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The Italian version of the Brief Assessment of Cognition in Affective Disorders: performance of patients with bipolar disorder and healthy controls

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ABSTRACT

Objectives: Cognitive deficits in Bipolar Disorder (BD) are significant enough to have an impact on daily functioning. Therefore, appropriate tools must be used to improve our understanding of the nature and severity of cognitive deficits in BD. In this study, we aimed to compare the cognitive profiles of patients with BD and healthy controls (HC) applying the Italian version of the Brief Assessment of Cognition in Affective Disorders (BAC-A).
Methods: This cross-sectional study included 127 patients with BD and 134 HC. The participants' cognitive profiles were evaluated using the Italian version of the BAC-A, which assesses verbal memory, working memory, motor speed, verbal fluency, attention & processing speed, executive functions, and two new measures of affective processing. The BAC-A raw scores were corrected using the normative data for the Italian population. In addition, we explored whether intelligence quotient (IQ) and specific clinical variables would predict the BAC-A affective, non-affective, and total composite scores of patients with BD and HC.
Results: HC performed better than patients with BD in all BAC-A subtests (all $p < .001$), except for subtests of the Affective Interference Test. ($p \geq .05$). The effect sizes varied in magnitude and ranged between $d = 0.02$ and $d = 1.27$. In patients with BD, lower BAC-A composite scores were predicted by a higher number of hospitalizations. There was a significant association between IQ and BAC-A composite scores in both bipolar patients and HC.
Conclusions: The Italian BAC-A is sensitive to the cognitive impairments of patients with BD in both affective and non-affective cognitive domains.

1. Introduction

Cognitive impairment is increasingly recognised as a core feature of bipolar disorder (BD) that is present in both acutely symptomatic as well as remitted states [1–4]. The main affected domains are sustained attention, working memory, executive function, verbal learning and verbal memory [1]. More recently, impairments in affective cognition have also been recognised as part of the neurocognitive profile and

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possible treatment targets in BD [5,6].

Importantly, patients with BD with either global or selective cognitive impairments report poorer quality of life, more perceived stress, and lower vocational functioning than cognitively intact patients, despite comparable levels of residual mood symptoms [7–11]. Therefore, it is imperative that appropriate cognitive measures are used to improve our understanding of the nature, severity, and correlates of cognitive deficits in BD.

In 2010, the International Society for Bipolar Disorders (ISBD) identified the MATRICS Consensus Cognitive Battery (MCCB), initially developed for schizophrenia, as a good starting point for assessing cognitive deficits in research studies on BD [12]. Nonetheless, some peculiarities of the cognitive profile of BD required the development of specific tests for a more in-depth evaluation. For instance, more complex measures of verbal memory, response inhibition, and abstraction have proved necessary [12]. In this context, the Brief Assessment of Cognition in Affective Disorders (BAC-A) was created based on the cognitive domains of the standard Brief Assessment of Cognition in Schizophrenia (BACS), adding the assessment of affective cognition [13]. Recent studies demonstrated that the BAC-A is sensitive to the cognitive impairments of patients with BD and has good sensitivity and discriminant validity [13–17]. Specifically, using different versions of the BAC-A (i.e. English, Chinese), it has been shown that patients with BD performed significantly worse than healthy controls (HC) both in affective and non-affective (mainly short-memory, verbal fluency and problem solving) cognitive domains [13–17]. This battery has been recently validated in the Italian population by our group [18]. However, to our knowledge, no study so far has applied the correction parameters derived from the normative study to compare BD and control groups. Thus, the sensitivity of the BAC-A in Italian samples remains to be tested.

To fill this research gap, we tested the cognitive functioning of patients with BD and HC using the Italian BAC-A and, for the first time, the related normative data for the Italian population. Based on previous studies, we hypothesised that BD patients would perform significantly worse than HC on most BAC-A subtests [13,15,16].

In addition, we explored whether intelligence quotient (IQ) and specific clinical variables would predict cognitive functioning (i.e., BAC-A scores) of patients with BD and HC.

