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NEUROCOGNITIVE HETEROGENEITY IN BORDERLINE PERSONALITY DISORDER: THE ROLE OF CHILDHOOD SEXUAL ABUSE

HETEROGENEIDAD NEUROCOGNITIVA EN EL TRASTORNO LÍMITE DE LA PERSONALIDAD: EL PAPEL DEL ABUSO SEXUAL INFANTIL

HETEROGENEIDADE NEUROCOGNITIVA NO TRANSTORNO DE PERSONALIDADE LIMÍTROFE: O PAPEL DO ABUSO SEXUAL INFANTIL

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Palavras-chave: *Transtorno de personalidade limítrofe; Abuso sexual infantil; Funções executivas; Memória verbal; Desregulação emocional.*

A B S T R A C T

Childhood sexual abuse (CSA) is strongly associated with borderline personality disorder (BPD). This cross-sectional study investigated clinical and neurocognitive differences in 193 women aged 20 to 39 years diagnosed with BPD, comparing those with a history of CSA (n = 78) and those without (n = 115). Participants completed standardized psychometric and neuropsychological assessments focused on impulsivity, core BPD symptoms, and cognitive functioning. Women with CSA showed greater clinical severity, including higher rates of self-harm, suicide attempts, dissociative and psychotic symptoms, along with elevated impulsivity and attention-deficit/hyperactivity disorder (ADHD)–related traits. Neuropsychological testing revealed significant deficits in attention, processing speed, and cognitive flexibility, along with lower performance on Stroop tasks assessing divided attention and interference control. While working memory and verbal fluency differences remained within normative ranges, age-stratified analysis revealed marked long-term memory impairments in the CSA group aged 30–39. These results suggest that neurocognitive deficits in BPD are not universal but may reflect the cumulative impact of early trauma and age. Trauma-informed assessment and tailored cognitive interventions may support more accurate profiling and inform tailored therapeutic strategies in this high-risk subgroup.

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R E S U M E N

El abuso sexual infantil (ASI) se asocia de forma consistente con el trastorno límite de la personalidad (TLP). Este estudio transversal examinó las diferencias clínicas y neurocognitivas en 193 mujeres de entre 20 y 39 años con diagnóstico de TLP, comparando aquellas con antecedentes de ASI (n = 78) y aquellas sin tales antecedentes (n = 115). Las participantes completaron evaluaciones psicométricas y neuropsicológicas estandarizadas centradas en impulsividad, sintomatología propia del TLP y funcionamiento cognitivo. Las mujeres con ASI mostraron una mayor gravedad clínica, incluyendo tasas más elevadas de autolesiones, intentos de suicidio, síntomas disociativos y psicóticos, así como una mayor impulsividad y presencia de rasgos relacionados con el trastorno por déficit de atención con hiperactividad (TDAH). A nivel neurocognitivo, se observaron déficits significativos en atención, velocidad de procesamiento y flexibilidad cognitiva, así como un rendimiento reducido en tareas que requerían atención dividida y control de interferencias. Si bien las diferencias en memoria de trabajo y fluidez verbal se mantuvieron dentro de los rangos normativos, los análisis estratificados por edad revelaron alteraciones marcadas en la memoria a largo plazo en el grupo con ASI entre los 30 y 39 años. Estos hallazgos sugieren que los déficits neurocognitivos en el TLP no son universales, sino que podrían reflejar el impacto acumulativo del trauma temprano y la vulnerabilidad asociada a la edad. La evaluación informada por el trauma y el diseño de intervenciones cognitivas personalizadas podrían contribuir a mejorar la precisión diagnóstica y la eficacia terapéutica en este subgrupo de alto riesgo.

R E S U M O

O abuso sexual infantil (ASI) está fortemente associado ao transtorno de personalidade limítrofe (TPL). Este estudo transversal investigou diferenças clínicas e neurocognitivas em 193 mulheres, com idades entre 20 e 39 anos, diagnosticadas com TPL, comparando aquelas com histórico de ASI (n = 78) e aquelas sem esse antecedente (n = 115). As participantes realizaram avaliações psicométricas e neuropsicológicas padronizadas, com foco na impulsividade, nos sintomas centrais do TPL e no funcionamento cognitivo. As mulheres com ASI apresentaram maior gravidade clínica, incluindo taxas mais elevadas de autolesão, tentativas de suicídio, sintomas dissociativos e psicóticos, bem como maior impulsividade e presença de características associadas ao transtorno de déficit de atenção/hiperatividade (TDAH). A avaliação neuropsicológica revelou déficits significativos em atenção, velocidade de processamento e flexibilidade cognitiva, além de pior desempenho em tarefas do Stroop que avaliam atenção dividida e controle de interferência. Embora as diferenças em memória de trabalho e fluência verbal tenham permanecido dentro dos intervalos normativos, análises estratificadas por idade revelaram prejuízos marcantes na memória de longo prazo no grupo com ASI entre 30 e 39 anos. Esses resultados sugerem que os déficits neurocognitivos no TPL não são universais, podendo refletir o impacto cumulativo do trauma precoce e da idade. Avaliações informadas pelo trauma e intervenções cognitivas personalizadas podem contribuir para uma caracterização mais precisa e para o desenvolvimento de estratégias terapêuticas adaptadas nesse subgrupo de alto risco.

