

COMMENTARY TO HABILITATION THESIS

Behavioral and neural characteristics and targeted treatments of borderline personality disorder

Pavla Horká Linhartová

Brief characterization of the investigated matter

Borderline personality disorder (BPD) is a severe mental disorder associated with intense and unstable emotional experiencing, impaired psychosocial functioning, frequent impulsive behaviors including self-harming and suicidal behaviors, and high healthcare utilization. Despite its prevalence and clinical significance, BPD has long been associated with considerable stigma and limited availability of effective treatment. Contemporary theoretical models conceptualize BPD primarily as a disorder of emotion dysregulation comprising from intense emotions and lack of healthy emotion regulation skills. Impulsive behaviors, interpersonal problems or cognitive difficulties directly stem from emotion dysregulation. Increasing evidence suggests that emotion dysregulation is associated with specific behavioral and neural mechanisms, including disturbances in emotional processing and regulation, cognitive and behavioral control, social cognition, or self-referential processing. The studies included in this habilitation thesis investigate behavioral and neural characteristics of BPD and their implications for treatment. The work integrates psychological, psychiatric, and neuroscientific perspectives and aims to contribute to the development and implementation of targeted evidence-based interventions for patients with BPD.

Objectives of the work

The primary objective of the research included in this habilitation thesis was to improve the understanding of mechanisms underlying emotional and behavioral dysregulation in BPD, to translate this knowledge into effective clinical interventions and support development and dissemination of different means of effective treatment.

The first objective was to investigate impulsivity as one of the central manifestations of BPD. Particular attention was devoted to examining whether impulsivity represents a unitary construct or a multidimensional phenomenon and whether different dimensions of impulsivity are associated with distinct psychological mechanisms across different diagnostic groups.

The second objective was to investigate neural correlates of emotional and social processing in patients with BPD using functional magnetic resonance imaging (fMRI). These studies aimed to examine whether the emotion dysregulation model of BPD is supported by neuroimaging findings and to identify neural mechanisms that could serve as treatment targets.

The third objective was to implement and evaluate innovative evidence-based interventions focused on emotion regulation enhancement. These interventions included

Dialectical behavior therapy (DBT), fMRI neurofeedback, and repetitive transcranial magnetic stimulation (rTMS). A further goal was to contribute to the dissemination and development of specialized BPD treatment within the Czech healthcare system.

Employed methodologies

The research combined clinical, behavioral, neuropsychological, neuroimaging, and interventional methodologies.

Behavioral studies examined multiple dimensions of impulsivity using standardized self-report questionnaires and computerized behavioral tasks assessing inhibitory control, impulsive decision making, and executive functioning in neutral and emotional contexts. Patients with BPD were compared with healthy controls and with other clinical populations characterized by high impulsivity, including patients with attention-deficit/hyperactivity disorder (ADHD) and Parkinson's disease.

Neuroimaging studies employed functional magnetic resonance imaging to investigate neural correlates of emotional experiencing and social exclusion processing. Additional, structural measures of brain morphology and physiological measures, including heart rate variability, were incorporated to provide a more comprehensive characterization of emotional processing in BPD.

Interventional studies focused on several methods of targeted emotion dysregulation treatment. These included implementation of a comprehensive Dialectical Behavior Therapy program, systematic investigation of fMRI neurofeedback as a possible method of voluntary regulation of brain activity associated with emotion regulation, and studies examining behavioral and neural effects of prefrontal repetitive transcranial magnetic stimulation.

Obtained results

The initial behavioral studies demonstrated that impulsivity is a multidimensional construct comprising several relatively independent dimensions. Patients with BPD exhibited elevated impulsivity primarily in emotional domains, particularly negative urgency, defined as the tendency to act impulsively under the influence of negative emotions. In contrast to patients with ADHD, individuals with BPD did not show substantial impairments in cognitive functioning or inhibitory control during emotionally neutral tasks. These findings indicate that impulsive behavior in BPD is primarily driven by emotional dysregulation rather than by cognitive deficits. Further analyses demonstrated that negative urgency was associated with clinically important outcomes, including suicide attempts and psychiatric hospitalizations. These findings identified emotional impulsivity as a key treatment target in BPD.