2. Material and methods

2.1. Sample

Two hundred and sixty-one participants were recruited as part of an Italian observational, case-control, multicentric study (GECO-BIP study) [18–22] at eight research sites: 1) Psychiatric Unit, AOUI-University of Verona, Verona; 2) Fondazione IRCCS Ca' Granda, Ospedale Maggiore Policlinico, Milan; 3) IRCCS Istituto Centro San Giovanni di Dio Fatebenefratelli, Brescia; 4) Hospital "Santo Spirito" Psychiatric Department, Casale Monferrato; 5) Department of Biomedical and Neuromotor Sciences, Psychiatry Unit, University of Bologna, Bologna; 6) Department of Brain and Behavioral Sciences, University of Pavia, Pavia; 7) Hospital "Ospedale di Circolo," Busto Arsizio; and 8) ASUI-UD "Santa Maria della Misericordia" University of Udine, Udine (Table S1).

All patients underwent the Structured Clinical Interview for the Diagnostic and Statistical Manual of Mental Disorders Axis I (SCID I) to confirm the diagnosis of BD and rule out other psychiatric diagnoses [23].

Exclusion criteria for both HC and BD included: (1) age $\leq$ 18 years, (2) intelligence quotient (IQ) $\leq$70 as measured through Raven's Progressive Matrices [24], (3) medical conditions under pharmacologic treatment, any neurological comorbidities, (4) not being an Italian native speaker. Additional exclusion criteria for HC were a diagnosis of cognitive impairment or a history of alcohol and/or drug abuse. Individuals with BD diagnosed with any other axis I psychiatric comorbidity were also excluded.

Written informed consent was obtained from all participants after a detailed description of the study. The study was approved by the local Ethics Committee at each research site and carried out under the ethical standards of the Declaration of Helsinki, 1975.

2.2. Assessment

Semi-structured interviews were conducted at each site to collect demographic and clinical data i.e., sex, age, education, global functioning, BD subtype (i.e., BD-1 or BD-2), age of onset, hospitalisations, duration of untreated illness (DUI), lifetime psychotic episodes, pharmacotherapy and current mood phase (as measured by the Bech-Rafaelsen Mania Rating Scale (BRMRS) [25] and the Hamilton Depression Rating Scale (HAM—D) [26]). Then, the Italian version of the BAC-A was administered to all participants to test their cognitive functioning [18]. All psychologists who administered the BAC-A underwent training to ensure uniformity of administration and scoring procedures across sites.

The BAC-A is a paper-and-pencil battery designed to assess cold (i.e., non-affective) and affective cognition in BD [13,18]. The BAC-A comprises the six subtests of the BACS, which measure verbal memory, working memory, motor speed, verbal fluency, attention and processing speed, and executive functions (i.e., Token Motor Task, Symbol Coding, List Learning, Digit Sequencing Task, Verbal fluency, Tower of London) [27]. In addition, the BAC-A includes two subtests specifically designed to measure the influence of emotionally-valenced stimuli on cold cognition, i.e. the Affective Interference Test and the Emotional Inhibition Test [13,15]. Briefly, the Affective Interference Test assesses immediate affective and non-affective memory and the delayed recognition of affective stimuli [28], whereas the Emotional Inhibition Test (i.e., a modified version of the emotional Stroop [29]), through lists of neutral or affective words, measures the ability to suppress irrelevant stimuli and read a word whose meaning identifies a different color from the color of presentation of the word (interference) [30]. A detailed description of each BAC-A subtest is given elsewhere [18].

2.3. Standardised BAC-A scores calculation

The BAC-A scores were standardised following a number of steps:

First, the raw score of each BAC-A subtest was corrected using the parameters derived from our previous normative study [18] that allow to factor out the scores' variance due to sex, age, education.

Second, the corrected BAC-A scores were standardised by creating z-scores (M $\pm$ SD: 0 $\pm$ 1) based on the overall means and standard deviations of the HC group [31]. Delayed Recognition False-Alarms for Affective and Non-Affective z-scores were multiplied by -1 so that higher scores indicated better performance across all tests.

