Borderline Personality Disorder and Emotion Dysregulation

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Latent class analysis of women with borderline personality disorder: the role of adverse childhood experiences in impulsivity, emotional dysregulation, and neurocognitive profiles

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Abstract

Introduction Borderline personality disorder (BPD) is a complex psychiatric condition strongly associated with adverse childhood experiences (ACEs). This study examined how childhood trauma interacts with impulsivity, emotion dysregulation, and cognitive functioning to identify distinct clinical subtypes in women with BPD and inform personalized treatment strategies.

Materials and methods In this cross-sectional study, 231 women with BPD completed standardized assessments of childhood trauma (CTQ-SF), impulsivity (Barratt Impulsiveness Scale), and emotion regulation (DERS-SF), along with a neuropsychological battery. An exploratory latent class analysis identified subgroups based on trauma exposure and clinical features. Between-class differences in impulsivity, emotion regulation, and cognitive functioning were examined using ANOVA.

Results Five distinct clinical profiles emerged. The most severe classes—characterized by continuous sexual abuse (17.3%) and early sexual abuse with polysubstance use (25.1%)—showed the highest impulsivity, severe emotion regulation difficulties, and deficits in attention, working memory, and cognitive flexibility. A low-severity class with early sexual abuse (13.4%) exhibited moderate emotion regulation challenges without cognitive impairments. In contrast, two classes without sexual abuse—minimal trauma or violence (31.6%) and violence with substance use (12.6%)—demonstrated better emotional and cognitive functioning, with the low-trauma group displaying the lowest impulsivity and symptom severity.

Conclusions These findings underscore the importance of trauma-informed and cognitively tailored interventions for enhancing therapeutic outcomes in women with BPD. Recognizing the interplay among trauma, impulsivity, emotion dysregulation, and neurocognition may support more effective treatment planning and resource allocation.

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Introduction

Borderline personality disorder (BPD) typically emerges in early adulthood and is more frequently diagnosed in women, accounting for up to 75% of cases. However, evidence regarding true sex-based prevalence remains inconclusive [13]. BPD is characterized by persistent emotional dysregulation, unstable interpersonal relationships, and marked impulsivity, often manifested through high-risk behaviors such as suicide attempts, self-harm, substance use, and risky sexual behavior. It is also linked to identity disturbance, difficulty in goal setting and self-direction, and stress-related cognitive impairments [39].

BPD frequently co-occurs with mood and anxiety disorders, substance use disorders (SUD), eating disorders, post-traumatic stress disorder (PTSD), attention-deficit/hyperactivity disorder (ADHD), and other personality disorders [15, 52]. It is also associated with enduring functional and psychosocial impairments, even after symptom remission—particularly among women with histories of abuse [3, 10, 66]. Although psychotherapy is effective for many individuals with BPD, a substantial proportion continues to struggle with functional difficulties, emotional instability, or relapse after treatment [33, 38, 39].

Although generalized neuropsychological impairments have been reported in patients with BPD, recent studies have increasingly focused on executive functions [42]. Neuropsychological deficits may differentially and interactively contribute to various symptom manifestations, helping to identify specific clinical profiles and behavioral patterns [61]. These deficits are associated with reduced functionality, increased risk of suicide and self-harm, greater healthcare use, and higher rates of treatment dropout and relapse [56, 58].

Adverse childhood experiences (ACEs) have been identified as significant risk factors for the development of BPD, increased comorbidity, and increased symptom severity [11, 21]. Individuals with BPD are 14 times more likely to have experienced ACEs than the general population and three times more likely than those with other psychiatric disorders [48]. ACEs function as environmental risk factors that disrupt the development of emotional regulation and impulse control when interacting with neurobiological abnormalities such as cognitive deficits [28, 58]. This interplay may increase vulnerability and the likelihood of further trauma exposure [11]. Individuals with BPD and a history of ACEs often constitute a more severe clinical subgroup, characterized by increased rates of hospitalizations, self-harm, and suicidal behaviors, along with poorer therapeutic outcomes [60], highlighting the public health implications of this issue.

This study aimed to investigate subpopulations of women diagnosed with BPD and identify potential associations between different forms of ACEs and their effects on current symptomatology and cognitive function. We hypothesized that the clinical and phenomenological variability observed in BPD may reflect distinct dysfunctional profiles shaped by early adversity. These profiles were expected to differ in terms of cognitive function, impulsivity, and emotional dysregulation. Identifying these subpopulations could provide valuable prognostic tools, enabling the development of more tailored and effective therapeutic strategies while optimizing health-care resources and clinical outcomes. Due to the marked heterogeneity of borderline personality disorder and its complex relationship with trauma, this study followed an exploratory approach without formulating fixed a priori hypotheses regarding the number or composition of latent classes. Instead, we aimed to identify meaningful subgroups based on patterns of trauma exposure and their interaction with impulsivity, emotion dysregulation, and neurocognitive functioning. This approach is supported by prior evidence documenting distinct clinical trajectories in individuals with BPD and histories of childhood adversity. While this multidimensional structure enhances the granularity of subgroup identification, it may reduce parsimony. Future confirmatory studies using more streamlined models are needed to define core dimensions and facilitate clinical translation.

