Cognitive Abilities in Schizoid Personality Disorder with and without Borderline Intellectual Functioning: The Burden in Psychopathology

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Abstract: *Background*: Borderline intellectual functioning (BIF) and schizoid personality disorder (Schizoid PD) are clinical conditions under-researched and poorly understood. The principal aim of this retrospective study was to investigate cognitive abilities in people with BIF and Schizoid PD. Clinical, demographic, and neuropsychological data of forty-seven Schizoid PD participants, with an average age of 35, were analyzed. The sample split into two groups: Schizoid PD with BIF (BIF+: n = 24; intelligence quotient – IQ range: 71-84) and Schizoid PD without BIF (BIF-: n = 23; IQ range: 89-121). A descriptive analysis of the clinical and demographic characteristics of the two groups was performed.

Methods: Neuropsychological measures (Wechsler Adult Intelligence Scale-Revised – WAIS-R IQ, factor index, subtest scores) and cognitive performance deficits in the two groups were compared using parametric and non-parametric tests, as necessary. Correlation coefficients were calculated for relationships between variables. Regression analyses were conducted to identify predictors associated with negative outcomes, such as substance use behavior.

Results: The results revealed that the cognitive profile of BIF+ deviated significantly from that observed in BIF-. Peculiar BIF+ dysfunctions were found in the domains of verbal and perceptual reasoning, attention, memory, processing speed, planning, and problem-solving. The verbal IQ had the highest discriminative value for the presence of BIF in patients with Schizoid PD.

Conclusions: The BIF condition and the verbal comprehension index were the predictors most associated with substance use behavior. Early identification of BIF should be relevant to planning targeted intervention strategies to improve daily life skills and outcomes.

Keywords: Cognitive functions, Personality disorders, Adaptive functioning, Verbal comprehension, Neuropsychological assessment, statistical analysis.

1. INTRODUCTION

Borderline intellectual functioning (BIF) is characterized by an intelligence quotient (IQ) score that ranges from 71 to 84, with difficulties in achieving developmental milestones and an impact on adaptive abilities for personal independence and social responsibility [1, 2]. In the absence of a clear definition of clinical, behavioral, and cognitive features of people with BIF [3], they have often been unrecognized by mental health professionals, receiving unneeded drug treatments and little, if any, psychological, educational, and social supports [4, 5]. Research has shown that BIFs are a large high-risk group for adverse outcomes, poor academic achievements [6], job insecurity [7], and lack of social skills [8]. BIF is over-represented in the criminal justice system [9, 10] and in the forensic addiction treatment center [11, 12]. Several longitudinal studies provide evidence that reduced intelligence

(low IQ) is a risk factor for the development of any personality disorder (PD) as well as for hospital admission and illness severity [4, 13,14]. In the Diagnostic and Statistical Manuals of Mental Disorders [1, 15], personality disorders (PDs) are described as inflexible and enduring patterns of inner experience and behavior that deviate markedly from the expectations of the individual's culture, and lead to clinically significant distress or impairment in social, occupational, or other important areas of functioning. In the DSM system, PDs are grouped into three Clusters based on phenotypic similarity: Cluster A includes odd or eccentric individuals (paranoid, schizoid, and schizotypal PDs); Cluster B includes dramatic, emotional, or erratic individuals (antisocial, borderline, histrionic, and narcissistic PDs); Cluster C includes anxious or fearful individuals (avoidant, dependent, and obsessive-compulsive PDs). Schizoid personality disorder (Schizoid PD) is a pervasive pattern of withdrawal and detachment from social relationships with a tendency toward solitary lifestyle, indifference to praise or criticism, emotional aloofness, lack of motivation, and low interest in activities [1,16-18].

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Although Schizoid PD patients are uncommon in clinical settings, probably due to the predisposition of these individuals to avoid social contact and professional help, there is a higher prevalence of Schizoid PD in the offender population [19]. The literature review shows that Schizoid PD is strongly related to substance abuse [20], violent crimes [21-23], as well as features of psychopathy and violent antisocial behavior [16, 24]. Poor parenting has been associated with BIF [25], Schizoid PD [26, 27], with the increased risk of substance use in BIF [28], and Schizoid PD [29]. Furthermore, research has provided evidence that exposure to adverse childhood experiences (ACEs), parental socioeconomic disadvantage (low SES), and the lack of appropriate stimulation in family and school environments may affect social cognitive development, increasing the risk of educational failures, mental illnesses, substance use and offending behaviors [27, 30-33].