Lastly, three different BAC-A composite scores were derived:

1) The BAC-A non-affective composite score, by averaging standardised primary z-scores of the six non-affective subtests: List learning, Token Motor Task, Digit Sequencing Task, Verbal Fluency, Symbol Coding, Tower of London Test.
2) The BAC-A affective composite score, by averaging standardised primary z-scores of the 12 affective subtests: Affective Interference Test (i.e., Affective words, Non-affective words, Cued affective words, Cued non-affective words), Affective Interference Test - delayed recognition (i.e., Affective words, Affective false alarms, Non-affective words, Non-affective false alarms), Emotion Inhibition Test (i.e., Color naming, Neutral color words, Affective color words, Neutral words).
3) The BAC-A total composite score, by averaging the z-scores of all BAC-A subtests (i.e., six non-affective, 12 affective scores).

In total, 21 BAC-A z-scores were obtained and included in the analysis (six affective, 12 non-affective, and three composite scores).

Table 1
Sample characteristics.

	BD (n = 127)	HC (n = 134)	(BD versus HC)		Site[§]
			β (95% CI)	p	Var
Sex, n (m/f)	51/76	54/80	–	–	
Age, yrs	44.46 ± 11.36; 20–68	41.46 ± 11.60; 20–67	2.56 (−0.33, 5.44)	0.082	0.04
Education, yrs	13.17 ± 3.88; 5–25	16.25 ± 4.69; 5–26	−2.66 (−3.73, −1.61)	<0.001*	0.17
IQ	112.61 ± 12.51; 85–128	122.78 ± 7.55; 94–128	−10.15 (−12.72, −7.57)	<0.001*	0.00
GAF	68.76 ± 11.01; 34–90	87.06 ± 5.45; 70–95	−18.30 (−21.53, −15.08)	<0.001*	0.00
Bipolar subtype (BD-1/BD-2)	89/41	–	–	–	–
BRMRS total score	3.59 ± 3.85; 0–15	–	–	–	–
HAM-D total score	5.33 ± 4.05; 0–17	–	–	–	–
Onset of illness, yrs	27.07 ± 9.67; 11–54	–	–	–	–
Hospitalisations, n	2.98 ± 3.47; 0–19	–	–	–	–
DUI, yrs	4.12 ± 6.66; 0–43	–	–	–	–
Lifetime psychotic episodes, n	1.12 ± 1.54; 0–7	–	–	–	–
Pharmacotherapy[a]		–	–	–	–
Antidepressant use, n (%)	49 (39)	–	–	–	–
Antipsychotics use, n (%)	91 (72)	–	–	–	–
Benzodiazepine use, n (%)	34 (27)	–	–	–	–
Mood stabilizers use, n (%)	101 (80)	–	–	–	–

BD = bipolar disorder; BRMRS = Bech-Rafaelsen Mania Rating Scale; HAM-D = Hamilton Depression Rating Scale; HC = healthy controls; DUI = duration of untreated illness; GAF = Global Assessment of Functioning scale; IQ = Intelligence Quotient; Var = variation; yrs. = years. Data are expressed as *mean ± sd; range*. Differences in sex distribution are measured with chi2 test ($\chi^2 = 0.001$, $p = .981$). *$p < .001$.
[a] Information about pharmacotherapy was missing in four patients with BD.
[§] Site level variation based on intraclass correlation (ICC).

Table 2
Differences in cognitive performance between patients with bipolar disorders and healthy controls.

