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Implicit cognitions on self-injurious and suicidal behavior in borderline personality disorder

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Abstract

Background and objectives: Performance on implicit measures of suicidality has been associated with suicidal and nonsuicidal self-injury. Despite the high prevalence of self-harm in patients with borderline personality disorder (BPD), no previous study has assessed implicit measures in this patient group.

Methods: Forty patients with BPD and 25 healthy controls completed three implicit association tests (IATs) (Death words – Me/Others words, Self-Harm pictures – Me/Others, and Self-Harm pictures – Good/Bad words) and a subliminal priming task (effect of the primes “dying”/“growing” on the categorization speed of positive/negative adjectives) as well as measures of psychopathology (suicidal ideation, previous nonsuicidal self-injury, border-line symptomatology, depression, and hopelessness).

Results: Patients with BPD had higher scores on all three IATs than healthy controls. The subliminal priming procedure did not reveal group differences. Correlations between implicit measures and psychopathology among patients with BPD were mostly weak and nonsignificant with a few exceptions: Positive correlations were observed between IAT Self-Harm – Good/Bad and lifetime frequency of nonsuicidal self-injury, between IAT Self-Harm – Me/Others and depression, and between IAT Death – Me/Others and depression. Correlations between implicit measures were weak to moderate.

Limitations: The study was cross-sectional only, and the study had reduced power as the sample size was limited.

Conclusions: As expected, patients with BPD had higher scores than healthy controls on the IATs, which indicates higher implicit self-identification with self-harm and death as well as stronger implicit positive attitudes towards self-harm. The mostly weak correlations between implicit and explicit measures speak against the discriminative value of IATs in patients with BPD.

1. Introduction

In Europe, the lifetime prevalence of attempted suicide is almost 3% (Castillejos et al., 2020); the presence of a mental disorder triples this percentage (Carrasco-Barrios et al., 2020). For nonsuicidal self-injury (NSSI), the lifetime prevalence has been estimated at 5.5% in a meta-analysis (Swannell et al., 2014), along with a higher prevalence for individuals with an emotional disorder (e.g. depression and anxiety disorder, Bentley et al., 2015). Further, NSSI tends to increase the chance of a later suicide attempt (Griep & MacKinnon, 2020; Ribeiro et al., 2016). The challenges of suicidality and NSSI are especially prominent in patients with borderline personality disorder (BPD; Goodman et al., 2012; Paris, 2019; Reichl & Kaess, 2021), in whom these self-harm behaviors are common (Black et al., 2004; Zanarini et al., 2008).

Still, it is very difficult to determine the risk that a patient will attempt suicide (Newton-Howes, 2018; Wang et al., 2016) or engage in NSSI (Woodford et al., 2019). Correct assessment, however, is essential (Wortzel et al., 2017) in treatment to prevent suicidality (D’Anci et al., 2019) and NSSI (Turner et al., 2014). If correctly assessed, patients can receive adequate treatment. There are, for example, effective treatments available for patients with BPD to reduce self-harm such as suicidal behavior or NSSI (for a review, see Levy et al., 2018).

Yet, researchers struggle to find reliable tools for assessing risk of

suicide or NSSI (for comprehensive meta-analyses; see Franklin et al., (2014) on risk factors for suicide; and see Fox et al. (2015) on risk factors for NSSI). Despite the existence of a range of instruments to assess suicidality or NSSI, their clinical use to reliably predict the risk is limited (for reviews, see Lotito & Cook (2015) on assessment instruments on suicidality and Faura-Garcia et al. (2021) on assessment instruments on NSSI). Furthermore, clinicians mostly rely on relatively unreliable single-item questionnaires or unstructured interviews for suicide risk monitoring (Roush et al., 2018). Moreover, people often conceal their suicidal ideation; a recent review concluded that about half of patients with suicide ideation deny it during interviews and that about half of people who died by suicide denied suicidal ideation in their last communication (Obegi, 2021). A comparison between adult psychiatric inpatients found nondisclosure of suicidal ideation to be more prevalent in patients with BPD than in patients with other disorders such as depressive disorders, bipolar disorders, psychoactive substance use disorders, or anxiety disorders (Høyen et al., 2022). Nondisclosure of NSSI is also common (Simone & Hamza, 2020). Reasons not to disclose suicidal ideation include shame and fear of rejection or hospitalization (Fulginiti & Frey, 2019); reasons to conceal NSSI are similar and also include shame as well as fear of rejection or abandonment (Simone & Hamza, 2020). To improve clinical assessment of suicide and NSSI risk, it is thus necessary to develop new measures, possibly using methodologies beyond self-report. New assessment approaches should then be tested and validated across different populations with increased risk of suicidality or NSSI, for example in patients with BPD.