To our knowledge, no prior studies have examined cognitive abilities in young adults with borderline intellectual functioning and schizoid personality disorder. Nevertheless, our clinical experience with these individuals has revealed their dramatic impairment in daily functioning and social adaptation, as well as persistent failures in meeting environmental challenges. Cognitive abilities are inextricably linked to emotion regulation, socio-affective skills, and personality development [34-36]. According to the literature, cognitive functioning may predict social adaptation [37], mostly in individuals living in adverse environments [38]. Furthermore, poor cognitive resources such as lower IQ represent a general vulnerability of the brain that increases the risk of negative outcomes across the life span [39]. Available studies on the cognitive features of individuals with BIF have focused mostly on children and adolescents. Although previous research has found comorbidity with learning disabilities in children with BIF due to poorer sustained attention, slower processing speed [40, 41], and limited executive functioning [28, 42], their difficulties are not confined to a specific domain [43]. Moreover, children with BIF showed problems with abstract reasoning, verbal comprehension deficits [44], and a lower capacity to generalize information from one learning context to another [45]. Impaired adaptive skills would seem to reflect general intellectual functioning limitations with a lack of compensatory strategies [46, 47], while the poor social abilities and behavioral problems in BIF have been associated with an inadequate system of Social Information Processing [48-50] (SIP). The cognitive characteristics of Schizoid PD individuals have been defined as "neuro-psychological syndrome of adaption/dysadaptation" [51], with a combination of executive dysregulation, memory reduction, and spatial disorders [45]. In the study of Hengartner *et al*. [52], the schizoid personality disorder was related to slower information processing speed associated with fluid intelligence and reduced emotional empathy characterized by low willingness to feel compassion for other people and high negative feelings in reaction to others' emotional expressions. In our previous study [53] investigating the cognitive correlates of BIF in participants diagnosed with borderline personality disorder (BPD) by using the Italian version of the Wechsler Adult Intelligence Scale-Revised – WAIS-R [54], we found that the verbal intelligence quotient (VIQ) and the verbal comprehension index (VC) had the highest discriminative value for the presence of BIF in BPD. In the current retrospective study, we aimed to explore the cognitive profile of BIF among people diagnosed with Schizoid PD. First, we tested 2 hypotheses:

(1)   the pattern of cognitive abilities in Schizoid PD patients with BIF (BIF+) deviates significantly from that in Schizoid PD patients without BIF (BIF-);

(2)   whether the proportions of performance deficits on the VIQ and the VC in BIF+ differ significantly from that in BIF-, verbal reasoning may be considered a more specific weakness of BIF condition. Conversely, whether the proportions of performance deficits on the VIQ and the VC in BIF+ do not differ significantly from that of BIF-, these two indexes may not have the highest discriminating value for the presence of BIF in people diagnosed with schizoid personality disorder.

Second, we examined the relationships between clinic, demographic, and cognitive characteristics in BIF+ and BIF-. Additionally, we sought to identify predictors associated with substance use (SU) behavior in participants with Schizoid PD.

2. MATERIALS AND METHODS

2.1. Participants

The present retrospective study included blind data collected between September 2012 - October 2020 from patients referred to the Clinical Section of Psychiatry participants within the Department of Head-Neck Care Unit of Psychiatry and Psychology Federico

II University Hospital Naples (Campania, Italy). The psychiatrist codified for each patient the presence or the absence of Axis II personality disorder using the Italian version of the Structured Clinical Interview for DSM-IV Axis II Personality Disorders (SCID-II; First *et al.*, 1997) [55], Axis I disorder using the Structured Clinical Interview for DSM-IV-TR Axis I Disorders Clinician Version [56] (SCID-CV), and substance use behavior using the Substance Use Module E of the SCID-I. The major inclusion criterion was Schizoid Personality Disorder (Schizoid PD) based on the DSM-IV-TR [1] and recorded in the system of the electronic patient file. Exclusion criteria were the presence of 1) IQ below 71; 2) neurological diseases and motor impairments; 3) head injury; 4) diagnosis of mental disorder other than Schizoid PD. A sample of 47 participants with an average age of 35 years was thus developed.

2.2. Procedure

In the Psychodiagnostics and Neuropsychology Participant Clinic of the Department mentioned above, the following variables were recorded: DSM-IV-TR axis II diagnosis, age, gender, level of education, marital status, pharmacological therapy, substance use, and neuropsychological data. After anonymous data processing was guaranteed, informed consent for collecting data from the electronic patient file was obtained from each patient. As a retrospective study, the approval by an ethics committee was not applicable, but the protocol was submitted and approved by the research office of the Ethical Committee of the University of Naples Federico II (part of the Division of Legal Medicine of the Department of Advanced Biomedical Sciences). Institutional Review Board (IRB) was obtained per institutional guidelines. All procedures performed in this study were in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for medical research involving humans.

2.3. Neuropsychological Assessment

The participants' intellectual functioning was assessed by using the Italian version of the Wechsler Adult Intelligence Scale-Revised [54] (WAIS-R). The WAIS-R consists of eleven subtests yielding raw scores, then converted to age-corrected scaled scores [57]. The full-scale intelligence quotient (FSIQ) is a measure of the individual's general cognitive ability obtained by summing all subtests' scaled scores and then converting them to age-corrected standard scores.

