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BRIEF REPORT

The interaction of affective states and cognitive vulnerabilities in the prediction of non-suicidal self-injury

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Non-suicidal self-injury (NSSI) is a serious public health concern and remains poorly understood. This study sought to identify both cognitive and affective vulnerabilities to NSSI and examine their interaction in the prediction of NSSI. A series of regressions indicated that low levels of positive affect (PA) moderated the relationships between self-criticism and brooding and NSSI. The associations of self-criticism and brooding with greater frequency of NSSI were attenuated by higher levels of PA. The interaction of cognitive and affective vulnerabilities is discussed within the context of current NSSI theory.

Keywords: Non-suicidal self-injury; Cognitive vulnerability; Positive affect; Negative affect; Cognitive style.

Non-suicidal self-injury (NSSI) has received heightened attention in both research and clinical domains and is now a part of the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) section on diagnoses needing further research. NSSI is defined as deliberate behavior, not socially sanctioned and without fatal intentions, that causes direct damage to one's body tissue (Nock, 2010). Individuals with a history of NSSI demonstrate increased risk for suicidal thoughts and attempts (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). NSSI occurs in approximately 13–45% of adolescents and 4% of adults (Klonsky, Oltmanns, & Turkheimer, 2003). NSSI is a serious public health concern, and research on factors that predict its occurence, although increasing in recent years (Nock, 2010), is urgently needed.

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Theoretical models posit that NSSI is utilised to regulate both affective and cognitive states based on intrapersonal and interpersonal needs (Nock, 2010). Indeed, affective and cognitive dysregulation puts one at increased risk for NSSI (Nock, 2010), and a substantial set of cognitive and affective risk factors for NSSI has been identified.

Cognitive vulnerabilities to NSSI

Self-criticism is a cognitive style marked by heightened internalised concern with self-definition and negative cognitive appraisals of the self. Self-criticism is often associated with feelings of failure, worthlessness and inferiority and is a risk factor for the presence of NSSI among adolescents and adults (Claes, Houben, Vandereycken, Bijttebier, & Muehlenkamp, 2010). Moreover, it is a robust predictor of prolonged endurance of physical pain, a hallmark feature of NSSI. In their proposal for the adoption of NSSI Disorder in DSM-5, Shaffer and Jacobson (2009) proposed self-criticism as one of six thoughts or feelings exhibited directly before an act of NSSI. Overall, self-criticism is a cognitive style consistently associated with NSSI.

Individuals with a history of NSSI also endorse ruminating significantly more than their non-self-injuring counterparts. A ruminative cognitive style is a vulnerability for NSSI (Armey & Crowther, 2008), and ruminative brooding moderates the relationship between depressive symptoms and NSSI (Hilt, Cha, & Nolen-Hoeksema, 2008). Emotional Cascade Theory (Selby, Anestis, & Joiner, 2008) posits that rumination may lead to negative affect (NA) and NSSI may subsequently be used as a distraction mechanism because of its associated physical sensations.

Affective predictors of NSSI

Affect regulation models of NSSI propose that the purpose of self-injury is to adjust one's emotional state (e.g., Klonsky, 2007). Individuals who engage in NSSI have higher levels of trait emotional reactivity than those who do not (Nock, Wedig, Holmberg, & Hooley, 2008). Research has focused predominately on NSSI as a mechanism for the reduction of NA. Proponents of these models assert that NSSI occurs during times of intense NA as a means to mitigate arousal (Chapman, Gratz, & Brown, 2006). For instance, retrospective studies demonstrate that anger and sadness often precede NSSI (Kamphuis, Ruyling, & Reijntjes, 2007). In a review of 18 articles, Klonsky (2007) found that NA precedes NSSI and that there is a sense of relief and subsequent decrease in NA after the self-injurious behavior. Thus, NA may be a risk factor for NSSI as individuals are motivated to change that state.

