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Neurobiology of Self-Harm in Borderline Personality Disorder

STAR
SELF-INJURY · TREATMENT ASSESSMENT RECOVERY

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Non-suicidal self-injury (NSSI) in BPD

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- **Non-suicidal self injury** (NSSI): deliberate destruction of body tissue without suicidal intent (APA, 2013)

- 50-80% of individuals with Borderline Personality disorder (Snir, Rafaeli, Gadassi, Berenson, & Downey, 2015) and 46.2-60% of mentally ill youth engage in NSSI (Groschwitz et al., 2015; Kaess et al., 2013)

- Long lasting damage for concerned individuals, higher risk for suicidal behavior (Guan, Fox, & Prinstein, 2012) and high costs for health care system (Wunsch, Kliem, & Kroger, 2014)

Overview

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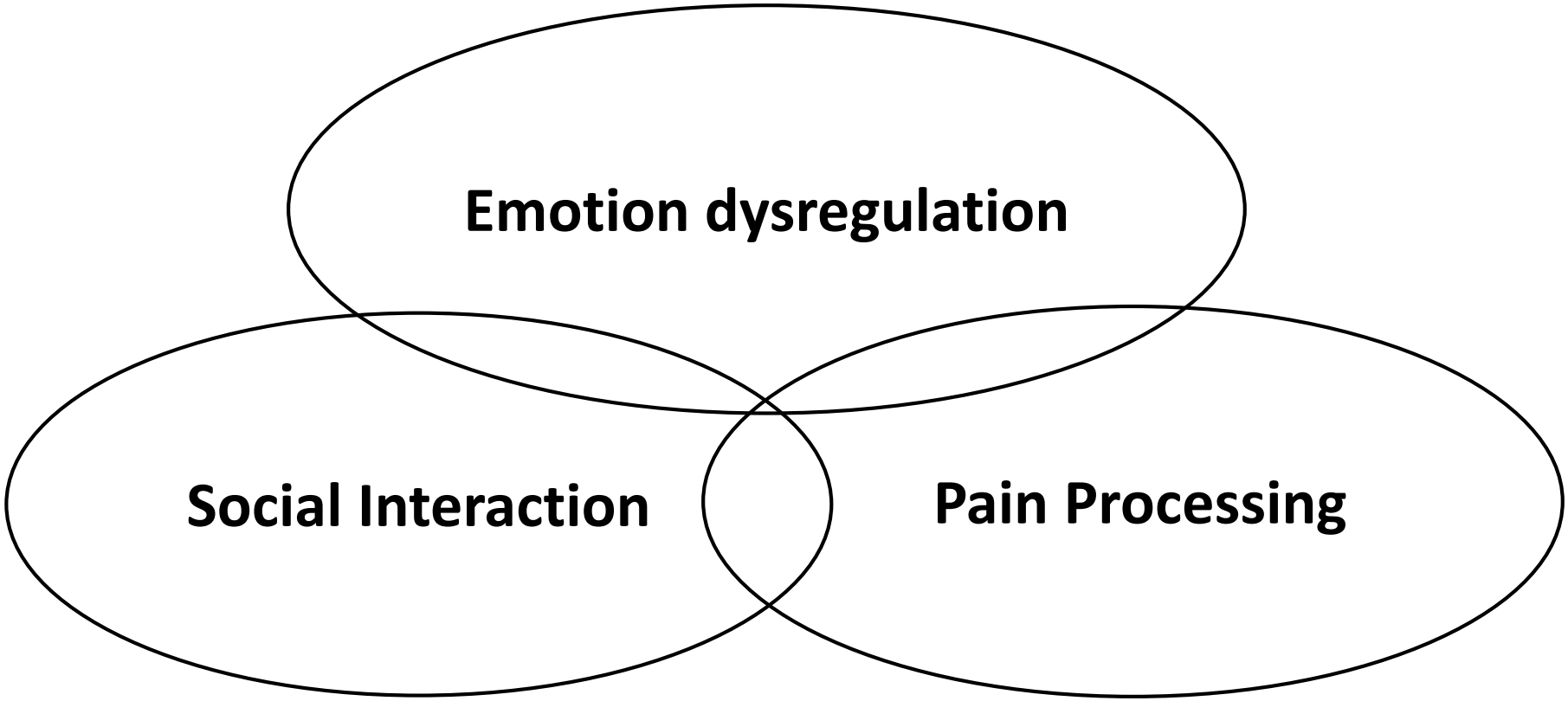

Non-suicidal self-injury in adolescence

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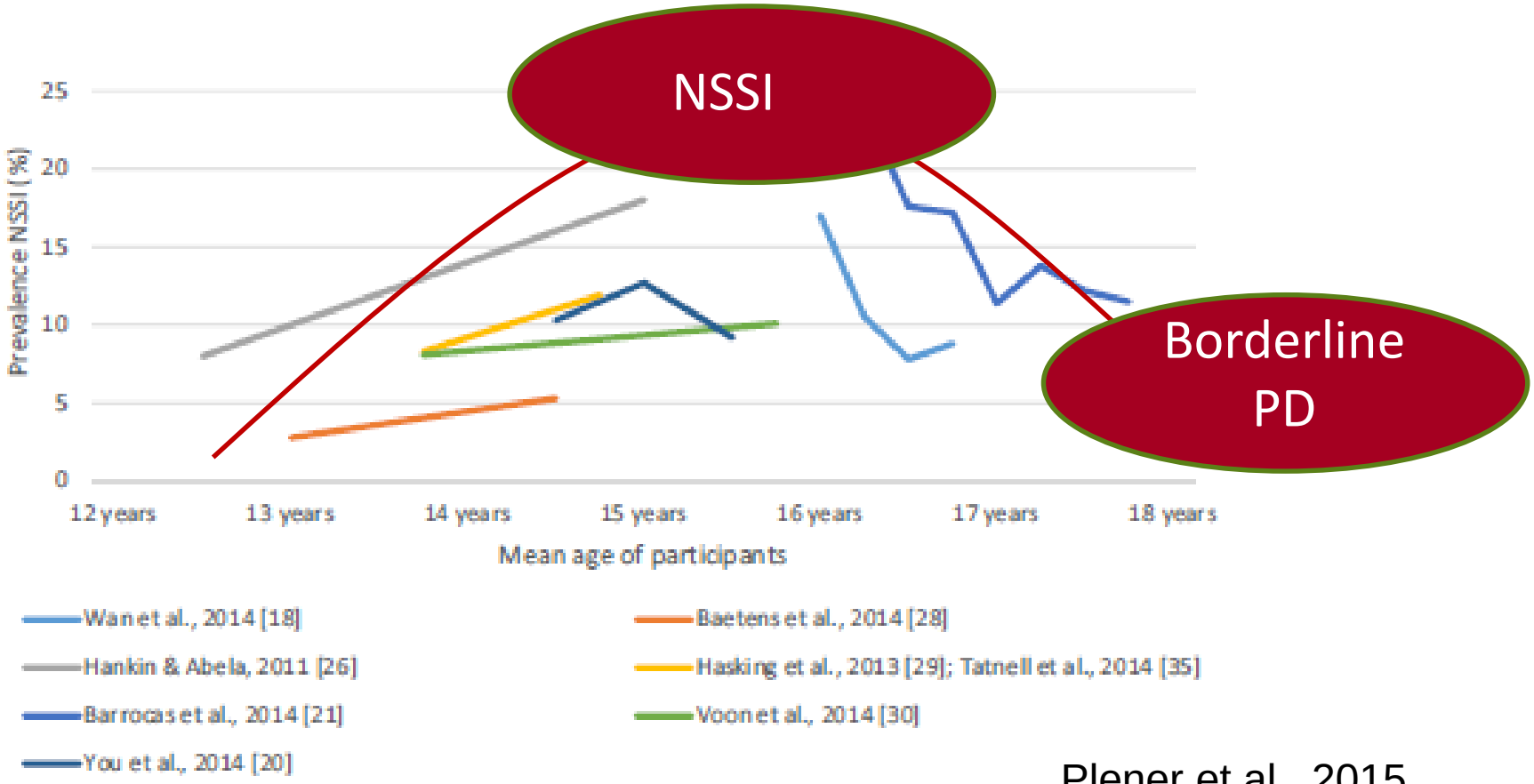

Plener et al., 2015

Motives for NSSI in BPD

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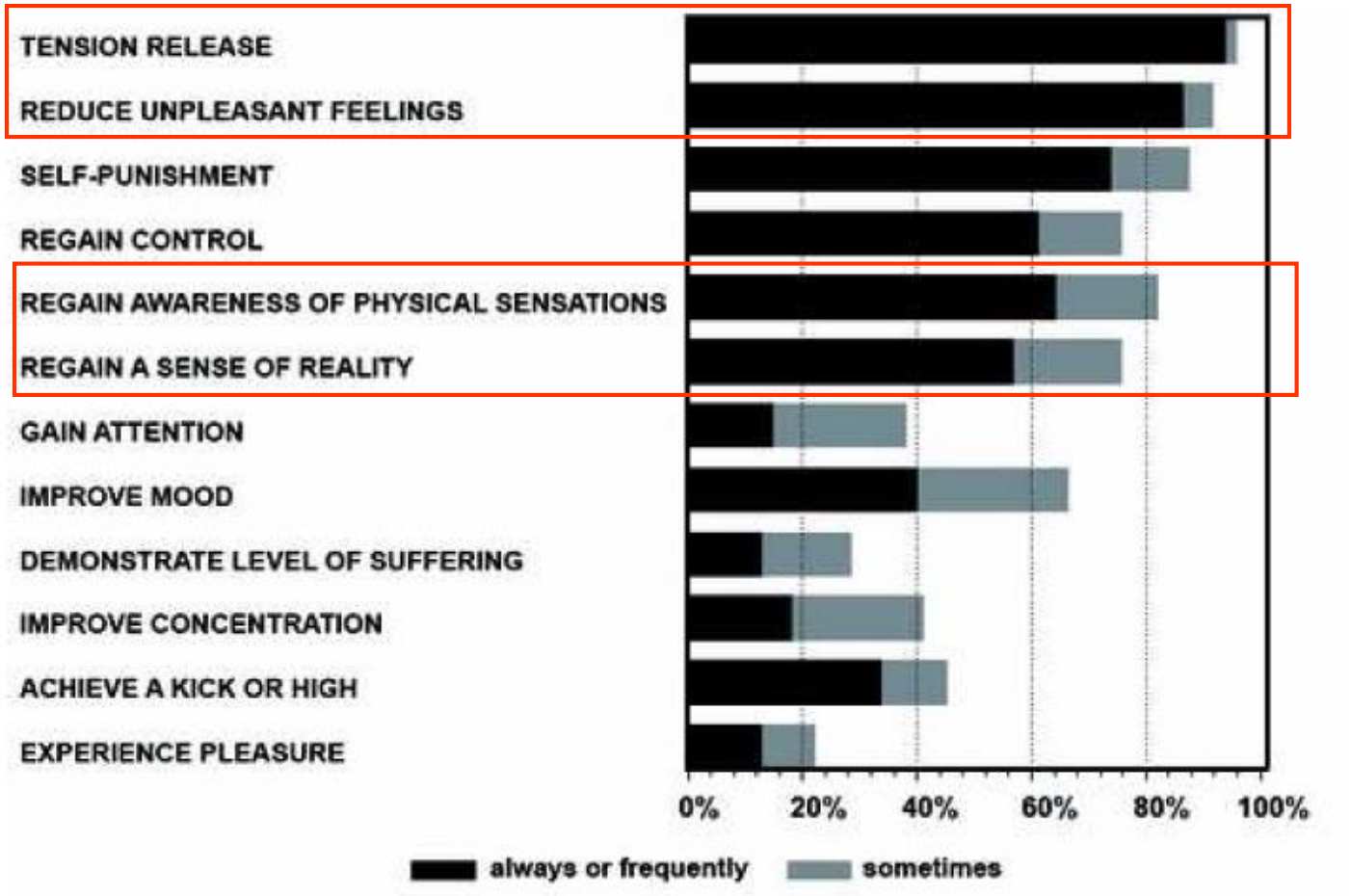

