

Psychopathology and the autonomic nervous system in borderline personality disorder.

Part 1. The Influence of Early Adversities, Dissociation, Self-stigma, Parenting and Attachment on Disorder Severity

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Abstract

BACKGROUND: Borderline Personality Disorder (BPD) is a complex psychiatric condition characterized by significant emotional instability, impulsivity, and intense interpersonal difficulties. This study examines the relationship between early traumatic experiences, attachment, dissociation, self-stigmatization, autonomic nervous system activity, specifically heart rate variability (HRV), and the severity of BPD symptoms.

OBJECTIVE: To explore the associations between psychosocial and physiological factors and the severity of BPD symptoms, with a focus on early adverse experiences, adult attachment styles, HRV, and self-stigmatization.

METHODS: The study sample consisted of 75 hospitalized BPD patients. HRV was measured, and self-report questionnaires were used to assess early traumas (Childhood Trauma Questionnaire), parenting style (Parental Bonding Instrument), adult attachment style (Experiences in Close Relationships Scale), and dissociation (Dissociative Experience Scale). Self-stigmatization was evaluated using the Internalized Stigma of Mental Illness (ISMI) scale, while symptom severity was assessed using self-report and clinician-administered scales, including the CGI-BPD, Beck Depression Inventory-II, and Beck Anxiety Inventory.

RESULTS: Significant correlations were found between early traumas, attachment, and the severity of BPD symptomatology. Higher levels of emotional abuse in childhood correlated with earlier onset and greater symptom severity. HRV analysis

indicated a link between sympathetic nervous system activation and specific BPD symptoms, particularly in patients with high levels of attachment anxiety. Self-stigmatization was associated with increased symptom severity and reduced treatment response. **CONCLUSION:** The findings confirm that early traumatic experiences, adult attachment, and self-stigmatization are key factors in understanding symptom severity and emotional dysregulation in BPD. Targeted interventions addressing these areas may significantly improve treatment outcomes for BPD patients.

INTRODUCTION

Borderline personality disorder (BPD) is a complex mental disorder characterized by unstable moods, behaviours, and relationships (American Psychiatric Association 2013). Patients with BPD experience intense episodes of anger, anxiety, and depression that can last from hours to days (Paris 2007). The disorder is characterized by marked emotional instability and rapid and intense mood swings (Linehan 1993), which may be accompanied by impulsive behaviours such as risky sexual behaviour, substance abuse, binge eating, or gambling (Sansone & Sansone 2011). BPD is also associated with high rates of self-harm and suicide attempts (Zanarini *et al.* 2008), as well as feelings of emptiness, anger issues, and difficulty being alone (Gunderson 2009). The feeling of emptiness can lead to despair in these patients and may be often associated with suicidal thoughts.

BPD is a relatively common mental disorder with an estimated prevalence in the general population of between 1.6% and 5.9% (Lenzenweger *et al.* 2007), with some studies suggesting that it may occur in up to 3% of the population (Torgersen 2001). The usual age of onset is early adulthood, but symptoms may be evident as early as childhood or adolescence (Zanarini *et al.* 2005). BPD occurs in both men and women, but some studies suggest that it is more common in women, and it is estimated that up to 75% of people diagnosed with BPD are women (Torgersen, 2001). Comorbidity with other mental disorders is common, especially with depressive and anxiety disorders, eating disorders, and substance use disorders (Zanarini *et al.* 1998).

Heart rate variability (HRV)

Heart rate variability (HRV) is a non-invasive indicator of autonomic nervous system (ANS) regulation and has been associated with depressive disorders (Thayer *et al.* 2012). Reduced HRV has also been found in patients with panic disorder (Prasko *et al.* 2011; Diveky *et al.* 2012) and borderline personality disorder (Cattaneo *et al.* 2021) and may be associated with a higher risk of cardiovascular disease. Studies show that HRV could serve as a biomarker for certain psychiatric conditions, including BPD (Carr *et al.*

2018). The ANS plays a crucial role in the regulation of bodily functions and can be influenced by early adversities and upbringing (Porges, 2007); in patients with BPD, ANS dysregulation may be one of the factors contributing to their emotional instability (Austin *et al.* 2007).

Dissociation

Dissociation is a psychological process that develops in the early stages of childhood development and allows unwanted emotional states or stressful events to be separated (Dell & O'Neil 2009). Dissociation acts as a defence mechanism, especially in the case of traumatic experiences or maltreatment, which can lead to serious psychopathology in adulthood (Schimmenti, 2017). In patients with BPD, dissociation often serves as a defence against intense emotions or traumatic memories, which can complicate therapeutic work (Zanarini *et al.* 1998). Therapeutic approaches that focus on working with trauma and dissociation, such as dialectical behavioural therapy (DBT) and schema therapy, can be effective in treating BPD (Linehan *et al.* 1999; Young *et al.* 2003; Assman *et al.* 2024).

Self-stigma

Psychiatric disorders often present several challenges, including managing symptoms, impacting daily life, confronting stigma, and coping with self-stigma (Corrigan 2000). Self-stigma involves internalizing negative stereotypes associated with the diagnosis, leading to decreased self-esteem and worsening mental health (Corrigan *et al.* 2006). Patients with BPD may be particularly vulnerable to self-stigma due to the negative stereotypes associated with the disorder, such as manipulative behaviour, relationship instability, and self-harm (Porr 2020). These patients may come to believe that they are "bad" or "useless," which can lead to a decrease in self-esteem and further deterioration of their psychological state (Porr, 2020).

Self-stigma also affects the relationships of BPD patients with others, including therapists (Grambal *et al.* 2016). Research suggests that therapists may have a more stigmatizing view of BPD than other mental disorders, which can lead to BPD patients feeling less understood and supported in their treatment (Porr 2020).

METHOD

This study focused on several key aspects of BPD, including heart rate variability, early adversities, parenting styles, dissociation, current psychopathology, and self-stigma.

Objectives

The study's primary objective is to examine various factors that may influence the course and severity of BPD symptoms. We focus specifically on the

Tab. 1. Study inclusion and exclusion criteria

INCLUSION CRITERIA	EXCLUSION CRITERIA
ICD-10 research criteria for Emotionally unstable personality disorder – Borderline type	Organic mental disorder
Age 18-65 years	Current or history of psychotic disorder
Signed informed consent	Substance addiction
	Dissocial personality disorder
	Suicidal tendencies (MINI suicidality index greater than 2)
	Partial or complete illiteracy or Mental retardation

influence of age, disorder order, early traumatic experiences, dissociation, heart rate variability, self-stigma, and attachment anxiety.

Hypotheses

Based on the literature review, hypotheses were created:

- (1) The severity of borderline symptomatology decreases with age
- (2) The earlier onset of the disorder is related to higher emotional abuse in childhood
- (3) The earlier onset of the disorder is related to more severe symptomatology
- (4) Higher levels of dissociation are related to higher sympathetic activity
- (5) Adverse childhood experiences are related to higher sympathetic activity
- (6) Adverse childhood experiences are related to more severe symptomatology
- (7) Adverse childhood experiences are related to higher levels of self-stigma
- (8) Maternal care in childhood is related to sympathetic activity
- (9) Attachment anxiety is related to sympathetic activity
- (10) The level of anxiety is related to sympathetic activity
- (11) The level of anger is related to the frequency of breathing
- (12) The level of specific borderline symptomatology is related to sympathetic activity
- (13) Attachment anxiety is related to the severity of symptomatology
- (14) The level of self-stigma is related to the severity of symptomatology

Methodological framework

The study only includes patients diagnosed with BPD according to the research criteria of the ICD-10 (1996) who were admitted to the Psychiatric Clinic University Hospital Olomouc and then underwent a Mini International Neuropsychiatric Interview for confirmation. Patients filled in a demographic questionnaire and informed consent.

Patients were assessed for the severity of borderline psychopathology (via Clinical Global Impression,

Clinical Global Impression – borderline personality disorder, Borderline Evaluation of Severity over Time), levels of anxiety and depression (via Beck Anxiety Inventory, Sheehan Patient-Rated Anxiety Scale, Beck Depression inventory), heart rate variability measuring, levels of dissociation (via Dissociation Experience Scale), adverse childhood events (Childhood Trauma Questionnaire), parenting style in the childhood of the patient (Parental Bonding Instrument), and adult attachment (Experiences in Close Relationship – Revised) and self-stigmatization (Internalized Stigma of Mental Disorders Scale). The researcher, an independent evaluator, and the patient conducted an assessment using rating scales and questionnaires at the beginning of the study.