Materials and methods

Participants

The present study included 231 women diagnosed with BPD based on the International Classification of Diseases and Related Health Problems (ICD-10), with a mean age of 27.49 ($SD = 7.78$). This descriptive, cross-sectional, naturalistic study followed an exploratory approach, hypothesizing that specific constellations of trauma exposure and clinical characteristics would result in distinct profiles differing in impulsivity, emotion dysregulation, and cognitive functioning.

Only female patients were included in the study, based on clinical and methodological considerations. In the participating unit, most referrals for personality disorder treatment involve women, reflecting the sex distribution commonly observed in specialized BPD services [13]. This approach also reduced heterogeneity related to sex-based differences in trauma responses, as women have shown distinct neurobiological and clinical patterns [68].

Additionally, recent literature highlights that the overrepresentation of women in BPD diagnoses may stem in part from gender-based diagnostic biases and differences in symptom expression [45]. Focusing on women thus ensured a clinically representative sample while reducing heterogeneity, given sex-based differences in trauma responses and potential diagnostic biases (Table 1).

The inclusion criteria were as follows: (1) admission to the intensive outpatient personality disorder treatment unit, (2) meeting the criteria for BPD, (3) abstinence from substance use for at least 24 h before assessment in occasional substance users, and (4) maintenance of stable pharmacological treatment for at least two weeks before the assessment. Exclusion criteria included: (1) comorbid psychotic disorders, (2) severe substance abuse or dependence within the past three months, (3) intellectual disability, (4) neurological disorders, and (5) other medical conditions that may influence cognitive status (e.g., malnutrition and infectious or endocrine diseases).

Measures

Sociodemographic data

Data on age, educational level, and employment status were collected.

Severity of symptoms

The severity of BPD symptoms in the past week was assessed using the 23-item Borderline Symptom List (BSL-23; Bohus et al., [9, 55]. The Spanish version of the BSL-23 replicated the unifactorial structure of the original version, explaining 48.11% of the variance and demonstrating high internal consistency with a Cronbach's alpha of 0.948. The test-retest analysis also showed satisfactory results ($r = .734$; $p < .01$). In addition, the occurrence of acute inpatient hospitalizations (yes/no) was recorded.

Traumatic experiences and violence

The severity of different traumatic experiences was assessed using the 28 Likert-type items of the Childhood Trauma Questionnaire-Short Form (CTQ-SF; Bernstein et al., [8, 30]) organized into five scales: emotional, physical, and sexual trauma and physical and emotional neglect before age 18 years. The total score on each scale was classified according to standardized instructions into the following categories: minimum, low to moderate, moderate to severe, and severe to extreme. The Spanish version of the CTQ-SF showed adequate internal consistency across all subscales ($\alpha = 0.66 - 0.94$).

Physical trauma was specifically evaluated via the physical abuse subscale of the CTQ-SF, which captures experiences of intentional physical harm during childhood and excludes accidental injuries or trauma unrelated to abuse, such as those resulting from accidents or falls.

The presence of child sexual abuse (SA; before 12 years of age, after 12 years of age, and both), bullying (yes/no), and intimate partner violence (yes/no) was also recorded.

Health-risk behaviors

Past self-harm behaviors without suicidal intent (cutting, scratching, burning, and hitting), suicide attempts (drug overdose, hanging, jumping, and cutting), sexual risk behaviors, eating disorders, and dissociation were assessed and recorded.

Substance use

Current use of alcohol, cannabis, benzodiazepines, and cocaine was recorded using dichotomous variables. Lifetime admissions to the detoxification unit were also recorded.

Impulsivity and emotional dysregulation

Impulsivity was assessed using the Barratt Impulsiveness Scale (BIS-11; Barratt [7, 44], a 30-item Likert-type questionnaire. The Spanish version of the BIS-11 has high internal consistency ($\alpha = 0.8$). Emotion regulation was assessed using the Short Form of the Difficulties in Emotion Regulation Scale (DERS-SF) [27, 31]. All subscales showed good internal consistency ($\alpha = 0.73 - 0.91$).

Cognitive function

General cognitive function was assessed using the following neuropsychological scales:

Symbol Digit Modalities Test (SDMT) [54] assessed attention and perceptual speed. Participants had 90 s to match as many geometric symbols to numbers as possible using a reference key. Scalar scores were used for analyses.

Trail Making Test (TMT) [49] assessed various cognitive functions including attention, psychomotor speed, and cognitive flexibility. Part A involved connecting 25 randomly distributed numbers in a sequence, whereas Part B alternated between numbers and letters. Although untimed, the completion durations were recorded for analysis.

Digit Span (forward digit span, FDS; and backward digit span, BDS) from the WAIS-IV [65] assessed attention and memory and required participants to repeat sequences of numbers both in forward and backward order. The participants made two attempts for each span, with the highest number of correctly completed spans recorded.

Verbal Fluency Tasks [4] involved participants generating as many words as possible within one minute for the given categories. For phonemic fluency, the specified letter was "p"; for semantic fluency, the category was "animals".

