASPD and iii) the relationship between bipolar disorder and violent or criminal behaviour.

Aims of the study

We investigated trait impulsivity, using the Barratt Impulsiveness Scale, severity of personality disorder symptoms, and course of illness in subjects with bipolar disorder, with and without concomitant antisocial personality disorder, compared with non-bipolar subjects with antisocial personality disorder and healthy controls.

Hypotheses were i) trait impulsivity would be increased in either bipolar disorder or antisocial personality disorder and highest with both, ii) coexisting bipolar disorder and antisocial personality disorder would have a more severe and complicated course than either alone, including substance-use disorders and suicidal behaviour and iii) the effects of coexisting disorders would be consequences of increased impulsivity.

Material and methods

Subjects

The study was approved by the Committee for the Protection of Human Subjects, Institutional Review Board (IRB) for the University of Texas Health Science Center at Houston. Potential participants, responding to fliers or advertisements approved by the IRB, were fully informed of the procedures, risks, and benefits of the study, and signed informed consent, before any study-related procedures. Controls did not meet criteria for any axis I [Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders (DSM-IV); SCID-I] (25) or Axis II disorder (SCID-II) (26). Sources of information included structured interviews for standard questionnaires and medical records. Past substance- or alcohol-use disorders were not exclusion criteria for bipolar disorder or ASPD groups, as most patients with these disorders also have alcohol and/or substance-use disorders (27,28). Negative breath alcohol and urine screens for drugs of abuse were required on days of study procedures.

There were 78 healthy comparison subjects (no Axis I or Axis II disorder) (37 men and 41 women), 34 with ASPD who had never met criteria for a non-substance-related Axis I disorder (29 men and 5 women), 61 with bipolar disorder who did not meet criteria for an Axis II disorder (28 men and 33 women), and 24 with bipolar disorder and ASPD (12 men and 12 women), including nine (five men and four women) with ASPD only, and 15 (seven men and eight women) with ASPD and borderline personality disorder.

All subjects with bipolar disorder had bipolar I disorder. Twelve additional subjects with bipolar II disorder were excluded because none had ASPD, so there would be no subjects with bipolar II disorder plus ASPD to compare with bipolar II disorder alone. The prevalence of cluster B personality disorder in bipolar disorder, and the lower rate with bipolar II disorder, are consistent with other reports in outpatient populations (2).

Personality disorders and demographic characteristics within bipolar disorder: Some subjects with bipolar disorder and ASPD also met criteria for borderline personality disorder. Subjects with ASPD with vs. without borderline personality disorder did not differ in age, gender, education, affective symptoms, or BIS-11 scores, so the groups were combined. ANOVA with respect to ASPD or borderline personality disorder revealed no significant effects or interactions between personality disorder diagnosis and gender, education, age, affective symptoms, or BIS-11 scores ($F < 1$).

Course of illness in bipolar disorder was determined by constructing a life chart of episodes using the SCID. The median age of onset was 16 (25th–75th percentile 11–22). Distributions of numbers of episodes could not be normalized; further, as the number of episodes increases, the accuracy of determining their exact number is likely to decrease. Therefore, we categorized the number of episodes. Based on distributions of episode counts, subjects were classified using as close an approximation to a median split as possible to define ‘many’ episodes. For manic/hypomanic episodes, the median was too many to count (44 subjects), even with every effort to list all episodes. The median number of depressive episodes was 25; 41 subjects had too many episodes to count. For total episodes, the median was too many depressive or manic episodes to count and at least four episodes of the other polarity; 15 subjects had too many depressive and too many manic episodes to count. Fifty-eight subjects had histories of substance-use disorders while 27 did not; 51 had histories of alcohol-use disorders while 35 did not, and 43 had made suicide attempts while 46 had not. These characteristics resemble those reported for bipolar disorder in the community (27,28). Numbers varied according to availability of reliable historic data.

Pharmacological treatments—Pharmacological treatments were independent of this study. Procedures were only done when there had been no dose changes of over 20% during the previous 2 weeks. Seven subjects with bipolar disorder were prescribed lithium (none as monotherapy), 47 an anticonvulsant (19 monotherapy), 24 an antipsychotic (four monotherapy), and 27 an antidepressant (five monotherapy). Sixteen subjects were taking no medicines, 28 one class, 28 two classes, seven three classes, and two were taking four or more classes. We have reported that neither pharmacological treatment class nor numbers of classes prescribed were significantly related to BIS-11 scores or demographic features (12), consistent with reports of neurocognitive deficits in bipolar disorder regardless of pharmacological treatment (29).