Measurements

Heart rate variability

Heart rate variability (HRV) is considered a key indicator of autonomic nervous system (ANS) activity and provides information about the balance between the sympathetic and parasympathetic nervous systems. Heart rate variability (HRV) measures the interval between two consecutive heartbeats. HRV analysis can be performed from short-term recordings, obtaining the results of the so-called short-term variability (Javorka *et al.* 2008). When evaluating using linear methods, frequency and time analysis are used (Slepecky *et al.* 2017). Spectral analysis is a method used in signal processing to analyse the frequency content of a signal (Thayer *et al.* 2012). We used the fast Fourier transform to analyse the influences that modulate the heart rate at a given moment when evaluating heart rate variability using frequency analysis.

Heart rate variability (HRV) measurements were conducted during the first and last weeks of the inpatient care. Each patient was measured under as similar conditions as possible using the ProComp Infiniti System with BioGraph Infiniti software (model T7500M). At the start of the measurement, patients were seated in a chair, and ECG electrodes (3) were placed on their chest, along with abdominal and chest belts to measure respiratory rate. Patients were asked to remain seated quietly and avoid speaking during the measurement. They were generally advised not to think

Tab. 2. Description of the sample in demographic, clinical and psychological variables

	MEAN	STANDARD DEVIATION
Age	27.04	9.11
Disorder onset	17.74	7.90
Disorder length	8.29	6.61
Number of hospitalizations	3.76	3.52
CTQ-emotional abuse	13.65	5.75
CTQ-physical abuse	7.72	4.30
CTQ-sexual abuse	7.37	5.41
CTQ-physical neglect	16.61	5.55
CTQ-emotional neglect	8.57	4.79
CTQ-total	53.93	17.72
PBI-maternal care	20.39	9.58
PBI-maternal control	17.63	9.50
PBI-paternal care	16.6	8.90
PBI-paternal control	13.49	7.69
ECR – Anxiety	3.79	1.86
ECR – Avoidance	4.07	1.07
BEST-total	40.77	12.34
BEST – TH	23.87	8.79
BEST N-B	9.81	4.54
BEST P-B	7.91	3.31
CGI-BPD Abandonment	4.21	1.99
CGI-BPD Unstable relationships	4.43	1.91
CGI-BPD Identity	4.58	1.94
CGI-BPD Impulsivity	4.38	1.62
CGI-BPD Suicidality and self-harm	3.59	2.12
CGI-BPD Affect instability	5.18	1.66
CGI-BPD Emptiness	4.94	1.73
CGI-BPD Anger	4.30	1.72
CGI-BPD Paranoid ideation	3.80	1.97
CGI-BPD TOTAL	4.73	1.22
DES	26.07	16.62
subjCGI	4.38	1.49
Sheehan anxiety scale	60.45	29.98
BAI	25.51	13.94
BDI-II	33.69	11.94
ISMI- TOTAL	44.81	14.37
ISMI Alienation	16.33	3.97
ISMI Stereotypes endorsement	13.72	4.47
ISMI Perceived discrimination	11.33	3.40
ISMI Social withdrawal	14.52	4.34
ISMI Stigma resistance	11.09	2.97

Tab. 3. Average Medication Dosages

Antidepressants: Paroxetine Index (n = 62)	45.47 ± 25.13
Anxiolytics: Diazepam Index (n = 15)	18.73 ± 21.37
Antipsychotics: Risperidone Index (n = 25)	3.67 ± 4.18
Antiepileptics: lamotrigine index (n = 20)	260.0 ± 166.7

about traumatizing or complex topics but rather to let their thoughts flow freely. The measurement itself lasted 10 minutes. Subsequent data processing involved manual artefact cleaning, such as removing motion-related distortions or extrasystoles.

In the frequency assessment of HRV, three bands are distinguished in clinical practice:

- High frequency (HF) (0.15–0.4 Hz) is a non-invasive index of cardiac vagal activity mediated by respiratory sinus arrhythmia. Javorka *et al.* (2008) reported that the HF component reflects predominantly parasympathetic activity. In connection with Porges' polyvagal theory, a lower parasympathetic tone supports mobilization behaviour (as in Fear and anxiety), and a higher parasympathetic tone supports socially adaptive behaviour (so-called "social engagement behaviour") (Porges 2009; Porges 2011). Breathing patterns strongly influence the HF component and generally increase with deep, calm breathing. High HF values are associated with lower stress levels and better relaxation abilities, which is important for restoring balance in the autonomic system (Porges, 2007).
- Low frequency (LF) (LF (0.04–0.15 Hz) probably represents the activities of both sympathetic and parasympathetic (Moak *et al.* 2009; Goldstein *et al.* 2011). The LF component results from the activities of both parts of the autonomic nervous system (ANS). The LF band is also significantly influenced by the activity of the baroreflex loop and other factors that act simultaneously and dynamically. Their share in forming oscillations in the LF band changes depending on the current state (Javorka *et al.* 2008). Some studies suggest that LF also reflects the so-called baroreflex sensitivity, which responds to changes in blood pressure (Reyes Del Paso *et al.* 2013). An increased LF value may signal a stress response or increased sympathetic activation (Thayer *et al.* 2012).
- Very low frequency (VLF) (0.003–0.04 Hz) is the most complex. It is assumed to reflect the influence of physiological systems, such as thermoregulation and renin-angiotensin, on autonomic functions (Shaffer *et al.* 2017). Research shows that low activity in the VLF band may be associated with higher levels of inflammation and stress (Ponikowski *et al.* 1997; Javorka *et al.* 2009).

Assessment tools

Mini International Neuropsychiatric Interview

The Mini International Neuropsychiatric Interview (MINI) provides screening for common mental

disorders meeting the criteria of the DSM-IV and ICD-10 (Sheehan *et al.* 1998; Amorim 2000)

Sheehan Patient-Rated Anxiety Scale

The Sheehan Patient-Rated Anxiety Scale (SPRAS) is a scale that examines the main symptoms of anxiety and panic disorders. It helps to assess and monitor how these symptoms and behaviours change over time. The assessment can be done by either the patient or a health-care professional. The scale contains 35 questions that address different aspects of the anxiety disorder. The first 16 questions focus on the core symptoms of anxiety. The remaining 19 questions address other manifestations and behaviours that are related to anxiety.

Beck Depression Inventory

The Beck Depression Inventory (BDI-II; Beck *et al.* 1996) consists of 21 items. In each item, the patient selects one of four options that best corresponds to his feelings in the last two weeks. The BDI-II correlates around 0.70 with other standardized depression scales, and its internal consistency (Cronbach's alpha) ranges from 0.73 to 0.95 (Domino & Domino 2006). This tool is widely used to assess the current level of depressive symptomatology both in clinical practice and in research. This test has been adapted for the Czech population (Preiss & Vacíř 1999). Ocisková *et al.* (2017) validated this inventory for the Czech population.

Beck Anxiety Inventory

The Beck Anxiety Inventory (BAI; Beck *et al.* 1988) is a 21-item assessment tool. Each item is rated on a four-point Likert scale, which the individual uses to indicate the severity of anxiety symptoms experienced in the past week. Kamarádová *et al.* (2015) validated the Czech version of the BAI. This inventory shows excellent internal consistency (Cronbach's $\alpha = 0.92$; Kamarádová *et al.* 2015).

Clinical Global Impression

The Clinical Global Impression (CGI) is a tool designed to assess the overall severity of a mental disorder. The CGI-O (Clinical Global Impression-Objective) assessment is based on a physician's comprehensive assessment of the patient (Guy 1976). The physician is tasked with recording the intensity of the patient's psychological problems on a seven-point scale. The CGI also has a subjective version (CGI-S), in which the patient assesses his or her overall condition.