Fifteen years ago, Nock and Banaji (2007) introduced implicit measures for the assessment of suicide risk, and then Nock et al. (2010) provided evidence in a prospective study that implicit measures can improve the prediction of a suicide attempt within a six-month period. Numerous studies followed which investigated implicit measures and their relation to suicidal and nonsuicidal self-harm behavior (Sohn et al., 2021). Implicit measures are usually tasks in which participants categorize items (e.g., words or pictures) as fast and accurately as possible. The idea behind the implicit measures is that it is easier to make the same behavioral response (e.g., categorizing words to one of two categories) to closely associated concepts than to less closely associated concepts (Greenwald et al., 1995). Thus, a person should react faster on these tasks if the same behavioral response (pressing a specific key) is requested for stimuli of closely associated concepts (e.g., words related to the categories “death” and “me”) then for less closely associated concepts (e.g., words related to the categories “life” and “me”). Consequently, comparisons of reaction times should indicate how closely a person associates different concepts with each other. The degree of association between concepts is thought to drive behavior (Greenwald & Banaji, 1995).

Some studies have related performance on one of the implicit measures — primarily the implicit association test (IAT) — to previous and future suicide attempts (Nock et al., 2010) and NSSI (Cha et al., 2016). Despite the growing research on these implicit measures (for reviews, see Moreno et al. (2022) and Sohn et al. (2021)), no previous study has investigated behavior on implicit tasks in a group comprised only of patients with BPD, even though patients with BPD are at high risk for NSSI (Zanarini et al., 2008) and suicidality (Black et al., 2004). In patients with BPD, for example, suicidality/suicidal ideation is sometimes “chronic” and has the unique function of reducing aversive inner states (e.g., hopelessness, anger; Hennings, 2020; Paris, 2004). Thus, similar to a previous investigation of implicit measures in a disorder-specific sample (i.e., depression; Wang et al., 2020), we investigated patients with verified BPD in this study.

Furthermore, other implicit measures for suicide risk assessment have been introduced (for a review, see Moreno et al., 2022), and different implicit measures might suit different purposes (Van Dessel et al., 2020). For example, Spruyt et al. (2015) found that a priming task predicted smoking relapse over a six-month period, whereas an IAT did not. However, there is little research on priming tasks to capture implicit cognitions on suicidality. Therefore, in the present study we wanted to test the subliminal priming procedure and its association with clinical measures. Priming procedures are thought to assess individual attitudes, similar to IATs, and are based on the related idea that a person reacts faster to a stimulus if the preceding prime’s automatic activation is concordant with the stimulus (e.g., a person identifies positive adjectives faster if the preceding prime evokes positivity; Fazio, 2001; Olson & Fazio, 2002). Thus, comparing response latencies following different primes should indicate the individual’s attitude toward each prime. In the subliminal priming procedure on suicidal associations (the one we are using in this study), participants were exposed to a prime associated with either life (“growing”) or death (“dying”) for a such a short time that it was most likely processed subliminally. Thereafter, participants categorized adjectives as “positive” or “negative.” If positive adjectives are categorized faster after the prime “dying” than after the prime “growing,” the concepts “dying” and “positive” are more closely associated with each other than with the concepts “growing” and “positive.” In this study, we wanted to test performance on the subliminal priming procedure in individuals with BPD.

We wanted to compare how implicit measures relate to relevant explicit measures. Therefore, we planned to assess suicidality and NSSI as well as important psychopathological features. For example, we investigated borderline symptomatology because it is associated with increased suicidality and NSSI (Pérez et al., 2017). Furthermore, we included depression as a variable because depression is common in patients with BPD (Köhling et al., 2015) and is a major risk factor for suicidality (Hawton et al., 2013), especially in BPD (Sher et al., 2016). Similarly, hopelessness is an important predictor of suicidality (Brown et al., 2000), including in patients with BPD (Horesh et al., 2003). Depression and hopelessness are also predictors for NSSI (Fox et al., 2015; Marco et al., 2015; Plener et al., 2015; Rodríguez et al., 2017). Therefore, we studied multiple implicit measures, assessed suicidal ideation and past NSSI, and incorporated borderline symptomatology, depression, and hopelessness as measures of relevant psychopathology.