ASPD and comorbidities—Among all subjects with ASPD, 37 had met criteria for a substance-use disorder while 22 had not; 34 had met criteria for an alcohol-use disorder while 24 had not, and 18 had made at least one suicide attempt while 34 had not. Among subjects with ASPD without bipolar disorder, 27 had histories of probation or parole while five did not; with both ASPD and bipolar disorder, 18 had histories of probation or parole while three did not [Fisher exact test (FET) = 0.52 for effect of bipolar disorder].

Diagnosis and clinical state

Diagnoses, including substance-related, were rendered by the Structured Clinical Interview for DSM-IV (SCID). Diagnosis of cluster B personality disorders used the SCID-II. Symptoms were rated using the Change version of the Schedule for Affective Disorders and Schizophrenia (SADS-C), designed to measure depressive, manic, anxiety, and psychotic symptoms concomitantly (30). The augmented SADS-C used in this and our previous work (31) had all 10 mania rating scale items from the full SADS (32), rather than the subset of five items in the conventional SADS-C (30). Raters were trained in these instruments, using standard rating tapes and materials. Diagnoses and histories were confirmed in consensus meetings that included co-authors A.C.S, F.G.M., and J.L.S.

Impulsivity

Impulsivity was assessed using the Barratt Impulsiveness Scale (BIS-11) (33). This 30-item self-rated scale has 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 non-planning, measuring the lack of sense of the future (34). Items are rated from 1 (absent) to 4 (most extreme); scores range from 30 to 120 with non-psychiatric controls generally scoring 50–60 (12). Internal consistency was good across several different samples of subjects ($\alpha > 0.79$).

Statistics

For normally distributed variables, we used general linear model (GLM) ANOVA or linear multiple regression analyzes. If criteria for normality were not met (Shapiro-Wilks test) we used appropriate nonparametric statistics. Kendall tau was used for nonparametric correlational analyzes because of its advantages in balancing type I and type II error (35). *Post hoc* comparisons, when appropriate ANOVA was significant, used the Tukey Honest Significant Difference Test corrected for unequal n. Effect sizes were calculated as the difference divided by the pooled standard deviation, weighted by sample size (36). For prediction of continuous dependent variables (like BIS-11 scores) by categorical and continuous independent variables, we used GLM analysis. For prediction of dichotomous variables (like history of suicide attempt) by categorical and continuous predictor variables, we used probit analysis (37).

Results

Demographic and clinical characteristics

Table 1 shows that subjects with either ASPD or bipolar disorder were older than controls, and slightly older than subjects with the combination. Educational attainment was lower in subjects with ASPD, whether or not bipolar disorder was also present. Within groups, age and educational attainment of men and women did not differ ($P > 0.3$).

Table 2 shows SADS-C factor scores for depression, mania, anxiety, and psychosis. Scores for depression and psychosis were higher in subjects with both bipolar and cluster B disorders than in bipolar disorder alone. Subjects with bipolar disorder included 24 interepisode subjects (did not meet criteria for depressive, manic, or hypomanic episode), 18 manic/hypomanic, 25 depressed, and 19 with combined depression and mania/hypomania. BIS-11 scores did not differ across clinical state [$F(3,82) < 2$, $P > 0.1$].

BIS-11 impulsivity scores

Comparison of bipolar and cluster B disorders—Table 3 shows BIS-11 scores in subjects with bipolar and/or ASPD and healthy comparison subjects. Bipolar disorder had very large effects on the BIS-11 and its subscales (effect size = 1.45). Effects of ASPD, while significant, were less prominent (effect size = 0.75). *Post hoc* analysis showed that all groups were different from controls across BIS-11 subscales. Subjects with bipolar disorder without ASPD had significantly higher total, motor, and attentional BIS-11 scores than subjects who had ASPD without bipolar disorder. Subjects with ASPD plus bipolar disorder had higher BIS-11 total, motor, and attentional scores than those with ASPD alone (effect sizes around 0.75). There was a significant interaction between bipolar disorder and ASPD for motor impulsivity; each had higher scores than controls, but the combination did not have higher scores than bipolar disorder alone. Education contributed significantly only to non-planning scores.