Tab. 4. Correlation of basic demographic factors with clinical and psychological factors

	AGE	DISORDER ONSET	DISORDER LENGHT	NUMBER OF HOSPITALIZATIONS
CTQ-emotional abuse	0.02	-0.23 $p < 0.05$	0.16	0.12
CTQ-physical abuse	0.12	-0.03	0.18	-0.05
CTQ-sexual abuse	0.15	0.05	0.11	0.26 $p < 0.05$
CTQ-physical neglect	0.12	-0.14	0.16	-0.04
CTQ-emotional neglect	0.09	-0.05	0.14	0.15
CTQ-total	0.12	-0.13	0.17	0.09
PBI-maternal care	-0.11	0.07	-0.13	-0.08
PBI-maternal control	0.06	-0.10	0.21	-0.09
PBI- paternal care	0.09	0.22 $p = 0.06$	-0.05	-0.07
PBI-paternal control	0.11	0.05	0.12	-0.10
ECR – Anxiety	-0.12	-0.06	-0.07	-0.02
ECR – Avoidance	0.07	-0.03	0.09	0.17
BEST-total	-0.29 $p < 0.05$	-0.26 $p < 0.05$	-0.19	0.03
BEST – TH	-0.28 $p < 0.05$	-0.23 $p < 0.05$	-0.19	-0.00
BEST N-B	-0.23 $p = 0.054$	-0.17	-0.23 $p < 0.05$	-0.05
BEST P-B	0.07	0.18	-0.02	-0.06
CGI-BPD Abandonment	-0.26 $p < 0.05$	-0.36 $p < 0.005$	0.08	0.16
CGI-BPD Unstable relationships	-0.09	-0.03	0.04	0.15
CGI-BPD Identity	-0.18	-0.20	-0.00	0.14
CGI-BPD Impulsivity	0.06	-0.10	0.11	-0.04
CGI-BPD Suicidality and self-harm	-0.16	-0.15	-0.13	0.15
CGI-BPD Affect instability	-0.15	-0.25 $p < 0.05$	-0.02	-0.01
CGI-BPD Emptiness	-0.27 $p < 0.05$	-0.19	-0.04	0.04
CGI-BPD Anger	-0.02	-0.17	0.17	-0.04
CGI-BPD Paranoid ideation	-0.02	-0.04	-0.09	0.14
CGI-BPD TOTAL	-0.27 $p < 0.05$	-0.35 $p < 0.005$	0.00	0.22
DES	-0.31 $p < 0.01$	-0.22 $p = 0.054$	-0.05	0.04
subjCGI	0.02	-0.07	0.17	0.26 $p < 0.05$
Sheehan anxiety scale	0.01	-0.14	0.18	0.17
BAI	0.04	-0.07	0.23 $p = 0.052$	0.17
BDI-II	-0.11	-0.19	-0.06	0.10
ISMI- TOTAL	0.11	-0.07	0.17	0.18
ISMI Alienation	0.28 $p < 0.05$	-0.05	0.17	0.19
ISMI Stereotypes endorsement	0.08	-0.03	0.24 $p < 0.05$	0.08
ISMI Perceived discrimination	0.09	-0.03	0.11	0.28 $p < 0.05$
ISMI Social withdrawal	-0.08	-0.17	0.04	0.17
ISMI Stigma resistance	0.03	0.03	0.07	0.05

Clinical Global Impression – borderline personality disorder

The CGI-BPD (Clinical Global Impression – borderline personality disorder) scale was adapted from the original Clinical Global Impression (CGI) scale. It is designed to assess severity and change after intervention in patients with borderline personality disorder (BPD). It contains ten items assessing nine relevant BPD psychopathological domains, plus an additional global score (Perez *et al.* 2007).

The CGI-BPD has two formats:

- CGI-BPD-S: Assesses current severity.
- CGI-BPD-I: Assesses improvement.

This scale has demonstrated good validity and reliability (α 0.85 and 0.89; CCI: 0.86 and 0.78), adequate sensitivity to change, and a two-factor structure that explains 67.4% of the total variance (Perez *et al.* 2007).

Borderline Evaluation of Severity over Time

The questionnaire abbreviated as BEST is the "Borderline Evaluation of Severity over Time." This tool is designed to assess the severity of borderline personality disorder symptoms over time (Pfohl *et al.* 2009). It comprises several subscales, including:

- BEST-total: Reflects the overall severity of symptoms.
- BEST-TH: Focuses on therapeutic aspects.
- BEST N-B: Assesses negative behavioural manifestations.
- BEST P-B: Evaluate positive behavioural manifestations.

This questionnaire is utilized in both clinical practice and research to monitor changes in the symptomatology of patients with borderline personality disorder. The tool displayed moderate test-retest reliability, high internal consistency, and high discriminant validity. The BEST was also sensitive to clinical change as early as week 4 of the RCT and correlated highly with other measures of illness severity.

Childhood Trauma Questionnaire – short revised

The Childhood Trauma Questionnaire (CTQ-SR) is a retrospective assessment tool for a wide range of traumatic experiences in childhood (Bernstein *et al.* 1997). It was developed as a short, reliable, and valid instrument for assessing experiences of childhood abuse and neglect (Bernstein *et al.* 2003). The CTQ is designed for adolescents and adults. It contains 28 items organized into four factors: physical and emotional abuse, emotional neglect, sexual abuse, and physical neglect (Spinoven *et al.* 2014). The CTQ has demonstrated a Cronbach's alpha of 0.95 for the total scale (Hagborg *et al.* 2022). The CTQ also demonstrated good test-retest reliability for a subgroup ($n = 40$) over a 2- to 8-month period, with an internal correlation for the total scale of 0.88 (Hagborg *et al.* 2022).

Parental Bonding Instrument

The Parental Bonding Instrument (PBI) is an instrument that was developed for the retrospective assessment of basic parenting styles as perceived by the child (Parker *et al.* 1979). This questionnaire consists of two scales: 'nurturing' and 'overprotectiveness' or 'controlling' (Parker *et al.* 1986). In developing the scale, items were generated indicating parental behaviours and attitudes of caring, affection, sensitivity, cooperation, availability, indifference, strictness, punishment, rejection, interference, control, overprotectiveness, and encouragement of autonomy and independence.

Experiences in Close Relationships – Revised

The Experiences in Close Relationship – Revised (ECR-R) questionnaire is an instrument that was developed to assess attachment patterns in different close relationships (Fraley *et al.* 2000). The ECR-R contains 36 items that measure individuals on two attachment subscales: avoidance and anxiety. In general, individuals with high attachment avoidance are uncomfortable with intimacy and seek independence, while individuals with high attachment anxiety tend to fear rejection and abandonment (Fraley *et al.* 2006). The ECR-R has demonstrated good validity and reliability (α 0.85 and 0.89; CCI: 0.86 and 0.78), adequate sensitivity to change, and a two-factor structure that explains 67.4% of the total variance (Fraley *et al.* 2000).

Internalized Stigma of Mental Disorders Scale

The Internalized Stigma of Mental Disorders Scale (ISMI; Ritsher *et al.* 2003) is a 29-item, four-point scale assessment tool. These items measure five domains of internalized stigma (Ritsher & Phelan 2004). These domains include:

- Feelings of alienation and not being a full member of society.
- Level of agreement with stereotypes about people with mental disorders.
- Perception of how the patient has been treated since diagnosis.
- Withdrawal from society.
- Level of resistance to stigma (Boyd *et al.* 2014).

The Czech version of the ISMI scale was standardized by Ociskova *et al.* (2014). This version shows excellent internal consistency (Cronbach's alpha $\alpha = 0.91$; Ociskova *et al.* 2015).