Table 1 Sample characteristics

Variables	*n* (%)
Educational level	
Secondary	88 (38.1)
Baccalaureate (A-level)	118 (51.1)
University	25 (10.8)
Employment status	
None	105 (45.5)
Studying	99 (42.9)
Working	27 (11.7)
Mental health-related disability status	
No	134 (58)
33–64% (without subsidy)	54 (23.4)
> 65% (with subsidy)	43 (18.6)
Borderline Symptom List	
Mild	47 (20.3)
Severe	65 (28.1)
Extreme	119 (51.5)
Emotional trauma	
None-minimum	0
Low-moderate	6 (2.6)
Moderate-severe	35 (15.2)
Severe-extreme	190 (82.3)
Physical trauma	
None-minimum	78 (33.8)
Low-moderate	30 (13)
Moderate-severe	28 (12.1)
Severe-extreme	95 (41.1)
Sexual trauma	
None-minimum	46 (19.9)
Low-moderate	38 (16.5)
Moderate-severe	44 (19)
Severe-extreme	103 (44.6)
Physical neglect	
None-minimum	26 (11.3)
Low-moderate	46 (19.9)
Moderate-severe	63 (27.3)
Severe-extreme	96 (41.6)
Emotional neglect	
None-minimum	13 (5.6)
Low-moderate	106 (45.9)
Moderate-severe	63 (27.3)
Severe-extreme	49 (21.2)
Sexual abuse	
No	105 (45.5)
< 12 years	50 (21.6)
> 12 years	35 (15.2)
Both	41 (17.7)
Acute inpatient hospitalization	96 (41.6)
Bulling	48 (20.8)
Intimate partner violence	95 (41.1)
Suicide overdose	155 (67.1)
Suicide hanging	36 (15.6)
Suicide jumping	19 (8.2)
Suicide cutting	26 (11.3)

Table 1 (continued)

Variables	*n* (%)
Cutting	177 (76.6)
Hitting	109 (47.2)
Burning	38 (16.5)
Scratching	61 (26.4)
Sexual risk behavior	90 (38.9)
Eating disorder	166 (71.9)
Dissociation	140 (60.6)
Cannabis use	152 (65.8)
Cocaine use	66 (28.6)
Benzodiazepine use	78 (33.8)
Alcohol use	96 (41.6)
Admission to detoxification unit	32 (13.9)

Stroop Color and Word Test [26] assessed cognitive flexibility and interference resistance. The standardized version, comprising three sections (word, color, and color-word), each comprising 100 items across five columns, was administered individually, with a 45-second time limit for reading each column.

Rey Auditory Verbal Learning Test (RAVLT) [50] assessed verbal learning and memory using 15 words. Participants underwent five encoding trials with immediate recall after each, followed by delayed recall after 30 min, with no distractor list used.

In addition, the presence of ADHD was assessed using the Adult ADHD Rating Scale [19, 47] using 18 Likert-type items, with reported sensitivity of 94.78% and specificity of 84.79% for discriminating participants diagnosed with ADHD.

Procedure

This cross-sectional observational study was conducted in a clinical sample of women diagnosed with BPD, referred by clinicians from specialized outpatient mental health services. Participants were consecutively included through non-probabilistic convenience sampling, based on their availability and eligibility during the recruitment period. All individuals were actively receiving treatment within the unit at the time of assessment, and no additional clinical procedures were introduced for research purposes.

Data were collected between December 2022 and June 2024 as part of the standardized third-phase clinical evaluation protocol at the intensive outpatient personality disorder treatment unit of Hospital Universitario de Gran Canaria Dr. Negrín (Las Palmas de Gran Canaria, Spain). The assessment battery included self-report measures such as the BSL-23, the BIS-11, and the ADHD-RS, among others. These instruments were completed independently by participants in a supervised clinical setting.

The neuropsychological battery was administered in a paper-and-pencil format by a clinical psychologist specialized in neuropsychology and lasted approximately 40 min. It included the RAVLT (encoding and delayed recall), Digit Span (FDS and BDS), SDMT, TMT, Stroop, and verbal fluency tasks (phonemic and semantic).

Given the naturalistic and retrospective design of the study, no additional informed consent was required. All data were extracted from clinical records and fully anonymized prior to analysis. The study protocol was reviewed and approved by the institutional Research Ethics Committee (CEIm Las Palmas, protocol code 2023-570-1), which confirmed that no further consent was necessary due to the anonymized and retrospective nature of the data. The study was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines [67].

Data analysis

Descriptive analyses were performed to explore the sample characteristics. A latent class analysis (LCA) was conducted using SPSS and SAS to identify subgroups of participants based on different traumatic experiences and associated conditions. LCA assigns each individual the probability of belonging to a specific subgroup based on their response patterns. Parameters were estimated using maximum likelihood through the expectation-maximization procedure, incorporating Newton–Raphson to estimate regression coefficients for covariates [37]. Model fit was evaluated using standard indices to determine the optimal number of classes. Each model estimation was replicated with different random starting values for the rho parameters, using 1,000 sets of random starting values. The final number of latent classes was selected based on (1) model fit, as indicated by Akaike's Information Criterion (AIC) and the sample-adjusted Bayesian Information Criterion (SABIC); (2) classification quality through entropy; and (3) class size and interpretability.

Differences in executive functions between class memberships were analyzed using three one-way multiple analyses of variance (MANOVA): impulsivity, emotion

regulation, and cognitive function. The variables were standardized to facilitate interpretation. Pillai's Trace correction (vs. Wilks' Lambda) was used when assumptions were violated. Pairwise comparisons were performed using either Šidák or Games-Howell post-hoc tests, according to homoscedasticity test. Effect sizes were calculated using Cohen's f ($f = \sqrt{(\eta_p^2/1 - \eta_p^2)}$; small = 0.10, medium = 0.25; large = 0.40).