Kleindienst et al., JNMD, 2008

Assessment of fluctuating data in daily life: EMA

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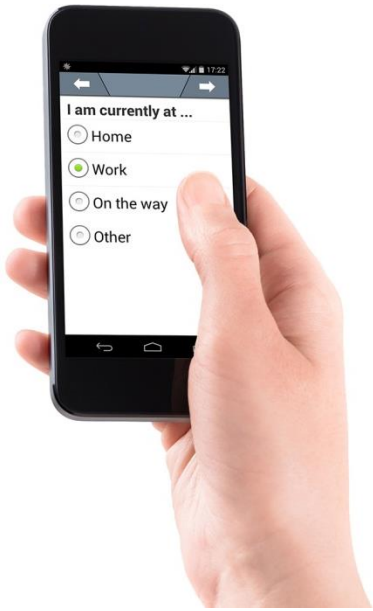
Ecological momentary assessment (EMA)

- Real life and real time data
- Avoiding recall bias
- Accurate tracking of fluctuating variables (e.g. affect, hormones)

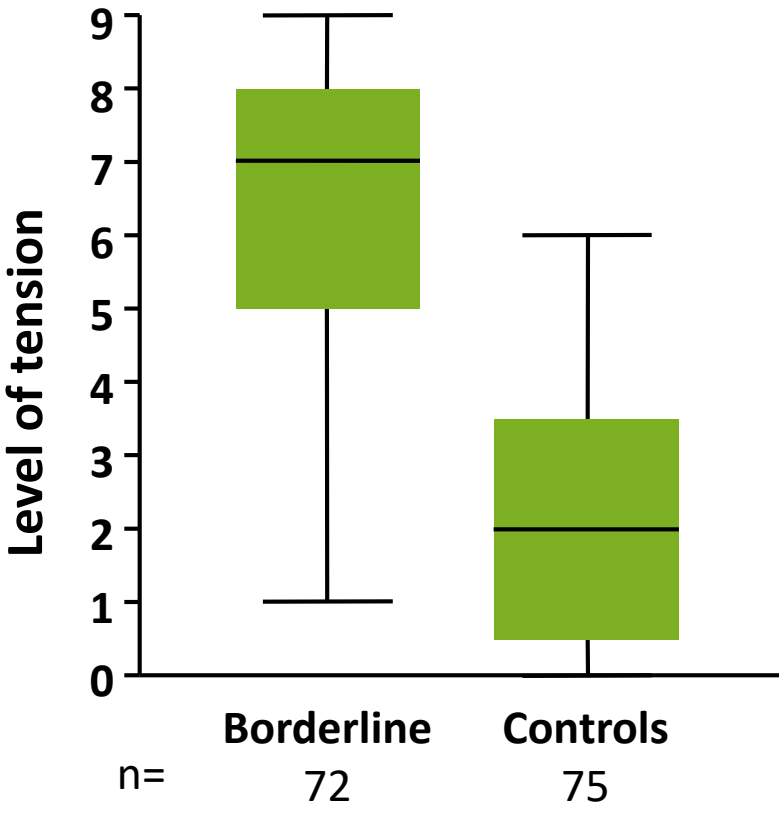
- e.g. Smartphone App based interventions, daily diary

- Different forms of assessment:
  - Random prompts
  - Event based prompts
  - Mixed design

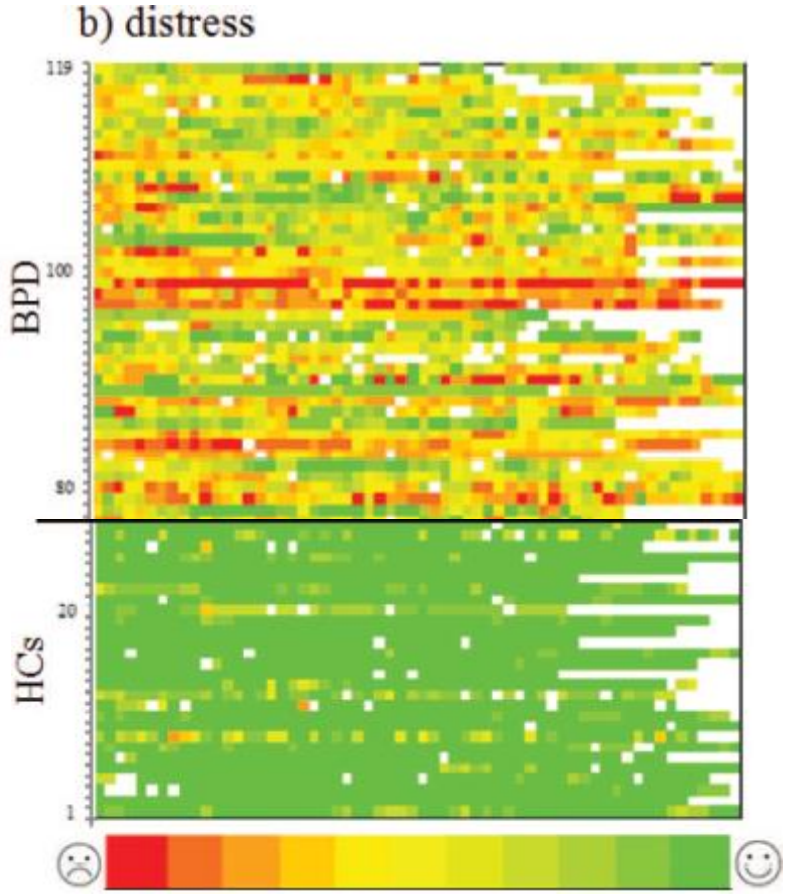


Source:https://www.movisens.com/en/products/movisensxs/

Affective Dysregulation



Stiglmayr et al., Acta Psychatr Scand 2005



Santangelo et al.,
J Abnorm Psychology 2015

Change in Emotions after NSSI

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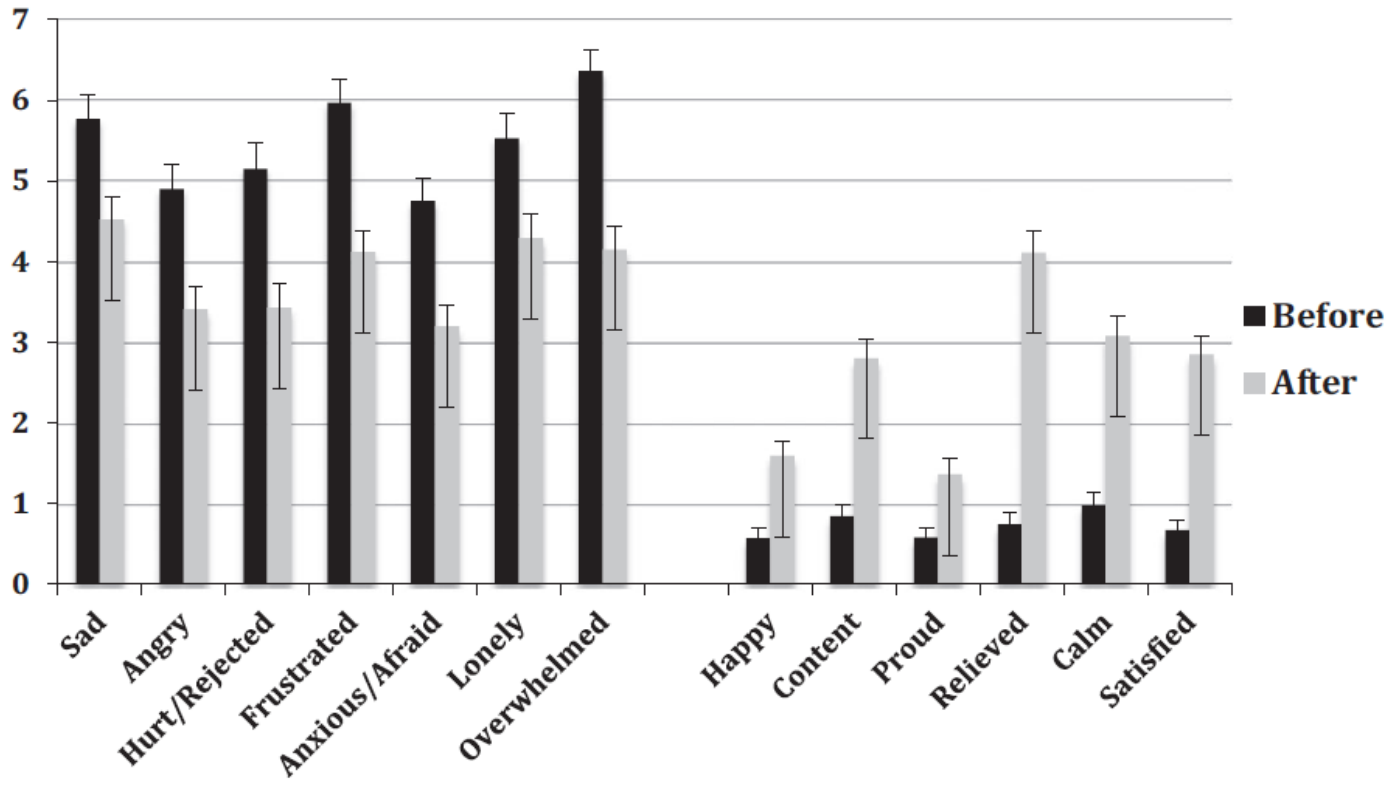
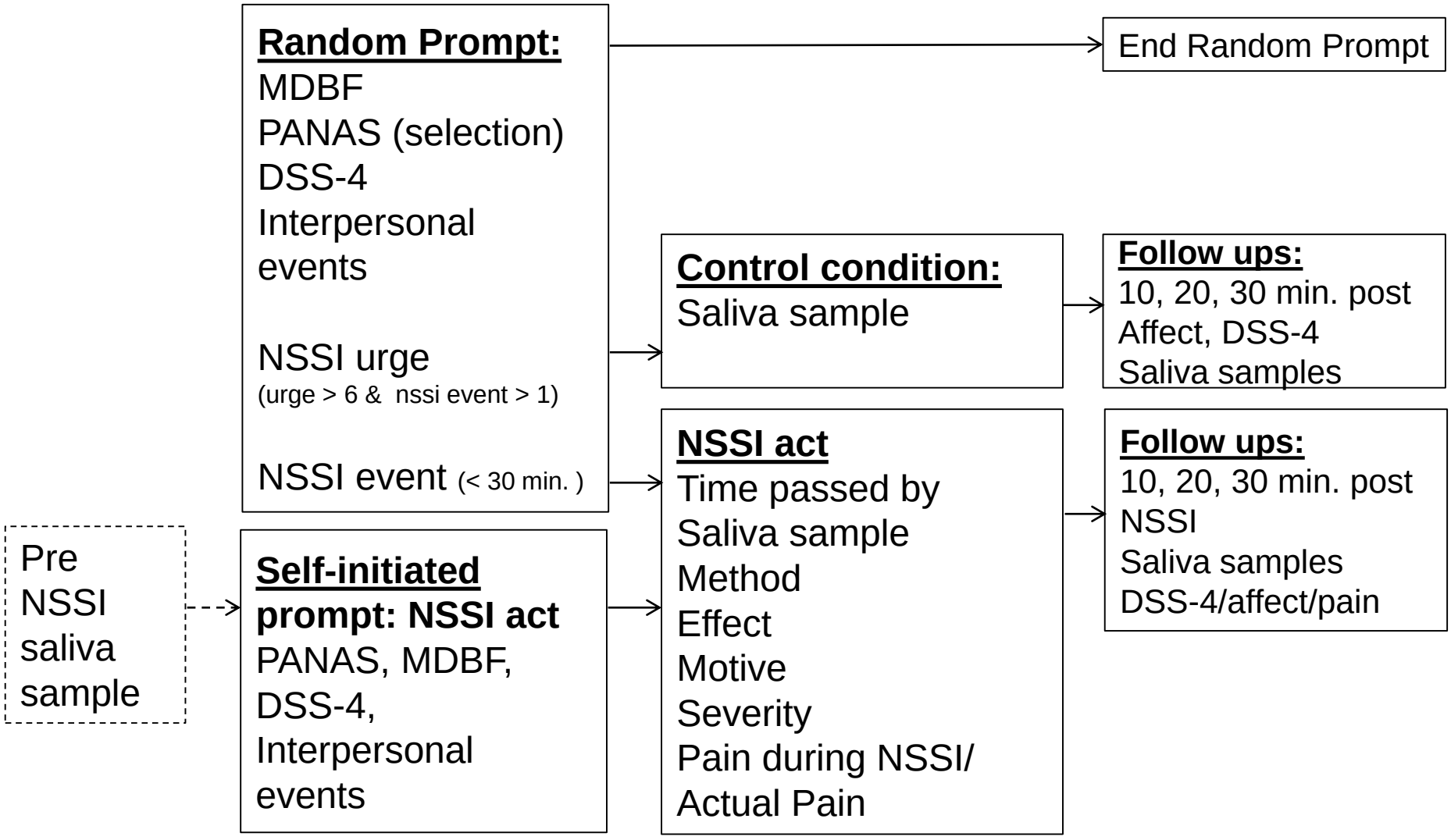