The verbal intelligence quotient (VIQ) is a measure of acquired knowledge, verbal reasoning, short-term memory, and mathematical skills calculated by summing the Information, Comprehension, Arithmetic Reasoning, Digit Span, Similarity, and Vocabulary subtest scaled scores. The performance intelligence quotient (PIQ) is a measure of perceptual reasoning, visuospatial abilities, and processing speed derived from the sum of Picture Completion, Picture Arrangement, Block Design, Object Assembly, and Digit Symbol-Coding subtest scaled scores (for an exhaustive description of the WAIS-R [53].

2.4. Statistical Analysis

According to the DSM-IV-TR criteria (APA, 2000), patients split into two groups: the Schizoid PD with BIF group (BIF+: 71 ≤ IQ ≤ 84) and the Schizoid PD without BIF group (BIF-: IQ ≥ 85). Descriptive statistics of clinical and demographic variables are presented in Table **1** as means, standard deviations, and frequencies. Shapiro–Wilk test was used to check for normality of data distribution, and homogeneity of variance was estimated using Levene's test. Non-parametric analyses were used when the assumptions of homogeneity of variance or normality were violated ($p < 0.05$). A first analysis was carried out to assess the clinical and demographic characteristics of the two groups. Continuous variables were compared between groups using the Student's t-test or Mann–Whitney U test, as appropriate. Comparisons of categorical variables were performed using Fisher's exact test or Pearson's Chi-square test, and *p*-values less than 0.05 were considered significant. Neuropsychological measures (WAIS-R IQ, three-factor index, eleven subtest scores) were compared between groups using t-tests or U-tests, and effect sizes (Cohen's d) were calculated. Frequency analyses on the proportions of performance deficits reported by the two groups were performed, and the effect sizes (Cramer's V) were calculated. Pearson or Spearman's correlation was used to check relationships between clinical, demographic, and cognitive features of Schizoid PD patients. Binary logistic regressions were carried out using the forward selection (Likelihood Ratio) method based on the Wald test statistics with substance use (SU) as the bimodal outcome (SU- = absent; SU+ = present) and as predictors the demographic and clinical variables in the regression model[a], the cognitive measures as the WAIS-R three factor indexes' z-scores in the regression model[b], and the eleven subtests' z-scores in the regression model[c], to determine whether cognitive skills account for

substance use, and to quantify (OR = odds ratio) to which extent this is so. Statistical analyses were performed using IBM SPSS Statistics software (version 21.0), adopting an alpha error rate of 0.05 (two-tailed) and a conservative statistical power of 95%.

3. RESULTS

3.1. Clinical and Demographic Characteristics

The study sample consisted of 47 Italian Schizoid PD patients (89% males; mean age 27.64 ± 8.32 years); 31 of them had attained the 12th grade of education (High school diploma), 8 completed the 8th grade (Middle school), and 8 had a University degree. Many Schizoid PD patients were single (81%), and all of them were compliant with the prescribed pharmacological therapy. The majority (91%) were receiving atypical antipsychotics and 9% SSRI drugs. Substance use was reported by 49% of Schizoid PD patients; of them, 79% were cannabis and tobacco smokers, and 21% were alcohol drinkers and tobacco smokers.

3.2. Comparisons of Demographic and Clinical Variables

According to the WAIS-R full-scale intelligence quotient score (i.e., FSIQ), the sample of 47 Schizoid PD patients was divided into two groups (mean total FSIQ = 91.83; SD = 14.56). The Schizoid PD with BIF group included 24 patients who scored from 71 to 84 (mean FSIQ = 79.92; SD = 4.49). In the Schizoid PD without BIF group, there were 23 patients with FSIQ scores higher than 84 (mean FSIQ = 104.26; SD = 10.30). A descriptive summary of the other demographic characteristics of the two groups appears in Table **1**. Data were not normally distributed (Shapiro–Wilk test, *p*< 0.05), and between-group variances were unequal (Levene's test, *p*< 0.05). Therefore, non-parametric analyses were performed. Statistical comparisons between the two Schizoid PD patient groups were run using the Mann-Whitney U-test for independent groups. No statistically significant differences were found among BIF+ and BIF- in age and years of education. The frequency analysis results showed no differences between the two groups in terms of demographic (i.e., gender, marital status) and clinical (i.e., pharmacological treatment) characteristics.