	BD versus HC			Site[§]
	β (95% CI)	*p*	*d*	Var
BAC-A non-affective subtests				
List learning	−0.78 (−1.05, −0.51)	**<0.001****	0.32	0.21
Token Motor Task	−0.93 (−1.21, −0.66)	**<0.001****	0.31	0.30
Digit Sequencing Task	−0.63 (−0.91, −0.35)	**<0.001****	0.46	0.03
Verbal Fluency	−0.81 (−1.07, −0.56)	**<0.001****	0.44	0.13
Symbol Coding	−1.13 (−1.36, −0.90)	**<0.001****	1.19	0.00
Tower of London Test	−0.85 (−1.16, −0.54)	**<0.001****	0.38	0.12
BAC-A affective subtests				
AIT: affective words	−0.58 (−0.83, −0.34)	**<0.001****	0.29	0.22
AIT: non-affective words	−0.49 (−0.75, −0.23)	**<0.001****	0.27	0.13
AIT: cued affective words	0.05 (−0.19, 0.29)	0.689	0.04	0.02
AIT: cued non-affective words	−0.45 (−0.72, −0.19)	**0.001****	0.35	0.03
AIT-DR: affective words	−0.14 (−0.40, 0.12)	0.304	0.08	0.10
AIT-DR: affective false alarms	−0.04 (−0.16, 0.24)	0.710	0.05	0.00
AIT-DR: non-affective words	−0.26 (−0.54, 0.02)	0.065	0.20	0.02
AIT-DR: non-affective false alarms	−0.31 (−0.63, 0.01)	0.056	0.23	0.01
EIT: Color naming	−1.11 (−1.40, −0.83)	**<0.001****	0.53	0.13
EIT: Neutral color words	−0.96 (−1.21, −0.70)	**<0.001****	0.92	0.00
EIT: Affective color words	−1.16 (−1.41, 0.66)	**<0.001****	0.84	0.04
EIT: Neutral words	−0.53 (−0.80, −0.27)	**<0.001****	0.22	0.23
BAC-A composite scores				
BAC-A Non-affective	−0.83 (−0.98, −0.68)	**<0.001****	1.27	0.01
BAC-A Affective	−0.50 (−0.64, −0.37)	**<0.001****	0.71	0.05
BAC-A Total	−0.62 (−0.74, −0.50)	**<0.001****	1.10	0.01

AIT = Affective Interference Test; AIT-DR = Affective Interference Test: Delayed Recognition; BAC-A = Brief Assessment of Cognition in Affective Disorders; BD = bipolar disorder; HC = healthy controls; EIT = Emotion Inhibition Test *$p < .05$ *(nominally significant)*; [§] Site level variation based on intraclass correlation (ICC). ****$p < .002$ (statistically significant after Bonferroni correction).**

2.4. Statistical analysis

The chi-squared test was used to assess differences between groups in sex distribution. A series of mixed-effect models were run to compare demographic characteristics (i.e., age, education, IQ) and BAC-A z-scores in patients with BD vs HC. This technique statistically accommodates dependency between observations in a nested design (i.e., participants within sites) [32]. *Site* was treated as a random intercept to account for the systematic site-level variation in the dependent variables expected to occur from differences in scanners, protocols, and assessments. The extent of variation explained by site-level differences was estimated as an intra-class correlation (ICC). First, we tested the effect of group (BD, HC) on each BAC-A z-score, which was treated as dependent variable.

Then, we explored whether IQ, global functioning, age of onset, DUI, hospitalisations, bipolar subtype, BRMRS and HAMD total scores, and lifetime psychotic episodes were able to independently predict the BAC-A affective, non-affective, and total composite scores in patients with BD. The association between IQ or global functioning and the BAC-A composite scores was also explored in HC.

The analyses were replicated accounting for sex, age, and education in the model to test the reliability of the correction parameters derived from our previous normative study [18].

Results on cognitive performance were adjusted for multiple comparisons using Bonferroni correction (i.e., $\alpha = 0.05/21$ BAC-A z-scores $= 0.002$ for the between-groups comparison and $\alpha = 0.05/3$ BAC-A composite scores $= 0.017$ for the within-group analysis).

Cohen's d was used to estimate the effect sizes of the BAC-A differences between groups based on the marginal means predicted by the model. All statistical analyses were performed using STATA 14 (StataCorp; 2015).