Borderline personality disorder (BPD) is a severe and disabling psychiatric condition that typically emerges during adolescence or early adulthood. It is characterized by pervasive patterns of emotional dysregulation, impulsivity, identity disturbance, and unstable interpersonal relationships (American Psychiatric Association [APA], 2022; National Institute of Mental Health [NIMH], 2024). Prevalence in the general population is estimated between 1% and 3%, although some studies report rates as high as 6% (Fung et al., 2023; Gunderson et al., 2018; Jin, 2023). In clinical settings, BPD is markedly overrepresented, affecting up to 25% of psychiatric inpatients (Crotty et al., 2024; Ellison et al., 2018). Approximately 75% of diagnosed cases involve women, a disparity attributed not only to diagnostic bias but also to gender-specific symptom profiles and differential exposure to early adversity (Bozzatello et al., 2024; Paggeot & Huprich, 2018). These sex-related patterns have been increasingly linked to developmental trauma and neurocognitive vulnerability.

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BPD imposes a considerable burden on healthcare systems. Its high comorbidity with other psychiatric disorders—including mood, anxiety, post-traumatic stress, substance use, and eating disorders—further increases its clinical complexity and contributes to greater functional impairment and reduced treatment responsiveness (Chapman et al., 2024; Leichsenring et al., 2024). Affected individuals frequently require emergency care, repeated hospitalizations, and long-term psychotherapeutic treatment (Bohus et al., 2021; Yaniv-Rosenfeld et al., 2024). Despite the lack of approved pharmacological treatments, polypharmacy remains widespread in clinical practice (Stoffers-Winterling et al., 2022; Tennant et al., 2023), and treatment outcomes remain frequently suboptimal. Meta-analyses indicate that up to 50% of patients experience clinically meaningful improvement (Cuijpers et al., 2024; Winsper et al., 2021). Even after diagnostic remission, many individuals continue to experience persistent impairments in academic, occupational, and interpersonal domains, with women often showing poorer long-term trajectories (Álvarez-Tomás et al., 2019; Soloff & Chiappetta, 2020; Wertz et al., 2020). These findings have intensified interest in developmental vulnerabilities and neurocognitive mechanisms as potential modulators of clinical severity and functional prognosis.

Among developmental risk factors, childhood sexual abuse (CSA) has emerged as one of the most robust and consistent predictors of BPD. Disproportionately reported by women with the disorder, CSA has been associated with earlier onset, increased clinical severity, elevated risk of suicidality, poorer treatment response, and reduced psychosocial functioning (de Aquino Ferreira et al., 2018; Ford & Courtois, 2021; Porter et al., 2020; Turniansky et al., 2019; Winsper et al., 2016). These findings highlight the importance of trauma-informed approaches in both diagnostic assessment and therapeutic intervention.

Beyond emotional and behavioral symptoms, neuropsychological studies have consistently reported significant cognitive impairments in individuals with BPD, particularly highlighting deficits in executive functions, such as working memory, cognitive flexibility, and attentional control. These executive dysfunctions are accompanied by impairments in processing speed, verbal memory, and inhibitory functioning (D'Iorio et al., 2024; Leichsenring et al., 2024; López-Villatoro et al., 2023; Thomsen et al., 2017). Neurocognitive deficits observed in BPD have been associated with difficulties in impulse control and affect regulation, as posited by both emotion dysregulation models and broader neurobiological frameworks implicating executive dysfunction (Herzog & Schmahl, 2018; Gagnon, 2017; Grecucci et al., 2023). However, growing evidence suggests that such impairments may not be intrinsic to the disorder itself, but rather reflect the influence of comorbid conditions, psychotropic medication, or early life trauma—especially CSA (Bustamante et al., 2009; Haaland & Landrø, 2009; Kalpakci et al., 2018; Poletti, 2009; Unoka & Richman, 2016; Vai et al., 2021). CSA has been shown to disrupt neurodevelopment during sensitive periods, increasing vulnerability to persistent cognitive dysfunction and long-term functional impairment (Bozzatello et al., 2023; Hawkins et al., 2021; Malarbi et al., 2017; Thomsen et al., 2017).

Despite growing interest in the neurocognitive profile of BPD, few studies have systematically compared cognitive functioning according to CSA history. Clarifying whether these impairments are specific to trauma-exposed subgroups remains crucial to understanding the clinical heterogeneity of the disorder.

This study investigates whether women with BPD and a history of CSA differ from those without such history in terms of clinical severity and neurocognitive functioning. Primary outcomes include borderline symptom severity, impulsivity, and cognitive performance in attention, processing speed, executive functioning, and verbal memory. Secondary analyses examine Stroop performance, verbal fluency, and age-related differences in long-term memory outcomes. By disentangling the role of CSA in shaping cognitive vulnerability within BPD, this study aims to clarify a key source of clinical heterogeneity and to support the development of trauma-informed, neuropsychologically tailored interventions.

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METHOD

Design

This observational cross-sectional study was conducted in a clinical sample of women diagnosed with BPD. Participants were referred by clinicians from specialized outpatient mental health services and selected through non-probabilistic convenience sampling. The study protocol was approved by the institutional ethics committee and conducted in accordance with the Declaration of Helsinki and its later amendments.

Participants

The study included 193 adult women with a confirmed diagnosis of BPD, based on clinical evaluation according to the criteria of the International Classification of Diseases, 10th edition (ICD-10; World Health Organization [WHO], 1992). Participants were aged between 20 and 39 years (*M* = 28.6, *SD* = 7.8) and were consecutively recruited from an intensive outpatient treatment program for personality disorders at a Spanish public hospital.

Based on trauma history, the sample was divided into two groups: (1) women with a documented history of childhood sexual abuse (CSA) (*n* = 78, 40.4%), and (2) women without such history (*n* = 115, 59.6%). Sociodemographic and clinical characteristics for both groups are presented in Table 1.