Results

Latent class model

Incremental fit indices and entropy values initially favored the 7-class model (Table 2). However, due to minor differences in fit indices, class sizes, and—most importantly—their theoretical interpretability, a 5-class model was selected (LL = – 3721.98, AIC = 5327.57, SABIC = 5381.89, entropy = 0.95).

Considering the item-response probabilities associated with each class, they were labelled as follows: Class 1: Extreme severity with continuous SA (17.3%, $n = 40$), Class 2: Extreme severity with early SA and polyuse (25.1%, $n = 58$), Class 3: Low severity with early SA (13.4%, $n = 31$), Class 4: Low severity with low trauma or violence (31.6%, $n = 73$), and Class 5: High severity with violence and polyuse (12.6%, $n = 29$) (Table 3).

All participants showed high probabilities of moderate to extreme emotional trauma, self-harm (e.g., cutting, hitting), eating disorders, dissociation, and cannabis use. The main characteristics of subgroups are as follows:

Class 1 (Extreme severity with continuous SA) involved pervasive sexual abuse across childhood and adolescence, combined with severe emotional trauma and marked BPD symptomatology. This subgroup exhibited elevated levels of impulsivity, dissociation, suicidal behaviors, and substance use, in the context of recurrent interpersonal violence.

Class 2 (Extreme severity with early SA and polyuse) experienced severe sexual abuse before age 12, marked BPD symptoms, and extensive polysubstance use, including detoxification admissions. Frequent suicidal behaviors and a high prevalence of intimate partner violence further distinguished this profile.

Class 3 (Low severity with early SA) reported early exposure to sexual abuse and presented with moderate symptom severity. Despite the presence of self-harm and alcohol use, individuals in this class showed relatively preserved cognitive function and milder emotional dysregulation.

Class 4 (Low severity with low trauma or violence) displayed the lowest levels of trauma and symptom severity, with no reported history of sexual abuse or intimate partner violence. This class showed the most adaptive emotional and cognitive functioning, with low rates of self-harm and substance use.

Class 5 (High severity with violence and polyuse) was marked by severe emotional trauma and clinical symptoms in the absence of sexual abuse. Bullying, intimate partner violence, and a history of detoxification for polysubstance use were prominent features.

Among the five identified profiles, those with early or ongoing sexual abuse histories (Classes 1 and 2) showed the most severe clinical profiles. These individuals exhibited heightened impulsivity and emotion dysregulation, along with pronounced deficits in attention, processing speed, cognitive flexibility, working memory, verbal fluency, and delayed recall. In contrast, Class 3 showed moderate emotional difficulties without significant cognitive impairments, while Classes 4 and 5 displayed more adaptive emotional and cognitive profiles, particularly in emotional rejection and confusion. Notably, Class 4 exhibited the lowest levels of impulsivity.

The latent profiles were interpreted in relation to patterns of childhood trauma—particularly sexual abuse—as well as symptom severity and co-occurring clinical features, including impulsivity, emotional dysregulation, and substance use. While some indicators may conceptually overlap (e.g., self-harm as both a symptom and a clinical marker), the variables included in the analysis represent distinct domains that jointly contributed to meaningful class differentiation.

Table 2 Latent class models for symptomatology of borderline personality disorder

Classes	LL	AIC	SABIC	Entropy
2	−3935.69	5514.98	5536.55	0.93
3	−3841.40	5406.39	5438.88	0.94
4	−3780.18	5363.96	5407.36	0.95
5	**−3721.98**	**5327.57**	**5381.89**	**0.95**
6	−3673.23	5310.06	5375.31	0.96
7	−3630.09	5303.78	5379.94	0.95
8	−3594.65	5312.90	5399.99	0.96

Chosen model shown in bold

LL Log-likelihood estimator for model convergence, *AIC* Akaike information criterion, *SABIC* Sample-adjusted Bayesian information criteria

Differences in dispositional and neuropsychological variables

Significant differences in impulsivity emerged across the five latent classes (Wilks' Lambda = 0.813, $p < .001$, $f = 0.27$). Class 4 consistently showed the lowest scores across all impulsivity subscales, while Classes 1 and 2 demonstrated notably elevated levels of cognitive and motor impulsivity. Non-planning impulsivity was particularly pronounced in Classes 2 and 5. Higher impulsivity levels were closely associated with greater difficulties in emotion regulation, especially in the dimensions of emotional rejection, confusion, and interference. In the Spanish version of the DERS-SF, the "impulse" and "strategies"