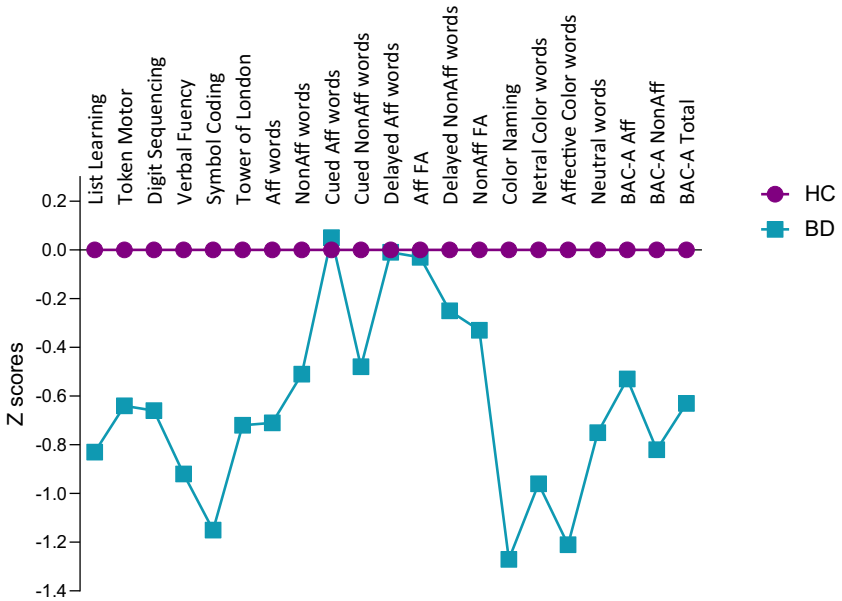

Fig. 1. Composite z-scores of the BAC-A scale in patients with BD and HC. Abbreviations: Aff = Affective; NonAff = Non affective; BAC-A Aff = affective BAC-A composite score; BAC-A Non Aff = Non-Affcetive BAC-A composite score; BAC-A Total = Total BAC-A composite score; BD = bipolar patients; HC = Healhty controls. $^{**}p < .002$ (statistically significant after Bonferroni correction).

Table 3
Association between BAC-A composite scores and demographic and clinical variables in patients with bipolar disorder and controls.

	BAC-A non-affective		BAC-A affective		BAC-A total	
	β (95% CI); *p*	*p*	*β* (95% CI)	*p*	*β* (95% CI)	*p*
IQ	0.22 (0.162, 0.278)0	**< .001******0**	0.10 (0.048, 0.160)0	**<.001****0	0.14 (0.092, 0.191)0	**<.001****0
BD	.11 (0.020, 0.201)	**.016****	.02 (−0.056, 0.106)	.547	.06 (−0.016, 0.132)	.127
HC						
GAF	0.00 (−0.011, 0.015)0	0.7630	0.01(−0.000, 0.020)0	0.0680	0.01 (−0.002, 0.018)0	0.1330
BD	.00 (−019, 0.027)	.704	.00 (−0.016, 0.023)	.706	.00 (−0.013, 0.021)	.669
HC						
Bipolar subtype [a]	0.06 (−0.182, 0.308)	0.614	0.22 (0.013, 0.426)	0.037*	0.17 (−0.021, 0.369)	0.080
Onset of illness, yrs	0.00 (−0.007, 0.017)	0.447	0.00 (−0.010, 0.011)	0.957	0.00 (−00.012)	0.611
Hospitalisations	−0.04 (−0.071, −0.006)	0.022*	−0.04 (−0.071, −0.016)	**0.002****	−0.04 (−0.068, −0.016)	**0.001****
DUI, yrs	0.00 (−0.001, 0.003)	0.214	0.00 (−0.001, 0.002)	0.648	0.00 (−0.001, 0.002)	0.350
BRMRS	−0.01 (−0.040, 0.020)	0.516	−0.02 (−0.042, 0.010)	0.0229	−0.01 (−0.037, 0.012)	0.324
HAM-D	−0.02 (−0.048, 0.010)	0.203	−0.015 (−0.039, 0.010)	0.241	−0.02 (−0.041, 0.005)	0.135
Lifetime psychotic episodes	−0.01 (−0.068, 0.089)	0.799	−0.019 (−0.086, 0.047)	0.568	−0.01 (−0.073; 0.052)	0.750