Kranzler et al. 2018

EMA- Study Design



NSSI and ß-endorphin

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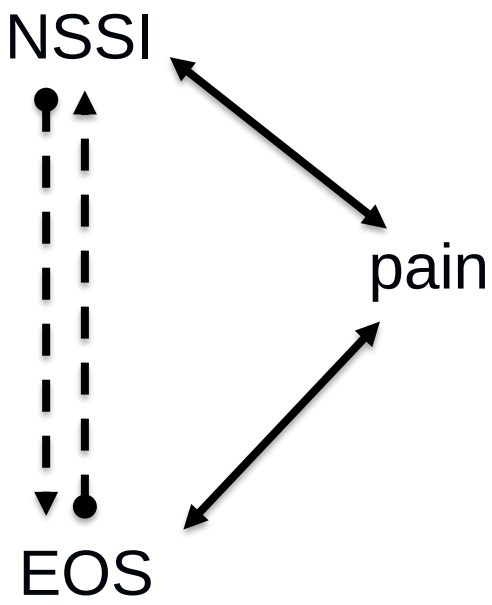
- **Endogenous Opioid System (EOS):**

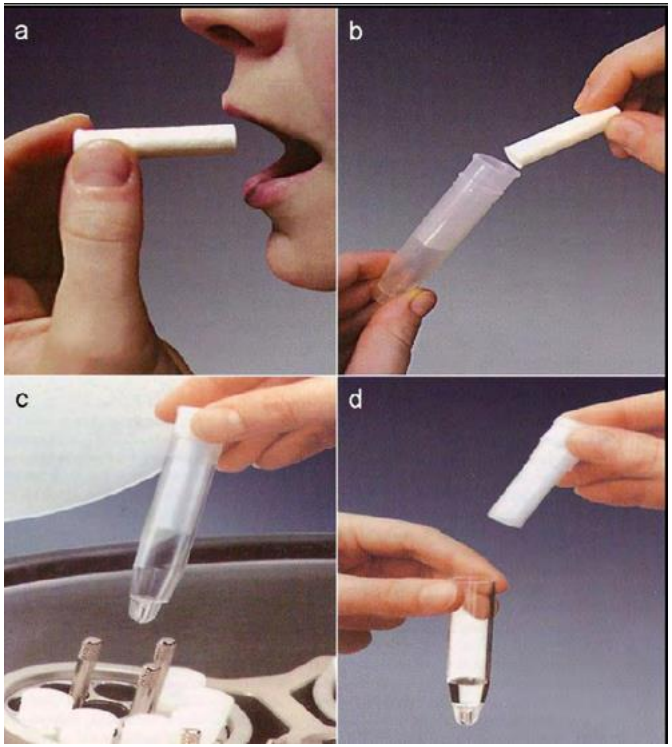
- Three classes of opioids: **β-endorphin**, enkephalin and dynorphin (μ-, δ-, and κ-opioid receptors; Dhawan et al., 1996)

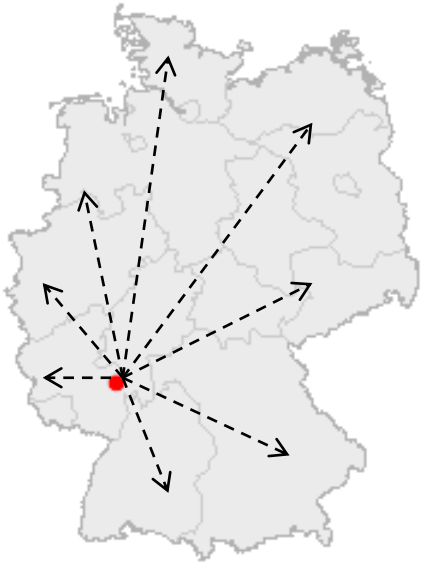
- **Activation ß-endorphin**: social, emotional, or physical pain/ emotionally or physically positive experiences (Bresin & Gordon, 2013 for an overview)

- → Can disturbance in β-endorphin be related to NSSI ?



Biosampling procedure





EMA-Study – Interpersonal Findings

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Before I self-harmed/since the last prompt, someone	Total number	% of NSSI prompts
Negative events		
… criticised me	13	10.1 %
… rejected/ excluded me	19	14.7%
… ignored my needs or feelings	24	18.6%
… behaved angry or aggressive towards me	14	10.9%
… let me down/ disappointed me	23	17.8%
… none of the above	90	69.8%
Positive events		
… suported/ helped me	3	2.3%
… showed me affection	10	7.8%
… respected my needs or feelings	6	4.7%
… gave me their attention or time	18	14.0%
… was interested in me, understood me	12	9.3%
… none of the above	110	85.3%

Stoerkel et al., in preparation

EMA-Study – Interpersonal Findings

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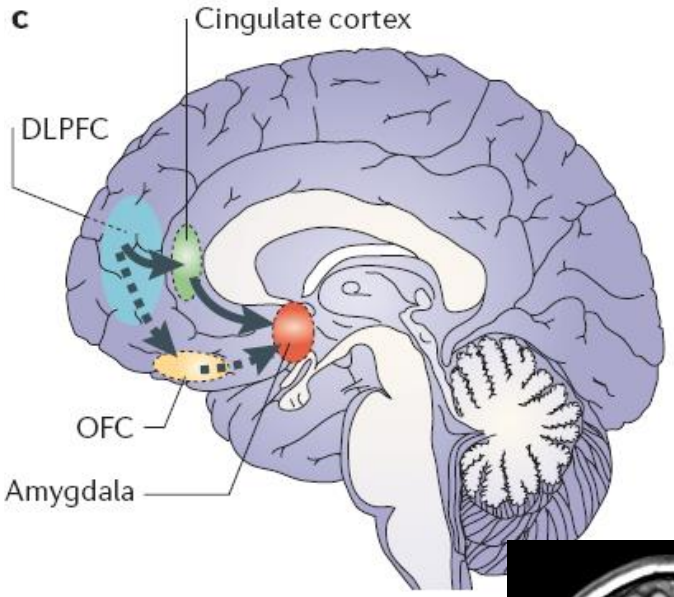
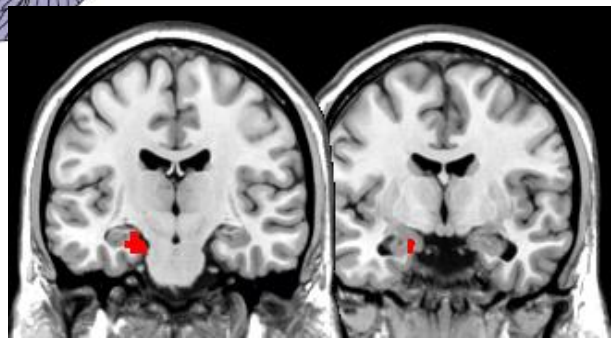
Hyp. 1: Negative interpersoal events predict higher probability of NSSI events.

Hyp. 2: NSSI reduces probability of negative social events (negative social reinforcement).

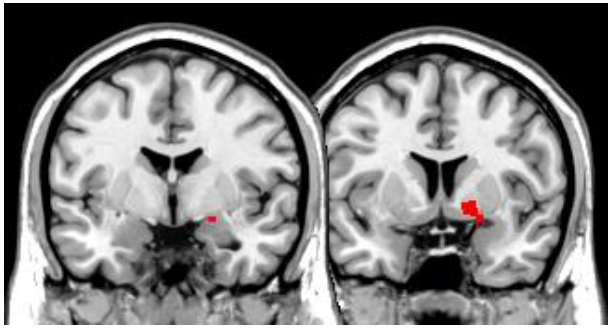
Hyp. 3: NSSI increases probability of positive social events (positive social reinforcement).



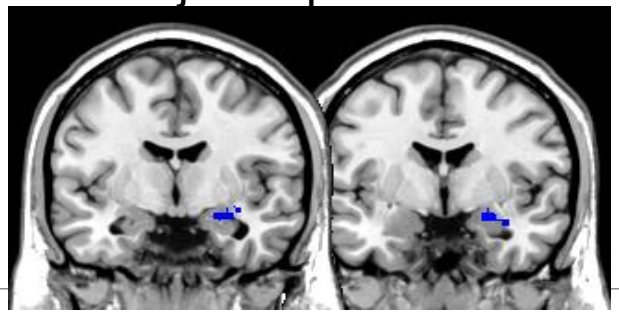
Borderline PD



PTSD



Major Depression



Meta-analysis of regions with positive (red) and negative (blue) response to emotional stimuli (significant with correction)