This comprehensive approach had two aims. First, we aimed to test whether people with BPD, who are a high-risk group for NSSI (Zanarini et al., 2008) and suicidality (Black et al., 2004), had higher scores on implicit measures of suicidality and NSSI (i.e., three implicit association tests, subliminal priming procedure) compared to healthy controls. Second, we wanted to provide initial insights related to this specific patient group (BPD) on the associations between these implicit measures on suicidality and NSSI and explicit measures on suicidality, NSSI, and psychopathology. We had two hypotheses. First, individuals with BPD show higher implicit suicidality than healthy controls. Second, in individuals with BPD, implicit measures of suicidality correlate with higher suicidality and with a higher frequency of NSSI as well as with increased borderline symptomatology, depressive symptomatology, and hopelessness.

2. Methods

2.1. Participants

We included 40 patients and 25 healthy controls (HCs). We recruited patients from multiple wards at a psychiatric clinic, where they had been pre-diagnosed with BPD. At the time of the assessment, they were in psychiatric care, where all received psychotherapy and most were also given psychotropic medication. To identify potential participants, a member of the study team went regularly onto the ward to discuss with the staff which of the new patients fulfilled the inclusion criteria. A member of the study team then personally informed potential participants about the study and provided written information about it. If patients agreed to participate (written informed consent), we arranged dates for the in-person assessments and handed out self-report questionnaires. We asked patients to fill out the self-report questionnaires one to two days prior to the assessment. The assessments took place in

the study's labs in the same building (on a different floor than the wards). We recruited HCs from the general population via word of mouth, an established subject pool, and leaflets. Similar to patients, HCs filled in the self-report questionnaires shortly before the in-person assessment.

Inclusion criteria for patients and healthy controls were (a) age 18–70 years, (b) fluency in German, (c) IQ > 70 as estimated by a vocabulary test, and (d) no neurological disorder. An additional criterion for the clinical sample was a BPD diagnosis verified by the Structured Clinical Interview for DSM-IV (SCID-II; First & Gibbon, 2004). Exclusion criteria for patients were a previous psychotic episode, tested via the Mini International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 1998). For HCs, exclusion criteria were (a) any disclosed previous psychotherapeutic or psychiatric treatment, (b) a history of psychopathology as determined by the M.I.N.I., or (c) lifetime NSSI as indicated by the Self-Injurious Thoughts and Behaviors Interview (SITBI, Nock et al., 2007). Both samples were parallelized based on age (BPD: $M = 25.40$ years ($SD = 10.37$); HC: $M = 26.84$ years ($SD = 8.20$); $t(59.407) = 0.621, p = .537$), gender (BPD: 85.0% female; HCs: 84.0% female; $\chi^2(1) = 0.012, p = .913$), and estimated IQ (BPD: $M = 96.25$ ($SD = 10.52$); HCs: 95.20 (11.28); $t(48.40) = 0.375, p = .710$). Furthermore, both groups had similar ratios of German versus any other nationality as well as similar ratios of German versus other language as first language (for both, BPD: 85.0% German nationality/first language; HCs: 80.0% German nationality/first language; $\chi^2(1) = 0.274, p = .601$).

2.2. Implicit measures

For each of the three Implicit Association Tests (IATs), which were conducted on a computer, we instructed participants to sort stimuli as fast as possible into categories using two response keys. In the IAT Death – Me/Others (for a detailed description see Nock et al. (2010)), the categories were the constructs “death” (e.g., “dying,” “suicide”) and “life” (e.g., “living,” “breathing”) as well as the attributes “me” (e.g., “I,” “mine”) and “others” (e.g., “you,” “yours”). In the relevant blocks, one construct and one attribute were paired and allocated to the same response key. In congruent blocks (in line with our hypothesis), “death” and “me” had the same response key and “life” and “others” had the other response key. In incongruent blocks, the pairings were reversed. In both self-harm IATs (Me/Others and Good/Bad; sometimes referred to as the “identity” and “attitude” versions; for a detailed description, see Nock & Banaji (2007)), the constructs were “cutting” and “not cutting,” for which participants categorized images of human skin with and without cuts. Attributes were “self” and “others” in the IAT Self-Harm – Me/Others; and “good” (e.g., “joy,” “love”) and “bad” (e.g., “misery,” “horrible”) in the IAT Self-Harm – Good/Bad. In congruent blocks, the construct “cutting” was paired with “self” or “good.” We compared the time participants took for the congruent versus incongruent blocks using the D600 algorithm (Greenwald et al., 2003). Higher scores in the resulting *D*-score indicated faster responses to the congruent blocks relative to the incongruent blocks, which we tested for association with increased suicidality and NSSI.