BAC-A = Brief Assessment of Cognition in Affective Disorder; BRMRS = Bech-Rafaelsen Mania Rating Scale; DUI = duration of untreated illness; GAF = Global Assessment of Functioning scale; HAM-D = Hamilton Depression Rating Scale; IQ = Intelligence Quotient; Var = variation; yrs. = years. * p < .05 (nominally significant), ** p < .017 (statistically significant after Bonferroni correction). [a] BD-1 = 0, BD-2 = 1

3. Results

3.1. Sample characteristics

The sample included 127 euthymic patients with BD (60% females) and 134 HC (60% females). Patients with BD and HC did not differ in sex distribution ($p = .981$) and mean age ($p = .082$). However, patients with BD had fewer years of education, lower IQ, and worse global functioning than HC (all $p < .001$). Demographic and clinical characteristics of the sample are shown in Table 1.

3.2. Cognitive profiles of patients with bipolar disorder and healthy controls

Patients with BD and HC differed significantly in all cognitive domains. Specifically, patients with BD performed worse in all affective and non-affective BAC-A subtests (except for five indexes of the Affective Interference Test) and obtained significantly lower affective, non-affective and total BAC-A composite scores (all $p < .001$) (Table 2 and Fig. 1). The effect sizes varied in magnitude and ranged between $d = 0.02$ and $d = 1.27$. Very large effect sizes (i.e., $d > 1.00$) were obtained for differences in Symbol Coding and non-affective and total BAC-A composite scores.

All the above-mentioned effects were confirmed after adjusting for sex, age, and education. In addition, the effect for cued affective words of the Affective Interference Test reached significance (i.e., BD < HC, $p < .001$) (Table S2).

3.3. Associations between demographic or clinical characteristics and BAC-A composite scores in patients with bipolar disorder and HC

Within the BD group, higher affective, non-affective and total BAC-A composite scores were predicted by higher IQ (all $p < .001$). Conversely, lower affective and total BAC-A composite scores were predicted by a higher number of hospitalisations ($p = .005$ and $p = .003$, respectively) (Table 3 and Fig. 2). In the HC group, higher IQ was associated with higher non-affective BAC-A composite scores ($p = .016$). These results were confirmed when controlling for age, sex, and education (Table S3).