Table 1

Sociodemographic, Clinical, and Substance Use Characteristics of Women with BPD According to CSA History

Variable	CSA Group	No CSA Group	*p*-value	Effect size
Sociodemographic variables				
Age (M ± SD)	28.4 ± 5.6	27.1 ± 5.1	.095	*d* = 0.24 (small)
Compulsory Secondary Education (%)	50.3	22.6	< .001***	*V* = 0.31 (moderate)
Post-Compulsory Secondary Education (%)	49.7	77.4	< .001***	*V* = 0.31 (moderate)
Currently Studying or Working (%)	41.0	68.7	< .001***	*V* = 0.28 (moderate)
Trauma and risk factors				
History of Intimate Partner Violence (%)	56.4	39.6	< .001***	*V* = 0.17 (small)
History of Bullying (%)	17.9	25.2	.291	*V* = 0.09 (small)
Clinical outcomes				
Lifetime Self-Harm (%)	97.4	89.6	.048	*V* = 0.14 (small)
Lifetime Suicide Attempt (%)	80.8	70.9	.004**	*V* = 0.18 (small)
Dissociative Symptoms (%)	71.8	54.3	.016*	*V* = 0.18 (small)
Psychotic Symptoms (%)	27.9	14.3	.027*	*V* = 0.16 (small)
Eating Disorder (%)	73.5	79.5	.387	*V* = 0.08 (small)
Acute Inpatient Hospitalization (%)	60.3	43.9	< .001***	*V* = 0.17 (small)
Substance use				
Cannabis Use (%)	79.5	64.8	.025*	*V* = 0.17 (small)
Cocaine Use (%)	40.3	33.9	.362	*V* = 0.07 (small)
Benzodiazepine Use (%)	58.7	48.3	.190	*V* = 0.11 (small)
Alcohol Use (%)	44.6	40.9	.767	*V* = 0.04 (negligible)
Admission to Detoxification Unit (%)	14.1	11.7	.822	*V* = 0.03 (negligible)

Note. CSA = Childhood Sexual Abuse. Values represent percentages unless otherwise indicated. Effect sizes are interpreted as follows: *d* = Cohen's *d*, *V* = Cramér's *V*. *p < .05. **p < .01. ***p < .001.

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Inclusion criteria were as follows: (a) enrollment in an intensive outpatient treatment program for personality disorders; (b) clinical diagnosis of BPD confirmed through psychiatric interview according to ICD-10 criteria; (c) age between 20 and 39 years; (d) abstinence from occasional substance use for a minimum of 24 hours prior to assessment; and (e) stable pharmacological treatment maintained for at least two weeks prior to testing.

Exclusion criteria included: (a) current or past diagnosis of a psychotic spectrum disorder; (b) severe substance use disorder or substance dependence within the previous three months; (c) diagnosis of intellectual disability; (d) history of neurological disorders (e.g., epilepsy, traumatic brain injury); and (e) medical conditions potentially affecting cognitive performance (e.g., malnutrition, endocrine disorders, infectious diseases).

Measures

Participants were assessed in person using a battery of validated psychometric and neuropsychological instruments, administered by trained clinical psychologists under standardized conditions. All neuropsychological assessments were conducted individually in a quiet clinical setting, using paper-and-pencil formats in accordance with standard administration protocols.

Sociodemographic data. Included age, educational attainment, employment status, and current pharmacological treatment. Information was collected through structured clinical interviews and cross-verified with medical records to ensure accuracy.

Personality Traits. Borderline personality traits were assessed using the Spanish version of the Millon Clinical Multiaxial Inventory-IV (MCMI-IV; Millon, 2019). The instrument has demonstrated excellent internal consistency in this population (Cronbach's $\alpha = 0.94$).

Symptom severity. The severity of borderline symptoms was assessed using the Spanish version of the Borderline Symptom List–23 (BSL-23; Bohus et al., 2009; Soler et al., 2013). The scale retains its original unifactorial structure, explaining 48.11% of the variance, and shows high internal consistency ($\alpha = 0.948$) and satisfactory test–retest reliability ($r = 0.734$, $p < .01$). Data on previous acute psychiatric hospitalizations were also recorded from clinical records.

Traumatic experiences. Exposure to childhood sexual abuse (CSA), bullying, and intimate partner violence (IPV) was assessed using dichotomous variables (yes/no). CSA was defined according to WHO criteria as any unwanted sexual contact occurring before the age of 18. When available, reports were cross-validated with clinical documentation to increase reliability.

Health-risk behaviors. Information regarding self-injurious behavior, suicide attempts, eating disorders, dissociative symptoms, and risky sexual behavior was gathered through structured clinical interviews. When possible, responses were corroborated with medical documentation.

Substance use. Current use of alcohol, cannabis, benzodiazepines, and cocaine was recorded as dichotomous variables, along with past admissions to inpatient detoxification programs. All data were obtained from structured clinical interviews and verified against medical records.

Impulsivity: Impulsivity was assessed using the 30-item Barratt Impulsiveness Scale-11 (BIS-11; Oquendo et al., 2001; Patton et al., 1995), which measures total impulsivity and three subdomains: attentional, motor, and non-planning impulsivity. The Spanish version has shown good internal consistency ($\alpha = 0.80$).

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ADHD symptoms. Symptoms of adult ADHD were evaluated using the 18-item ADHD Rating Scale (ADHD-RS; DuPaul et al., 1998; Pereira et al., 2024), which captures inattention and hyperactivity–impulsivity according to DSM-5 criteria. The scale has shown high sensitivity (94.78%) and specificity (84.79%) in adult clinical populations.
Neuropsychological functioning. The following paper-and-pencil tests were used to assess cognitive domains:

- Symbol Digit Modalities Test (SDMT) (Smith, 2002): Assesses processing speed and sustained attention through a symbol–digit substitution task completed within a 90-second time limit. The total number of correct pairings was recorded.