Schulze et al. 2019

Overview

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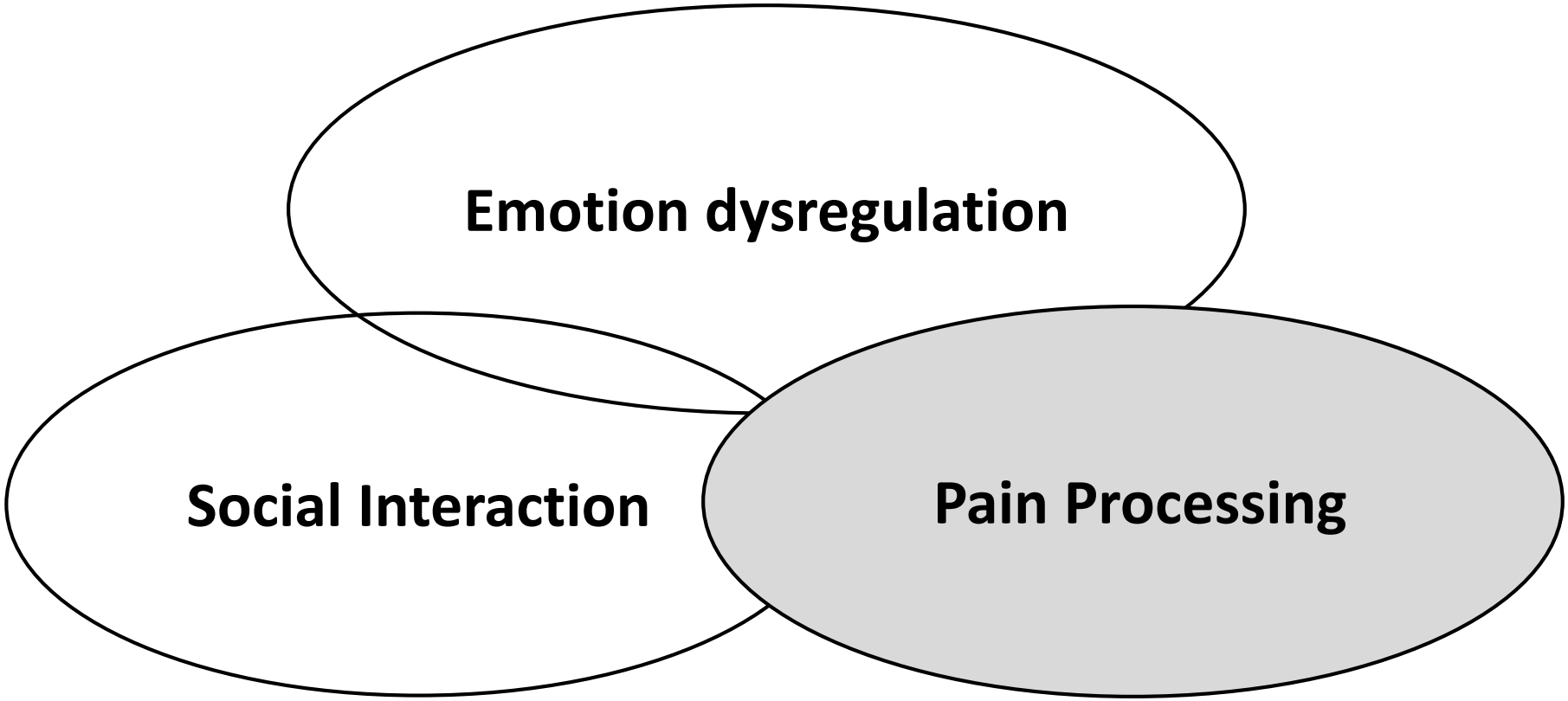
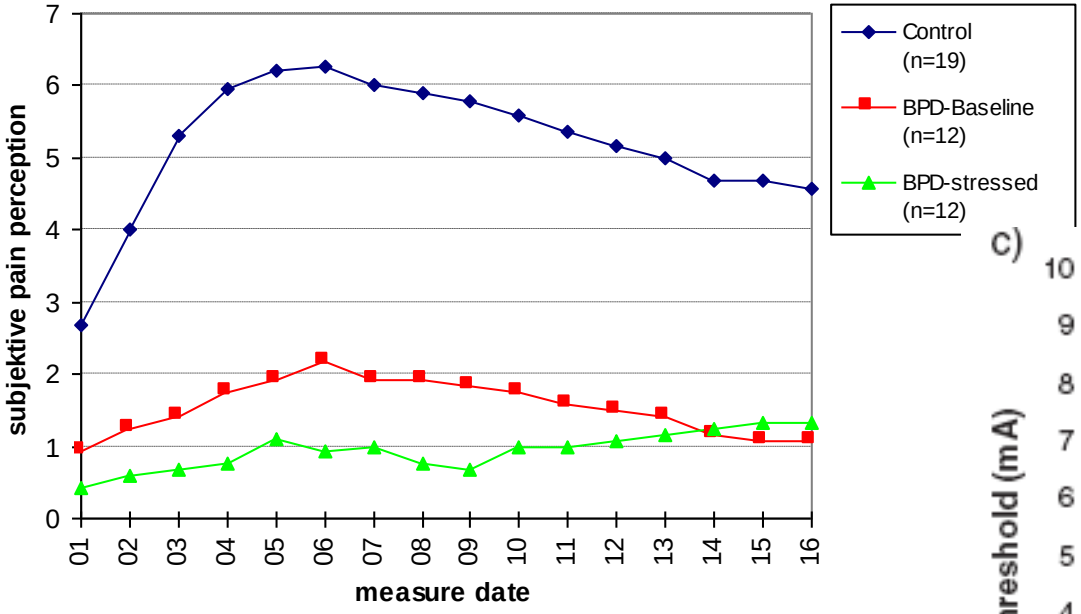
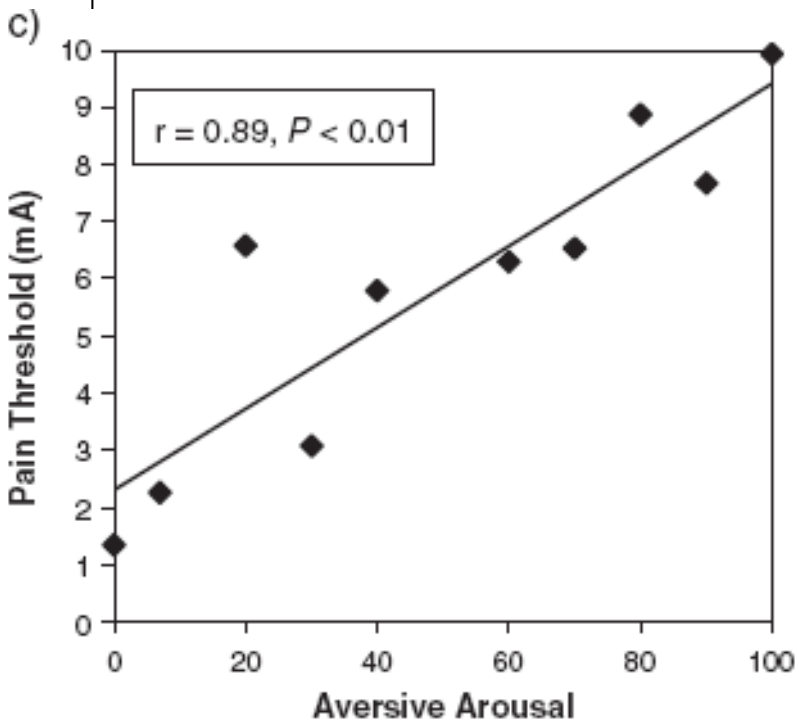


Pain sensitivity and Stress in BPD



Bohus et al., Psychiatry Res 2000



Ludäscher et al., Psychiatry Res 2007

Cortisol-Stressreagibility and NSSI

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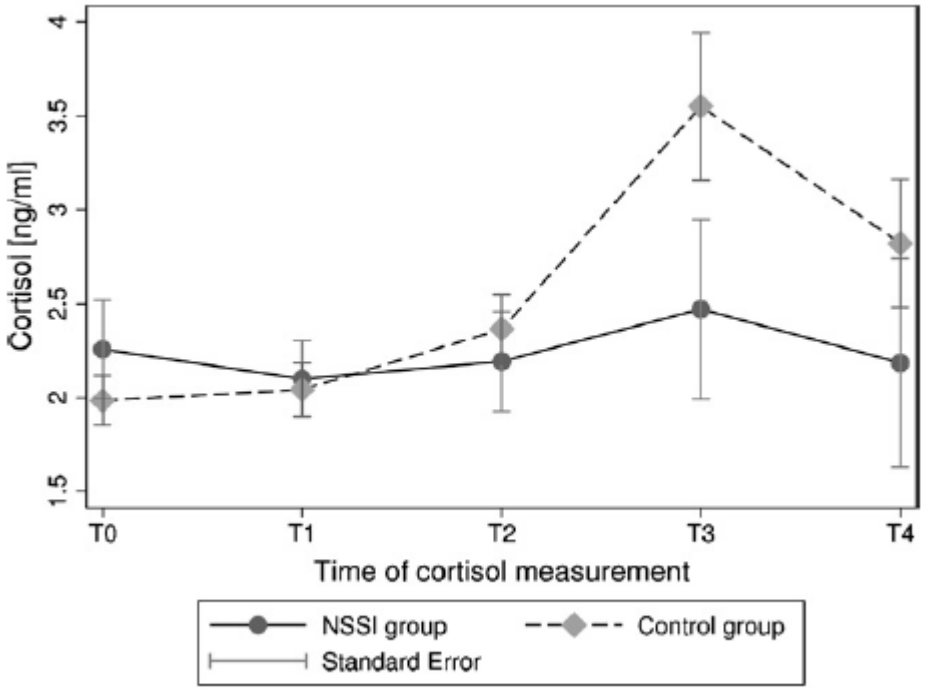
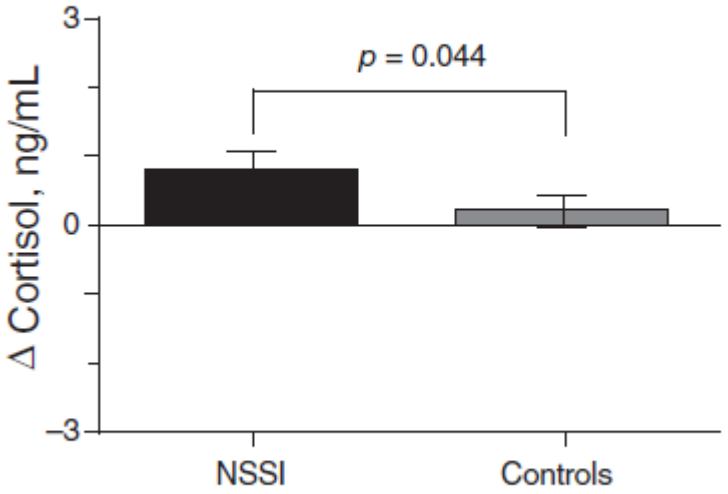
TSST



Kaess et al. 2012

Schmerz



Koenig et al. 2017

Meta-Analysis
Pain sensitivity and NSSI

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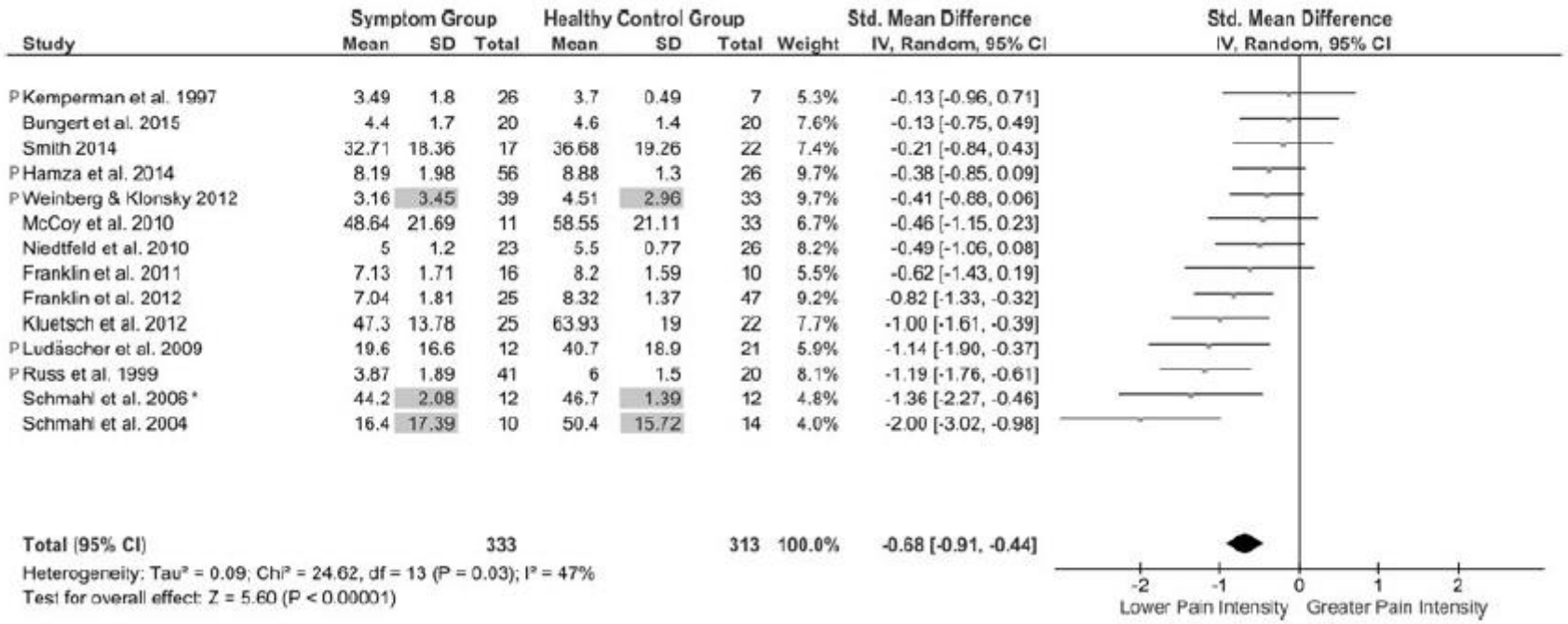