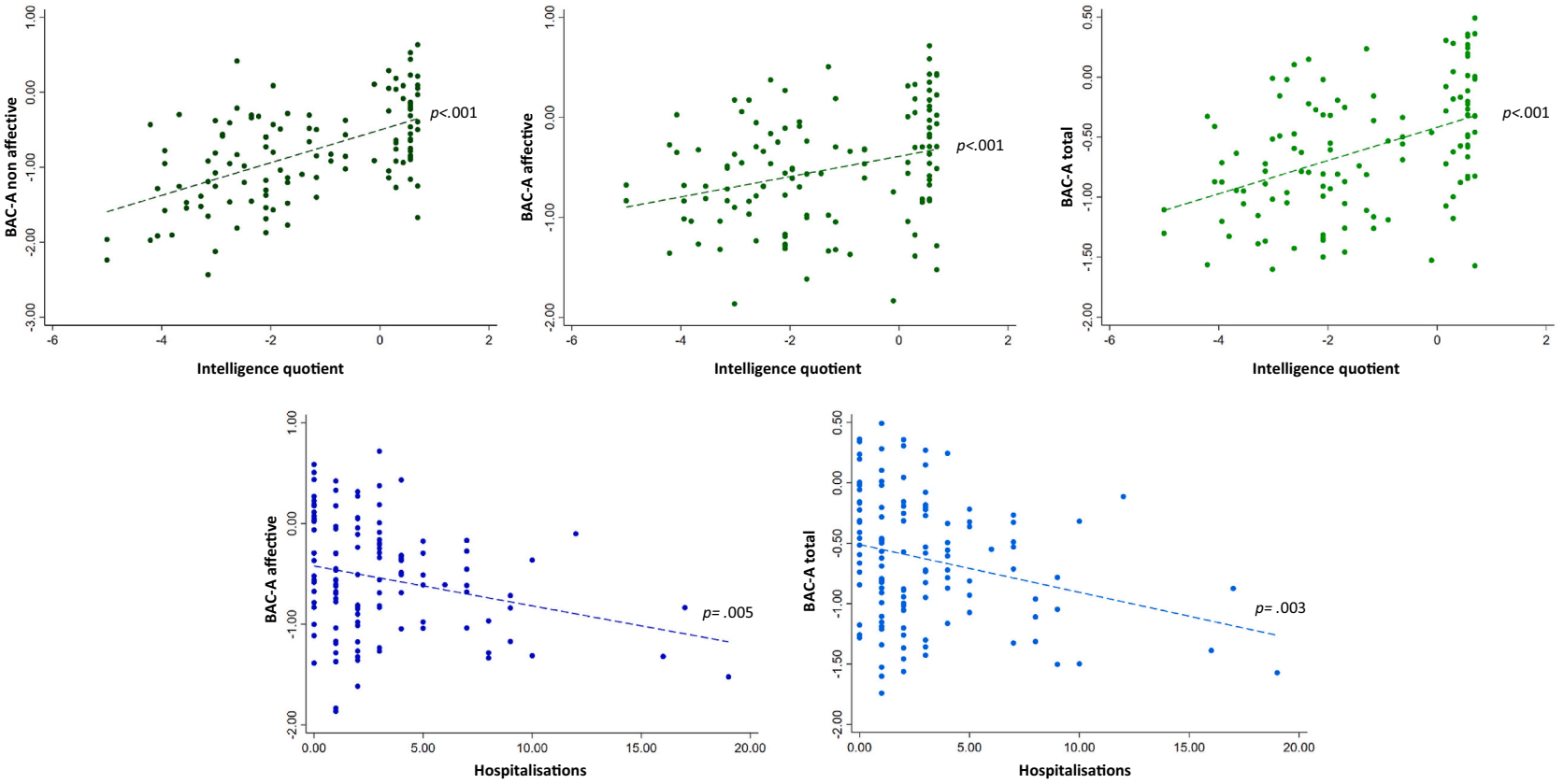

Fig. 2. Associations between the BAC-A composite scores and hospitalisations and IQ in BD patients. Only significant associations are reported. IQ scores were z-transformed. Abbreviations: BAC-A Aff = affective BAC-A composite score; BAC-A NonAff = Non-Affective BAC-A composite score; BAC-A Total = Total BAC-A composite score. $^{**}p < .017$ (statistically significant after Bonferroni correction).

4. Discussion

In this study, we aimed to compare the cognitive profile of patients with BD and HC using the Italian version of the BAC-A, and related normative data for the Italian population. Our analyses found that patients with BD had poorer performance in all cognitive dimensions measured by the BAC-A than HC. Within the BD group, the affective, non-affective, and total BAC-A composite scores were predicted by IQ and hospitalisations but not global functioning, age of onset, DUI, BD subtype, BRMRS and HAM-D total scores or lifetime psychotic episodes. Moreover, there was a significant relationship between IQ and non-affective composite scores also in HC.

A number of previous studies have used the BAC-A to evaluate the cognitive functioning of bipolar and control samples [4,14–16]. Keefe et al. (2014) found that the BAC-A was sensitive to impairments both in traditional (cold) and affective cognitive domains among patients with BD, at least in the depressed mood state. Bauer et al. (2015) summarised the BAC-A scores in eight cognitive domains (i.e., short-term and delayed affective and non-affective memory, visuomotor, verbal fluency, inhibition, and problem solving) and reported that patients with BD had significant deficits in short-term non-affective memory and verbal fluency, which may reflect inefficient learning strategies and/or difficulties in retrieving information. Barbosa et al. (2018), applied Bauer's methodology and showed that patients with BD presented impairments in affective processing, verbal memory, verbal fluency, and executive functioning. Our results using the Italian version of the BAC-A are generally consistent with these previous reports. Furthermore, matching our results, Lee et al. (2018) showed that HC performed better than patients with BD in all BAC-A subtests, except for the Affective Interference Test-Delayed Recognition.