3.3. Comparisons of Neuropsychological Variables

Results obtained with the neuropsychological assessment groups-averaged WAIS-R IQ, three-factor index, and eleven subtest scores appear in Table **2**. Comparisons between groups of cognitive measures were performed to test the hypothesis (1). The results of the statistical analysis using the Mann-Whitney U-test for independent groups and Cohen's effect sizes are listed in Table **2**. There were significant differences between the scores of the two groups on all verbal subtests, such as the Information, Vocabulary, Comprehension, Similarities, Digit Span, and Arithmetic Reasoning. BIF+ performed significantly worse than BIF- on subtests such as Picture Arrangement, Digit

Table 1: Descriptive Statistics of Demographic and Clinical Variables of Schizoid PD Patients with and without BIF

	Schizoid PD with BIF (n = 24)	Schizoid PD without BIF (n = 23)	Test statistic	
	M ± SD	*M ± SD*	*U*	*p-value*
Age (years)	25.83 ± 6.91	29.52 ± 9.35	217.50	0.217
Education (years)	12.17 ± 2.82	13.78 ± 2.79	199.00	0.103
	Frequencies (%)	*Frequencies (%)*	*χ2*	*p-value*
Gender				
Males/Females	21/3 (87%)	21/2 (91%)	0.18	0.672
Marital status				
Engaged/Single	3/21 (12%)	6/17 (26%)	1.40	0.237
Pharmacological treatment				
SSRI	2/22 (8%)	2/21 (9%)	0.00	0.965
Atypical antipsychotics	22/2 (92%)	21/2 (91%)	0.00	0.965

Note: U= Mann-Whitney U-test for independent groups on years of age and education of the two groups: Schizoid PD with BIF (n=24) and BPD without BIF (n = 23); $χ^2$ = frequency analysis (Pearson's Chi-square test) on gender, marital status, and pharmacological dreatment (SSRI, Atypical antipsychotics) data of the two groups; p-value was significant at .05 level.

Table 2:   Comparisons between Neuropsychological Data of Schizoid PD Patients with and without BIF

WAIS-R	BIF+ (n = 24)				BIF- (n= 23)				Test statistic					
	M	SD	scores > 1SD below the mean Frequencies	scores > 1SD below the mean %	M	SD	scores > 1SD below the mean Frequencies	scores > 1SD below the mean %	U	p-value	Cohen's d	$\chi2$	p-value	Cramer's V
IQ														
Verbal	82.96	6.94	13/11	54%	108.87	11.67	0/23	-	6.50	0.000	0.70	17.22	0.000	0.60
Performance	80.33	7.95	14/10	58%	97.43	11.35	2/21	9%	63.50	0.000	0.43	12.89	0.000	0.52
Factor index														
Verbal Comprehension	7.60	1.40	8/16	33%	10.93	1.85	0/23	-	38.00	0.000	0.54	9.24	0.002	0.44
Perceptual Organization	7.44	1.55	7/17	29%	9.55	1.89	2/21	9%	133.00	0.000	0.27	3.18	0.075	0.26
Freedom from Distractibility	7.64	1.32	7/17	29%	10.91	2.24	0/23	-	108.50	0.000	0.46	7.88	0.005	0.41
Subtest scaled														
Information	7.50	2.30	7/17	29%	11.09	3.27	2/21	9%	103.00	0.000	0.29	3.18	0.075	0.26
Vocabulary	7.50	2.20	10/14	42%	11.26	2.54	2/21	9%	73.00	0.000	0.39	6.71	0.010	0.38
Comprehension	8.08	2.04	5/19	21%	10.83	2.39	0/23	-	109.50	0.000	0.26	5.36	0.021	0.34
Similarities	7.33	2.63	8/16	33%	10.57	2.92	1/22	4%	110.50	0.000	0.26	6.37	0.012	0.37
Block Design	7.38	2.02	7/17	29%	9.48	2.63	2/21	9%	132.50	0.002	0.20	3.18	0.075	0.26
Picture Arrangement	7.17	2.76	11/13	46%	10.35	2.82	2/21	9%	110.00	0.000	0.26	8.10	0.004	0.41
Picture Completion	7.96	2.54	7/17	29%	9.57	2.59	2/21	9%	188.50	0.064	0.07	3.18	0.075	0.26
Object Assembly	7.25	2.44	7/17	29%	8.83	2.66	2/21	9%	164.50	0.018	0.12	3.18	0.075	0.26
Arithmetic Reasoning	7.54	2.39	10/14	42%	11.52	2.84	1/22	4%	83.00	0.000	0.36	9.12	0.003	0.44
Digit Symbol-Coding	6.42	2.45	13/11	54%	8.83	3.47	7/16	30%	160.50	0.014	0.10	2.71	0.100	0.24
Digit Span	8.96	2.51	6/18	25%	12.39	2.29	0/23	-	82.50	0.000	0.36	6.60	0.010	0.37