- Trail Making Test (TMT) (Reitan, 1958): Measures visual scanning, processing speed, and cognitive flexibility. In Part A, participants connected numbers in sequence; in Part B, they alternated between numbers and letters (1–A–2–B…). Completion time in seconds was recorded for both parts.

- Digit Span (subtest of the Spanish version of the WAIS-IV; Wechsler, 2012): Evaluates attention span and working memory through the repetition of digit sequences in both forward and backward order. Raw scores reflected the longest sequence correctly recalled in each condition.

- Verbal Fluency Tasks (Artiola i Fortuny et al., 1999): Examine lexical access and executive functioning via two 60-second trials administered in Spanish. In the phonemic task, participants generated words beginning with the letter "P"; in the semantic task, they named animals. Repetitions and invalid responses were excluded from the final score.

- Stroop Color and Word Test (SCWT) (Golden, 2007): Assesses selective attention, cognitive control, and interference resistance. The Golden version includes three 45-second subtasks with 100 items each: reading color words (W), naming colored rectangles (C), and naming the ink color of incongruent color words (CW). Age-adjusted T-scores were calculated based on Spanish normative data for individuals aged 16–44.

- Rey Auditory Verbal Learning Test (RAVLT) (Rey, 1958): Assesses verbal learning and long-term memory consolidation using the Spanish version of the classic RAVLT. A single list of 15 words was presented over five learning trials, followed by immediate and delayed recall after 30 minutes. The interference list (List B) was not included in the testing protocol.

Procedures

Participants were referred from specialized outpatient mental health services to the intensive outpatient treatment unit for personality disorders at a public hospital in Spain. The recruitment and assessment process was conducted between June 2022 and January 2024. Eligible participants were identified by their clinical care teams and screened by researchers based on the study's inclusion and exclusion criteria. A flowchart of the recruitment process is provided in Figure 1.

Following written informed consent, participants underwent a comprehensive clinical and neuropsychological evaluation as part of routine care. Participants were instructed to adhere to the inclusion criteria, including maintaining stable pharmacological treatment and abstaining from substance use prior to testing.

Assessments were conducted individually by trained clinical psychologists across three standardized sessions. The first two sessions focused on clinical interviews and psychometric testing, while the third session was dedicated to the administration of the neuropsychological battery, which lasted approximately 40 minutes. Tests were

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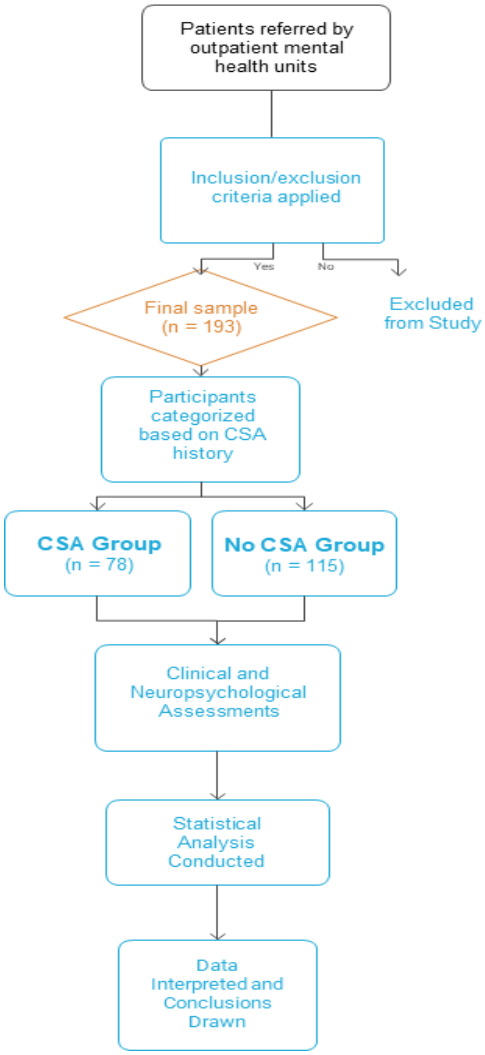
administered in a fixed sequence: RAVLT (encoding), Digit Span, SDMT, SCWT, Verbal Fluency, and RAVLT (delayed recall). All evaluations took place under standardized conditions during morning hours to minimize fatigue-related variability.

Raw scores from the neuropsychological tests were converted to z-scores using age- and education-adjusted normative data from the NEURONORMA project (Tamayo et al., 2012; Casals-Coll et al., 2013) and from Golden (2007) for Stroop scores. Following standard neuropsychological conventions, z-scores ≤ –1.0 were considered clinically significant, while scores between –0.66 and –0.99 were classified as below average, indicating subclinical deficits.

The study protocol was approved by the hospital's institutional ethics committee and complied with the principles of the Declaration of Helsinki and its later amendments.

Figure 1.
Recruitment and Assessment Flowchart



The diagram illustrates the recruitment process, application of inclusion/exclusion criteria, group allocation based on CSA history (CSA vs. No CSA), and subsequent clinical and neuropsychological assessments. It also depicts the statistical analysis and interpretation of results.

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Data Analysis

Statistical analyses were performed using R software (version 4.3.2; R Core Team, 2023). The normality of continuous variables was assessed using the Kolmogorov–Smirnov test, suitable for moderate-to-large sample sizes. Descriptive statistics included means, standard deviations, and interquartile ranges. The choice of statistical test was based on the distributional characteristics of each variable.