Dissociation Experience Scale

The Dissociation Experience Scale (DES) assesses different dissociative experiences (Bernstein & Putnam 1986). This questionnaire is useful for screening for dissociative disorders, especially dissociative identity disorder (multiple personalities) and dissociative disorders not elsewhere classified. It is also often used in patients with borderline personality disorder (Grambal *et al.* 2016; Prasko *et al.* 2016; Khosravi 2020;

Tab. 5. Aversive childhood events, parenting style, adult attachment, and self-stigma to general psychopathology

	DES	subjCGI	SPRAS	BAI	BDI-II
CTQ-emotional abuse	0.28 $P<0.05$	0.15	0.31 $P<0.01$	0.33 $P<0.005$	0.33 $P<0.005$
CTQ-physical abuse	0.27 $P<0.05$	0.12	0.30 $P<0.01$	0.33 $P<0.005$	0.29 $P<0.05$
CTQ-sexual abuse	0.27 $P<0.05$	0.10	0.17	0.36 $P<0.005$	0.36 $P<0.005$
CTQ-physical neglect	0.18	0.15	0.27 $P<0.05$	0.13	0.25 $P<0.05$
CTQ-emotional neglect	0.16	0.11	0.25 $P<0.05$	0.11	0.15
CTQ-total	0.32 $P<0.01$	0.11	0.36 $P<0.005$	0.32 $P<0.005$	0.41 $P<0.001$
PBI-maternal care	-0.14	-0.05	-0.18	-0.15	-0.16
PBI-maternal control	0.14	0.02	0.02	0.05	0.04
PBI-paternal care	0.01	-0.18	-0.08	-0.02	-0.14
PBI-paternal control	-0.13	-0.04	-0.11	0.06	-0.10
ECR – Anxiety	0.14	0.14	0.34 $P<0.01$	0.22 ($p=0.06$)	0.30 $P<0.01$
ECR – Avoidance	0.04	-0.07	-0.23 ($p=0.052$)	-0.17	0.05
ISMI- TOTAL	0.34 $P<0.005$	0.29 $P<0.05$	0.53 $P<0.0001$	0.53 $P<0.0001$	0.56 $P<0.0001$
ISMI Alienation	0.24 $P<0.05$	0.23 $P<0.05$	0.51 $P<0.0001$	0.46 $P<0.0001$	0.53 $P<0.0001$
ISMI Stereotypes endorsement	0.26 $P<0.05$	0.22 ($p=0.06$)	0.38 $P<0.001$	0.42 $P<0.005$	0.42 $P<0.005$
ISMI Perceived discrimination	0.36 $P<0.05$	0.22 ($p=0.06$)	0.40 $P<0.0005$	0.42 $P<0.0005$	0.43 $P<0.0001$
ISMI Social withdrawal	0.43 $P<0.0001$	0.23 ($p=0.06$)	0.50 $P<0.0001$	0.49 $P<0.0001$	0.49 $P<0.0001$
ISMI Stigma resistance	0.07	-0.26 $P<0.05$	-0.19	-0.18	-0.27 $P<0.05$

Zanarini *et al.* 2023). The DES consists of 28 items that assess the frequency of various dissociative symptoms in the patient's daily life (Bernstein & Putnam 1986). Pathological DES (DES-T) includes more severe dissociative symptoms (DES items 3, 5, 7, 8, 12, 13, 22, and 27) (Waller *et al.* 1996).

Demographic Questionnaire

The demographic questionnaire contains basic data – age, gender, age of onset of mental problems, duration of mental problems, marital status, partnership, education, employment, disability, number of hospitalizations, length of attendance at a psychiatric outpatient clinic, time since last hospitalization, number of psychiatrists visited, and current.

Data processing and analysis methods

All analyses were performed using SPSS statistical software version 26. The data were processed in several steps:

- *Descriptive analysis*: Basic descriptive statistics were processed for all variables, including means, standard deviations, and minimum and maximum values. These data were used to describe the basic characteristics of the sample, such as age, duration of the disorder, number of hospitalizations, and scores on psychological and physiological indicators.
- *Correlation analysis*: Pearson correlation analysis was used to determine the relationships between variables, such as early life experiences, level

of dissociation, self-stigma, attachment, and heart rate variability (HRV). Spearman correlation analysis was used if the variables did not meet the normality distribution.

- *T-tests and analysis of variance (ANOVA)*: To assess differences between patient subgroups.

Statistical significance: Statistical tests were evaluated at a significance level of $p < 0.05$.

Ethics

The studies conducted within the framework of this dissertation follow the latest version of the Declaration of Helsinki and the Principles of Good Clinical Practice (APA 1982; EMEA 2002). The Ethics Committee of the University Hospital Olomouc approved the project on October 14 2014 (decision no. 108/14).

File characteristics

Patients admitted to the department were diagnosed according to ICD-10 (1996) criteria by the admitting psychiatrist from January 1, 2020, to August 31, 2023, according to MINI. Their diagnosis was verified by two other psychiatrists (the head of the department and the head of the clinic (Table 1).

Tab. 6. Adverse childhood events, parenting style, and adult attachment to borderline psychopathology

	BEST-total	fear of abandonment	Unstable relations	Identity	Impulsivity	Suicidality a self-harm	Emotional instability	Feelings of emptiness	Anger	Paranoid	Total score skór
CTQ-emotional abuse	0.35 p < 0.01	0.29 p < 0.05	0.14	0.28 p < 0.05	0.18	0.21	0.08	0.37 p < 0.005	0.22	0.27 p < 0.05	0.41 p < 0.0005
CTQ-physical abuse	0.37 p < 0.005	0.23 p = 0.06	0.14	0.28 p < 0.05	0.22	0.05	-0.02	0.20	0.23 (p = 0.06)	0.12	0.22
CTQ-sexual abuse	0.08	0.01	0.26 p < 0.05	0.13	0.16	0.23	-0.01	0.09	0.03	0.02	0.29 p < 0.05
CTQ-physical neglect	0.17	0.24 p = 0.06	0.06	0.17	0.17	-0.05	0.04	0.21	0.17	0.01	0.18
CTQ-emotional neglect	0.10	0.13	0.00	0.20	-0.01	0.10	0.03	0.28 p < 0.05	-0.11	-0.15	0.19
CTQ-total	0.27 p < 0.05	0.21	0.17	0.26 p < 0.05	0.21	0.19	0.07	0.34 p < 0.01	0.15	0.12	0.37 p < 0.005
PBI-maternal care	-0.14	-0.09	0.12	-0.10	-0.25 p < 0.05	0.16	-0.06	-0.16	0.09	-0.03	-0.10
PBI-maternal control	0.13	0.15	-0.05	-0.04	0.18	-0.01	-0.06	0.02	0.28 p < 0.05	0.09	0.01
PBI- paternal care	-0.13	-0.15	-0.02	-0.09	0.01	0.09	0.05	-0.20	-0.02	0.10	-0.09
PBI- paternal control	0.03	-0.19	0.05	-0.05	-0.06	-0.22	-0.17	0.10	0.06	-0.03	-0.20
ECR – Anxiety	0.43 p < 0.0001	0.37 p < 0.005	0.23 (p = 0.06)	0.26 p < 0.05	-0.00	-0.04	0.11	0.18	0.18	0.17	0.28 p < 0.05
ECR – Avoidance	-0.51 p < 0.0001	-0.23 (p = 0.06)	0.01	-0.04	-0.01	0.07	-0.13	-0.09	-0.06	-0.03	-0.09
ISMI- TOTAL	0.35 p < 0.005	0.25 p < 0.05	0.18	0.33 p < 0.01	0.26 p < 0.05	0.25 p < 0.05	0.12	0.37 p < 0.005	0.25 p < 0.005	0.17	0.44 p < 0.0005
ISMI Alienation	0.25 p < 0.05	0.11	0.18	0.22	0.22	0.17	0.10	0.22	0.20	0.16	0.32 p < 0.01
ISMI Stereotypes endorsement	0.18	0.24 (p = 0.05)	0.16	0.24 (p = 0.05)	0.25 p < 0.05	0.16	0.07	0.23 (p = 0.06)	0.23 (p = 0.06)	0.06	0.32 p < 0.01
ISMI Perceived discrimination	0.30 p < 0.01	0.16	0.17	0.33 p < 0.01	0.19	0.24 (p = 0.05)	0.11	0.41 p < 0.0005	0.19	0.12	0.41 p < 0.0005
ISMI Social withdrawal	0.45 p < 0.0001	0.20	0.23 (p = 0.06)	0.37 p < 0.005	0.20	0.20	0.20	0.40 p < 0.005	0.21	0.26 p < 0.05	0.39 p < 0.01
ISMI Stigma resistance	-0.08	-0.21	-0.08	-0.07	-0.07	0.06	-0.21	-0.05	-0.10	0.03	-0.21