Note: U=Mann-Whitney U-test for independent groups on IQ, factor index, and subtest scores obtained by the two Schizoid PD groups: BIF+ (n = 24) and BIF- (n = 23); Cohen's d effect size of U-test comparisons; $\chi2$ = frequency analysis (Pearson's Chi-square test) on scores that were more than one standard deviation below the normative mean of IQ (mean = 100; SD = 15; > – 1 SD = ≤ 84), and from the mean of factor index and subtest scores (mean = 10; SD = 3; > – 1 SD = ≤ 6); Cramer's V effect size of Chi-square comparisons; p-value was significant at .05 level.
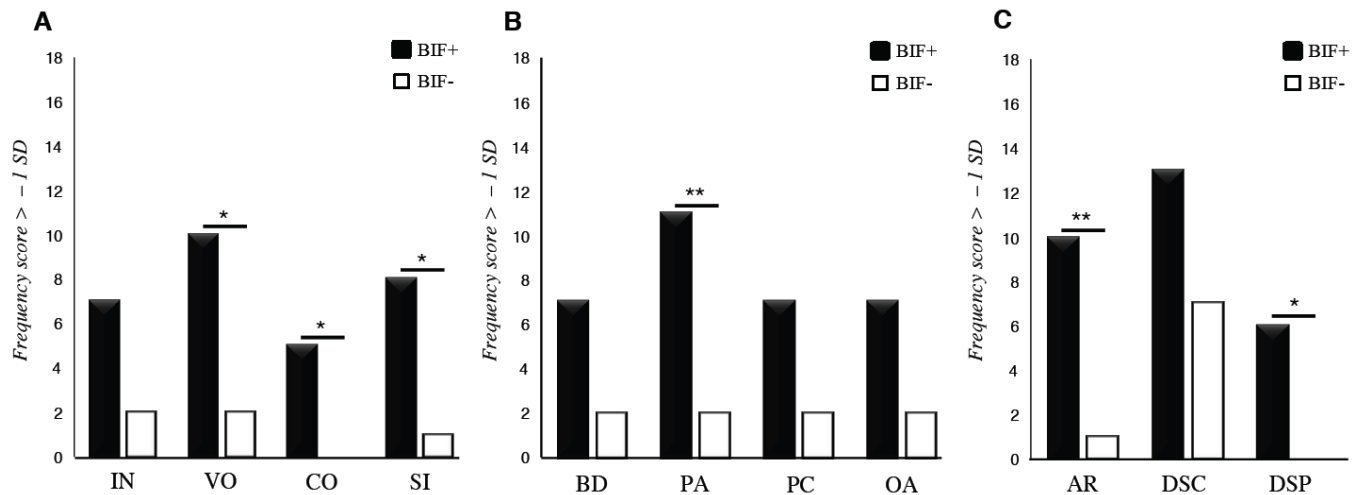
Figure 1: Frequency analysis of WAIS-Rperformance deficits (scores that were more than one standard deviation below the normative mean, i.e., ≤ 6) observed inSchizoid PD patients with BIF (BIF+: n = 24; black bars) and in Schizoid PD patients without BIF (BIF-: n = 23; white bars). **A**) Verbal comprehension index; **B**) Perceptual organization index **C**) Freedom from distractibility index. The results of χ^2 are listed in Table **2**, and the p-value was significant at 0.05 level.

Note: IN= Information; VO= Vocabulary; CO= Comprehension; SI= Similarities; BD= Block Design; PA= Picture Arrangement; PC= Picture Completion; OA= Object Assembly; AR= Arithmetic Reasoning; DSC= Digit Symbol-Coding; DSP= Digit Span.

* p < 0.05.

** p < 0.01.

Symbol-Coding, Object Assembly, and Block Design. There was no statistically significant difference between the two groups' performances on the Picture Completion subtest. Thereby, statistically significant between-group differences were found in the verbal IQ (d = 0.70), the performance IQ (d = 0.43), the verbal comprehension index (d = 0.54), the freedom from distractibility index (d = 0.46), and the perceptual organization index (d = 0.27) scores.

3.4. Comparisons of Performance Deficits

On a standardized assessment, a cognitive processing deficit is defined by a score that is more than one standard deviation below the population mean. Comparisons between the two groups' proportions of performance deficits on the WAIS-R IQs (mean = 100; SD = 15; deficit scores = ≤ 84), three-factor indexes, and the eleven-subtests (mean = 10; SD = 3; deficit score = ≤ 6) [53,57-59] were performed with Pearson's Chi-square analysis to test the hypothesis (2). Results of frequency analysis and significant Cramer's V effect sizes are listed in Table **2**. There was a significant between-groups difference in the proportions of the Vocabulary subtest's performance deficits, as 42% of BIF+ compared to 9% of BIF- reported deficit scores on this subtest. No BIF- obtained deficit scores on the Comprehension and Digit span subtests compared to 21% and 25% of BIF+, respectively. Statistically significant differences

between the proportions of performance deficits were observed in the Picture Arrangement (46% of BIF+ than 9% of BIF-), the Arithmetic Reasoning (42% than 4%), and the Similarities (33% than 4%) subtests. There were no significant differences with respect to deficit scores of the two groups on the Information, Block Design, Picture Completion, Object Assembly, and Digit Symbol-Coding subtests (see Figure **1**). While no BIF- reported poor verbal IQ, verbal comprehension, and freedom from distractibility index scores, the majority of BIF+ (54%) obtained a verbal IQ score lower than one standard deviation below the normative mean, the 33% of them reported poor verbal comprehension index scores, and the 29% of patients obtained poor freedom from distractibility index scores. There was no statistically significant difference between the two groups' proportion of performance deficits on the perceptual organization index.