The association of positive affect (PA) with NSSI also has been studied, although to a lesser extent than NA. Jenkins and Schmitz (2012) found that PA (and not NA) after engaging in NSSI was associated with more lifetime acts of NSSI. Thus, when NSSI is used to cultivate PA, it may be positively reinforcing (Hilt et al., 2008; Jenkins & Schmitz, 2012). This is congruent with the theory that endogenous opioids, which can create a feeling of euphoria, are released when one self-injures (Nock, 2010). Other studies (e.g., Nock & Prinstein, 2004) suggest that NSSI can be used as a conduit for the cultivation of more positive emotional states, perhaps improving upon an initial deficit in PA. Thus, initial high levels of PA could serve as a protective factor for NSSI.

The confluence of affective and cognitive vulnerabilities in the prediction of NSSI

A multitude of cognitive and affective vulnerabilities to NSSI have been identified; however, existing research has either (1) examined affective or cognitive predictors of NSSI separately, or (2) posited the joint influence of both affective and cognitive variables in theoretical models (e.g., Nock, 2010), but failed to explore this interaction empirically. Research on depression, which is consistently associated with NSSI (Nock et al., 2006), suggests that affective states can amplify or attenuate existing cognitive vulnerabilities. For example, higher levels of NA may intensify the effects of negative cognitive style and rumination,

thereby increasing depressive symptoms (Hankin & Abramson, 2001). In contrast, PA has been shown to build psychological resilience (Tugade, Fredrickson, & Feldman Barrett, 2004). It is therefore plausible that higher levels of PA may attenuate the relationship between cognitive vulnerabilities and NSSI, whereas higher levels of NA may amplify such risk factors.

The present study

We sought to examine the roles of NA and PA in NSSI and explore how they may interact with candidate cognitive styles, namely self-criticism and brooding, in the prediction of NSSI. We hypothesised that higher levels of PA would serve as a protective factor and would attenuate the impact of self-criticism and brooding on NSSI. Second, we hypothesised that higher levels of NA would strengthen the association between these cognitive vulnerabilities and NSSI.

METHOD

Participants

Sample recruitment

Adolescents from Philadelphia-area public high schools and colleges (ages 14–19) were selected for participation in a behavioural high-risk study designed to evaluate characteristics of individuals hypothesised to be at high versus low risk for a first onset of bipolar disorder based on Behavioral Approach System (BAS) sensitivity (see Alloy et al., 2012). All procedures were approved by the Temple University Institutional Review Board. Participants were selected as part of a two-phase screening procedure. During Phase I, students (N = 9991) were screened using a demographics measure and two self-report BAS sensitivity measures: the Behavioral Inhibition System/Behavioral Activation System (BIS/BAS) Scales (Carver & White, 1994) and Sensitivity to Punishment/Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, Avila, Molto, & Caseras, 2001). Students who scored in the highest 15th percentile on both the BAS-Total score of the BIS/BAS Scales and the Sensitivity to Reward (SR) scale of the SPSRQ were categorised as High BAS (HBAS), whereas students who scored between the 40th and 60th percentiles on both measures were categorised as Moderate BAS (MBAS).

A subsample of the adolescents who met criteria for inclusion in the HBAS or MBAS groups was randomly invited to participate in the Phase II screening. In Phase II, participants were administered the mood and psychosis sections of the expanded Schedule for Affective Disorders and Schizophrenia—Lifetime (SADS-L; Endicott & Spitzer, 1978) diagnostic interview. Participants were excluded from the final sample if they met criteria for any disorder in the bipolar spectrum (bipolar I or II, cyclothymia or bipolar not otherwise specified [NOS]) with onset prior to the date of the participant's completion of the Phase I screening measures, or if they met criteria for any lifetime psychotic disorder or could not write or speak fluent English (see Alloy et al., 2012, for further details).