Tab. 7. Adverse events in childhood, parenting style, adult attachment and self-stigma

	Total	Alienation	Agreeing with stereotypes	Experience of discrimination	Social withdrawal	Resistance to stigma
CTQ-emotional abuse	0.44 $p < 0.0001$	0.38 $p < 0.001$	0.36 $p < 0.005$	0.41 $p < 0.0005$	0.43 $p < 0.0001$	0.00
CTQ-physical abuse	0.19	0.16	0.13	0.18	0.22 $p = 0.06$	0.03
CTQ-sexual abuse	0.41 $p < 0.0005$	0.44 $p < 0.0001$	0.24 $p < 0.05$	0.44 $p < 0.0001$	0.32 $p < 0.005$	0.07
CTQ-physical neglect	0.26 $p < 0.05$	0.14	0.26 $p < 0.05$	0.12	0.16	0.31 $p < 0.001$
CTQ-emotional neglect	0.41 $p < 0.0005$	0.29 $p < 0.05$	0.38 $p < 0.001$	0.43 $p < 0.0001$	0.32 $p < 0.005$	-0.18
CTQ-total	0.48 $p < 0.0001$	0.42 $p < 0.0005$	0.36 $p < 0.005$	0.44 $p < 0.0001$	0.43 $p < 0.0001$	-0.10
PBI-maternal care	-0.19	-0.16	-0.19	-0.17	-0.15	0.01
PBI-maternal control	0.07	0.11	0.07	0.11	0.02	0.07
PBI-paternal care	-0.08	-0.01	-0.15	-0.00	-0.04	0.10
PBI-paternal control	0.08	0.08	0.11	0.11	0.08	0.13
ECR – Anxiety	0.46 $p < 0.0001$	0.44 $p < 0.0001$	0.37 $p < 0.005$	0.41 $p < 0.0005$	0.44 $p < 0.0001$	0.02
ECR – Avoidance	0.05	-0.05	-0.03	0.01	0.02	-0.15

Tab. 8. HRV parameters and demographic data

	LF %	HF %	LF/HF	Respiratory rate	LF	HF
Age	0.14	-0.19	0.10	-0.15	-0.13	-0.22($p=0.06$)
Disorder onset	0.11	-0.17	0.16	0.08	0.02	-0.10
Disorder length	0.03	-0.05	-0.02	-0.12	-0.24 $p < 0.05$	-0.19
Number of hospitalizations	-0.05	-0.08	-0.01	-0.08	-0.31 $p < 0.01$	-0.27 $p < 0.05$
CTQ-total	0.48 $p < 0.0001$	0.42 $p < 0.0005$	0.36 $p < 0.005$	0.44 $p < 0.0001$	0.43 $p < 0.0001$	-0.10

RESULTS

Sample description

The study included 75 patients, 9 men and 66 women. Nine had a university education, 30 had a secondary education, 17 had a vocational education, and 19 had a primary education. Fifty-two were single, 12 were married, 11 were divorced, 21 lived with a partner. Other demographic, clinical and psychological variables are listed in Table 2.

Treatment

Pharmacotherapy

The average doses of drugs, converted to the index dose of the basic drug, are in Table 3.

Demographic factors and their relationship to other variables

The relationship between early aversive experiences, parental upbringing influences, adult attachment, psychopathology and self-stigma with age, onset of the disorder, duration and number of hospitalizations is shown in the following table (Table 4).

The severity of borderline symptomatology decreases with age, as shown in the patient-completed BEST questionnaire and the therapist-rated CGI-BPD scale (Table

4). Similarly, the level of dissociation (DES) decreases with age, but feelings of alienation (ISMI Alienation) increase significantly.

Emotional abuse in childhood, assessed by the CTQ questionnaire, negatively correlates with the onset of the disorder (Table 4). On the other hand, paternal care assessed by the PBI questionnaire positively correlates with the age of the disorder's development. The total score of borderline symptomatology assessed by the BEST scale also negatively correlates with both age and the age of onset (Table 6). The earlier the disorder appeared, the higher the scores of clinician-assessed Abandonment, the Affect Instability and Total Clinical Severity of the Disorder on the CGI-BPD scale.

The duration of the disorder negatively significantly correlates only with the BEST N-B subscale and positively, at the border of statistical significance, with total anxiety assessed by the BAI (Table 4). However, the duration of the disorder positively significantly correlates with the agreement with stereotypes in the ISMI self-stigma questionnaire - the longer the patient is ill, the more they identify with the stereotypes about mental disorders.

The total number of hospitalizations is statistically significantly positively correlated with childhood sexual

Tab. 9. HRV parameters and types of aversive events in childhood

	LF %	HF %	LF/HF	Respiratory rate	LF	HF
CTQ-emotional abuse	-0.10	0.13	-0.08	-0.18	0.06	0.08
CTQ-physical abuse	-0.08	0.10	0.01	-0.02	-0.08	-0.03
CTQ-sexual abuse	0.22^S(p = 0.05)	-0.10	0.20	-0.11	-0.06	-0.17
CTQ-physical neglect	0.01	0.03	0.06	-0.21^P(p = 0.06)	0.02	-0.01
CTQ-emotional neglect	-0.09	0.05	0.00	0.03	-0.18	-0.13
CTQ-total	-0.02	0.04	0.00	-0.18	-0.05	-0.03

abuse, assessed by the CTQ questionnaire. This means that the higher the sexual abuse scores a patient has, the more often they are hospitalized (Table 4). The total number of hospitalizations is also statistically significantly positively correlated with the subjective feeling of the overall severity of the disorder and with the experience of discrimination in the ISMI self-stigma questionnaire.

The relationship of adverse childhood events to psychopathology and self-stigma

Another important area that the research focused on was the relationship between adverse events in childhood, psychopathology, and self-stigmatization in adulthood.

Adverse childhood events and severity of psychopathology

The table shows the correlation coefficients and statistical significance of individual correlations between adverse events assessed by the CTQ questionnaire and its subscores, parenting style assessed by the PBI questionnaire subscores, and relationship bonding assessed by the ECR questionnaire subscores (Table 5).

Adverse childhood events in their total score (CTQ-total) are significantly positively correlated with the degree of dissociation (DES), total anxiety (SPRAS and BAI) and the degree of depression (BDI-II). Similarly, the CTQ items Emotional Abuse and Physical Abuse are positively correlated and, except for total anxiety in SPRAS, also sexual abuse (Table 5).

Adverse childhood experiences assessed by CTQ-total are statistically significantly positively correlated with the total score BEST-total, a subjective

assessment of borderline symptomatology by the patient (Table 6). The CTQ-emotional abuse subscale and the CTQ-physical abuse subscale also correlate statistically significantly with the BEST total.

Adverse childhood experiences assessed by the CTQ-total are statistically significantly positively correlated with the total CGI-BPD score assessed by a psychiatrist and with the CGI-BPD subscales Identity and Emptiness (Table 6). Individual items then correlate with different types of childhood abuse or neglect, as can be seen in Table 6.

Adverse childhood events and self-stigma

The total score of childhood adverse events assessed by the CTQ-total questionnaire is statistically significantly positively correlated with the ISMI questionnaire in the Total score and all subscores except the Resistance to Stigma sub-score (Table 7). Similarly, in all subscores except Stigma resistance, the CTQ subscores emotional abuse, physical abuse and emotional neglect are positively correlated, while Physical abuse is positively significantly correlated only with social withdrawal and Physical neglect with the total ISMI score, Stereotype endorsement and Stigma resistance (Table 7).

The relationship between parenting style in childhood and psychopathology

Parenting style and severity of psychopathology

None of the parenting styles showed a correlation with psychopathology assessed by the patient's overall subjCGI subjective anxiety assessment by the SPRAS or BAI, depression by the BDI-II, or dissociation assessed by the DES (Table 5).