Neuroimaging studies provided additional support for the emotion dysregulation model. Current meta-analytic evidence, together with findings from studies conducted at our department, indicates abnormalities in neural systems involved in emotional processing, emotion regulation, social cognition, and self-referential thinking. Patients with BPD experienced greater emotional distress during social interactions and showed altered hippocampal responses during social exclusion. The findings also highlighted the potential role of trauma-related neural alterations in the pathophysiology of BPD.

The translational component of the research focused on implementation of targeted treatments. In 2019, the first comprehensive healthcare-based DBT program in the Czech

Republic was established at our department. Since then, more than 135 patients have successfully completed the program, and our research contributed to successful dissemination of DBT in the Czech Republic during the past years.

Additional work focused on innovative neurobiological interventions. A systematic review summarized the current state of fMRI neurofeedback research in emotion regulation and contributed to the implementation of this methodology in BPD research. Pilot studies of prefrontal rTMS demonstrated beneficial effects on BPD symptoms and functional brain connectivity, leading to the initiation of a larger controlled clinical trial investigating rTMS both as a standalone intervention and as an augmentation strategy for psychotherapy for which we obtained a grant project.

Applicant's contribution

The applicant initiated and coordinated a long-term research program focused on behavioral and neural mechanisms of borderline personality disorder and their translation into clinical practice. She participated in the conception, design, implementation, analysis, and publication of studies investigating impulsivity, emotion regulation, neuroimaging correlates, and treatment outcomes in BPD.

A major contribution of the applicant consists in establishing a comprehensive research and clinical program dedicated to BPD at the Department of Psychiatry, University Hospital Brno. This included implementation of the first comprehensive healthcare-based DBT program in the Czech Republic, initiation of international collaborations with leading European research centers, implementation of innovative neuroimaging and neuromodulation methods, and successful acquisition and coordination of multiple research grants.

Beyond scientific contributions, the applicant has substantially contributed to the dissemination of evidence-based treatment for BPD in the Czech Republic, establishment of the Czech DBT professional community, and development of new specialized treatment programs. These activities represent a direct translation of research findings into routine clinical practice and have contributed to improving the availability and quality of care for patients with BPD.

Bibliographic record of published scientific results included in the habilitation thesis

Accessibility and classifications

[1] **LINHARTOVA, Pavla**, Jan SIRUCEK, Anastasia EJOVA, Richard BARTECEK, Pavel THEINER and Tomas KASPAREK. Dimensions of Impulsivity in Healthy People, Patients with Borderline Personality Disorder, and Patients with Attention-Deficit/Hyperactivity Disorder. *Journal Of Attention Disorders* [online]. 2021, **25**(4), 584–595. ISSN 1557-1246. Available at: doi:10.1177/1087054718822121

Original article, IF = 3,196; PSYCHOLOGY, DEVELOPMENTAL Q2

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
80	20	70	40

[2] **LINHARTOVA, Pavla** **(corresponding author)**, Adela LATALOVA, Richard BARTECEK, Jan SIRUCEK, Pavel THEINER, Anastasia EJOVA, Pavlina HLAVATA, Barbora KOSA, Barbora JERABKOVA, Martin BARES and Tomas KASPAREK. Impulsivity in patients with borderline personality disorder: a comprehensive profile compared with healthy people and patients with ADHD. *Psychological Medicine* [online]. 2020, **50**(11, Article Pii S0033291719001892), 1829–1838. ISSN 1469-8978. Available at: doi:10.1017/S0033291719001892

Original article, IF = 7,723; PSYCHIATRY Q1

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
80	20	70	40

[3] BARTECEK, Richard, Jana HORINKOVA, **Pavla LINHARTOVA** and Tomas KASPAREK. Emotional impulsivity is connected to suicide attempts and health care utilization in patients with borderline personality disorder. *General Hospital Psychiatry* [online]. 2019, **56**, 54–55. ISSN 1873-7714. Available at: doi:10.1016/j.genhosppsych.2018.11.008