Study sample

The present sample consisted of 177 participants (113 HBAS; 64 MBAS) who completed the Phase II assessment and the measure of NSSI. The NSSI measure was added after study recruitment had started, so some participants did not complete the measure. The present study reports on the subset of participants who completed the measure. The sample was, on average, 18.69 years old (SD = 0.84), and 72% female. In addition, the sample was 69.5% Caucasian, 14.1% African-American, 6.8% Hispanic/Latino, 7.3% Asian-American, 1.7% Native American and 0.6% Multiracial. Participants who completed the NSSI measure did not differ from those who did not with the exception of age (older in the present sample by a mean of 1.15 years: $t(259.10) = 6.41$, $p < .01$) and race (greater proportion of Caucasian participants in the present sample: $\chi^2(1) = 14.85$, $N = 336$, $p < .01$).

Procedure

Following completion of Phase I and the diagnostic assessment of Phase II, eligible participants completed additional measures assessing depression, cognitive styles, emotionality and impulsivity. Participants reported whether they engaged in NSSI in the past year. All participants who indicated that they engaged in any NSSI behavior underwent a risk assessment with a trained interviewer and received referral information.

Measures used for sample selection

BAS sensitivity

The BIS/BAS Scale (Carver & White, 1994) is a 20-item questionnaire used to assess individual differences in BIS and BAS sensitivity. Participants respond to questions on a 4-point Likert-type scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). A total BAS score was calculated by summing all BAS items, with higher scores indicating higher BAS sensitivity. The BIS/BAS scales have demonstrated good internal consistency and retest reliability (Carver & White, 1994). The internal consistency (α) of the BAS total scale in this sample was .80.

The SPSRQ (Torrubia et al., 2001) is a 48-item self-report measure used to assess an individual's SR and sensitivity to punishment (SP), with 24 items on each subscale. The SPSRQ was used in conjunction with the BIS/BAS scale to determine group status. Both subscales have demonstrated good internal consistency and retest reliability (Torrubia et al., 2001). In the current study, the SR and SP subscales demonstrated good internal consistency (α's = .76 and .84, respectively).

Cognitive vulnerability measures

Self-criticism

The Depressive Experiences Questionnaire (DEQ; Blatt, D'Afflitti, & Quinlan, 1976) is a 66-item self-report measure of depressive personality styles. Participants rate how much they agree with statements about their personality on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*). The DEQ is composed of two primary subscales: self-criticism and dependency. Because the focus of the present manuscript was cognitive styles, we used only the self-criticism subscale. The DEQ has demonstrated high internal consistency and retest reliability (Blatt et al., 1976), and the factors have shown good construct validity. The measure is scored based on weighted factor loadings of standardised scores according to Blatt et al. (1976). Internal consistency of the self-criticism subscale was α = .80.

Rumination

The Ruminative Responses Scale, brooding subscale (RRS-BR; Treynor, Gonzalez, & Nolen-Hoeksema, 2003) assesses brooding rumination in response to a dysphoric mood. Participants are asked to rate each of the five items on a Likert scale (1 = *almost never* to 4 = *almost always*) about how often they participate in certain responses to their depressed mood (e.g., "analyze recent events to try to understand why you are depressed"). The RRS-BR has demonstrated good internal consistency and test–retest reliability (Treynor et al., 2003). In the present study, the RRS-BR demonstrated good internal consistency, α = .85.

We chose to evaluate self-criticism and brooding, as opposed to cognitive styles more relevant to other disorders such as bipolar disorder, because of their theoretical relevance to NSSI and the support received for these factors in relation to NSSI in previous research.

Affect measure

The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) consists of 10 positive and 10 negative adjectives, which measure PA and NA. Participants rated how much they have felt each of the 20 items over the past 30 days on a scale from 1 (*very slightly or not at all*) to 5 (*extremely*). Scores on the positive and negative adjectives are summed separately to yield the PA and NA subscales. The PANAS has demonstrated good psychometric properties,

including construct validity and test–retest correlations (Watson et al., 1988). Additionally, research has shown that there is no significant correlation between PA and NA, which is an indication of divergent validity. In the current study, PANAS-NA and PANAS-PA demonstrated good internal consistency, α = .85 and α = .89, respectively. PANAS scores were used to assess participants' state affect, an evaluation of how they were feeling, on average, over the past 30 days.