Tab. 10. Correlation coefficients between HRV parameters, parenting styles and relationship bonding

	LF %	HF %	LF/HF	Respiratory rate	LF	HF
PBI-maternal care	-0.03	0.07	-0.17	0.06	-0.16	-0.07
PBI-maternal control	0.07	-0.05	0.08	-0.01	0.05	0.00
PBI- paternal care	-0.14	0.08	-0.11	0.16	-0.09	-0.03
PBI- paternal control	0.10	-0.02	0.07	-0.12	0.04	-0.01
ECR – Anxiety	0.12	-0.01	0.07	-0.00	-0.22 p = 0.06	-0.25 p < 0.05
ECR – Avoidance	-0.11	-0.09	-0.13	-0.17	0.27 p < 0.05	0.28 p < 0.05

Parenting style and severity of borderline psychopathology
None of the parenting styles correlated with the patient's overall assessment of borderline symptomatology in the BEST questionnaire (Table 6) or with the clinician's overall assessment of borderline symptomatology in the CGI-BPD scale. However, the PBI-Maternal Care subscale is significantly negatively correlated with the CGI-BPD-Impulsivity subscale, and the PBI-Maternal Control subscale is significantly positively correlated with the CGI-BPD-Anger subscale (Table 6).

Adult attachment and psychopathology

Attachment and severity of general psychopathology

The dimension ECR-Anxiety significantly correlated with total anxiety assessed by the SPRAS, borderline positively with the BAI, and statistically significantly with the level of depression assessed by the BDI-II (Table 5).

Attachment and the severity of borderline psychopathology

The relationship aspects assessed by the ECR-Anxiety dimension are statistically significantly positively correlated with the overall borderline symptomatology assessed by the patient in the BEST-total and the Total Clinician-Assessed Symptom Score in the CGI-BPD, as well as with the Abandonment, Unstable Relationships,

and Identity subscores. The relationship assessed by the ECR-Avoidance questionnaire is statistically significantly negatively correlated with the overall borderline symptomatology assessed by the patient in the BEST-total and with the Fear of abandonment subscore (Table 6).

Attachment and self-stigmatization

The ECR-anxiety subscale assessing the relationship attachment has a statistically significant positive correlation with the total self-stigma score assessed by the ISMI questionnaire and all its subscales except the Stigma resistance subscale (Table 7). The ECR-Avoidance subscale does not correlate with any subscale of the ISMI self-stigma questionnaire or its total score.

Correlations of HRV variables to childhood experiences and psychopathology

HRV and demographic data

Table 8 shows the correlation coefficients and their statistical significance for HRV parameters and basic demographic data. Patient's age negatively correlates at the border of statistical significance only with HF. The onset of the disorder does not correlate significantly with any of the evaluated HRV parameters. The duration of the disorder statistically significantly negatively

Tab. 11. HRV parameters and psychopathology

	LF %	HF %	LF/HF	Respiratory rate	LF	HF
BEST-total	-0.12	0.25 $P < 0.05$	-0.21	-0.08	-0.24 $P < 0.05$	-0.12
BEST – TH	-0.09	0.19	-0.20	0.00	-0.26 $P < 0.05$	-0.12
BEST N-B	-0.18	0.31 $P < 0.01$	-0.22 $P = 0.06$	-0.05	-0.24 $P < 0.05$	-0.10
BEST P-B	-0.05	-0.02	-0.02	0.26 $P < 0.05$	-0.16	-0.11
CGI-BPD Abandonment	0.05	-0.05	0.06	-0.03	-0.18	-0.15
CGI-BPD Unstable relationships	-0.07	0.14	-0.20	-0.33 $P < 0.01$	-0.26 $P < 0.05$	-0.14
CGI-BPD Identity	-0.29 $P < 0.05$	0.41 $P < 0.0005$	-0.36 $P < 0.005$	-0.11	-0.20	0.03
CGI-BPD Impulsivity	0.06	0.10	0.00	-0.24 $P < 0.05$	-0.16	-0.13
CGI-BPD Suicidality and self-harm	0.04	-0.13	0.06	-0.05	-0.10	-0.07
CGI-BPD Affect instability	-0.04	0.03	-0.14	-0.14	-0.31 $P < 0.05$	-0.18
CGI-BPD Emptiness	-0.16	0.19	-0.19	0.02	0.00	0.13
CGI-BPD Anger	0.04	0.06	-0.09	-0.27 $P < 0.05$	-0.25 $P < 0.05$	-0.14
CGI-BPD Paranoid ideation	-0.22	0.10	-0.25 $P < 0.05$	-0.12	-0.18	-0.08
CGI-BPD TOTAL	-0.08	0.11	-0.18	-0.17	-0.17	-0.03
DES	-0.02	0.02	0.04	0.05	0.03	-0.00
subjCGI	0.05	-0.05	0.01	-0.08	-0.33 $P < 0.005$	-0.28 $P < 0.05$
Sheehan Anxiety Scale	-0.03	-0.00	-0.03	-0.04	-0.39 $P < 0.001$	-0.31 $P < 0.01$
BAI	0.10	-0.06	0.01	0.00	-0.24 $P < 0.05$	-0.20
BDI-II	-0.03	0.13	-0.12	-0.13	-0.13	-0.06

Tab. 12. HRV and self-stigma parameters

	LF %	HF %	LF/HF	Respiratory rate	LF	HF
ISMI Alienation	0.15	-0.05	0.08	-0.11	-0.17	-0.22p = 0.053
ISMI Stereotypes endorsement	0.10	0.01	0.08	0.03	-0.14	-0.15
ISMI Perceived discrimination	-0.01	0.02	-0.02	-0.02	-0.23 p < 0.05	-0.20
ISMI Social withdrawal	-0.01	0.01	-0.06	0.12	-0.28 p < 0.05	-0.23 p < 0.05
ISMI Stigma resistance	0.15	-0.12	0.12	-0.23 p < 0.05	-0.06	-0.14
ISMI-Total	0.04	0.01	-0.01	-0.05	-0.18	-0.16

correlates with LF. The number of hospitalizations statistically significantly negatively correlates with LF and HF (Table 8).

HRV and adverse childhood events

The table of correlation coefficients between HRV parameters and adverse childhood events assessed by the CTQ questionnaire shows that CTQ-sexual abuse positively correlates at the level of statistical significance with LF% and CTQ-physical neglect negatively correlates at the level of statistical significance with breathing (Table 9).

HRV and parenting styles

Parenting styles assessed by the PBI questionnaire do not significantly correlate with HRV assessments (Table 10).

HRV and adult attachment

The relationship assessed by the ECR questionnaire negatively correlates with LF in the ECR-Fear item at the border of statistical significance and statistically significantly with HF (Table 10). The ECR-Avoidance item correlates significantly with both HF and LF.

HRV and psychopathology

The table shows the correlations between the assessed HRV parameters and the items assessing the severity of symptomatology (Table 11).

HRV and self-stigma

Statistically significant negative correlations were found between the HRV parameter LF and two components of self-stigma: Perceived discrimination ($p < 0.05$) and Social withdrawal ($p < 0.05$). Similarly, HF also shows a negative correlation between Perceived discrimination and Social withdrawal. Furthermore, a significant negative correlation was found between Stigma resistance and respiratory rate ($p < 0.05$), which may indicate a connection between physiological activation and the ability to resist internalized stigma (Table 12). The total self-stigma index (ISMI TOTAL) correlates negatively with LF and HF, although these correlations

are not statistically significant. The results suggest that higher levels of self-stigma may be associated with lower parasympathetic activation, reflecting a lower autonomic nervous system adaptive capacity (Table 12).

Relationship between psychopharmacology and other factors

Index doses of antidepressants are statistically significantly correlated with the severity of anxiety symptoms assessed in the BAI (Pearson $r = 0.27$; $p < 0.05$), negatively with PBI-maternal care (Pearson $r = -0.25$; $p < 0.05$), positively with Fear of abandonment (Pearson $r = 0.27$; $p < 0.05$), positively with Instability in relationships (Pearson $r = 0.29$; $p < 0.05$), positively with the total score of the CGI-BPD (Pearson $r = 0.32$; $p < 0.05$). Index doses of antidepressants do not correlate with any HRV parameter. Index doses of antipsychotics, anxiolytics, or antiepileptics did not correlate statistically significantly with any of the monitored parameters.