Study	Symptom Group Mean	SD	Total	Healthy Control Group Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
P Kemperman et al. 1997	3.49	1.8	26	3.7	0.49	7	5.3%	-0.13 [-0.96, 0.71]
Bungert et al. 2015	4.4	1.7	20	4.6	1.4	20	7.6%	-0.13 [-0.75, 0.49]
Smith 2014	32.71	18.36	17	36.68	19.26	22	7.4%	-0.21 [-0.84, 0.43]
P Hamza et al. 2014	8.19	1.98	56	8.88	1.3	26	9.7%	-0.38 [-0.85, 0.09]
P Weinberg & Klonsky 2012	3.16	3.45	39	4.51	2.96	33	9.7%	-0.41 [-0.88, 0.06]
McCoy et al. 2010	48.64	21.69	11	58.55	21.11	33	6.7%	-0.46 [-1.15, 0.23]
Niedtfeld et al. 2010	5	1.2	23	5.5	0.77	26	8.2%	-0.49 [-1.06, 0.08]
Franklin et al. 2011	7.13	1.71	16	8.2	1.59	10	5.5%	-0.62 [-1.43, 0.19]
Franklin et al. 2012	7.04	1.81	25	8.32	1.37	47	9.2%	-0.82 [-1.33, -0.32]
Kluetsch et al. 2012	47.3	13.78	25	63.93	19	22	7.7%	-1.00 [-1.61, -0.39]
P Ludäscher et al. 2009	19.6	16.6	12	40.7	18.9	21	5.9%	-1.14 [-1.90, -0.37]
P Russ et al. 1999	3.87	1.89	41	6	1.5	20	8.1%	-1.19 [-1.76, -0.61]
Schmahl et al. 2006 *	44.2	2.08	12	46.7	1.39	12	4.8%	-1.36 [-2.27, -0.46]
Schmahl et al. 2004	16.4	17.39	10	50.4	15.72	14	4.0%	-2.00 [-3.02, -0.98]
Total (95% CI)			333			313	100.0%	**-0.68 [-0.91, -0.44]**

Heterogeneity: Tau² = 0.09; Chi² = 24.62, df = 13 (P = 0.03); I² = 47%
Test for overall effect: Z = 5.60 (P < 0.00001)

König et al. 2016

Neural Pain Processing in BPD

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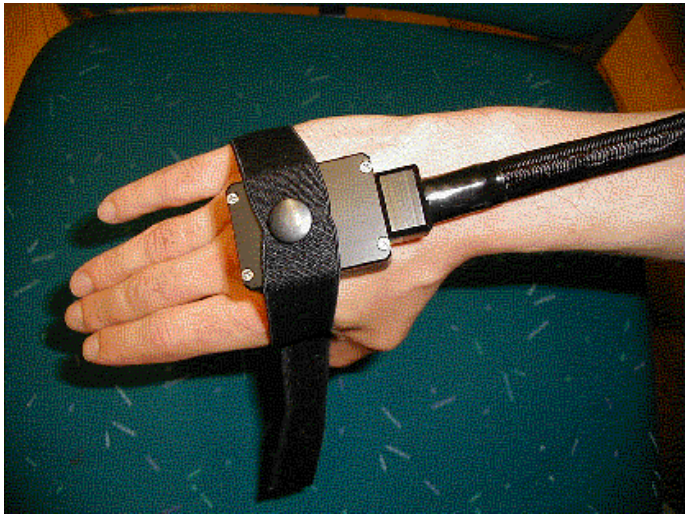

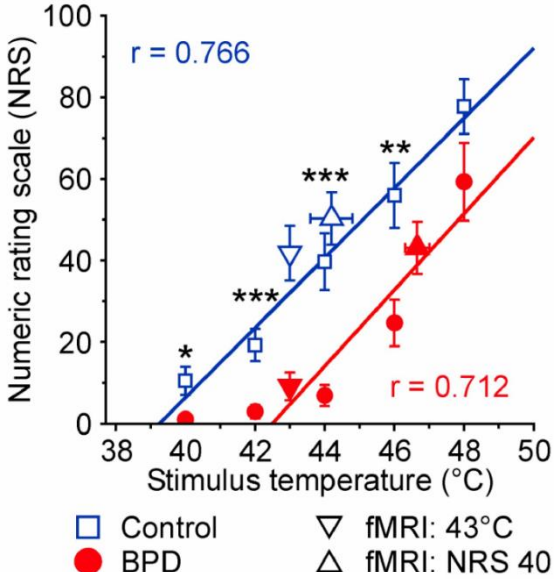

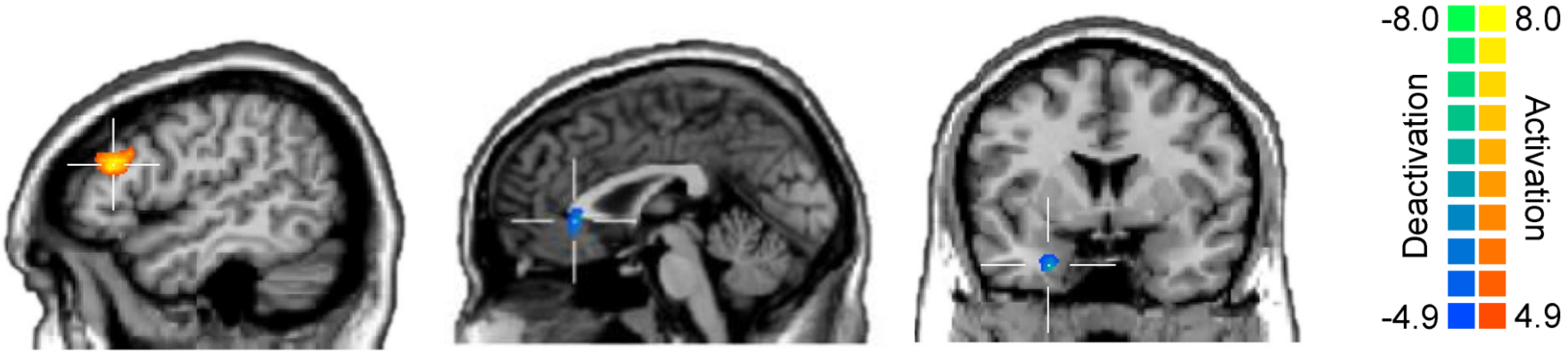

Schmahl et al., Arch Gen Psychiatry 2006

Emotion Regulation and Pain in BPD

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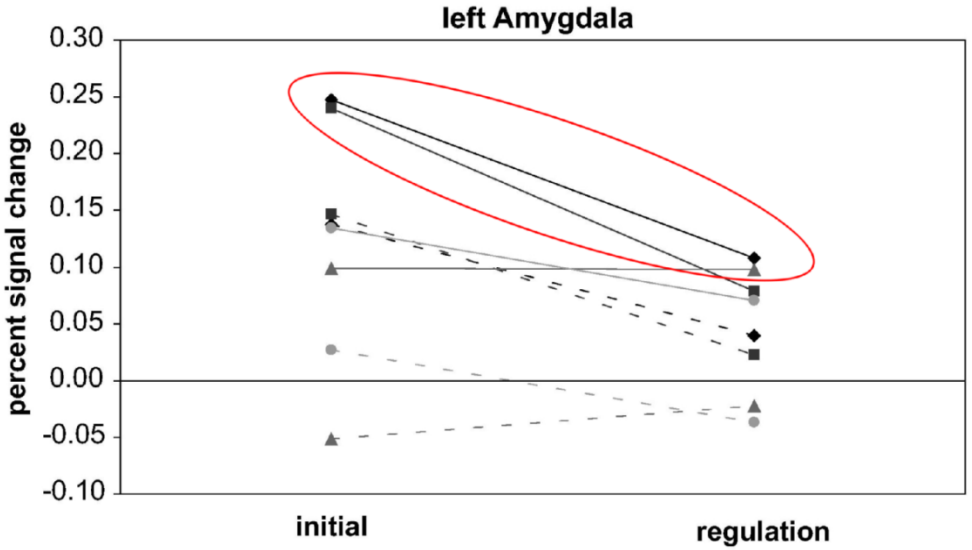

Niedtfeld et al., Biol Psychiatry 2010

Emotion Regulation and Incision in BPD

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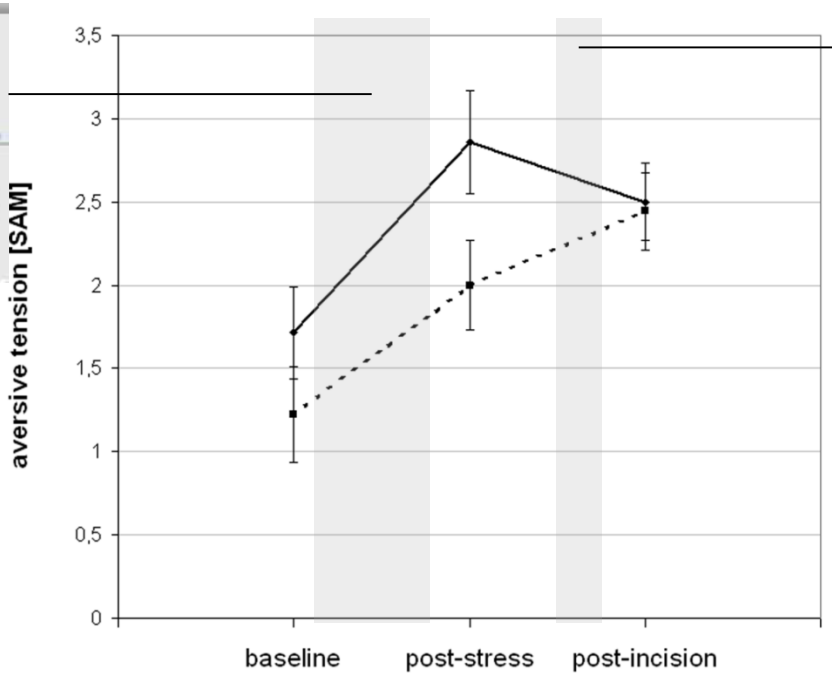
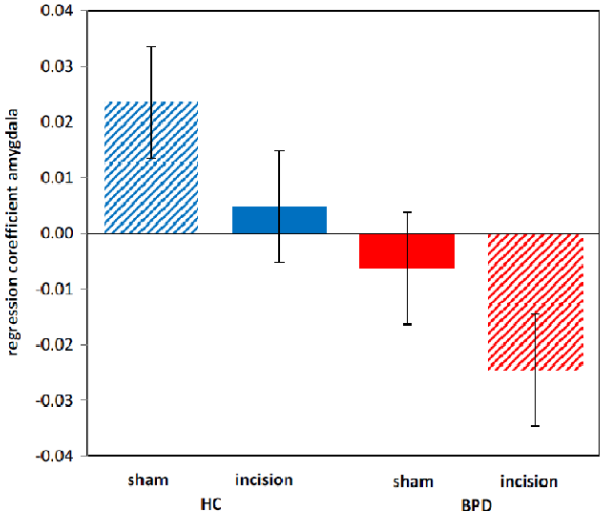


Reitz et al.,
JPD 2012

Amygdala activity



Reitz et al.
Br Journal Psychiatry 2015

Role of Tissue Injury

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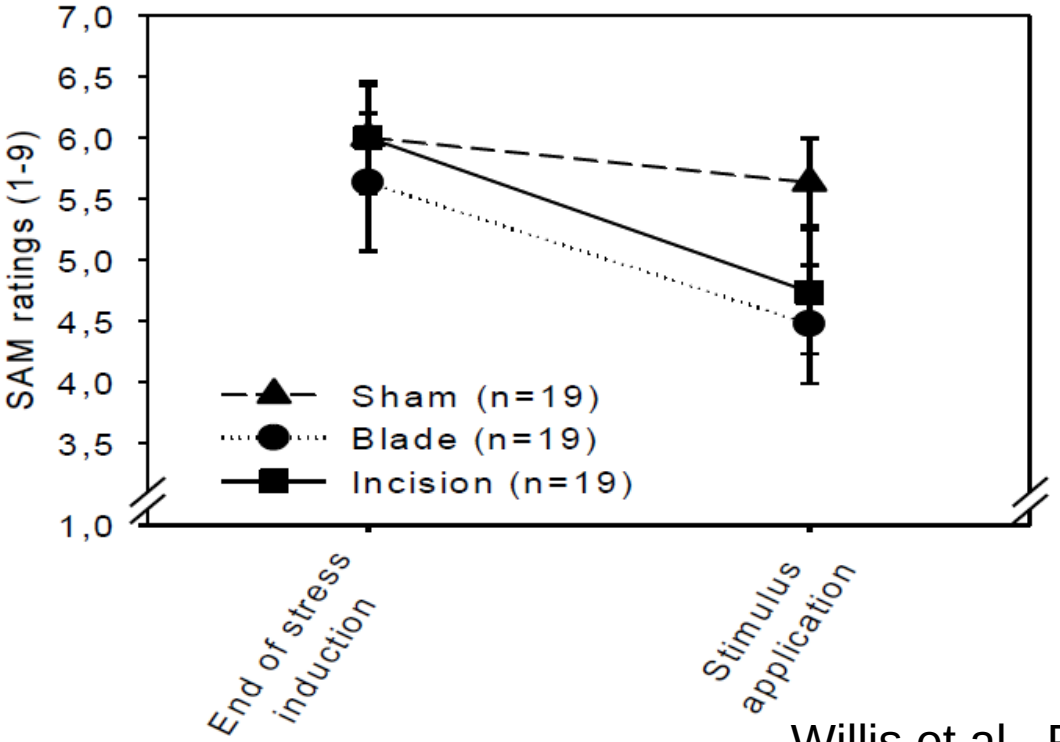

Willis et al., Pain 2017

The role of seeing blood and perspective (self/other)

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Self-inflicted & no blood (n=20)	Other-inflicted & no blood (n=20)
Self-inflicted & blood (n=20)	Other-inflicted & blood (n=20)

Self-injury and Pain – Interim Summary

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- Reduced pain sensitivity: yes
- Reduction of stress and amygdala activity by pain stimuli: yes
- Influence of tissue injury: (no)
- Influence of seeing blood: (yes)

- Role of perspective (self/other) : ?