Age and education had significant effects of their own but did not account for the prominent group differences in BIS-11 scores (Table 3). For all subjects, BIS-11 scores did not correlate significantly with age other than a modest correlation ($r = 0.152$, $P = 0.04$) with non-planning impulsivity. BIS-11 scores correlated significantly and negatively with education ($r = -0.2$ to -0.3, $P = 0.02$–0.001).

Within bipolar disorder, ANOVA revealed no significant differences in BIS-11 scores between subjects with ASPD alone and ASPD plus borderline personality disorder (all F ratios <1).

Psychiatric symptoms and BIS-11 scores—We have reported that BIS-11 scores correlated with SADSC symptom factor scores (38). SADS-C factor scores in subjects with bipolar disorder were higher than in ASPD or controls. Therefore, we investigated the role of SADS-C factor scores in variation of BIS-11 scores across subject groups using GLM analysis, similar to that in Table 3 except that SADS-C depression, mania, anxiety, and psychosis factor scores as were added as independent variables. Main effects and interactions involving bipolar disorder and ASPD all persisted. In addition, there were significant effects of depression on BIS-11 total [$F(1,127) = 4.2$, $P = 0.043$] and non-planning [$F(1,127) = 4.9$, $P = 0.028$] scores, of anxiety on non-planning scores [$F(1,127) = 4.6$, $P = 0.033$], and of mania on total [$F(1,127) = 5.8$, $P = 0.018$], non-planning [$F(1,127) = 4.1$, $P = 0.045$], and motor scores [$F(1,127) = 4.8$, $P = 0.03$]. Therefore, psychiatric symptoms were related to BIS-11 scores but did not account for the large group differences.

BIS-11 scores and substance-use disorders—Most subjects with either bipolar disorder or ASPD had also met criteria for a substance-use disorder. Because there were no controls without ASPD or bipolar disorder who had a substance-use disorder, substance-use disorder could not be included as an independent variable in the analysis in Table 3. ANOVA in subjects without a substance-use disorder revealed results similar to those in Table 3, with significant main effects of bipolar disorder [$F(1,127) = 24.9$, $P < 0.0001$] and ASPD [$F(1,127) = 5.1$, $P = 0.026$] on BIS-11 total score (for the interaction, $F = 0$). Therefore, substance-use disorder contributed to, but did not completely account for, elevated BIS-11 scores in ASPD or in bipolar disorder. Among subjects with bipolar disorder, BIS-11 scores were higher in those with than without substance-use disorder [total 84.2 ± 13.4 vs. 70.9 ± 13.1, t(63 d.f.) = 4.3, effect size = 1, $P < 0.0001$]. In ASPD the relationship was similar but weaker, not reaching statistical significance due in part to the smaller number of subjects [68.1 ± 4.9 vs. 63.2 ± 8.6, t(36 d.f.) = 1.4, effect size = 0.6, $P = 0.18$].

Comorbidities and course of illness

Presence of ASPD and course of bipolar disorder—In subjects with bipolar disorder, comorbid ASPD was associated with history of suicide attempt (17 of 26 subjects with ASPD, vs. 15 of 43 without ASPD, FET = 0.013). ASPD was also associated with increased frequency of drug or alcohol-use disorder (21 of 23 vs. 34 of 51, FET = 0.03).

Co-existing ASPD was significantly related to a history of many manic episodes (15 of 21 with ASPD vs. 14 of 37 without, FET = 0.014) or many depressive episodes (14 of 19 with ASPD vs. 12 of 36 without, FET = 0.005). ASPD was not associated with significantly different age at onset of bipolar disorder (15.1 ± 8.0 years with vs. 18.1 ± 9.4 years without, $t = 1.4$, $P = 0.18$).

Relationships between impulsivity and cluster B diagnosis in course of bipolar disorder

We investigated relative contributions of personality disorder diagnosis and BIS scores to course of bipolar disorder using probit analysis. The dependent variable was presence of the characteristic in question, categorical independent variables were personality disorder diagnoses, and continuous independent variables were BIS-11 total score, age, and education. Because a substantial number of subjects with bipolar disorder and ASPD also had borderline personality disorder, both ASPD and borderline personality were included in the model. Because there were no subjects with borderline personality disorder but not ASPD, it was impossible to compute a Wald statistic, so χ^2 for type I sum of squares is shown instead. Table 4 shows that histories of many manic or depressive episodes were related to ASPD and borderline personality disorder, but not BIS-11 score. Comorbid substance-use disorder was related strongly to BIS-11 scores and more weakly, but significantly, to ASPD and borderline personality disorder. History of a suicide attempt was related to presence of either ASPD or borderline personality disorder. Educational attainment contributed (negatively) to histories of many manic episodes and non-alcohol substance abuse.