In the computerized task Subliminal Priming (Olson & Fazio, 2002), each trial followed the same sequence on the screen. First, a prime word (“dying” or “growing”) was displayed for 28 ms, followed by a mask (alphanumeric string) for 42 ms and then the actual target word (an adjective). The target word stayed on the screen until participants categorized it as positive or negative by pressing one of the response keys. After eight practice trials using a “pseudo” prime, 128 experimental trials followed in which each prime (“dying” and “growing”) was combined twice with each of the 32 adjectives (“positive” and “negative,” 16 each). Patients received feedback only on the eight practice trials. The mean reaction time after the prime “dying” minus the mean reaction time after the prime “growing” led to the scores Life-Positive (calculated using positive adjectives) and Life-Negative (calculated using negative adjectives). Thus, a faster reaction after the prime “growing” to positive adjectives resulted in higher Life-Positive scores. Similarly, higher Life-Negative scores stemmed from faster reaction times to negative adjectives after the prime “growth.” We expected lower Life-Positive and higher Life-Negative scores to be associated with increased suicidality and NSSI.

2.3. Additional measures

We measured suicidal ideation via self-report using the Beck Scale for Suicidal Ideation (BSS), items 1–19. We used the self-report scale Short Version of the Borderline Symptom List (BSL-23; Bohus et al., 2009) to quantify severity of BPD symptomatology. To assess depression, we administered the self-report Beck Depression Inventory-II (BDI-II; Beck et al., 1996) and rated depression with the Hamilton Depression Rating Scale (HDRS; Hamilton, 1960). Additionally, we included the self-report Beck Hopelessness Scale (BHS; Beck et al., 1974). All self-report scales had very good internal consistency (Cronbach's alpha) in the entire sample (BSS: $\alpha = 0.89$, BSL-23 $\alpha = 0.98$, BDI-II: $\alpha = 0.96$, BHS: $\alpha = 0.94$) and at least acceptable internal consistency in the BPD group (BSS: $\alpha = 0.88$, BSL-23: $\alpha = 0.91$, BDI-II: $\alpha = 0.77$, BHS: $\alpha = 0.74$). Suggested cutoffs for increased suicide risk are > 2 for the BSS, > 22 for the BDI-II, > 8 for the BHS, and > 18 for the HDRS (Brown et al., 2000). Additional clinical interviews were the Mini International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 1998), the Self-Injurious Thoughts and Behaviors Interview (SITBI; Nock et al., 2007), and the subsection on BPD of the Structured Clinical Interview for DSM-IV (SCID-II; First & Gibbon, 2004).

2.4. Procedures

Participants completed a series of self-report questionnaires prior to in-person assessment. During the assessment, participants completed the experimental implicit measures in randomized order. Furthermore, a member of the study team (who had at least a bachelor's degree in psychology and who was trained and supervised by a licensed psychotherapist) rated depression with the 17-item version of the HDRS and conducted the M.I.N.I. An experienced staff member (at least postgraduate level) performed the SITBI with patients with BPD in a second in-person assessment together with the BPD section of the SCID-II. All participants gave written informed consent and received 20 euros as compensation. The local medical board's ethics committee approved the trial (trial number PV5263).

2.5. Sample size calculation

Due to the exploratory nature of the study, the sample size calculation was an approximation only. Aiming at $n = 40$, we chose a sample size similar to previous IAT studies on psychological disorders. The calculation of group differences via independent *t*-test in our sample (unequal allocation ratio $n = 40$ vs. $n = 25$) allows the detection of medium effect sizes of Cohen's $d = 0.65$. For the correlational analyses within the sample of patients with BPD, a sample size of $n = 37$ allows the detection of effect sizes of $r = 0.4$ (medium effect) with a power of 0.80. We used G*Power 3.1.9.7 for both power calculations (Faul et al., 2007).