NSSI measure

The Form and Function Self-Injury Scale (FAFSI; Jenkins & Schmitz, 2012) assesses the methods, course and reasons for engaging in NSSI. The current study only included the first portion of the FAFSI, which assesses the frequency of various NSSI methods. The FAFSI inquires about 13 distinct forms of NSSI (e.g., cutting, burning, ingesting noxious substances, biting self, as well as a fill-in "other" category). For each of the NSSI methods, participants first respond to the dichotomous question, "Have you ever engaged in [X]?" (0 = *No* and 1 = *Yes*). For each method endorsed, participants report how many times they engaged in that behavior in their lifetime. However, because 50% of participants reported the absence of any NSSI and there was considerable variability in the reported frequency of specific acts of NSSI (with several participants entering "infinity"), we decided to minimise frequency variability by classifying NSSI frequency into five categories (0, 1, 2–5, 6–20 and 20+ NSSI acts; Whitlock et al., 2013). The internal consistency of the dichotomous items was good (α = .77), and all methods of NSSI were endorsed by at least one participant.

For the purposes of this article, instead of dichotomizing NSSI acts (i.e., no/yes), we elected to use the frequency of NSSI as the outcome variable. Allowing for a range of responses to NSSI behaviours permits greater variability rather than possibly oversimplifying the data and the phenomenon of interest.

RESULTS

Regression analyses evaluated whether PA and NA would moderate the effect of self-criticism and brooding on the frequency of NSSI. PA and NA were entered with one cognitive style (brooding or self-criticism) and the two interaction terms (PA × cognitive style and NA × cognitive style) into each regression analysis (Table 1). Significant interactions were probed at high and low (±1 SD) levels of affect (Aiken & West, 1991).

As hypothesised, there was a significant interaction between brooding and PA in the prediction of frequency of NSSI (Figure 1a). Among individuals with lower levels of PA, brooding predicted greater frequency of NSSI (t = 2.11, p = .04). However, among individuals with higher levels of PA, brooding did not predict greater frequency of NSSI (t = −1.47, p = .14). In contrast, the

Table 1. *Hierarchical linear regressions with cognitive styles (brooding and self-criticism) interacting with PA and NA predicting frequency of NSSI*

Predictor	β	t
Brooding × Affect interactions		
BAS-Total	−.04	−.40
SPSRQ-SR	.16	1.61
Brooding	.04	.43
PANAS-PA	−.07	−.90
PANAS-NA	.26	2.91**
Brooding × PANAS-PA	−.17	−2.39*
Brooding × PANAS-NA	−.08	−1.01
Self-criticism × Affect interactions		
BAS-Total	−.06	−.55
SPSRQ-SR	.16	1.59
Self-criticism	.27	2.98**
PANAS-PA	.01	.07
PANAS-NA	.10	1.09
Self-criticism × PANAS-PA	−.16	−2.20*
Self-criticism × PANAS-NA	.04	.51

BAS-Total, Total score on the Behavioral Inhibition System/Behavioral Approach System scales; SPSRQ-SR, Sensitivity to Punishment/Sensitivity to Reward Questionnaire, Sensitivity to Reward Subscale; PANAS-NA, Positive and Negative Affect Scale—Negative Affect; PANAS-PA, Positive and Negative Affect Scale—Positive Affect.

*p < .05, **p < .01.