3.5. Relationships between Clinical Demographic and Cognitive Variables

Spearman's correlation coefficient analysis revealed the age of BIF+ was significantly associated with gender (r = 0.50; p = 0.01) since females were older compared to male patients in this group and with years of education (r = 0.66; *p*< 0.001). There was a negative association between the age of BIF+ and the perceptual organization index (r = -0.48; *p* = 0.01), especially with scores on the Picture Completion (r = -

0.46; p = 0.02) and the Block Design (r = -0.45; p = 0.03) subtests. Gender of BIF+ was significantly associated with scores on the Vocabulary subtest (r = 0.44; p = 0.03) and the perceptual organization index (r = -0.51; p = 0.01), in particular with scores on the Block Design subtest (r = -0.57; p = 0.003). BIF+ female patients performed better on the Vocabulary subtest and worse on the Block Design subtest compared to BIF+ male patients. The full-scale IQ scores of BIF+ were slightly more associated with the verbal comprehension index (r = 0.66; p< 0.001) compared to the perceptual organization index (r = 0.41; p = 0.04). There were no statistically significant associations between pharmacological therapy, marital status, and the other variables in the BIF+. The age of BIF- was significantly associated with years of education (r = 0.54; p = 0.01) and with the freedom of distractibility index (r = 0.42; p = 0.04), especially with the Digit span subtest scores (r = 0.48; p = 0.02). The full-scale IQ scores of BIF- were slightly more associated with verbal comprehension (r = 0.73; p< 0.001) compared to the perceptual organization (r = 0.62; p = 0.002), and the freedom from distractibility (r = 0.45; p = 0.03) indexes. There were no statistically significant associations between gender, marital status, pharmacological therapy, and other variables in the BIF-. Significant correlations were found between the global cognitive capacity (FSIQ) of the total Schizoid PD sample and years of education (r = 0.30; p = 0.04), the verbal comprehension (r = 0.87; p< 0.001), the freedom from distractibility (r = 0.75; p< 0.001), and the perceptual organization (r = 0.66; p< 0.001) indexes. The full-scale IQ scores of the total sample were more associated with verbal IQ (r = 0.94; p < 0.001) than with the performance IQ (r = 0.79; p< 0.001) scores. There were no statistically significant associations between age, gender, marital status, pharmacological therapy variables, and FSIQ scores of the total Schizoid PD sample.

3.6. Logistic Regression Models for Substance Use Behavior

Forward binary logistic regression analysis with substance use behavior (SU) as an outcome and the demographic (i.e., age, gender, education, marital status) and clinical (i.e., pharmacological therapy, borderline intellectual functioning) as predictors variables revealed that only BIF condition accounted for the presence of substance use behavior (SU+ vs. SU-) in the total sample of Schizoid PD patients (see Table **3**). The Wald criterion (testing the null hypothesis that the risk of SU associated with the predictor variable is unity) demonstrated that borderline intellectual functioning made significant contributions (Wald $\chi^2_{[1]}$ = 8.709, p = 0.003) to the prediction of substance use behavior, providing an odds ratio (OR) – (Exp[betas]) of 6.9 for SU+ than SU- categorization (OR higher than 1 indicate a risk factor for SU+). This result means that BIF+ were about 6 times more likely substance users than not. The regression model[a] explained the 72% variation in the outcome, correctly classifying up to 74% of SU+ and 71% of SU-. Results of forward binary logistic regression analyses with cognitive variables (i.e., the WAIS-R three factor indexes' z-scores = model[b]; the eleven subtests' z-scores = model[c]) as predictors, and substance use as outcome showed that the verbal comprehension index z-scores reliably discriminated between absence/presence of substance use in Schizoid PD patients (Wald $\chi^2_{[1]}$ = 8.619, p = 0.003; OR=0.21), as well as the Vocabulary subtest performances were negatively related to the outcome (Wald $\chi^2_{[1]}$ = 9.364, p = 0.002; OR=0.28). These results would mean that for each one-unit increase in the standard deviation of the verbal comprehension index and in the Vocabulary subtest scores, the likelihood of being a substance user may decrease by about 79% and 72%, respectively (OR lower than 1 indicate a protective factor for SU+).