3. Results

Patients reported high psychopathology. The mean borderline symptomatology (BSL-23) score was 56.6, which is higher than in the patient validation sample (47.2; Bohus et al., 2009) and higher than in the HCs ($M = 5.8, t(57.029) = 16.955, p < .001, d = 3.67$). Scores on the BDI-II indicated severe depression for all but 6 patients (who had scores indicating moderate depression). Patients with BPD had higher average scores than HCs on the BDI-II (37.6 vs. $5.5, t(61.614) = 18.365, p < .001, d = 4.35$) and HDRS (20.2 vs. $1.6, t(49.715) = 21.886, p < .001, d =$

4.59). Patients' mean BSS score was 16.2, which is similar to scores recorded in a psychiatric emergency department (e.g., a mean of 17.2 in Healy et al., 2006), whereas no HC scored above zero ($t(39.000) = 12.096, p < .001, d = 2.43$).

Hotelling's T^2 test revealed that the scores on the implicit tests differed between the patients with BPD and HC, with a large effect size ($T^2 = 26.809; F(5, 59) = 5.021; p < .001; \eta_p^2 = 0.299$). As depicted in Fig. 1 and tested with post-hoc Welch's t -tests, patients with BPD had higher scores on the three IATs with large Cohen's d effect sizes (Death – Me/Others: $d = 0.70, t(57.618) = 2.846, p = .006$; Self-Harm – Me/Others: $d = 1.09, t(62.891) = 4.718, p < .001$; Self-Harm – Good/Bad: $d = 0.70, t(57.823) = 2.864, p = .006$). Group performance was similar on the two scores from the subliminal priming tasks (Life-Positive: $d = 0.08, t(44.568) = 0.314, p = .756$; Life-Negative: $d = 0.05, t(53.089) = 0.195, p = .846$).

Table 1 depicts Pearson correlations within the BPD sample between the five implicit scores and the various clinical scales. As the outcomes Frequency of Lifetime NSSI and 12-Month NSSI were metric but were positively skewed with outliers, we performed rank-based normalization (using Rankit's formula), which is a common procedure for NSSI frequency (e.g., Anestis et al., 2013). Three significant correlations (after Bonferroni correction) emerged: IAT Death – Me/Others correlated with the depression measure BDI, IAT Self-Harm – Me/Others correlated with the depression measure HDRS, and IAT Self-Harm – Good/Bad correlated with Frequency of Lifetime NSSI; all correlations were positive, as expected. In the HC group, no significant correlation emerged between implicit measures and clinical scales ($p > .05$).

We calculated Pearson correlations among the IATs. The IAT Self-Harm – Me/Others correlated moderately with both the IAT Death – Me/Others ($r = 0.33, p = .007$) and the IAT Self-Harm – Good/Bad ($r = 0.38, p = .002$). The IAT Death – Me/Others and IAT Self-Harm – Good/Bad were not significantly correlated ($r = 0.14, p = .282$), and none of the IATs correlated with either Life-Positive or Life-Negative from the subliminal priming procedure ($r \leq |0.14|, p \geq .254$).

4. Discussion

This study investigated how patients with BPD performed on four different implicit tests on suicidality and NSSI in comparison to healthy controls (HCs) and how their scores on the different implicit tests related to various clinical outcome measures. Confirming our first hypothesis and extending previous evidence in patients with depression compared with HCs (Wang et al., 2020), patients with a verified BPD diagnosis had higher scores on the three different implicit association tests (IATs) than the HCs did, indicating higher implicit self-identification with self-harm and death as well as stronger implicit positive attitudes towards self-harm. However, the two groups did not differ on a subliminal priming procedure.

Moreover, we found weak correlations between implicit measures and various measures of BPD and depressive symptomatology, suicidality, and frequency of previous NSSI. This is generally in line with Sohn et al. (2021), who observed in their meta-analysis larger effects between individuals with and individuals without a history of suicidality in community samples compared to acute care samples (e.g., Kene, 2017; Millner et al., 2019). In the current study, however, only three correlations were significant after correcting for multiple testing: more positive implicit attitudes towards self-harm (higher scores on the IAT Self-Harm – Good/Bad) were associated with a higher lifetime frequency of NSSI, and stronger implicit identification with self-harm and death (higher scores on both the IAT Self-Harm – Me/Others and on the IAT Death – Me/Others) was associated with higher levels of depression.