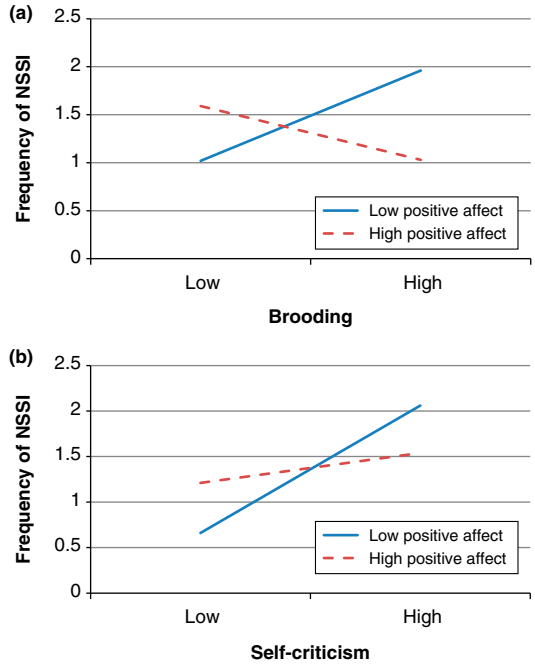

Figure 1. *Interactions between PA and (a) brooding, and (b) self-criticism predicting frequency of NSSI.*

interaction between brooding and NA was not significant.

Similarly, there was a significant interaction between self-criticism and PA in the prediction of frequency of NSSI (Figure 1b). Among individuals with lower levels of PA, self-criticism predicted a greater frequency of NSSI (t = 3.55, p < .001). However, among individuals with higher levels of PA, self-criticism did not predict a greater frequency of NSSI (t = 1.06, p = .29). In contrast, the interaction between self-criticism and NA was not significant. All results reported above remained consistent when controlling for BAS group.

This pattern of results was consistent with the hypothesis that PA may attenuate the impact of each of the brooding and self-criticism cognitive styles on NSSI, whereas NA did not appear to influence the impact of these cognitive styles on the frequency of NSSI.

DISCUSSION

Although many cognitive and affective vulnerabilities for NSSI exist, most empirical research has examined these constructs separately. In contrast, theoretical models of NSSI posit the interaction of cognitive and affective dysregulation as a risk factor for NSSI (e.g., Nock, 2010). This study is one of the first to examine the moderating effects of affect on the relationship between cognitive vulnerability factors and NSSI. We hypothesised that high levels of PA would attenuate the impact of cognitive vulnerabilities on NSSI and that high levels of NA would strengthen the relationship between cognitive vulnerabilities and NSSI.

Overall, the results were consistent with our hypotheses for PA, but not for NA. PA moderated the association between self-criticism and brooding and NSSI such that individuals with negative cognitive styles more frequently engaged in NSSI if they had lower PA over the past month, but not if they had higher PA. In contrast, NA did not moderate the relationship between cognitive styles and NSSI. The impact of negative cognitive styles on NSSI appeared to be stronger among individuals with lower levels of PA. A lack of PA may, perhaps in conjunction with other more distal risk factors such as negative cognitive styles, lead individuals to engage in NSSI as a means of affective and cognitive regulation.

Cognitive vulnerability and affect interaction

NSSI is thought to be employed as a means to regulate the experience, of either over- or under-arousal, produced by aversive emotions and cognitions (Chapman et al., 2006). Indeed, research indicates that emotional (Armey & Crowther, 2008) and cognitive (Chapman et al., 2006) reactivity and low distress tolerance (Nock et al., 2008) are predictors of NSSI. Thus, individuals may turn to NSSI as a pragmatic means (Nock, 2010) to regulate their affective and cognitive state.

Importantly, the results of this study identify specific cognitive and affective variables that

interact in the enhancement of risk for NSSI, suggesting that low PA may amplify the saliency of self-criticism and brooding. Together, this affective and cognitive interaction may cultivate an intolerable phenomenology that the individual is motivated to regulate. To these ends, individuals may employ NSSI to engender PA and temper self-criticism and/or brooding. When PA is present, it may serve as a protective factor and no such regulation is necessary.

The importance of PA in NSSI and the refinement of theoretical models

To date, the vast majority of NSSI research has focused on the role of NA. This study, however, not only indicates that PA may have an important role, but also, at least in certain circumstances, may have more explanatory power than NA. This is a marked departure from the overwhelming body of literature that consistently points to NA as one of, if not the most important, risk factor for NSSI. Subsequently, low PA should be considered as an important variable in future research and included in theoretical models of NSSI. Indeed, the inclusion of PA may offer some precision for the prevailing theoretical models of NSSI.