Table 3 Item-response probabilities according to latent class membership

Variables/classes	Extreme severity, continuous SA	Extreme severity, early SA & polyuse	Low severity, early SA	Low severity, low trauma/violence	High severity, violence & polyuse
Clinical Symptomatology and Severity					
BSL-23					
Mild	**0.2763**	0.0661	**0.3253**	**0.2366**	0.1633
Severe	0.1965	0.1622	**0.3486**	**0.4683**	0.0997
Extreme	**0.5271**	**0.7717**	**0.3261**	**0.2951**	**0.7370**
Acute Inpatient Hospitalization (AIH)	**0.3747**	**0.8811**	0.1924	**0.2385**	**0.2297**
Dissociation	**0.7847**	**0.9221**	**0.3895**	**0.3546**	**0.5889**
Childhood Trauma and Neglect					
Emotional trauma					
None-minimum	0.0000	0.0000	0.0000	0.0000	0.0000
Low-moderate	0.0000	0.0172	0.0976	0.0275	0.0000
Moderate-severe	0.0926	0.0543	**0.2316**	**0.2710**	0.0441
Severe-extreme	**0.9074**	**0.9284**	**0.6708**	**0.7015**	**0.9559**
Physical trauma					
None-minimum	**0.3177**	0.1481	**0.4738**	**0.3944**	**0.4543**
Low-moderate	0.0000	0.0894	0.1247	**0.2588**	0.0744
Moderate-severe	0.1276	0.0603	0.0444	0.1565	**0.2253**
Severe-extreme	**0.5546**	**0.7023**	**0.3571**	0.1903	**0.2461**
Sexual trauma					
None-minimum	0.0000	0.0000	0.0000	**0.3975**	**0.5817**
Low-moderate	0.0000	0.0000	0.0000	**0.3982**	**0.3080**
Moderate-severe	0.0460	0.1110	**0.5730**	**0.2042**	0.1103
Severe-extreme	**0.9540**	**0.8890**	**0.4270**	0.0000	0.0000
Physical neglect					
None-minimum	0.0251	0.0000	0.0970	**0.2131**	**0.2214**
Low-moderate	0.1183	0.0174	0.1692	**0.3352**	**0.3616**
Moderate-severe	0.1723	**0.2599**	**0.5505**	**0.2572**	0.1834
Severe-extreme	**0.6843**	**0.7227**	0.1833	0.1944	**0.2336**
Emotional neglect					
None-minimum	0.0000	0.0000	0.0325	0.1366	0.0705
Low-moderate	**0.2848**	0.1635	**0.6837**	**0.6312**	**0.6163**
Moderate-severe	**0.4084**	**0.3396**	**0.2201**	0.1803	**0.2386**
Severe-extreme	**0.3068**	**0.4969**	0.0637	0.0519	0.0746
Sexual abuse					
No	0.0000	0.0505	0.0000	**1.0000**	**1.0000**
< 12 years	**0.2119**	**0.2051**	**0.9610**	0.0000	0.0000
> 12 years	**0.5673**	0.1884	0.0390	0.0000	0.0000
Both	**0.2207**	**0.5560**	0.0000	0.0000	0.0000
Interpersonal Violence and Victimization					
Bullying	**0.3916**	0.0877	0.1986	**0.2027**	**0.2130**
Intimate partner violence (IPV)	**0.3445**	**0.9202**	**0.3212**	0.1234	**0.3101**
Self-Harm and Suicidal Behaviors					
Suicide overdose	**0.7207**	**0.9330**	**0.4855**	**0.5070**	**0.6881**
Suicide hanging	0.1420	**0.2991**	0.0957	0.1106	0.0684
Suicide jumping	0.0286	0.1567	0.1235	0.0370	0.0787
Suicide cutting	0.1341	0.1869	0.0575	0.0685	0.1034
Cutting	**1.0000**	**0.8899**	**0.5253**	**0.6973**	**0.6250**
Hitting	**0.5466**	**0.6950**	**0.3813**	**0.2871**	**0.4828**
Burning	**0.3698**	**0.2425**	0.0345	0.0435	0.1645
Scratching	0.1836	**0.2373**	**0.3187**	**0.2320**	**0.4490**
Sexual Risk Behaviors and Eating Disorders					

Table 3 (continued)

Variables/classes	Extreme severity, continuous SA	Extreme severity, early SA & polyuse	Low severity, early SA	Low severity, low trauma/violence	High severity, violence & polyuse
Sexual risk	**0.7059**	**0.3342**	0.1696	**0.3511**	**0.3893**
Eating disorder	**0.8193**	**0.7786**	**0.6477**	**0.6082**	**0.8098**
Substance Use					
Cannabis	**0.6698**	**0.9077**	**0.5336**	**0.4101**	**0.8947**
Cocaine	0.0000	**0.6387**	0.1988	0.0000	**0.7827**
Benzodiazepine	0.1700	**0.7763**	0.0719	0.1366	**0.4827**
Alcohol	**0.3450**	**0.7888**	**0.4389**	0.0965	**0.5443**
Admission to detoxification unit (ADU)	0.0000	**0.3096**	0.0370	0.0224	**0.3866**

Item-response probabilities higher than 0.20 are shown in bold

Abbreviations: *SA* Sexual Abuse, *BSL-23* Borderline Symptom List

subscales—grouped under "lack of control"—have shown strong associations with borderline traits [22], with "strategies" particularly relevant to suicidal behavior [36].

Emotion regulation also differed significantly between classes (Pillai's Trace = 0.748, $p < .001$, $f = 0.48$). Class 2 exhibited the greatest difficulties in regulating emotions, followed by Class 1. In contrast, Class 4 showed the most adaptive profile, consistent with its low impulsivity scores and minimal trauma exposure. Cognitive functioning varied significantly across classes (Pillai's Trace = 0.529, $p < .001$, f = 0.39). Classes 1 and 2 displayed notable deficits in attention, processing speed, working memory, cognitive flexibility, and delayed recall. By contrast, Class 4 outperformed the rest in most cognitive domains, while Class 3 exhibited intermediate performance.