Effect of bipolar disorder on the course of ASPD

In ASPD, substance-related comorbidities were increased with co-existing bipolar disorder compared with subjects with ASPD alone: 20 of 33 subjects without bipolar disorder, vs. 22 of 24 with bipolar disorder, also had an alcohol or other substance-abuse disorder (FET = 0.013). Potential causes include increased impulsivity (Table 3), bipolar disorder *per se*, or the fact that borderline personality disorder was more prevalent in ASPD with than without bipolar disorder (FET = 3.8, $P = 0.04$), but not bipolar disorder, borderline personality disorder, age, or education ($P > 0.3$ except age where Wald statistic = 3.2, $P = 0.08$),

contributed to this relationship. There were similar trends for alcohol-use disorder (FET = 0.11) and non-alcohol substance-use disorder (FET = 0.08).

Subjects with ASPD and bipolar disorder were more likely than those with ASPD alone to have made a suicide attempt (one of 26 vs. 17 of 26; FET < 0.001). Probit analysis showed that BIS-11 score (Wald statistic = 7.2, $P = 0.008$), but not bipolar disorder, borderline personality disorder, age, or education (Wald statistics <1), contributed to this relationship.

Relationship between impulsivity and criminal behaviour

Twenty-eight subjects with bipolar disorder and 34 with ASPD had been convicted of crimes. BIS-11 scores did not differ significantly between those who had or had not been convicted. Of these, eight with bipolar disorder and 15 with ASPD had been convicted of severely violent or destructive crimes. Among subjects convicted for crimes, two-way ANOVA (bipolar disorder vs. ASPD, violent vs. non-violent) revealed main effects of diagnosis for BIS-11 scores [$F(1,56) = 12.7$, $P < 0.001$, bipolar disorder higher] but no main effects for type of crime. There was a significant interaction between diagnosis and type of crime for motor impulsivity, which was significantly higher in those with less violent crimes in bipolar disorder [30.6 ± 4.9 vs. 24.8 ± 6, $F(1,56) = 8.1$, $P = 0.006$; Tukey Honest Significant Difference = 0.03] but not in ASPD (23.6 ± 3.2 vs. 25.1 ± 5.3).

Discussion

With respect to our hypotheses, i) trait impulsivity was increased relative to controls in bipolar disorder or ASPD, and was higher in subjects with both than in ASPD alone, but not bipolar disorder alone, ii) among subjects with bipolar disorder, history of attempted suicide was more frequent in subjects with co-existing ASPD than in those with bipolar disorder alone and iii) diagnosis of ASPD or borderline personality disorder was associated with many manic or depressive episodes. These effects were not accounted for by BIS-11 scores. Among subjects with ASPD, co-existing bipolar disorder was associated with increased substance-use disorders and suicide attempts; these effects were accounted for by higher BIS-11 scores.

Trait impulsivity in bipolar and cluster B disorders

Subjects with bipolar disorder or ASPD had higher BIS-11 scores than healthy comparison subjects, but the effect of bipolar disorder was greater than that of ASPD (for BIS-11 total score, effect size for ASPD was 0.75; effect size for bipolar disorder was 1.45). Subjects with combined bipolar disorder and ASPD had higher BIS-11 scores than those with ASPD alone (effect size = 0.87 for BIS-11 total score), but not higher than subjects with bipolar disorder alone (effect size = 0.14 for BIS-11 total score). A possible explanation is that subjects with ASPD alone were less likely to have co-existing borderline personality disorder than subjects with ASPD plus bipolar disorder (FET < 0.001). BIS-11 scores did not differ, however, among subjects with bipolar disorder who had either ASPD or both cluster B disorders [$F(1,89) < 0.9$], consistent with shared impulsivity across diagnoses (14).

Subjects with bipolar disorder and ASPD differed with respect to BIS-11 subscale scores, with a larger effect of bipolar disorder for attentional impulsivity and of ASPD for non-planning impulsivity (Table 3), resembling a report comparing bipolar II and borderline disorders (15). Unlike the earlier report, we did not find higher BIS-11 scores in subjects with both bipolar and cluster B disorders than in bipolar disorder alone. Potential causes include the facts that subjects in the current study had bipolar I rather than bipolar II disorder, and that the composition of subjects with cluster B disorders differed between the two studies.