Looking at the magnitude of the effects, our findings confirm previous meta-analytic evidence of medium-to-large deficits in BD samples on overall (non-affective) cognition, processing speed [33,34] and verbal fluency [35]. Specifically, we found a very large effect size ($d > 1$) for differences between BD and HC groups in Symbol Coding, a measure of processing speed, and the non-affective composite score. Notably, according to the ISBD cognition task force, Symbol Coding is one of the tests of the BAC-S with high clinical utility for BD [12].

In addition, there was evidence of medium-to-large effect-size impairment ($d = 0.5$–0.9) on measures of affective cognition mainly the Emotion Inhibition Test and the BAC-A affective composite score. The Emotion inhibition Test is a modified version of the Emotional Stroop Test, one of the most common tests used in BD to assess implicit emotion regulation (as measured the degree of attentional interference of task performance by emotional distractor stimuli). The Emotional Stroop Task has shown sensitivity to impairments across BD states and has been indicated by the ISBD cognition task force as a test of choice for future studies on the interplay between affective and non-affective cognition (i.e. attentional interference and emotional bias) in BD [6].

Overall, our study suggests a good sensitivity of the Italian version of the BAC-A for assessing neurocognitive impairments in BD, both in affective and non-affective domains. Nonetheless, our findings varied from small to very large effect sizes and need replication in larger samples.

The results of the within-group analysis revealed that the overall affective and non-affective cognition (indexed by the BAC-A composite scores) was significantly worse in patients with BD who reported a lower IQ and a higher number of hospitalisations (a proxy of illness severity), which is in line with previous studies. Indeed, it has been shown that higher IQ predicted preserved cognition [36] or better cognitive performance over time [37,38] in BD, whereas an increasing number of major affective episodes, which commonly results in hospitalisation, correlated with greater cognitive impairments [39]. Lastly, we observed a positive association between non-affective cognition and IQ also in HC. This is not surprising as the relationship between intellectual function and cognitive ability is well established and abundant evidence has shown that the variance of neuropsychological tests is partially explained by IQ [40–43].

Our study comes with some strengths and limitations. The major strengths are the large sample size and the robust statistical approach. We used a multilevel analysis method to account for inter-site heterogeneity in sample characteristics and we replicated all analyses controlling for differences in demographics (i.e. sex, age, education). As such, we are confident that we accounted for the impact of these variables in estimating the results.

As for the limitations, our BD sample consisted of both BD-I and BD-II patients. Nonetheless, all patients were clinically stabilized at the time of the cognitive assessment. Second, several factors that may be associated with cognitive abilities, such as premorbid functioning, impulsivity or cognition-related genes, were not addressed in this study and need to be tackled in future studies. For instance, specific genetic polymorphisms that are involved in impulsivity and other clinical dimensions of BD, as previously studied in bipolar patients from our consortium [19,22] may also play a role in affective and non-affective cognition. Lastly, patients were on psychiatric medication at the time of the assessment, thus we cannot exclude that the cognitive deficit observed in our BD sample may be partially influenced by psychotropic drugs. However, given that the majority of BD patients are under treatment, our sample can be considered representative of the general BD population that may be tested with the BAC-A in clinical practice. Future studies comparing medicated and drug-free BD samples may be useful to test the sensitivity of the Italian BAC-A to detect medication-related cognitive deficits.

Yet, this was the first study comparing the cognitive profile of a large sample of patients with BD and HC, carefully recruited excluding major psychiatric comorbidities, using the Italian version of the BAC-A and the related normative data for the Italian population.

Our findings validate the existing knowledge on the role of affective and non-affective cognitive dysfunctions in BD and support the utility of the Italian version of the BAC-A for the assessment of cognition in BD, regardless of BD subtype. Further studies should be conducted in homogenous samples of either remitted or symptomatic patients with BD to better clarify the sensitivity of the BAC-A subtests in the different clinical phases of the disease while increasing our understanding of which affective/non-affective cognitive changes are state- or trait-related.

Data availability statement

The data supporting the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Declaration of Competing Interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.comppsych.2022.152335.

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