Neuropsychological raw scores were converted into *z*-scores based on age- and education-adjusted normative data, allowing for standardized comparisons across cognitive domains.

Between-group comparisons were performed using Student's *t*-tests for normally distributed continuous variables and Mann–Whitney *U* tests for non-normally distributed ones. Fisher's exact test was applied for categorical variables. When applicable, Welch's correction was used to adjust for potential variance inequality.

Effect sizes were calculated using Cohen's *d* for continuous variables and Cramér's *V* for categorical variables. These were interpreted using conventional thresholds: for *d*, values of 0.2, 0.5, and 0.8 indicated small, medium, and large effects, respectively; for *V*, thresholds of 0.1, 0.3, and 0.5 indicated small, medium, and large associations.

All statistical tests were two-tailed. Statistical significance was set at $p < .05$. No corrections for multiple comparisons were applied, as analyses were exploratory and intended to identify potential neurocognitive patterns associated with CSA history. All variables included in the analyses had complete data; no missing values were identified.

Post hoc power analyses were conducted based on the sample size of the study (n = 193; 78 with CSA and 115 without CSA). Sensitivity estimates indicated that the study was adequately powered to detect moderate between-group effects, whereas statistical power was more limited for small effects. Specifically, with $\alpha = .05$, the estimated power was approximately 0.53 for d = 0.30, 0.69 for d = 0.36, 0.81 for d = 0.42, 0.91 for d = 0.49, and 0.97 for d = 0.56. These estimates suggest that the study was adequately powered to detect the main moderate effects observed, although smaller effects should be interpreted with greater caution.

RESULTS

Sociodemographic and clinical characteristics

Table 1 presents the sociodemographic and clinical profiles of participants with and without a history of CSA. Although no significant age difference was observed ($p = .095, d = 0.24$), women with CSA were more likely to have completed only compulsory secondary education ($p < .001, V = 0.31$) and to be less engaged in academic or occupational activities ($p < .001, V = 0.28$), both with moderate effect sizes.

Clinically, this group also showed higher rates of self-harm ($p = .048, V = 0.14$), suicide attempts ($p = .004, V = 0.18$), dissociative symptoms ($p = .016, V = 0.18$), and psychotic symptoms ($p = .027, V = 0.16$), indicating statistically significant differences of small magnitude.

No differences emerged in exposure to bullying ($p = .291, V = 0.09$) or benzodiazepine use ($p = .190, V = 0.11$), while cannabis use was significantly more frequent in the CSA group ($p = .025, V = 0.17$).

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Psychometric assessment

Table 2 presents the results of psychometric instruments assessing borderline symptom severity, impulsivity, ADHD symptoms, and behavioral dysregulation.

On the MCMI-IV Borderline scale, both groups scored above the clinical threshold ($T > 85$), with no statistically significant difference between groups ($p = .159$, $d = 0.21$).

On the ADHD-RS, although both groups exceeded the clinical cut-off, the CSA group scored significantly higher ($p = .015$, $d = 0.36$).

Regarding impulsivity, the CSA group showed significantly higher total scores on the BIS-11 ($p = .006$, $d = 0.42$), as well as greater motor impulsivity ($p = .002$, $d = 0.45$). No group differences were observed in attentional impulsivity ($p = .105$, $d = 0.24$) or non-planning impulsivity ($p = .232$, $d = 0.17$).

On the BSL-23, the CSA group reported significantly higher scores on both the general ($p = .023$, $d = 0.33$) and behavioral subscales ($p = .001$, $d = 0.52$).

Table 2.
Clinical Assessment Results by CSA History

Test	Subscale	CSA Group (M ± SD)	No CSA Group (M ± SD)	p-value	Effect Size (Cohen's *d*)
MCMI-IV	Borderline	106.5 ± 16.6	103.2 ± 15	.159	0.21 (small)
ADHD-RS	Total	33.3 ± 10.3	29.6 ± 10.4	.015**	0.36 (moderate)
BIS 11	Total	73.9 ± 13.2	68.2 ± 14.5	.006**	0.42 (moderate)
	Attentional	22.3 ± 3.8	21.4 ± 3.8	.105	0.24 (small)
	Motor	27.1 ± 6.6	23.8 ± 7.7	.002**	0.45 (moderate)
	Non-planning impulsiveness	24.4 ± 7.4	23.0 ± 8.4	.232	0.17 (small)
BSL-23	General	64.3 ± 18.0	58.1 ± 19.1	.023*	0.33 (moderate)
	Behavior	12.1 ± 8.9	8.1 ± 6.3	.001***	0.52 (large)

Note. CSA= Childhood Sexual Abuse; MCMI-IV= Millon Clinical Multiaxial Inventory-IV; ADHD-RS= Adult ADHD Rating Scale; BIS-11= Barratt Impulsiveness Scale; BSL-23= Borderline Symptom List 23. Higher scores indicate more severe symptomatology. *$p < .05$. **$p < .01$. ***$p < .001$

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Neuropsychological profile

Neuropsychological test results revealed significant between-group differences in several cognitive domains. Table 3 displays standardized *z*-scores across measures of attention, processing speed, executive functioning, working memory, and verbal fluency.

Attention, processing speed, and executive functioning

Participants with a history of CSA performed significantly worse on the SDMT, TMT-A, and TMT-B. Between-group differences were statistically significant across all three measures (*SDMT: p = .003; TMT-A: p = .009; TMT-B: p = .005*), with effect sizes in the moderate range (*d = 0.40–0.49*).

Working memory and verbal fluency

In working memory tasks, the CSA group obtained significantly lower scores on Digit Span Forward (*p = .050, d = 0.30*), and especially on Digit Span Backward (*p < .001, d = 0.56*), reflecting a moderate-to-large effect size.