Table 3:   Statistics for Logistic Forward Regression Models with Substance Use as the Criterion Variable

Variable in the equation	B*	p-value	Exp(B)†	95%CIfor Exp(B)	
				Lower bound	Upper Bound
Clinical variable					
Borderline intellectual functioning	1.929	0.003	6.881	1.911	24.773
Cognitive variables					
Verbal comprehension	- 1.568	0.003	0.209	0.073	0.594
Vocabulary	- 1.260	0.002	0.284	0.127	0.636

Note: Forward binary logistic regression models with substance use as the outcome (SU- vs. SU+) in the Schizoid PD patients sample (n = 47). Predictors not eligible to enter into the equation were demographic (age, gender, education, marital status) and clinical (pharmacological therapy) variables for regression model[a], WAIS-R three-factor indexes (verbal comprehension, perceptual organization, freedom from distractibility) z-scores for regression model[b]; WAIS-R 11 subtests' z-scores for regression model[c].
*B= regression coefficient; p-value= significant at .05 level; † Exp(b)= odds ratio; 95%CI = 95% confidence interval.

The regression model[b] explained 77% of the variation in the outcome, correctly classifying up to 78% of SU+ and 75% of SU- cases, compared to 70% of the variation in the substance use behavior explained by the regression model[c] that is correctly classifying up to 70% of SU+ and 71% of SU- cases.

4. DISCUSSION

The principal aim of this study was to investigate the clinical, demographic, and cognitive profile of patients with schizoid personality disorder and borderline intellectual functioning (BIF+) assessed in our daily outpatient psychiatry practice. While BIF+ have shown a pattern of cognitive abilities that deviated significantly from that observed for BIF-, there were no between-group differences on clinical and demographic profiles. The neuropsychological assessment revealed BIF+ compared to BIF- performed worse on all WAIS-R cognitive tasks other than the Picture Completion subtest. In line with other studies, Schizoid PD patients might have a low reality contact and poor awareness of environmental details, and they may be less able to understand part-whole visuospatial relationships needed for visual object perception [44]. This finding would seem to suggest that the Picture Completion subtest is not useful for discriminating the presence of BIF in Schizoid PD. Furthermore, there was no significant difference between the two groups' proportions of deficit scores on the perceptual organization index. This WAIS factor index provides an estimate of abstract fluid reasoning, integration of visual perceptual stimuli with relevant motor responses, ability to solve unfamiliar problems, and planning and interpreting social events [59]. Of all subtests, including the perceptual organization index, BIF+ reported significantly more performance deficits only on the Picture Arrangement subtest compared to BIF-. As has been previously reported in the literature, the WAIS Picture Arrangement reveals information about an individual's ability to grasp the essential messages in social interaction, comprehension of irony, and capacity to anticipate consequences of someone's actions [60,61]. Patients with schizoid personality disorder reportedly do not desire relationships due to deficits in their capacity to relate meaningfully with others, difficulties understanding social interaction, and an unintentional tendency to disregard social conventions [62,15]. A number of authors have recognized that dysfunctions in mentalizing abilities connected with executive functions may explain destructive social interactions among persons with borderline intellectual functioning [47,63,64]. According to Hengartner *et al.*

[52] many Schizoid PD patients included in the present study reported slow information processing speed (i.e., low scores on the WAIS Digit Symbol-Coding), associated with fluid intelligence that is highly relevant for social functioning and psychosocial adaptation [65,66]. The cognitive profile of BIF+ is worth discussing. Besides the severe impact on social and adaptive abilities, these patients have reported difficulties in verbal and perceptual abstract reasoning, as well as slower processing speed and impaired working memory. The difficulty with abstract material in BIFs has been associated with limited capacity to hold and manipulate information in mind (i.e., poor working memory), and this might explain their low concept formation, difficult understanding of the meaning of many words, and poor motivation to learn [67-69]. BIFs may have less efficient cognitive abilities to constantly update personal knowledge with new information, to learn by experience, and to master real-life situations adaptively [70,53]. Further, the findings that BIF+ compared to BIF- have reported poorest performances on tasks that require verbal understanding, mathematical skills, and the ability to remember instructions manipulating information in short-term memory (i.e., lower scores on the WAIS Arithmetic Reasoning and Digit Span) would support the notion that working memory impairment is closely related to deficit performance on arithmetic word problems, and might represent a high-risk factor for educational underachievement (Swanson and Sachse-Lee, 2001; Gathercole *et al*. 2006; Alloway, 2010) [42,71,72]. In line with the results of our previous study [53], BIF+ compared to BIF- reported more frequently impaired performances on the WAIS Vocabulary, Similarities, and Comprehension. Moreover, in the present study, the effect sizes indicate primarily deficits in the verbal IQ and verbal comprehension (VC) domain in BIF+ than BIF- suggesting specific weaknesses related to verbal reasoning underlying the BIF condition. We can assume the WAIS verbal IQ and VC may be the most useful indexes discriminating the presence of BIF in people diagnosed with schizoid personality disorder. Consistent with the correlational findings, in the BIF+ group, males compared to females reported lower scores on the verbal subtest Vocabulary, while females performed worse than males on the performance subtest Block Design. The present results can be interpreted as poorer logical reasoning to solve unfamiliar problems than acquired knowledge and the ability to express thoughts verbally for BIF+ females compared to males. Conversely, BIF+ males could have more difficulty, as compared to females, in expressing thoughts verbally and/or have poor