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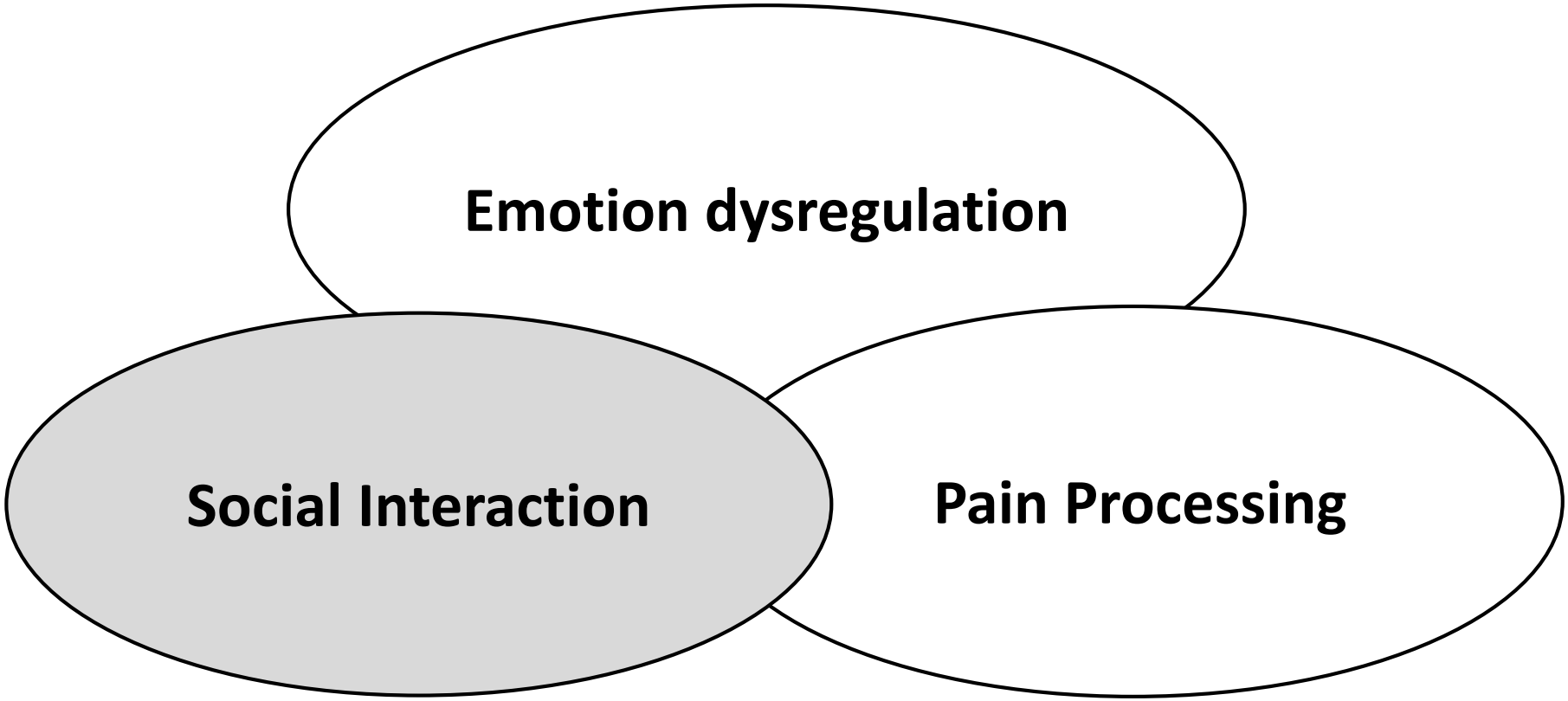
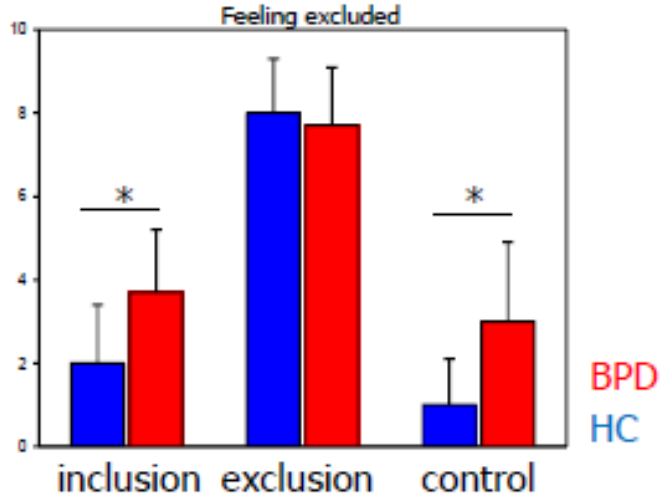
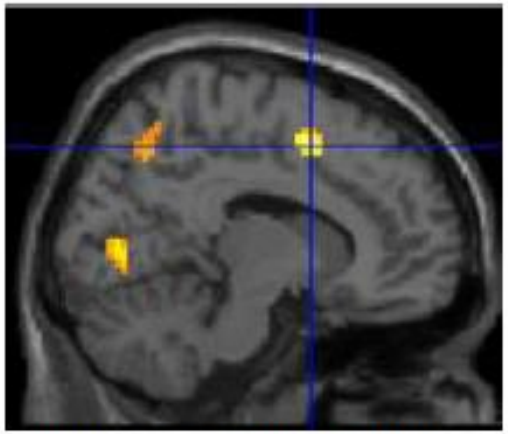
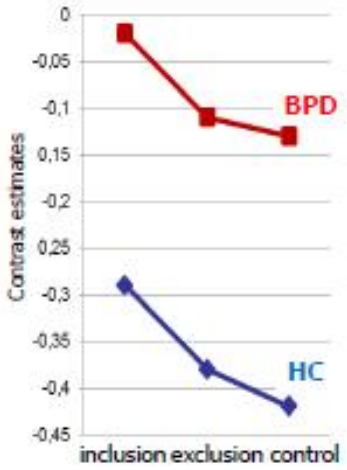


Social Exclusion and BPD



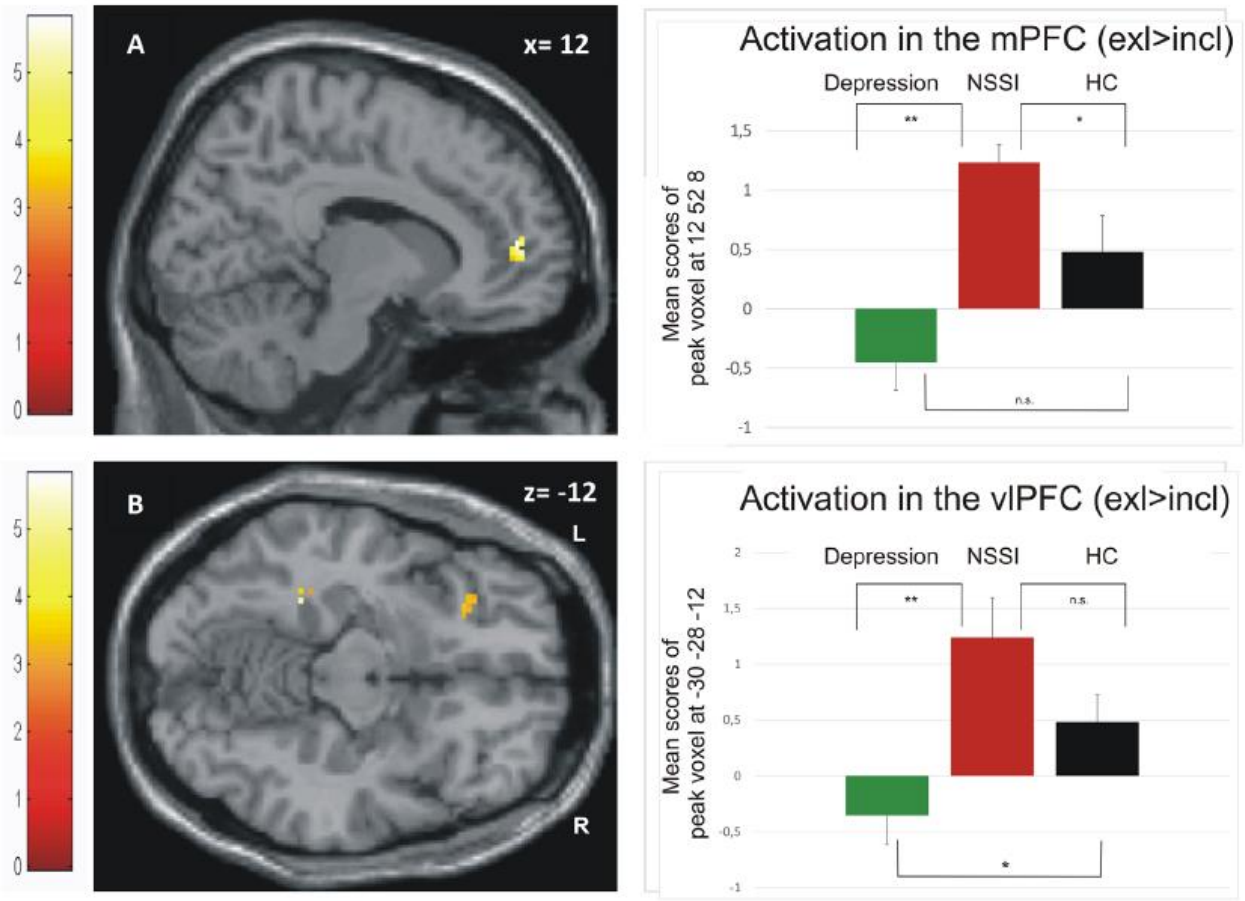


dACC: (x,y,z= 12, 8, 49), svc (FWE<0.05)