Regarding verbal fluency, participants with CSA showed significantly lower performance on semantic fluency (*p = .036, d = 0.36*). A statistically significant difference was also observed in phonemic fluency (*p* = .012, *d* = 0.31), although the effect size was small.

Table 3

Neuropsychological z-Scores by CSA History

Domain	Test	CSA Group (M ± SD [*z*])	No CSA Group (M ± SD [*z*])	p-value	Effect Size (Cohen's *d*)
Attention and Processing Speed	SDMT	35.4 ± 11.4 *[–1.0]*	40.5 ± 9.8 [–0.66]	.003**	0.49 (moderate)
	TMT A	36.6 ± 16.1 *[–1.0]*	30.9 ± 12.5 [–0.33]	.009**	0.40 (moderate)
Cognitive Flexibility	TMT B	92.7 ± 48.2 *[–1.0]*	75.5 ± 31.3 [–0.66]	.005**	0.43 (moderate)
Working Memory	FDS	5.1 ± 1.0 [–0.66]	5.4 ± 1.0 [–0.33]	.05*	0.30 (small)
	BDS	3.7 ± 0.9 [–0.66]	4.2 ± 0.9 [–0.66]	< .001***	0.56 (large)
Verbal Fluency	SVF	20.5 ± 5.5 [–0.66]	22.5 ± 5.5 [–0.33]	.036*	0.36 (moderate)
	PVF	15.9 ± 4.8 [0]	17.3 ± 4.5 [0]	.012*	0.31 (small)

Note. CSA = Childhood Sexual Abuse; SDMT = Symbol Digit Modalities Test; TMT A = Trail Making Test Part A; TMT B = Trail Making Test Part B; FDS = Forward Digit Span (WAIS-IV); BDS = Backward Digit Span (WAIS-IV); PVF = Phonological Verbal Fluency (letter "P"); SVF = Semantic Verbal Fluency (category: animals). Italicized z-scores indicate clinically significant deficits ($z \leq -1.0$). Normative data from Tamayo et al. (2012), and Casals-Coll et al. (2013). *$p < .05$. **$p < .01$. ***$p < .001$.

Stroop Performance

Table 4 summarizes the age-adjusted *T*-scores obtained on the SCWT. Participants with a history of CSA performed significantly worse than those in the No CSA group across all subtasks. Specifically, the CSA group scored in the below-average range on the W and CW conditions and in the impaired range on the C condition. In contrast, the No CSA group performed within normative limits across all SCWT conditions. Effect sizes for between-group

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comparisons were large for W, C, and CW (all $p < .001$; $d = 1.20–1.23$) and moderate for Resistance to Interference (R-Int) ($p = .002$, $d = 0.44$), indicating consistent between-group differences across SCWT measures.

Table 4.
SCWT Performance by CSA History

Task	CSA Group (M ± SD, [*T*, *z*])	No CSA Group (M ± SD, *[T, z]*)	p-value	Effect Size (Cohen's *d*)
Word (W)	95.33 ± 15.29 [*T* = 44; *z* = –0.66]	111.57 ± 12.69 [*T* = 52; *z* = 0.33]	< .001***	1.20 (large)
Color (C)	59.46 ± 12.41 [*T* = *36*; *z* = *–1.33*]	73.93 ± 10.59 [*T* = 46; *z* = –0.33]	< .001***	1.23 (large)
Color-Word (CW)	37.47 ± 11.80 [*T* = 42; *z* = –0.66]	49.51 ± 11.01 [*T* = 54; *z* = 0.33]	< .001***	1.10 (large)
Resistance to interference (R-Int)	0.43 ± 8.59 [*T* = 50; *z* = 0]	4.66 ± 9.82 [*T* = 54; *z* = 0.33]	.002**	0.44 (moderate)

Note. *CSA* = Childhood Sexual Abuse; SCWT = Stroop Color–Word Test; *M* = Mean; *SD* = Standard Deviation; *T* = *T*-score; *z* = *z*-score. Scores derived from Spanish normative data for individuals aged 16–44 years (Golden, 2007). *Z*-scores in italics (when $z \leq –1.0$) indicate clinically significant deficits. *$p < .05$. **$p < .01$. ***$p < .001$.

Verbal learning and memory (RAVLT)

Table 5 summarizes age-stratified scores for Total Recall (TR) and Delayed Recall (DR).

Among participants aged 20–29, both groups performed within normative expectations on TR (CSA group: $z = –0.1$; No CSA group: $z = 0.2$), with no significant between-group difference ($p = .425$, $d = 0.18$). On DR, the CSA group obtained lower scores ($z = –0.8$) than the No CSA group ($z = 0.2$), with a small-to-moderate effect size ($p = .082$, $d = 0.36$), though not reaching statistical significance.

In the 30–39 group, both subgroups scored below normative expectations on TR (CSA: $z = –1.2$; No CSA group: $z = –0.9$), with a non-significant difference between them ($p = .369$, $d = 0.21$). A similar pattern was observed in DR, with lower performance in the CSA group ($z = –1.3$) relative to No CSA group ($z = –1.0$), and a small-to-moderate effect size ($p = .056$, $d = 0.45$).

In this age range, scores fell below the normative threshold ($z \leq –1.0$) for both TR and DR in the CSA group, and for DR in the No CSA group.

Full statistical details are provided in Supplementary **Table S1**.

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Table 5.
RAVLT Recall Scores by Age Range and CSA History.