The functional model of NSSI (Nock, 2010) posits that NSSI is a mechanism to regulate affective and cognitive experience and that NSSI is reinforced by intrapersonal and/or interpersonal contingencies. In both interpersonal and intrapersonal domains, negative reinforcement occurs when an individual engages in NSSI to remove a negative state, whereas positive reinforcement occurs with the generation of a desirable experience (Nock & Prinstein, 2004). Although research has found that intrapersonal reward tends to be more strongly implicated in the maintenance of NSSI (Nock & Prinstein, 2004), there is a lack of research (1) on PA within this context and (2) that examines the influence of NA and PA in conjunction with cognitive vulnerabilities in the intrapersonal domain. This research is an important first step in filling these voids.

Limitations and future directions

This is a relatively novel study of the interactive association of affective and cognitive factors with NSSI, although there are several limitations that should be acknowledged. First, the FAFSI assessed NSSI over the lifetime, whereas the PANAS measured affect over the past 30 days. Thus, the temporal sequencing of these two variables is rather difficult to parse apart, and this study lacks the precision to best examine the roles of affect before and after an NSSI event posited by theoretical models of NSSI (e.g., Nock, 2010). It is certainly possible that many of the NSSI acts took place prior to the levels of affect reported in the study, which could suggest NSSI among individuals with negative cognitive styles leads (at least in the longer term) to the development of lower PA following NSSI acts. This possibility would be consistent with the research that suggests that the cultivation of PA after a NSSI event is reinforcing. Nevertheless, individuals likely did not complete the PANAS immediately after engaging in NSSI. Moreover, although affect often fluctuates across situations, studies have shown that individuals' overall levels of PA and NA tend to be relatively stable over time and may be a good representation of trait affect (eight-week test–retest reliability, PA, $r = .68$, NA, $r = .71$; Watson et al., 1988). Together, these reasons indicate that the pathway (from affect to NSSI) implied by our analyses could well be accurate and that PA likely is not a vulnerability, but a protective, factor.

Relatedly, some of the literature reviewed in this manuscript focuses on dynamic-affective shifts surrounding an NSSI event and, as mentioned, the cross-sectional nature of these data do not permit a precise analysis of these fluctuations in affect. However, because the PANAS evaluated the participant's previous 30 days, this research suggests that the predominance of low levels of PA prior to NSSI could serve as a risk factor, not for the desire to generate momentary PA afterwards, but because individuals are motivated to change their affective state more globally. Additionally, although state affect is highly correlated

with trait affect, affect certainly fluctuates and a 30-day evaluation of affect is indeed more precise than a wider time window. Nonetheless, future research should consider longitudinal designs with repeated measurements and alternative paradigms such as ecological momentary assessment (EMA), which are able to more precisely evaluate the sequencing and timing of these variables.

Although this study found rather robust effects for certain cognitive and affective factors, there are other vulnerabilities that have been previously studied that were not included in our analyses. More specifically, to further parse apart the differential relationships of PA and NA with cognitive vulnerabilities, future research should examine interpersonally oriented cognitive vulnerabilities within a similar affect by cognition interaction model. Doing so will further help the precision of theoretical modelling of NSSI, specifically in regard to affect and cognitive vulnerabilities.

Finally, all of the measures included in this study were self-reported. Consequently, future research should employ neurobiological indices, behavioural tasks or collateral information from family and friends. Yet, because of the low base rate and distinctly private nature of NSSI, self-report does seem a reasonable mode of inquiry. Additionally, the sample included individuals with and without a NSSI history and future studies may examine similar affective and cognitive variables within a more diagnostically consistent sample.

Conclusions

This study identifies the interaction of specific affective and cognitive vulnerabilities implicated in the maintenance of NSSI. Overall, PA attenuated the relationship between self-criticism and brooding and frequency of NSSI. These findings have important implications for future research, and the refinement of current theoretical models of NSSI.

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