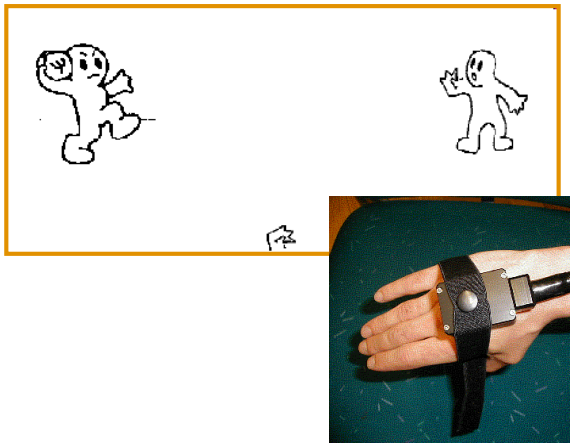
Domsalla et al. 2014

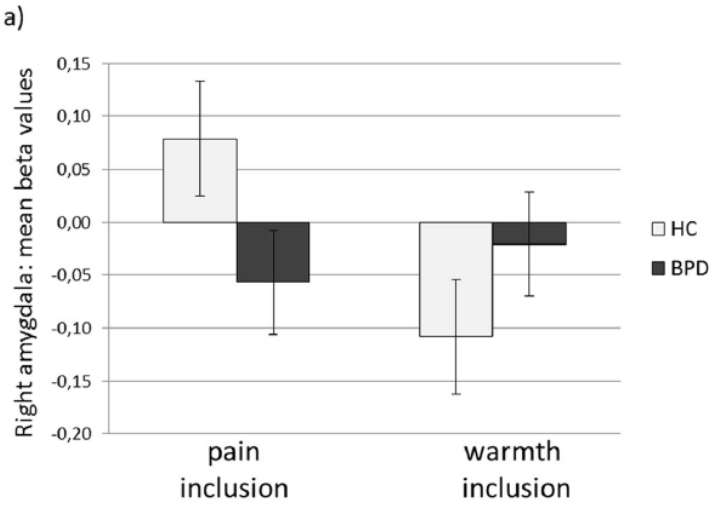
Social Exclusion and NSSI

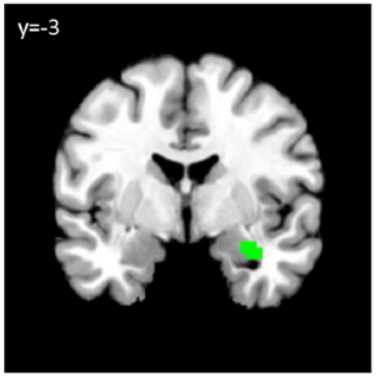


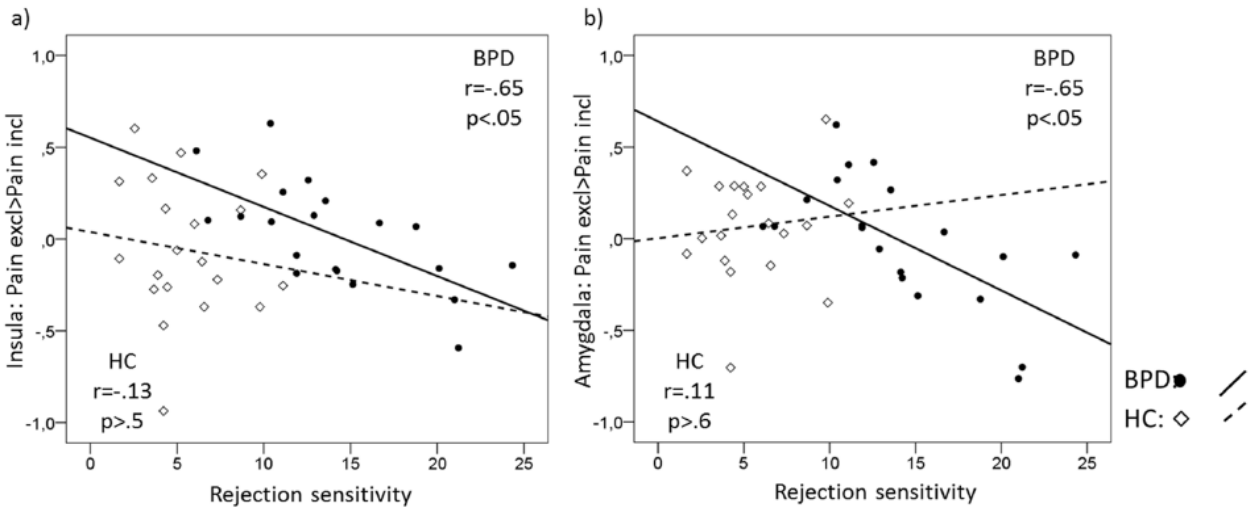
Groschwitz et al. 2016

Social Exclusion and Pain









Bungert et al. 2015

Can these mechanisms be modified?

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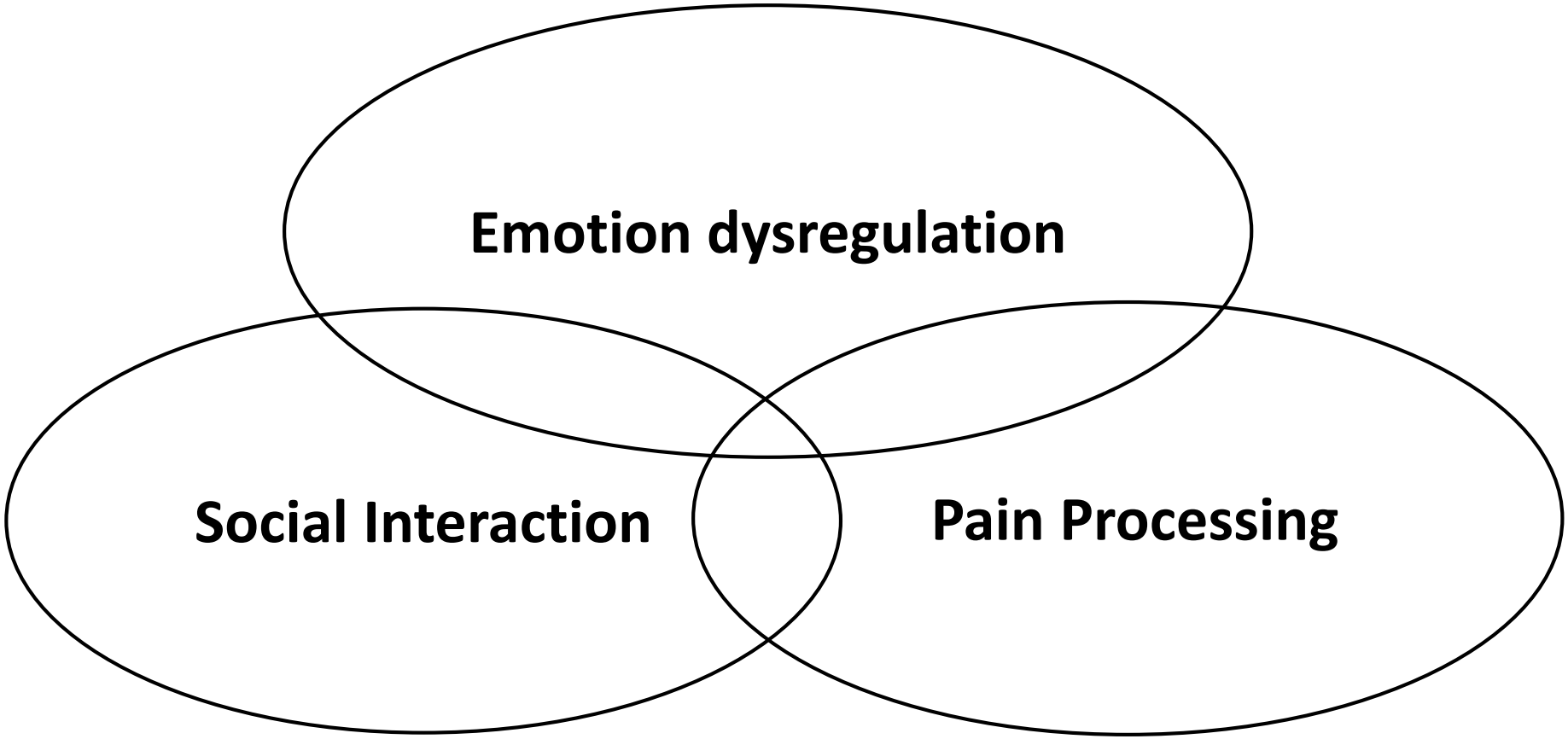

Pain sensitivity and Remission

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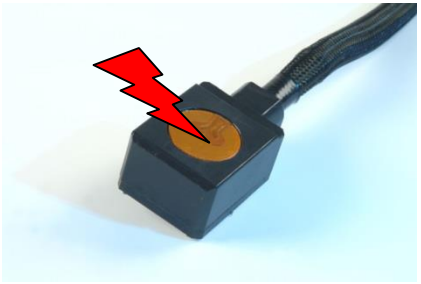
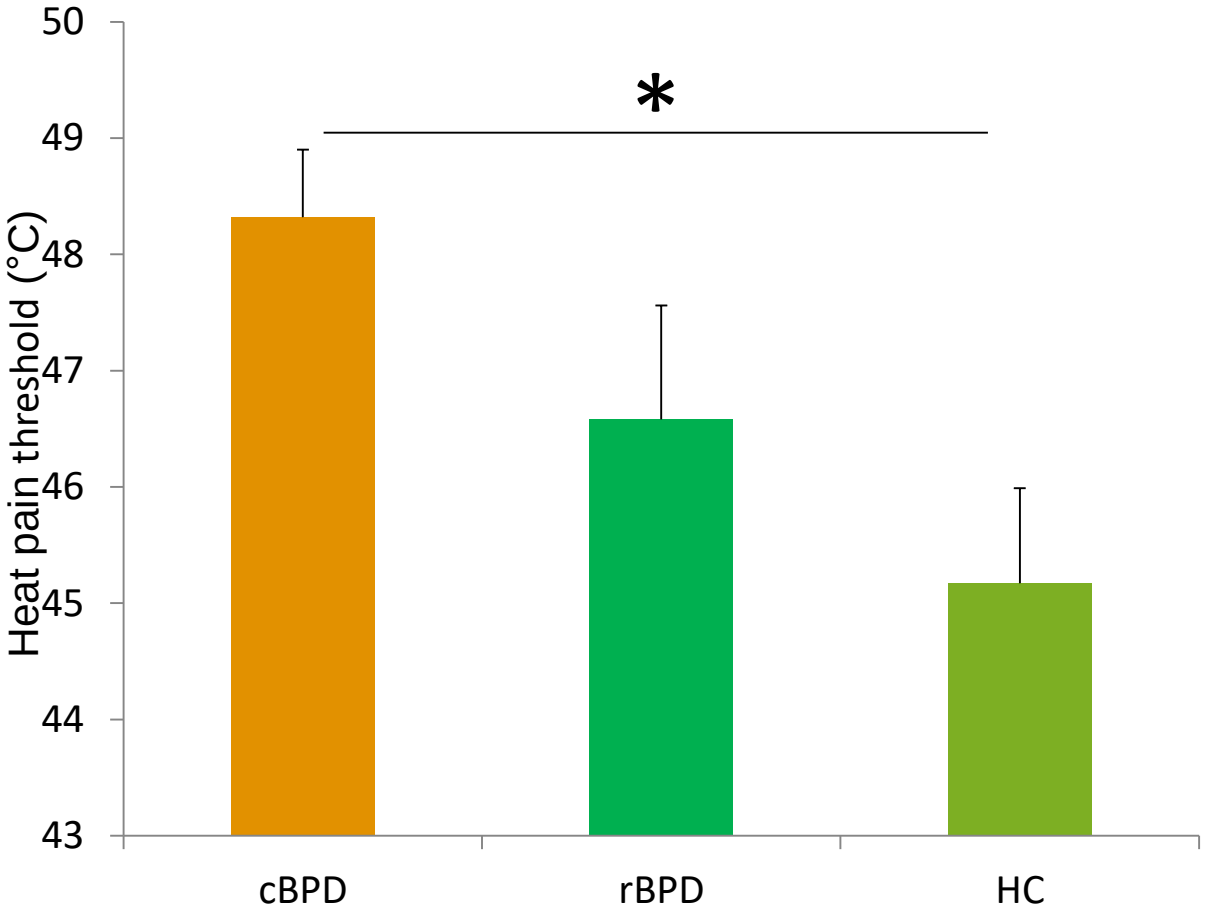
29 current BPD
19 remitted BPD
22 healthy controls