Age Range	Variable	Normative (M ± SD)	No CSA Group (M ± SD, *n*)	CSA Group (M ± SD, *n*)	*p*-value	Effect Size (Cohen's *d*)
20–29	**Total Recall**	52.3 ± 8.0	56.8 ± 11.8 (*n* = 66)	54.7 ± 14.2 (*n* = 44)	.425	0.16 (small)
	Delayed Recall	11.2 ± 2.5	11.3 ± 2.7 (*n* = 66)	10.3 ± 3.0 (*n* = 44)	.082	0.36 (moderate)
30–39	**Total Recall**	53.6 ± 8.3	51.7 ± 14.4 (*n* = 49)	49.1 ± 11.8 (*n* = 34)	.369	0.19 (small)
	Delayed Recall	11.4 ± 2.4	9.9 ± 3.6 (*n* = 49)	8.4 ± 3.4 (*n* = 34)	.056	0.44 (moderate)

Note. RAVLT = Rey Auditory Verbal Learning Test; CSA = Childhood Sexual Abuse; M = Mean; SD = Standard Deviation. Normative scores derived from Strauss et al. (2006). $p < .05$. $^{**}p < .01$. $^{***}p < .001$.

The overall pattern of findings indicates group differences across multiple clinical and neurocognitive domains. These were most consistently observed in impulsivity, behavioral dysregulation, and measures of attention, cognitive flexibility, and verbal memory. Age-related patterns were particularly evident in delayed recall performance. These results are further examined and contextualized in the following discussion.

DISCUSSION

Women with BPD and a history of CSA showed more severe clinical profiles than their counterparts without such history. Specifically, the CSA group exhibited higher rates of self-harm, suicide attempts, dissociative symptoms, and psychotic features—findings consistent with previous studies linking CSA to more complex and treatment-resistant presentations of BPD (Bozzatello et al., 2021; Samson et al., 2024; Schulze et al., 2024).

While no differences were observed in alcohol use, cannabis use was significantly more frequent among women with a history of CSA. This aligns with prior research suggesting that trauma exposure may be associated with increased vulnerability to cannabis misuse, which some authors interpret as a possible maladaptive coping response to trauma-related distress (De la Peña-Arteaga et al., 2021; Gerhardt et al., 2022; Kondev et al., 2021).

Neurocognitive impairments were more prominent in the CSA subgroup, particularly in attention, processing speed, cognitive flexibility, and delayed verbal memory. However, verbal memory deficits were also observed in the No CSA group among older participants (30–39 years), suggesting that such alterations are not necessarily exclusive to trauma-exposed individuals. These findings challenge the view of global neurocognitive dysfunction as a core feature of BPD and instead support trauma-informed and subtype-sensitive frameworks that account for the disorder's clinical heterogeneity and contextual moderators (Bustamante et al., 2009; Bozzatello et al., 2023; Haaland & Landrø, 2009; López-Villatoro et al., 2024; Unoka & Richman, 2016).

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From a neurocognitive perspective, the CSA group exhibited statistically significant deficits in attention, processing speed, and cognitive flexibility, as reflected in their performance on the SDMT, TMT-A, and TMT-B. These findings are consistent with previous research linking early trauma to disruptions in executive functioning (Bozzatello et al., 2023; Grecucci et al., 2023; Xiao et al., 2024). Reduced cognitive flexibility has been associated with difficulties adapting to changing demands, which may contribute to emotion dysregulation and impulsivity in individuals with BPD (Drabble et al., 2014; Nilsson et al., 2021).

Although working memory and verbal fluency remained within normative limits, the CSA group performed significantly worse in both domains. Previous research suggests that even mild working memory impairments may interfere with emotion regulation and stress adaptation, potentially affecting therapeutic engagement (Garrison & Schmeichel, 2022; Goodman et al., 2019; Wahlers et al., 2025). Additionally, lower scores in semantic fluency may reflect executive dysfunction in lexical retrieval and self-monitoring, which may contribute to interpersonal difficulties in individuals with BPD (Petersen et al., 2024).

Stroop performance revealed significant deficits in tasks requiring divided attention and cognitive flexibility, with C subtest scores falling within the clinical range in the CSA group. In contrast, inhibitory control appeared relatively preserved across both groups, despite elevated impulsivity scores in the CSA subgroup. These findings align with previous research suggesting that impulsivity in BPD may be more strongly linked to emotional dysregulation or comorbid ADHD than to primary inhibitory dysfunction (Linhartová et al., 2020; Sebastian et al., 2013).

Regarding memory performance, total recall on the RAVLT remained largely within normative limits across age groups, although delayed recall scores were significantly lower in the CSA group, particularly among participants aged 30–39, whose performance fell below the normative threshold ($z \leq -1.0$), as detailed in Supplementary Table S1. Notably, participants without CSA also exhibited below-average delayed recall in this age range, albeit to a lesser degree.

In the younger 20–29 subgroup, both groups performed within normative limits on both recall measures, although comparatively lower scores were again observed in CSA participants. This dissociation between preserved total recall and impaired delayed recall has been consistently reported in trauma-exposed populations (Malarbi et al., 2017; Hawkins et al., 2021) and aligns with previous findings of age-related verbal memory decline in comparable BPD samples (Laffite et al., 2025). While longitudinal studies are required to establish causal relationships, these findings suggest a cumulative vulnerability in verbal memory consolidation associated with trauma exposure and age-related cognitive decline within the BPD population.