Cognitive performance varied significantly across groups (Pillai's Trace = 0.529, $p < .001$, $f = 0.39$). Classes 1 and 2 exhibited the most pronounced impairments, with deficits in attention, processing speed, working memory, cognitive flexibility, and delayed recall. Class 4 outperformed the other groups across most domains, while Class 3 showed intermediate cognitive performance. These neurocognitive impairments appeared alongside higher emotional and behavioral dysregulation, underscoring the interplay between cognitive deficits and clinical severity.

In contrast, no significant differences were observed across classes in inhibitory control (Stroop) or ADHD symptoms (ADHD-RS), suggesting that these dimensions may not be as sensitive to subgroup distinctions within this sample.

Finally, Classes 2 and 5—characterized by early sexual abuse with polysubstance use and by violence with polysubstance use, respectively—shared high levels of unplanned impulsivity. However, only Class 2 showed marked emotion regulation and cognitive impairments. Both classes reported the highest internalizing symptoms on the BSL-23.

A detailed summary of means and standard deviations for all dispositional and neurocognitive variables is presented in Table 4.

Discussion

This study identified five clinically meaningful subgroups of women with BPD, differentiated by patterns of childhood trauma, symptom severity, and co-occurring features such as impulsivity, emotion dysregulation, and neurocognitive functioning. Rather than reflecting overlapping constructs, the selected variables captured complementary domains, each assessed independently through standardized instruments. This multidimensional approach enabled a nuanced characterization of trauma-related heterogeneity, enhancing the interpretability and clinical relevance of the identified profiles despite reduced parsimony.

The two most impaired classes—those exposed to early or repeated sexual abuse—displayed pronounced neurocognitive deficits (particularly in attention, working memory, and cognitive flexibility), alongside severe emotion dysregulation and elevated impulsivity. These impairments may compromise inhibitory control and the capacity to manage trauma-related distress, potentially reducing treatment responsiveness. Even mild working memory disruptions can compromise the modulation of negative affect and the implementation of adaptive coping strategies in emotionally challenging situations, thereby affecting therapeutic engagement [23, 25, 64]. Cognitive flexibility facilitates perspective-shifting and the application of appropriate emotion regulation strategies [12]. Reduced flexibility has also been linked to difficulties adapting to changing demands, reinforcing behavioral rigidity in emotionally charged contexts [18, 43]. Altogether, these results align with prior research on the compounding effects of childhood trauma on symptom severity and functional vulnerability in BPD (de Aquino Ferreira et al., [10, 12, 16, 35, 56].

Table 4 Differences in dispositional variables and cognitive functioning between clinical classes

Variables	M (SD)				
	Extreme severity with continuous SA	**Extreme severity with early SA and polyuse**	**Low severity with early SA**	**Low severity with low trauma or violence**	**High severity with violence and polyuse**
Impulsivity					
Cognitive	23.65 (3.18)[1]	22.03 (4.06)[1 2]	20.94 (3.64)[1 2]	20.68 (3.87)[2]	22.52 (3.27)[1 2]
Motor	27.75 (7.37)[1]	26.50 (5.54)[1]	24.52 (8.19)[1 2]	22.22 (7.48)[2]	23.62 (7.03)[2]
Non-planning	23.65 (6.55)[1 2]	26.84 (8.30)[1]	22.19 (8.23)[1 2]	21.22 (7.77)[2]	26.52 (7.46)[1]
Emotional regulation					
Lack of control	35.88 (6.75)[1]	38.66 (5.69)[1]	33.52 (5.76)[2]	32.01 (6.09)[2]	35.31 (6.61)[1 2]
Life interference	17.35 (1.86)[1]	15.83 (4.32)[1 2]	13.32 (4.96)[2]	12.43 (4.15)[2]	13.48 (3.51)[2]
Lack of attention	16.67 (1.86)[1]	17.62 (2.63)[1]	13.71 (3.05)[2]	11.96 (3.01)[2]	12.97 (3.15)[2]
Confusion	15.38 (2.30)[1]	15.62 (3.35)[1]	11.84 (2.44)[2]	9.99 (2.34)[2]	11.21 (2.50)[2]
Rejection	27.90 (4.96)[1]	29.95 (7.38)[1]	24.06 (4.99)[2]	15.40 (7.36)[3]	16.10 (6.74)[3]
Cognitive functioning					
SDMT	7.08 (2.96)[1]	5.71 (2.97)[1]	8.35 (2.11)[2]	8.93 (2.15)[2]	7.93 (2.53)[2]
TMT A	38.58 (15.51)[1]	39.67 (17.71)[1]	28.96 (6.84)[2]	26.08 (7.12)[2]	31.55 (10.92)[2]
TMT B	96.85 (50.21)[1]	99.28 (47.69)[1]	66.08 (24.09)[2]	64.15 (18.74)[2]	71.21 (30.05)[2]
FDS	4.98 (0.97)[1]	5.50 (0.96)[1 2]	5.61 (0.72)[1 2]	6.04 (0.94)[2]	5.90 (0.90)[2]
BDS	3.50 (0.78)[1]	3.79 (0.87)[1 2]	4.00 (0.78)[1 2]	4.49 (0.96)[2]	4.24 (0.64)[2]
PVF	14.02 (4.18)[1]	15.55 (4.78)[1]	18.29 (3.50)[2]	18.26 (4.51)[2]	18.55 (4.21)[2]
SVF	20.68 (5.29)[1 2]	20.05 (5.19)[1]	22.84 (4.61)[2]	23.08 (5.97)[2]	21.59 (4.95)[1 2]
Stroop R-Int	49.77 (9.42)[1]	48.22 (12.56)[1]	51.26 (9.99)[1]	51.85 (10.27)[1]	48.62 (9.63)[1]
RAVLT DR	9.80 (2.98)[1]	8.14 (3.70)[1]	11.81 (2.36)[2]	11.25 (2.51)[2]	10.24 (3.19)[1 2]
ADHD-RS	33.90 (9.86)[1]	32.10 (10.60)[1]	27.55 (9.94)[1]	28.50 (10.29)[1]	33.10 (10.36)[1]