Cluster B diagnosis and course of bipolar disorder

Antisocial personality disorder, with or without borderline personality disorder, was related to many depressive or manic episodes and to history of a suicide attempt, even after taking BIS-11 score, education, and age into account. The relationship to suicide attempt was consistent with results from a large clinical population studied with the Personality Disorders Questionnaire (39). Probit analysis showed that BIS-11 scores, but not ASPD, were related to history of a substance or alcohol-use disorder, but BIS-11 scores did not account for the increased history of many previous episodes or of suicide attempts in bipolar disorder with co-existing ASPD (Table 4).

These data support other evidence that aspects of cluster B disorders, including but not limited to impulsivity, are related to severity of bipolar disorder (1,2). Cluster B personality disorder (usually borderline) was associated with poor outcome after a manic episode (4), higher incidence of suicide attempts (17,39), and a 'difficult' course of illness (16). Prevalence of personality disorder is greater in multi-episode than in first-episode bipolar disorder; this could represent a more recurrent form of the illness, or a consequence of many episodes (40).

Bipolar disorder and course of ASPD

There is little information on effects of comorbid bipolar disorder on ASPD. Subjects with the combined disorders were more likely than those with ASPD alone to have histories of substance-use disorders or suicide attempts. These differences were related to higher impulsivity, rather than to bipolar disorder *per se* or to the increased prevalence of borderline personality disorder in subjects with ASPD and bipolar disorder. This is consistent with other results implicating antisocial characteristics and impulsivity in suicidal behaviour in personality disorders (39,41,42).

Impulsivity and severity of criminal behaviour

Impulsivity was associated with other aspects of severity, but not with severity of criminal behaviour. In fact, motor impulsivity was lower in subjects with bipolar disorder who had been convicted for more severe crimes. This is consistent with more premeditation in the more severe crimes. This is consistent with the formulation that, in addition to impulsivity, antisocial behaviour requires a contrasting, more calculating characteristic referred to as psychopathy (43). Psychopathy, like impulsivity, is complex and dimensional (44), and may be orthogonal to impulsivity. Elements of psychopathy and impulsivity may cut across ASPD and bipolar disorder and contribute differentially to their severity.

Significant outcomes

- Trait impulsivity is increased more in bipolar disorder than in antisocial personality disorder (ASPD), even after accounting for psychiatric symptoms and psychotropic medicines.
- The addition of bipolar disorder to ASPD worsens course of illness, largely because of increased impulsivity, while the addition of ASPD to bipolar disorder worsens outcome, but because of some factor other than impulsivity.
- Impulsivity was not related to severity of criminal behaviour in ASPD or bipolar disorder.

Limitations

- Characteristics related to course of bipolar disorder and to diagnosis of personality disorders were determined retrospectively.
- Subjects with bipolar disorder were taking a variety of medicines and covered a range of affective states, unlike those in the other experimental groups.
- The exclusion of subjects with recent medicine changes may have biased the group with bipolar disorder to more stable illness.
- Our primary focus was on ASPD, but borderline personality disorder could not be excluded given its high overlap with ASPD and bipolar disorder, and was more prevalent in subjects with combined bipolar disorder and ASPD than in those with ASPD only. Within bipolar disorder, however, cluster B diagnosis did not affect the Barratt Impulsiveness Scale scores.

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Table 1

Demographic characteristics

Bipolar disorder	ASPD	No. subjects	Age	Education
No	No	78	32.4 ± 10.8	14.7 ± 2.2
No	Yes	34	38.2 ± 10.0	12.9 ± 2.0
Yes	No	61	38.2 ± 10.4	14.1 ± 2.1
Yes	Yes	24	36.2 ± 6.9	12.8 ± 26
F(1,194) bipolar			1.2	1
F(1,194) ASPD			1.6	18.8 (<0.00002)
F(1,194) bipolar × ASPD interaction			49.2 (0.028)	0.6

ASPD, antisocial personality disorder.