Collectively, the findings from the present study challenge the notion of global neurocognitive dysfunction as an intrinsic feature of BPD (Aslan et al., 2023; Veerapandian et al., 2023; McClure et al., 2016). While women with a history of CSA exhibited broader and more pronounced impairments—particularly in executive and memory domains—the No CSA group generally performed within normative limits, aside from reduced delayed recall among older participants. This pattern supports the view, based on our data, that cognitive deficits in BPD are not universal but may reflect the cumulative effects of early trauma and age-related vulnerability. These results contribute to a more nuanced understanding of clinical heterogeneity in BPD and underscore the relevance of trauma- and developmentally informed explanatory models (Estric et al., 2022; Xu et al., 2025).

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Clinical implications and contributions

The present findings highlight the importance of systematically incorporating neurocognitive screening into the assessment of individuals with BPD and a history of CSA. In this subgroup, specific impairments—particularly in attention, cognitive flexibility, and working memory—were observed, with some reaching clinically significant levels, especially among older participants. Early detection of these deficits may inform tailored treatment planning and improve therapeutic outcomes.

Cognitive remediation programs targeting executive functions have shown promising effects in enhancing psychosocial functioning and reducing suicidal behavior in individuals with BPD (Arza et al., 2009; Pascual et al., 2015; Vita et al., 2018). When integrated into broader interventions such as Dialectical Behavior Therapy (DBT), these programs may strengthen the cognitive foundations of emotion regulation and goal-directed behavior. Moreover, DBT itself has been shown to produce improvements in neuropsychological functioning, enhancing executive functions and cognitive control, which contribute to better clinical outcomes (Afshari et al., 2022; Ruocco & Direkoglu, 2013; Vijayapriya & Tamarana, 2023; Wahlers et al., 2025).

Adopting trauma-informed and neurocognitively adapted treatment approaches may enhance therapeutic engagement, reduce dropout rates, and help prevent long-term functional decline. Importantly, tailoring interventions to each individual's trauma history and cognitive profile—particularly in young adults—could mitigate long-term deterioration and promote sustained recovery.

Limitations and future directions

This study presents several limitations that should be considered. First, its cross-sectional design precludes causal inferences regarding the relationship between CSA, neurocognitive functioning, and clinical severity in BPD. Second, although the sample size was adequate, the exclusive inclusion of women limits the generalizability of the findings. However, this focus is justified by the higher prevalence of BPD in women and the existence of sex-specific neurobiological and clinical responses to trauma (Ellison et al., 2018; Yue et al., 2023). Third, the study focused specifically on childhood sexual abuse, without assessing other forms of adversity such as emotional abuse, neglect, or household dysfunction. Future research should adopt broader trauma profiles to disentangle the specific and cumulative contributions of different types of early adversity to neurocognitive outcomes. Additionally, although post hoc power analyses indicated adequate statistical power to detect moderate effects, the study may have been underpowered to reliably detect small between-group differences. Furthermore, systematic outlier detection procedures were not applied, which may have affected the precision of the results. These factors should be considered when interpreting the findings.

Additionally, the clinical heterogeneity of BPD—including diverse symptom expressions and frequent psychiatric comorbidities—may have introduced variability in cognitive performance. While this complexity poses interpretative challenges, it also enhances the ecological validity of the findings. Importantly, all participants were assessed using standardized clinical interviews and validated neuropsychological instruments, which strengthens internal validity. Although comorbid substance use and ongoing pharmacological treatment may represent potential confounders, their inclusion reflects real-world clinical conditions and increases the external validity of the results.

Despite these limitations, the study also offers notable strengths. It integrates clinical and neurocognitive data from a carefully characterized sample of young adult women with BPD, using standardized and validated tools. The specific focus on childhood sexual abuse—a clinically and etiologically salient trauma subtype—provides a focused

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basis for future research. Overall, the study contributes to the growing literature supporting trauma-informed, neurocognitively sensitive frameworks in the assessment and conceptualization of BPD.

CONCLUSIONS

This study highlights the role of CSA in shaping the clinical and neurocognitive profiles of women with BPD. Participants with CSA histories exhibited more severe psychopathology—including higher rates of self-harm, suicide attempts, dissociative experiences, and psychotic symptoms—as well as significant impairments in attention, processing speed, and cognitive flexibility.

In terms of memory performance, no impairments were observed among younger participants (ages 20–29). However, among older participants (30–39), the CSA group showed significant deficits in both total and delayed verbal recall, while the No CSA group exhibited performance near normative thresholds in total recall and reduced delayed recall only. These findings suggest that long-term memory may be particularly sensitive to age-related decline in BPD, with earlier and more pronounced deterioration among individuals with trauma histories.
Collectively, these results challenge the notion of generalized neurocognitive dysfunction in BPD and instead support a trauma- and age-sensitive perspective. Incorporating neurocognitive assessment into routine clinical evaluation may facilitate more accurate profiling and guide individualized treatment planning.

Finally, integrating evidence-based psychotherapies with targeted cognitive interventions—particularly those addressing executive and memory functions—may represent a promising direction for future treatment development. This study contributes to a more nuanced understanding of the neurocognitive sequelae of early trauma and underscores the importance of multidisciplinary, developmentally informed approaches to optimize care for individuals with BPD. These findings may inform future research on trauma-related cognitive phenotypes in BPD and contribute to more targeted clinical approaches.

Author Contributions (CRediT taxonomy):

Horus Laffite Cabrera: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing.
María F. Martínez-Huidobro: Investigation, Data curation, Writing – review & editing.
Raquel Alonso-Sosa: Investigation, Data curation.
Fernando Rodríguez-Otero: Methodology, Supervision, Writing – review & editing.
José L. Hernández-Fleta: Supervision, Writing – review & editing.
Juan Antonio Díaz-Garrido: Conceptualization, Supervision, Writing – review & editing.

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The authors declare no competing interests.

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The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

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