Bekrater-Bodmann et al., 2015, Pain

Changes of pain-related mechansims in remission

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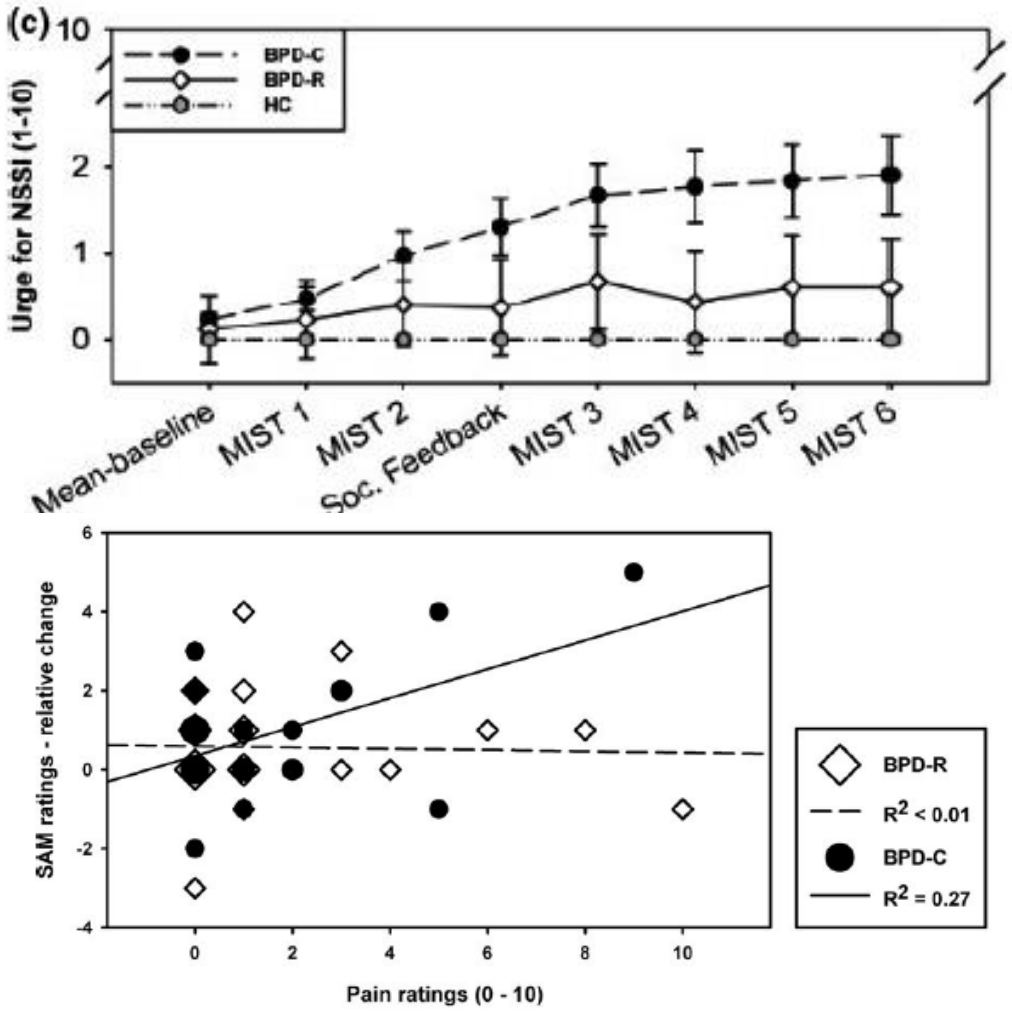

- No strong increase of urge for NSSI after stress induction
- No relation between painfulness and stress reduction

Wilis et al., Brain Behav 2018

Changes of pain-related mechanims after psychotherapy

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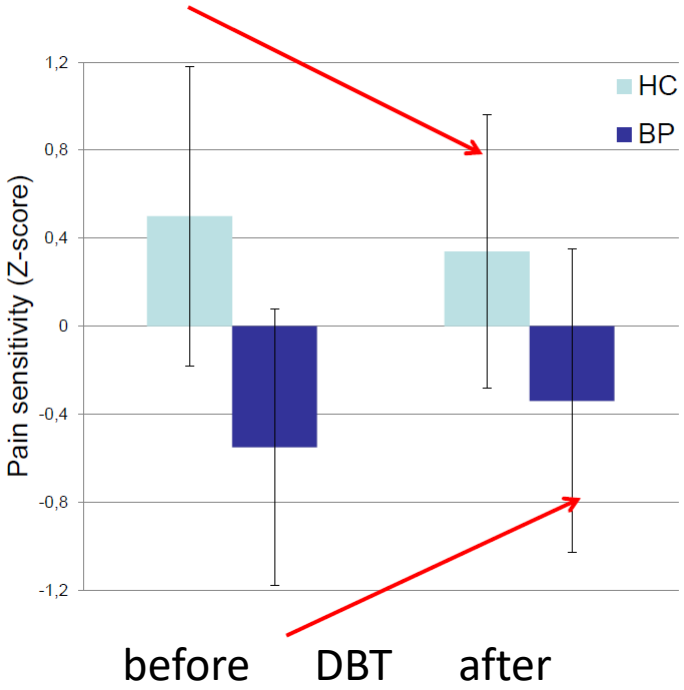

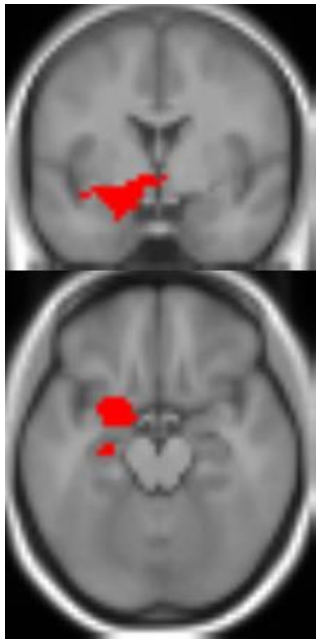

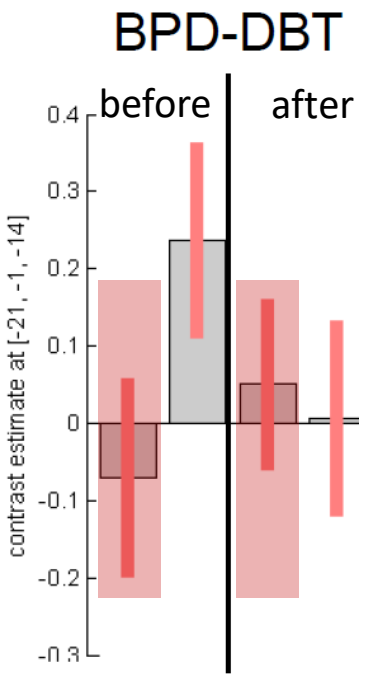

Negative pictures + pain

Niedtfeld et al., SCAN 2017

Assessment of longitudinal changes

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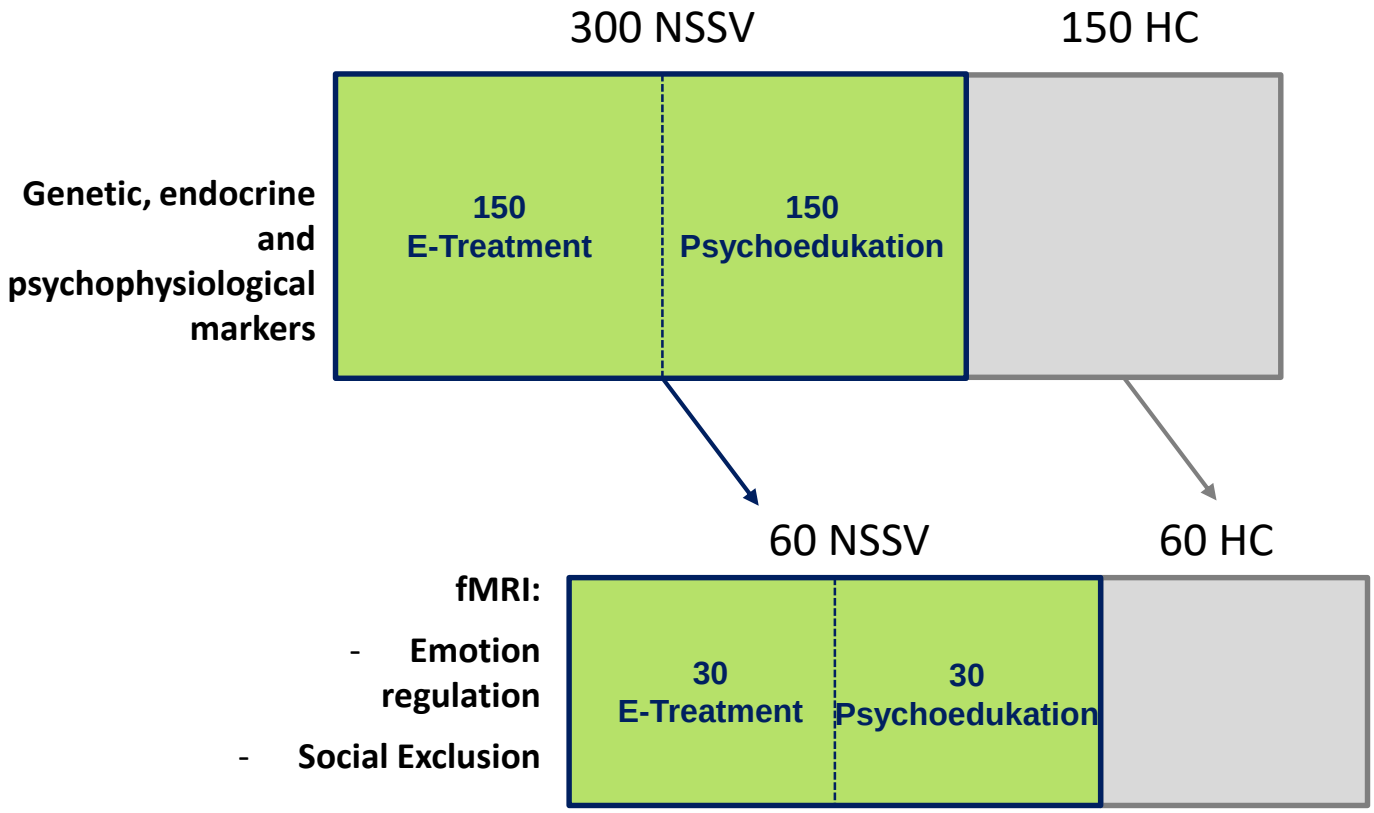
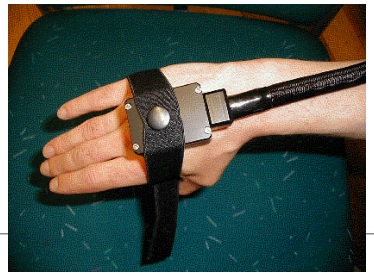
STAR
SELF-INJURY · TREATMENT ASSESSMENT RECOVERY





Summary

STAR
SELF-INJURY · TREATMENT ASSESSMENT RECOVERY

- NSSI is clearly related to reduced pain sensitivity
- Underlying neural mechanisms point to a dysregulation of the prefrontal-amygdala axis
- Remission and psychotherapy can change these mechanisms (back to normal)
- Better understanding of neurobiological correlates of NSSI helps to de-stigmatize behavior and improve psychotherapy

Thanks to coworkers, collaborators and funders

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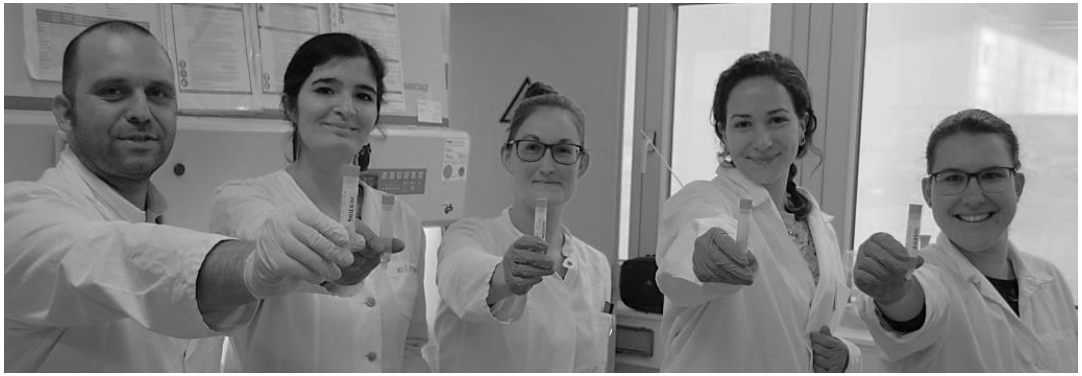

Dr. Alexander Karabatsiakis and his lab

DFG Deutsche Forschungsgemeinschaft

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