DISCUSSION

The following can be said about the individual hypotheses that we set at the beginning of the research:

(1) The severity of borderline symptomatology decreases with age

The results of this study support the hypothesis that the severity of borderline personality disorder (BPD) symptomatology decreases with age, as shown by both patient self-reports (BEST scale) and clinical assessments (CGI-BPD). This improvement is consistent with long-term clinical studies that suggest that prominent BPD symptoms tend to decrease with age. Sansone & Wiederman (2014) and Valdivieso-Jiménez *et al.* (2018) suggest that age-related hormonal changes may play a role in alleviating some of the characteristic symptoms of BPD. This theory suggests that the decline in symptoms with age may be the result of a natural decline in levels of certain hormones, such as testosterone, which are associated with impulsivity and aggression. Studies by Zanarini *et al.* (2024) and Stepp *et al.* (2012) have shown that older adults with BPD often show less

severe symptom intensity compared to younger age groups, with a particularly marked decrease in impulsive and suicidal behaviour. This decrease in symptomatology is interpreted as a result of the maturation of brain structures associated with emotional regulation and decision-making (Paris 2003). This trend may also be explained by the fact that interpersonal conflict management and relationship problem-solving skills improve with age.

(2) The earlier onset of the disorder is related to emotional abuse in childhood

The results of the study show a significant negative correlation between emotional abuse in childhood and earlier onset of BPD symptomatology. The more intense emotional abuse patients report in childhood, the earlier they develop BPD symptoms. This finding is consistent with the results of some studies that emphasize the importance of early traumatic experiences in the aetiology of BPD. Schore (2011) interprets this as meaning that emotional abuse in childhood may impair the development of brain structures associated with emotion regulation, which increases the susceptibility to developing BPD in early adulthood. Agrawal *et al.* (2004), in their review, find that emotional abuse and insecure attachment in childhood are significant risk factors for the development of emotion dysregulation and maladaptive relationship patterns.

(3) The earlier onset of the disorder is related to more severe symptomatology

The results of this study support the hypothesis that earlier onset of borderline personality disorder (BPD) is associated with more severe symptomatology, as evidenced by both patient assessments (BEST scale) and clinical assessments (CGI-BPD). This finding suggests that early onset of BPD may be associated with more severe symptoms of the disorder. This relationship may be explained by the fact that individuals with early onset BPD are exposed to risk factors for longer and have less developed emotional coping mechanisms, which may lead to the development of more intense and difficult-to-control symptoms. Similar results were observed in a study (Prasko *et al.* 2016) in patients with depression, where the earlier onset of the disorder and its longer duration were shown to be predictors of a chronic course and higher severity of symptomatology in adulthood. Furthermore, the study by Battle *et al.* (2004) points out that individuals with early onset BPD have more frequent episodes of depression, anxiety and risky behaviour, which contributes to a higher severity of overall symptomatology. This phenomenon may result from long-term emotional dysregulation and ineffective stress-coping mechanisms. Similarly, Paris (2003) suggests that a longer period of exposure to negative factors in individuals with early onset BPD may lead to a chronic course of the disorder, a deeper entrenchment of maladaptive

ways of coping with emotions and a higher resistance of symptoms to treatment.

(4) Higher levels of dissociation are related to sympathetic activity

The hypothesis that higher levels of dissociation are related to sympathetic nervous system activation measured by HRV was not confirmed in this study. Dissociation, assessed by the DES scale, showed no significant correlation with HRV parameters. Autonomic activation of the sympathetic system may not be a direct mechanism of dissociative states in patients with BPD. This finding is in contradiction with some previous findings that have assumed a connection between dissociation and increased autonomic reactivity, especially in the context of reaction to trauma (Koenig *et al.* 2021; Sigrist *et al.* 2021). Lanius *et al.* (2006) suggest that dissociation in patients with post-traumatic stress disorder (PTSD) tends to be associated with a hyperreactive state.

On the contrary, the results of our study suggest that dissociation in BPD may have a different nature than dissociation observed in PTSD, which may indicate mechanisms other than direct sympathetic activation. Krause-Utz *et al.* (2014) point out that dissociative states in BPD do not necessarily induce increased sympathetic activation but may rather be associated with a disconnection or suppression of emotional responses. This state would correspond to a hypoactive rather than hyperactive sympathetic system, which could explain the absence of a relationship between dissociation and HRV parameters in our study. This finding is also consistent with Porges' (2007) polyvagal theory, which suggests dissociation may be an adaptive response through parasympathetic rather than sympathetic activation, especially in cases where threatening situations are perceived as intractable. This would imply that dissociation in BPD may be regulated by neurophysiological mechanisms other than autonomic activation of the sympathetic nervous system, which explains the absence of the expected correlation between dissociation and HRV parameters (Austin *et al.* 2007; Kuo 2016).

(5) Adverse childhood experiences are related to sympathetic activity

The study did not significantly find a correlation between HRV parameters and adverse childhood experiences. However, the weak correlation between the percentage of low-frequency oscillations (LF%) and experience of sexual abuse suggests a possible trend that could be further explored in future studies. Also, the polyvagal system theory of Porges (2007) may also be relevant, suggesting that trauma may cause dysregulation through the parasympathetic rather than the sympathetic system, which may be the reason why we did not observe a direct correlation between HRV parameters and aversive experiences. The impact of trauma on autonomic dysregulation is more complex and may

involve complex adaptive responses that are not always associated with increased sympathetic activation.

(6) Adverse childhood experiences are related to more severe symptomatology.

The results of our study support the hypothesis that adverse childhood experiences, particularly emotional and physical abuse and neglect, are associated with more severe BPD symptomatology. The positive correlations between CTQ scores and clinical indicators such as anxiety (assessed by the SPRAS and BAI scales), depression (BDI-II), dissociation (DES), and severity of borderline symptoms (BEST-total and CGI-BPD) highlight the importance of early trauma for the later development of BPD.

Similar to our study, Lopez-Villatoro *et al.* (2023) found that high CTQ scores were significantly correlated with more intense symptoms of depression and anxiety in adulthood. Edwards *et al.* (2021) and colleagues report that repeated exposure to childhood abuse may impair the ability to regulate emotions and cope with stress, a key factor in the aetiology of BPD.

Another important contribution of our study is the proven connection between adverse childhood experiences and the severity of dissociation (assessed with the DES scale). This finding is in line with a study by Schimmenti *et al.* (2014), which showed that people with high levels of dissociation often have a history of early emotional or physical abuse. Dissociation can then function as a defence mechanism against insurmountable trauma, which is why it often occurs in patients with BPD.

Also, Ditrich *et al.* (2021) and Krause-Utz *et al.* (2022) have shown that childhood trauma is closely associated with more intense anxiety and depression, leading to more pronounced clinical symptomatology and potentially complicating treatment.

(7) Adverse childhood experiences are related to higher levels of self-stigma

Our research has shown that higher levels of childhood adverse experiences, as measured by the CTQ, are associated with higher levels of self-stigma, as assessed by the ISMI. This result suggests that childhood traumas, such as emotional and physical abuse or neglect, can significantly contribute to the internalization of stigmatizing attitudes towards themselves. This majorly impacts patients' self-perception and can complicate their therapeutic process.

The results of our study are also consistent with the conclusions of Boyd *et al.* (2014), who found that self-stigma may be a direct consequence of early traumatic experiences and that individuals with a history of abuse are particularly vulnerable to internalizing negative beliefs about themselves.

A significant contribution of our study also lies in identifying specific domains of self-stigma, such as social withdrawal and stereotype acceptance, that

correlate with high CTQ scores. This relationship supports the findings of Schomerus *et al.* (2011), who demonstrated that individuals with high levels of early trauma are more likely to withdraw from social interactions and adopt negative stereotypes associated with mental disorders.

(8) Maternal care in childhood is related to sympathetic activity

Our results did not demonstrate a statistically significant relationship between maternal caregiving in childhood and heart rate variability (HRV) parameters, suggesting that the relationship between parenting and autonomic regulation may not be straightforward. This result is inconsistent with previous findings suggesting that quality parental caregiving, particularly maternal caregiving, may promote the development of stress-coping skills and influence autonomic regulation. However, our findings also support theories that specific manifestations of BPD, such as emotional dysregulation and increased impulsivity, may interfere with the direct influence of early relationship bonds on the autonomic system (Crowell *et al.* 2009). Crowell and colleagues found that while the quality of parental caregiving influences stress-coping skills in most populations, this relationship is more complex in BPD patients due to significant emotional and relational instability that may reduce sensitivity to parental influences.