Mean (Standard deviation). Subscripts indicate between-group differences in post-hoc analyses. Groups with the same subscript did not differ significantly from each other. Variables are shown in direct scores to facilitate their interpretation

Abbreviations: *SA* Sexual Abuse, *SDMT* Symbol Digit Modalities Test, *TMT* Trail Making Test, *FDS* Forward Digit Span subtest from the Wechsler Adult Intelligence Scale (WAIS IV), *BDS* Backward Digit Span subtest from the Wechsler Adult Intelligence Scale (WAIS IV), *PVF* Phonological Verbal Fluency task using the letter "P", *SVF* Semantic Verbal Fluency or Semantic Category Evocation of animals, *Stroop R-Int* Stroop Resistance to Interference task, *RAVLT DR* Rey Auditory Verbal Learning Test Delayed Recall, *ADHD-RS* Attention deficit hyperactivity disorder-Rating Scale

Although inhibitory control is considered a core component of executive functioning, no between-group differences emerged in this domain. Inhibitory processes may remain relatively preserved in individuals without comorbid ADHD, even when self-reported impulsivity is elevated. This pattern aligns with prior research suggesting that impulsive behaviors in BPD are more strongly linked to emotional dysregulation or contextual triggers than to primary deficits in inhibition [41, 51]. Additionally, self-reported impulsivity often correlates weakly with performance-based inhibition tasks, suggesting that these instruments tap into distinct constructs [32]. In our sample, substance use—particularly cannabis and, to a lesser extent, benzodiazepines—was more prevalent among individuals exposed to high levels of emotional abuse. This pattern aligns with prior research linking childhood trauma to increased vulnerability to cannabis misuse [17, 24, 34]. In this context, substance use may serve as a maladaptive coping strategy to manage trauma-related distress, especially in individuals with elevated emotion dysregulation [59]. These findings underscore the relevance of integrated, trauma-informed care models for individuals with dual pathology. This trauma-related profile was also characterized by more severe clinical symptoms, including self-harm, suicide attempts, and dissociation. In such cases, impulsive behaviors may serve as maladaptive strategies to regulate overwhelming negative affect, reinforcing a dysregulation cycle that amplifies clinical risk [35, 40]. This dynamic may help explain the consistent association between the co-occurrence of impulsivity and emotion dysregulation and increased suicide risk in BPD [2, 22, 36]. Our findings support previous research highlighting the importance of recognizing trauma-informed profiles, which may guide personalized treatment planning and risk stratification. Still, the inclusion of multiple domains—while clinically informative—introduced interpretative complexity that may hinder clinical translation, despite improving the granularity of subgroup identification. Further studies are needed to refine these profiles and evaluate their utility in clinical settings.

Limitations

This study employed a comprehensive latent class analysis to identify trauma-related subtypes in women with BPD, integrating clinical, neurocognitive, and trauma-related variables. This complexity, while clinically informative, may limit parsimony.

Several methodological limitations should be acknowledged. First, the cross-sectional design precludes causal inferences regarding the directionality between childhood trauma and clinical outcomes. Second, the reliance on retrospective self-report to assess adverse childhood experiences may be subject to recall bias, although such instruments have demonstrated clinical validity in identifying trauma-related patterns. Third, some conceptual overlap between diagnostic criteria and clinical indicators—such as self-harm and dissociation—may introduce redundancy; however, these variables were deliberately included to capture their variability across trauma-based subgroups.

The inclusion of patients receiving pharmacological treatment and those with active substance use may have introduced confounding effects. While this may reduce internal control, it reflects the complexity of real-world clinical populations. Additionally, although the Spanish version of the DERS-SF showed robust psychometric properties, the decision to merge subscales into broader domains—such as "lack of control"—may reduce construct specificity and limit comparability with studies using the original subscale structure.

Another limitation is the absence of a priori power analysis. Although the sample size ($N = 231$) meets recommended thresholds for LCA, the naturalistic sampling strategy may have reduced the ability to detect between-group differences. Future studies should incorporate prospective power calculations to reduce the risk of Type II error.

Finally, the generalizability of the findings may be constrained. The exclusive inclusion of women was guided by epidemiological and clinical considerations but limits its applicability to male populations, who may differ in trauma exposure and symptom expression. In light of these limitations, the present findings should be interpreted as preliminary and hypothesis-generating, pending replication in larger, longitudinal, and more diverse clinical samples. Despite these limitations, the present study offers novel insights into trauma-related heterogeneity in BPD.