Table 2

Psychiatric symptom factor scores in bipolar disorder and/or ASPD Bipolar disorder

Bipolar disorder	ASPD	*n*	Depression	Anxiety	Mania	Psychosis
No	No	58	1.07 ± 1.84	0.45 ± 0.84	0.34 ± 0.97	0.03 ± 0.18
No	Yes	22	4.55 ± 5.45	1.95 ± 2.85	1.95 ± 2.42	0.18 ± 0.39
Yes	No	51	13.34 ± 8.71	6.55 ± 4.70	8.53 ± 7.23	1.80 ± 2.20
Yes	Yes	22	15.61 ± 10.62	5.83 ± 4.00	6.89 ± 5.84	2.06 ± 1.98
F(1,167) bipolar			**77.1 (<0.0001)**	**76.5 (<0.0001)**	**49.1 (<0.0001)**	**44.1 (<0.0001)**
F(1,167) ASPD			3.9 (0.052)	0.1	0.2	0.42
F(1,167) bipolar × ASPD			0.04	2.11	3.8 (0.056)	2.1

Depression, anxiety, mania, and psychosis are factor scores from the Schedule for Affective Disorders and Schizophrenia.

ASPD, antisocial personality disorder.

F ratios shown in bold face were statistically significant.

Table 3

BIS-11 Scores in bipolar disorder and ASPD

Group no	Bipolar disorder	ASPD	*n*	Total	Non-planning	Motor	Attentional
1	No	No	74	55.4 ± 8.2	20.8 ± 4.1	20.9 ± 3.7	13.6 ± 3.3
2	No	Yes	33	65.5 ± 11.1	26.0 ± 5.0	23.9 ± 4.3	15.7 ± 3.9
3	Yes	No	52	78.2 ± 14.6	29.4 ± 6.1	28.1 ± 6.7	20.8 ± 4.0
4	Yes	Yes	24	81.4 ± 14.2	29.1 ± 6.1	29.7 ± 5.1	22.7 ± 5.1
F(1,193) bipolar disorder				**85.9 (<0.0001)**	**36.4 (<0.0001)**	**51.5 (<0.0001)**	**103.9 (<0.0001)**
F(1,193) ASPD				**5.4 (0.022)**	2.6	3.8 (0.052)	**4.6 (0.033)**
F(1,193) bipolar × ASPD				2.9 (0.093)	**7.3 (0.008)**	0.2	0.5
F(1,193) age				0.1	1.2	0.1	3.4 (0.07)
F(1,193) education				**4.3 (0.04)**	**8.9 (0.0034)**	0.5	1.4
F(1,193) gender				0.4	0.5	0.4	0.1
There were no significant interactions related to gender, age, or education							
Significant *post hoc* comparisons, Tukey Honest Significant Difference (*P*-values in parentheses)				All different (0.0005), except 3–4	1 vs. 2, 3, or 4 (0.0005)	1 vs. 2 (0.02), 1 vs. 3 or 4 (<0.00001), 2 vs. 3 or 4 (0.004)	1 vs. 2 (0.02), 1 vs. 3 or 4 (0.0001), 2 vs. 3 (0.004)

Results of general linear models analyzes with BIS-11 total, non-planning, motor, or attentional scores as dependent variables and presence of bipolar disorder, presence of a cluster B disorder, age, and years of education as independent variables are shown. *P*-values for the *F* ratios or *post hoc* comparisons are in parentheses *post hoc* comparisons used the Tukey Honest Significant Difference test, corrected for unequal *n*.

ASPD, antisocial personality disorder; BIS-11, Barratt Impulsiveness Scale.

F ratios shown in bold face were statistically significant.

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Table 4

Relative contributions of BIS-11 Score and personality disorder to course of bipolar disorder

	Many manic episodes	Many depressive episodes	Alcohol-use disorder	Non-alcohol substance-use disorder	Suicide attempt
Age	0.12	0.05	0.1	0.02	0.16
Education	**6.51 (0.01)**	0.23	0.2	**6.66 (0.01)**	0.73
BIS-11 total	2.37 (0.12)	1.91 (0.17)	**13.1 (<0.001)**	**11.79 (<0.001)**	3.16 (0.07)
ASPD	**4.56 (0.03)**	**10.99 (0.002)**	2.74 (01)	0.4	–
Borderline	**4.22 (0.04)**	**8.44 (0.004)**	0.1	0.9	–
Either ASPD or borderline	–	–	–	–	**4.26 (0.04)**

Chi-square for type 1 sum of squares is given, with *P* (if <02) in parentheses. Significant effects are shown in bold face.

ASPD, antisocial personality disorder; BIS-11, Barratt Impulsiveness Scale.