(9) Attachment anxiety is related to sympathetic activity.

Our results did not find clear evidence for the hypothesis that attachment anxiety is directly related to sympathetic activation. Although a weak trend was found between the attachment anxiety scale (ECR-anxiety) and LF, it did not reach statistical significance, suggesting that sympathetic activation in patients with borderline personality disorder (BPD) is not influenced by attachment anxiety. This result is consistent with some previous studies showing that the influence of attachment anxiety on the autonomic nervous system (ANS) may be indirect and influenced by other factors (Mikulincer & Shaver 2019). However, we found a significant correlation between the ECR-avoidance scale and both LF and HF, suggesting a possible different physiological reactivity associated with attachment avoidance compared to attachment anxiety. This result corresponds with a study by Diamond *et al.* (2008), which showed that individuals with avoidant attachment show increased ANS activation in response to interpersonal stressors. The attachment avoidance style is often associated with suppressing emotional responses, which may increase sympathetic activation during interpersonal conflict or emotional stress (Diamond *et al.* 2008; Roisman *et al.* 2007).

Also important is the relationship between ECR-fear and HF, which showed a negative statistically significant correlation. This result could indicate that in

individuals with BPD and attachment anxiety, parasympathetic activity (represented by HF) is reduced, which may be related to their reduced ability to relax. This finding is consistent with the work of Maunder and Hunter (2001), who found that anxious attachment is associated with lower heart rate variability and overall lower parasympathetic activity, which may be a consequence of chronic stress associated with fears of rejection and separation.

In conclusion, while our research did not demonstrate a direct relationship between attachment anxiety and sympathetic activation, the results suggest a more complex relationship between different attachment styles and autonomic regulation. Attachment avoidance may be associated with increased ANS activation, whereas attachment anxiety may contribute to decreased parasympathetic activity. These differences highlight the need for further research on the effects of different attachment styles on the ANS in patients with BPD.

(10) The level of anxiety is related to sympathetic activity

Our results support the hypothesis that anxiety levels are related to sympathetic activation, as evidenced by the negative correlation between LF (low-frequency components of HRV) and anxiety symptom severity. This result suggests that in patients with borderline personality disorder (BPD), sympathetic activation is significantly linked to anxiety levels, which is consistent with previous studies showing that high sympathetic activation is a typical manifestation of anxiety disorders (Thayer *et al.* 2000).

Thayer and Lane (2000), in their theory of "neurovisceral integration", propose that dysregulation between brain structures responsible for emotional processing and the autonomic nervous system (ANS) contributes to anxiety symptoms. Lower LF may indicate an impaired ability to adaptively change heart rate in response to emotional or environmental stimuli, leading to increased anxiety and stress reactivity (Thayer *et al.* 2000; Appelhans & Luecken, 2006).

(11) The level of anger is related to the frequency of breathing

The study's results support the hypothesis that anger levels are related to breathing patterns, as evidenced by a significant negative correlation between respiratory rate and anger levels. This relationship suggests that intense anger may slow breathing rates, which is consistent with previous studies investigating the effects of emotions on physiological functions (Gross & Levenson, 1997). A decrease in breathing rate during anger may be part of a physiological response aimed at managing emotional tension, or it may indicate attempts to suppress this tension.

Our results suggest that breathing patterns may indicate emotional tension and are linked to autonomic

responses to emotional arousal. This finding supports the idea that breathing calming techniques, including breath control and mindfulness, could be effective in treating patients with BPD and contribute to their ability to better manage negative emotions such as anger.

(12) The level of specific borderline symptomatology is related to sympathetic activity

Our finding that altered sympathetic activation is associated with more severe symptoms of borderline personality disorder (BPD) underscores the importance of physiological mechanisms in the expression of emotional dysregulation that is common in this population. The significant negative correlation between LF and borderline symptomatology, as assessed by patients (BEST questionnaire) and clinicians (CGI-BPD), reflects a specific link between autonomic dysregulation and the intense emotions or interpersonal problems experienced by these patients.

This finding is consistent with research showing that patients with BPD exhibit increased sympathetic reactivity in response to emotional stressors. For example, a study by Herpertz *et al.* (1999) showed that patients with BPD exhibit higher sympathetic responses to emotional stimuli than controls. Similarly, Fitzpatrick & Kuo (2016) found that the autonomic nervous system of patients with BPD often responds more intensely to fear- and anger-evoking stimuli, which may contribute to their persistent emotional instability and impulsivity. This association of autonomic activation with specific symptomatology highlights the need to focus on physiological regulation as part of therapy for patients with BPD.

(13) Attachment anxiety is related to the severity of symptomatology

Our results support the hypothesis that attachment anxiety is significantly related to the intensity of BPD symptoms. The significant correlations between attachment anxiety, the severity of anxiety and depression symptoms, and specific borderline symptoms (e.g., Fear of abandonment, relationship instability, identity issues) indicate that relationship patterns play a crucial role in the manifestation of BPD.

This finding is consistent with research showing that patients with attachment anxiety tend to have higher emotional reactivity and difficulties in interpersonal relationships. Mikulincer and Shaver (2019) report that individuals with anxious attachment are particularly sensitive to signs of rejection and have a strong tendency to seek reassurance and support, which can lead to impulsive reactions and significant relationship instability in the context of BPD. This mechanism may contribute to the development and maintenance of BPD symptoms.

These results suggest that working on relationship skills may be key to reducing emotional reactivity and improving overall functioning in patients with BPD.

(14) The level of self-stigma is related to the severity of symptomatology

The results support the hypothesis that higher levels of self-stigma are associated with more severe borderline personality disorder (BPD) symptomatology. Significant correlations between total self-stigma scores and severity of borderline symptoms (assessed both by patients using the BEST and clinically using the CGI-BPD) suggest that self-stigma may be a major factor reinforcing emotional dysregulation and perceptions of self-inadequacy and isolation.

This finding is consistent with research by Corrigan *et al.* (2006), who found that self-stigma can lead to lower self-esteem and reduced efficacy in coping with symptoms.

Moreover, a study by Ritsher *et al.* (2003) showed that self-stigma not only affects overall psychological health but also promotes social isolation, which can amplify negative relationship patterns and BPD symptoms such as feelings of alienation and paranoid tendencies. This isolation may prevent patients from developing supportive interpersonal relationships that could help stabilize their emotional state.

Based on these findings, it is clear that reducing self-stigma is an important therapeutic goal for patients with BPD.

CONCLUSIONS

This study confirms the significant relationships between adverse childhood experiences, adult attachment, self-stigma, psychopathology, and autonomic functions in patients with BPD. The results suggest that the severity of symptomatology decreases with age, which may be related to the natural course of symptom reduction, supported by increasing experience and skills in emotional regulation and interpersonal relationships. The connection between early traumatic experiences, especially emotional abuse, and the early onset and higher intensity of BPD symptomatology indicates the need for targeted therapeutic interventions aimed at processing trauma.

Another key finding is the relationship between attachment anxiety and symptom severity, which confirms the importance of attachment patterns and BPD manifestations. Patients with attachment anxiety show higher emotional dysregulation and intensification of BPD symptomatology, which supports the need for therapeutic work aimed at correcting these patterns. The results of the study also confirm the importance of self-stigma, which worsens the psychological state of patients and complicates treatment. Reducing self-stigma may promote a positive self-concept and enhance the effectiveness of therapy.

Although no clear relationship has been found between childhood aversive experiences and autonomic dysregulation, the correlation of heart rate with attachment and the evidence of a link with anxiety or

breathing during anger indicate a complex relationship that likely involves multiple factors, such as coping mechanisms and the specifics of traumatic experiences. The significant association of autonomic dysregulation with emotional manifestations confirms that physiological activation plays a significant role in emotional processing in BPD, with increased sympathetic activity being associated with more severe symptomatology.

This study underscores the importance of a comprehensive approach to the treatment of BPD that considers the influence of early experiences, attachment patterns, and self-stigma as key factors. Therapeutic interventions targeting these areas, including working with trauma, changing attachment patterns, and reducing self-stigma, could improve therapeutic outcomes and reduce distressing symptoms of BPD.

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