acquired knowledge to face everyday situations than logical problem-solving ability. However, there is still an ongoing debate in the literature on gender differences in verbal and spatial abilities, as well as crystallized and fluid intelligence in normally developing individuals [73-77]. Since these relationships were not found for BIF-, further studies are needed to evaluate the relevance of cognitive gender differences for borderline intellectual functioning in schizoid personality disorder condition. In the present study, the global cognitive abilities (i.e., the WAIS FSIQ scores) of Schizoid PD patients were strongly associated with the capacity of acquisition, organization, and retrieval of knowledge (i.e., the WAIS VIQ), as well as positive related to the level of educational attainment. One can argue that individuals with higher cognitive abilities could have more cognitive resources available to acquire knowledge and achieve academic success. The 49% of Schizoid PD patients included in the current study reported substance use. The regression analysis finding that BIF+ were 7 times more likely to be substance users than not is in line with studies that have identified a relationship between increased substance use and frequency of PD in individuals with BIF [12, 78, 79]. Further, Schizoid PD patients were more able to learn and generalize verbal information to solve novel problems (i.e., higher verbal comprehension index scores) and express thoughts verbally (i.e., better performances on the WAIS Vocabulary) and were less likely to be substance users. Although the Vocabulary subtest score is the best indicator of general intelligence and an individual's intellectual potential, often used to estimate the premorbid level of functioning [80] the performance is susceptible to improvement by experience or schooling [81]. Probably, adequate cognitive resources, a wealthy educational background, and normal language development may be protective factors for substance use. This interpretation is in accord with previous population-based and longitudinal studies that investigated cognitive functioning in childhood, academic achievement, and substance use in adulthood. Researchers found that poorer verbal reasoning abilities and decreased ability to express thoughts verbally accounted for by parental and low basic education, were associated with lower academic attainment and lifetime substance use [82,83]. Several interpretations can be made from our findings. First, weakened verbal abstract reasoning and reduced working memory may exert a negative influence on mastering other basic abilities such as reading, writing, and mental arithmetic calculating required to achieve personal independence. In the case of an educational

environment that fails to provide adequate stimuli, individuals with these difficulties might be less motivated to learn, avoiding mental training with abstract materials [69,84]. As a result, these individuals may face long-term learning difficulties, experiencing constant situations of failure and academic underachievement. Moreover, feelings of incompetence due to not being able to reach age-appropriate expectations (especially in BIFs) may increase the withdrawal from life experiences and social interactions, hindering the development of useful coping strategies to deal with stressful events, likewise, social competency to establish interpersonal relations (characteristics of schizoid traits). When individual features interfere extremely with the ability to form relationships, control impulses or emotions, perceive oneself and others accurately, and enjoy life or function at work, personality is defined as pathological [81]. Nevertheless, this study is a reflection of actual daily clinical practice, and several limitations need to be addressed. First, the participants were assessed using the DSM-IV rather than DSM-5 [15] and were administered the WAIS-R rather than the WAIS-IV [85]; still, the last was not standardized in the Italian population when neuropsychological data were collected (i.e., from September 2012). Further limitations are the reduced sample size for detecting smaller effects and the lack of information related to perceived social support, occupation, and married status satisfaction, which are useful to investigate the quality of participants' lives. Taken together, the main results of the present retrospective study suggest the need for neuropsychological evaluation in patients with schizoid personality disorder to identify weakened cognitive skills important to plan targeted strategies able to prevent negative outcomes. Early identification of borderline intellectual functioning and specialized treatments improving verbal reasoning abilities, possibly incorporating family or community interventions, may support these individuals to resume a healthier trajectory and attain social and vocational functioning.

CONCLUSIONS

- BIF in Schizoid PD participants is correlated with a peculiar cognitive pattern of verbal, perceptual, attention, memory, planning, and problem-solving dysfunctions

- The verbal IQ and the Verbal Comprehension Index (VC) discriminated the presence of BIF in Schizoid PD participants

- The BIF condition and the VC index were the predictors most associated with substance use behavior in people diagnosed with schizoid personality disorder

DECLARATIONS OF INTEREST

None.

FUNDING

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