Clinical implications

The present findings highlight the need for personalized interventions that address the heterogeneity of BPD, particularly in domains such as emotion regulation, impulsivity, and cognition.

Evidence-based therapies like Dialectical Behavior Therapy (DBT), Mentalization-Based Therapy (MBT), Transference-Focused Psychotherapy (TFP), and Schema Therapy have demonstrated efficacy in improving affect regulation and reducing self-harm in individuals with BPD [6, 10]. When trauma-related symptoms are prominent, stage-based approaches like DBT-PTSD or DBT-Prolonged Exposure may be especially beneficial, although clinical stabilization should precede trauma-focused work [29, 57].

Comorbid substance use—especially among trauma-exposed individuals— requires integrative care models. Adaptations such as DBT-SUD and Dynamic Deconstructive Psychotherapy have shown effectiveness in treating dual pathology and improving adherence [14, 53].

Neurocognitive screening may further personalize treatment by identifying patients at higher risk of dropout or poor response. Cognitive remediation programs targeting executive functioning have shown promising effects in improving psychosocial adjustment, alleviating clinical symptoms, and enhancing treatment adherence in individuals with BPD [5, 20, 46, 63]. When integrated into broader treatments such as DBT, these programs may strengthen the cognitive foundations of emotion regulation and goal-directed behavior. DBT itself has also been associated with improvements in neuropsychological functioning contributing to better clinical outcomes [1, 62]. Adopting trauma-informed and neurocognitively adapted strategies may enhance therapeutic engagement, reduce attrition, and help prevent long-term functional decline. Tailoring treatment to each patient's trauma history and cognitive profile—especially in young adults—could promote recovery and mitigate future deterioration.

This classification system may serve as a pragmatic tool to guide stepped-care planning based on trauma load, clinical severity, and cognitive functioning. Individuals in Classes 1 and 2 may benefit from more structured or trauma-focused programs, while those in Classes 3 to 5 may be adequately managed in outpatient care with a focus on skills training and emotional stabilization.

Given limited access to specialized psychotherapies in many healthcare settings, patients with BPD are often treated by generalist providers [10]. Incorporating trauma-informed principles and neurocognitive screening into early assessment could improve treatment matching and resource allocation. Structured risk stratification may further help distinguish those requiring intensive care from individuals who can be effectively managed in less demanding settings.

Future research directions

The current findings represent an initial step toward delineating trauma-related heterogeneity in BPD. However, their generalizability and predictive utility require confirmation through larger, longitudinal, and multisite studies. Future research should examine the temporal stability of the identified subgroups and their association with treatment outcomes, relapse risk, and functional recovery.

Efforts should also focus on validating and refining the latent class structure by identifying core dimensions that optimally distinguish clinically meaningful subtypes. Improving parsimony and conceptual clarity may facilitate integration into real-world clinical workflows. To this end, future studies should incorporate prospective power analyses, standardized neurocognitive batteries, and clinician-administered diagnostic tools to enhance methodological rigor and subgroup characterization.

Finally, further work is needed to evaluate the clinical value of these trauma-informed profiles in guiding personalized treatment. Investigating their role in predicting treatment response and informing stepped-care allocation could support more targeted, scalable, and cost-effective approaches to BPD care.

Conclusions

This study identified distinct subgroups of women with BPD based on trauma exposure, impulsivity, emotion dysregulation, and neurocognitive functioning. These profiles offer a clinically relevant framework to improve diagnostic precision and inform tailored interventions.

However, given the exploratory and cross-sectional nature of the study, findings should be interpreted cautiously.

Replication in longitudinal and diverse clinical samples is needed to confirm subgroup stability and clarify their role in predicting treatment response and long-term outcomes.

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Authors' contributions

H.L. conceptualized and designed the study, collected and curated the data, performed the main data analysis, and wrote the original draft of the manuscript.V.M.L. supervised the overall study design and methodology, provided advanced statistical guidance, contributed significantly to the interpretation of results, and critically revised the manuscript.J.A.D.G. supported the study design, supervised data collection, and provided critical feedback on the manuscript draft.J.L.O.C. assisted with data analysis, interpretation, and prepared the figures and tables.J.L.H.F. contributed to data curation, methodology, and manuscript editing.All authors reviewed and approved the final version of the manuscript for submission.

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Data availability

Data Availability Statement: The datasets generated during this study involve sensitive information related to childhood abuse and are anonymized to protect participant confidentiality. These data are not publicly available but can be accessed upon reasonable request from the corresponding author, H.L.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the ethical standards of the Declaration of Helsinki [45] and Good Clinical Practice guidelines. It was approved by the Ethics Committee for Research at the University Hospital of Gran Canaria Dr. Negrín (CEIm Las Palmas, Protocol V.1, 27/12/2023; Code: 2023-570-1). Given its retrospective design, the use of fully anonymized data, and the absence of any impact on participants' clinical care, informed consent was waived by the committee. Clinical evaluations were not influenced by research procedures.

Consent for publication

Not applicable, since the study does not involve publication of identifiable personal data.

Competing interests

The authors declare no competing interests.

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