Additionally, our design enabled us to compare different IATs with each other. Correlations between the three IATs were weak to moderate and similar to Millner et al. (2019). IATs of different (but related) concepts should correlate moderately (e.g., Blair et al., 2015; Gawronski, 2002). Thus, the results support the assumption that IATs measure different implicit cognitions or self-concepts (e.g., one related to NSSI, another to suicidality).

The subliminal priming procedure did not reveal group differences. A possible reason might be the experimental procedure. The length of time the prime was presented may not have been optimal (too short or too long) or the stimuli may not have been strong enough (potentially, the strength could be increased by using different words, pictures instead of word, or a variety of words). Moreover, the concepts "dying" and "growing" may not have been closely associated with the positive and negative adjectives selected and thus the measured differences across participants were too small. Either different adjectives or different concepts (e.g., related to self-concept, similar to IATs such as "me" and "other") might reveal group differences on this task.

The study has some limitations. First, it is cross-sectional and thus does not inform us about the potential of implicit measures to predict behavior. Second, a clinical comparison group is missing. Third, the sample size is small and only allowed to detect medium to large effect sizes ($d = 0.65$). Fourth, we did not investigate all possible confounds, such as ongoing psychotherapeutic/pharmacological treatment or ethical background. Fifth, in a paper titled "best research practices for using the implicit association test," a group of over 20 authors (Greenwald et al., 2022) suggest administering the same IAT multiple times.

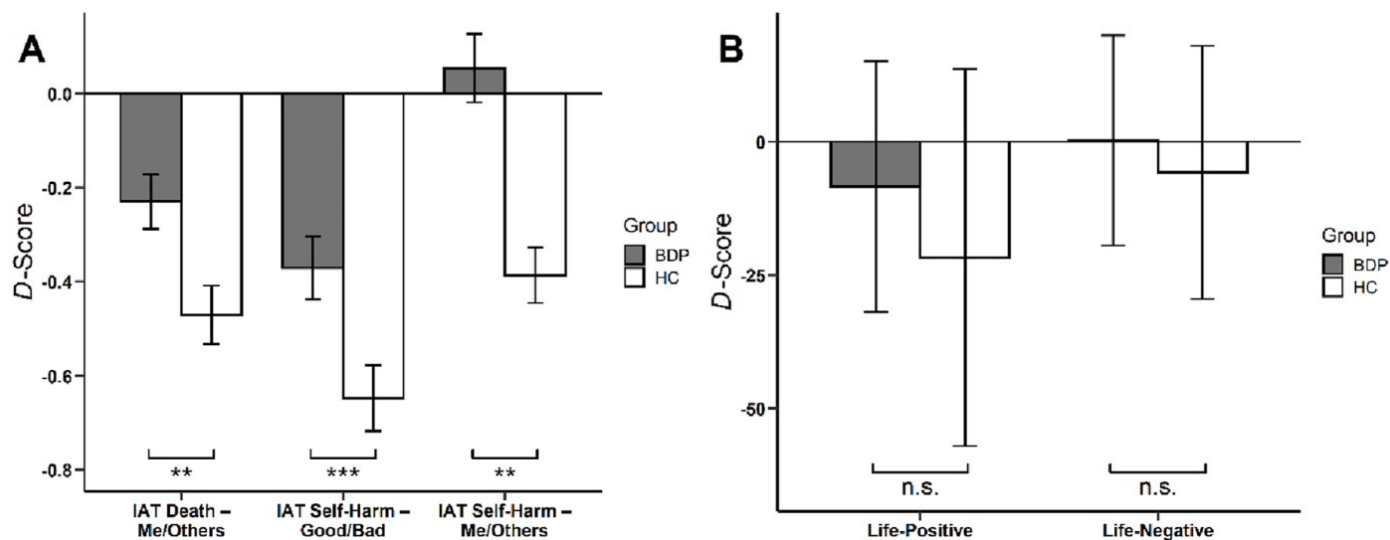


Fig. 1. Bar plots display group differences between patients with borderline personality disorder (BPD; gray) and healthy controls (HCs; white). For implicit association tests (IATs), higher D-scores were expected to be associated with increased suicidal and NSSI behavior (bar plot A). For subliminal priming, lower Life-Positive and higher Life-Negative scores were expected to be associated with increased suicidal and NSSI behavior (bar plot B). Error bars indicate the standard error of the mean. Asterisks indicate level of significance (** $p < .01$; *** $p < .001$; n.s. stands for "nonsignificant").