Letter to editor (including original data analysis), IF = 2,860; PSYCHIATRY Q2

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
80	10	30	40

[4] HLAVATA, Pavlina, **Pavla LINHARTOVA**, Rastislav SUMEC, Pavel FILIP, Miroslav SVETLAK, Marek BALAZ, Tomas KASPAREK and Martin BARES. Behavioral and Neuroanatomical Account of Impulsivity in Parkinson's Disease. *Frontiers In Neurology* [online]. 2020, **10**(1338, Article 1338). ISSN 1664-2295. Available at: doi:10.3389/fneur.2019.01338

Original article, IF = 4,003; NEUROSCIENCES Q2

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	20	30	30

[5] JURICKOVA, Veronika, **Pavla LINHARTOVA**, Petr ADAMEK, Andrea NICHTOVA, Jakub FIGUEROA, Marek PAV, Marek PREISS and Jan VEVERA. Behavioral inhibition in neutral and emotional contexts in acutely violent patients with schizophrenia spectrum disorders. *Current Psychology* [online]. 2023, **42**(28), 24088–24096. ISSN 1936-4733. Available at: doi:10.1007/s12144-022-03415-1

Original article, IF = 2,500; PSYCHOLOGY, MULTIDISCIPLINARY Q2

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
5	30	40	30

[6] RADIMECKA, Monika, Adela LATALOVA, Martin LAMOS, Martin JANI, Patrik BARTYS, Alena DAMBORSKA, Pavel THEINER and **Pavla LINHARTOVA**. Facial emotion processing in patients with borderline personality disorder as compared with healthy controls: an fMRI and ECG study. *Borderline Personality Disorder And Emotion Dysregulation* [online]. 2024, **11**(1, Article 4). ISSN 2051-6673. Available at: doi:10.1186/s40479-024-00245-4

Original article, IF = 2,700; PSYCHIATRY Q2

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	80	30	80

[7] LATALOVA, Adela, Monika RADIMECKA, Martin LAMOS, Martin JANI, Alena DAMBORSKA, Pavel THEINER, Eliska BARTECKOVA, Patrik BARTYS, Helena VLCKOVA, Katarina SKOLIAKOVA, Tomas KASPAREK and **Pavla LINHARTOVA**. Neural correlates of social exclusion and overinclusion in patients with borderline personality disorder: an fMRI study. *Borderline Personality Disorder And Emotion Dysregulation* [online]. 2023, **10**(1, Article 35). ISSN 2051-6673. Available at: doi:10.1186/s40479-023-00240-1

Original article, IF = 4,000; PSYCHIATRY Q1

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
30	80	30	80

[8] THEINER, Pavel, **Pavla LINHARTOVA** and Adela LATALOVA. Dialectical behavioral therapy; [DIALEKTICKA BEHAVIORALNI TERAPIE]. *Psychoterapie*. 2021, **15**(1), 23–29. ISSN 1802-3983. Available at:

<https://journals.muni.cz/psychoterapie/article/view/14209/12016>

Review article (Czech)

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
40	40	40	60

[9] LINHARTOVA, Pavla *(corresponding author)*, Adela LATALOVA, Barbora KOSA, Tomas KASPAREK, Christian SCHMAHL and Christian PARET. fMRI neurofeedback in emotion regulation: A literature review. *Neuroimage* [online]. 2019, **193**, 75–92. ISSN 1095-9572. Available at: doi:10.1016/j.neuroimage.2019.03.011

Review article, IF = 5,902; NEUROSCIENCES Q1

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
75	30	75	30

[10] SVERAK, Tomas, Pavla LINHARTOVA *(contribution author)*, Martin GAJDOS, Matyas KUHN, Adela LATALOVA, Martin LAMOS, Libor USTOHAL and Tomas KASPAREK. Brain Connectivity and Symptom Changes After Transcranial Magnetic Stimulation in Patients With Borderline Personality Disorder. *Frontiers In Psychiatry* [online]. 2022, **12**(770353, Article 770353). ISSN 1664-0640. Available at: doi:10.3389/fpsyt.2021.770353

Original article, IF = 4,700; PSYCHIATRY Q2

Experimental work (%)	Supervision (%)	Manuscript (%)	Research direction (%)
40	40	40	40