Table 1

Pearson's correlation coefficients between implicit measures and various outcome measures.

	<i>n</i>	<i>Mean (SD)</i>	IAT Death – Me/Others	IAT Self-Harm – Me/Others	IAT Self-Harm – Good/Bad	Life-Positive	Life-Negative
Suicidality							
BSS	40	16.2 (8.4)	.23	.27	.10	-.01	.14
NSSI							
Frequency of Lifetime NSSI ^a	35	1291.8 (4557.0) ^b	-.09	.15	.47**	.02	.23
Frequency of 12-Month NSSI ^a	37	126.6 (321.8) ^b	.19	.35*	.38*	.09	.07
Psychometric Measures							
BSL-23	40	56.6 (16.7)	.29	.19	.19	-.22	.07
BDI	40	37.5 (8.2)	.51***	.21	.02	-.11	.11
HDRS	40	20.1 (5.0)	.33*	.44**	-.15	-.10	-.17
BHS	40	13.7 (3.5)	.30	.23	.01	-.17	.14

Notes. * $p < .05$; ** $p < .01$; *** $p < .001$; ^a = rank-based normalized; ^b = before rank-based normalization; correlations in bold remained significant after controlling for multiple testing (Bonferroni correction; level of significance reduced to $p < .01$); IAT = Implicit Association Test; BSS = Beck Scale for Suicidal Ideation; NSSI = nonsuicidal self-injury; BSL-23 = Short Version of the Borderline Symptom List; BDI = Beck Depression Inventory-II; HDRS = Hamilton Depression Rating Scale; BHS = Beck Hopelessness Scale.

However, the effect of presenting similar IATs in a single session is unclear (there is the possibility of decreased validity of the measures due to limited concentration, increased ability to manipulate the tests, or priming effects).

Even though the subliminal priming procedure did not reveal any group differences in this study, researchers should consider developing and adapting alternatives to the IAT (e.g., Franklin et al., 2014; Tucker et al., 2018). Moreover, implicit measures could be improved by refinements in stimuli selection (Millner et al., 2019) or method of presentation (e.g., optimal presentation time of prime for the subliminal priming procedure). There has also been some enlightening research on mechanisms of implicit measures on suicidality, such as findings that implicit measures capture a decreased desire to live rather than a desire to die (Harrison et al., 2014) and that differences between explicit and implicit suicidality measures are more likely driven by poor introspective awareness than by deliberate deception (Podlogar et al., 2020). Thus, research that helps us to better understand the mechanisms behind IATs might lead to developments that improve the internal and external validity of implicit measures.

5. Conclusion

This study investigated how patients with BPD perform on various implicit measures on self-harm behavior (suicidality and NSSI). The IATs differentiated well between healthy controls and patients with BPD. This suggests that patients with BPD have higher implicit self-identification with both self-harm and death, as well as stronger implicit positive attitudes towards self-harm, than healthy controls. However, within the group of patients with BPD, discriminative value of IATs was low. Moreover, the subliminal priming procedure did not reveal group differences. Nonetheless, our study offers the first insights into how patients with BPD perform on these various implicit measures.

Ethical standards

The authors assert that all procedures contributing to this work complied with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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CRedit authorship contribution statement

Jakob Scheunemann: Writing – original draft, Investigation, Formal analysis, Visualization. **Simone Kühn**: Conceptualization, Software, Methodology, Funding acquisition, Writing – review & editing. **Sarah V. Biedermann**: Resources, Investigation, Writing – review & editing. **Michael Lipp**: Resources, Investigation, Writing – review & editing. **Judith Peth**: Funding acquisition, Methodology, Writing – review & editing. **Jürgen Gallinat**: Conceptualization, Funding acquisition, Supervision, Resources, Methodology, Software, Writing – review & editing. **Lena Jelinek**: Conceptualization, Funding acquisition, Project administration, Data curation, Supervision, Methodology, Formal analysis, Writing – review & editing.

Declaration of competing interest

None.

Data availability

Data will be made available on request.

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