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Cognitive and Emotion-Regulatory Mediators of the Relationship between Behavioral Approach System Sensitivity and Non-Suicidal Self-Injury Frequency

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Abstract

Non-suicidal self-injury (NSSI) is highly prevalent among late adolescents and predicts the onset of suicidal ideation and behavior. Although research has established an association between the behavioral approach system (BAS) and NSSI, less research has explored mechanisms underlying this relationship. The authors examined negative and positive emotion regulation patterns, as well as the BAS-relevant cognitive style of self-criticism, as potential mechanisms through which a hypersensitive BAS might be related to NSSI frequency. Late adolescents (N=177) with high and moderate BAS levels completed measures of self-criticism, positive emotion regulation, brooding, and both lifetime and last year frequency of NSSI. Results indicated that self-criticism and positive emotion dampening independently mediated the relationship between BAS and last year frequency of NSSI. Self-criticism also mediated the relationship between BAS and lifetime frequency of NSSI. Results suggest that cognitive and emotion-regulatory styles may help to explain why high BAS individuals are likely to engage in NSSI.

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Keywords

non-suicidal self-injury; behavioral approach system; adolescents; emotion regulation; cognitive style

It is estimated that between 4 to 6% of the general population have engaged in non-suicidal self-injury (NSSI), the act of intentionally self-injuring without lethal intent (Nock, 2010). The rate of NSSI is substantially higher among individuals under the age of 30, and lifetime prevalence estimates range from 7% to 38% among college samples (Gratz, Conrad, & Roemer, 2002; Whitlock, Eckenrode, & Silverman, 2006). Given that NSSI serves as a robust predictor of both suicidal ideation and behaviors (Hamza, Stewart & Willoughby, 2012), recent research has focused on identifying its etiology to better prevent the behavior.

BAS Hypersensitivity Model

One biobehavioral mechanism that may initiate or maintain NSSI is the behavioral approach system (BAS; Gray, 1991), a neurobiological system proposed to regulate appetitive motivation, or goal-oriented approach behavior. The BAS is theorized to be reactive to both conditioned and unconditioned cues of reward and is responsible for regulating the negative and positive reinforcement value of rewards (Pickering & Gray, 2001). A hypersensitive BAS can lead to excessive activation in response to events that involve goal striving, goal attainment, and rewards, which, in turn, leads to hypomanic/manic symptoms. It also can lead to excessive deactivation in response to non-attainment of goals/rewards and, in turn, depressive symptoms (Alloy & Abramson 2010). Therefore, it has been proposed that a hypersensitive BAS leads to a low threshold for both BAS activation and deactivation, resulting in mood dysregulation.

Behavioral Approach System Sensitivity and NSSI

Given the strong association between BAS sensitivity and mood dysregulation, it is surprising that only two known studies have examined the relationship between the BAS and NSSI, a behavior hypothesized to result from severe mood dysregulation (Nock, 2010). NSSI history and frequency was associated with elevated levels of BAS on the Fun-Seeking dimension (willingness to approach rewards impulsively) (Cerutti, Presaghi, Manca, & Gratz, 2012). Additionally, BAS Drive (a general tendency to approach rewards) and BAS Fun Seeking predicted a higher lifetime frequency of NSSI (Jenkins, Seelbach, Conner, & Alloy, 2013).

The Four-Function Model of NSSI (FFM; Nock, 2010) may help explain the relationship between BAS hypersensitivity and NSSI. The FFM asserts that the maintenance of NSSI occurs because of four main functional reinforcement processes. These include: automatic negative and positive reinforcement (i.e. intrapersonal) and social negative and positive reinforcement (i.e. interpersonal). Automatic negative reinforcement reflects NSSI's reduction of distressing affective and/or cognitive states, whereas automatic positive reinforcement reflects NSSI's generation of positive affect or other forms of stimulation. The FFM posits that vulnerabilities to affective and cognitive dysregulation may increase

one's risk for NSSI by increasing the desire for the rewarding intrapersonal reinforcement properties of NSSI (Nock, 2010).

Given that the BAS responds to both positive and negative reinforcing stimuli (Gray, 1991), we posited that BAS hypersensitivity may increase individuals' sensitivity to NSSI's reinforcing properties. We compared NSSI frequency in individuals with high versus moderate BAS sensitivity at an age of high risk for the behavior, and examined potential mechanisms through which a hypersensitive BAS may lead to NSSI. Given that emotional and cognitive dysregulation have been consistently, albeit indirectly, linked with BAS hypersensitivity and are vulnerabilities for NSSI in the FFM (Nock, 2010), we hypothesized that BAS hypersensitivity may indirectly lead to NSSI through its association with emotional and cognitive dysregulation.

Negative Emotion Regulation Style: *Brooding*

Ruminative brooding, the comparison of one's current situation with an unachieved standard by turning inward as a means of problem solving, is one style of negative emotion regulation that has received research attention in association with mood dysregulation (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Individuals with high BAS sensitivity exhibit greater levels of rumination than do individuals with moderate BAS sensitivity (Stange et al., 2013a). Importantly, ruminative brooding is also a vulnerability for NSSI (Armey & Crowther, 2008). We propose that individuals with a highly sensitive BAS may be more likely to ruminate, leading to greater levels of negative affect and emotion dysregulation, and a greater likelihood of employing NSSI as a means to benefit from its automatic negative reinforcement processes.

Positive Emotion Regulation Style: *Dampening*

We propose that the positive emotion regulation strategy of dampening, a strategy aimed at cognitively diminishing any positive moods elicited from stimuli, also may help to explain the relationship between BAS hypersensitivity and NSSI (Feldman, Joorman, & Johnson, 2008). A daily diary study found that undergraduates with a history of NSSI experience positive affect less often and with lower inertia (i.e. a higher rapidity of returning to homeostasis after experiencing affect) than those without any NSSI (Bresin, 2013). This pattern of results potentially could be explained by the employment of dampening strategies, which could lower levels of both the occurrence and the inertia of positive affect. Thus, we hypothesized that individuals with a highly sensitive BAS would maladaptively regulate their positive emotions via dampening, which may reduce the occurrence and the inertia of their positive affect, and in turn, increase likelihood to engage in NSSI as a means of automatic positive reinforcement.

Self-Criticism, BAS, and NSSI

In addition to examining emotion regulation strategies as mechanisms through which BAS hypersensitivity leads to NSSI, we also examined self-criticism as a possible mechanism. Self-criticism is a cognitive style associated with heightened negative cognitive appraisals of the self (Claes, Houben, Vandereycken, Bijttebier, & Muehlenkamp, 2010). Notably, self-

criticism has been identified as a BAS-relevant cognitive style found to predict a greater likelihood of hypomanic and manic episodes among high BAS individuals (Alloy et al., 2009). In addition, research has demonstrated that self-criticism is an important risk factor for NSSI across development (Claes et al., 2010; Glassman, Weierich, Hooley, Deliberto, & Nock, 2007). In line with our hypotheses that BAS sensitivity may predict NSSI frequency through emotional dysregulation (via brooding and dampening), we hypothesized that those with a hypersensitive BAS would be more likely to engage in self-criticism, which, in turn, increases one's likelihood to engage in NSSI as a means of automatic negative reinforcement.

Current Study

Thus, we investigated differences in NSSI frequency between individuals with a hyper-sensitive and moderately sensitive BAS, and tested potential mechanisms for this relationship.

Method

Participants and Procedure

Sample Recruitment—Participants for the present study were recruited as part of a behavioral high-risk longitudinal study designed to examine characteristics of individuals hypothesized to be at high versus low risk for first onset of bipolar disorder based on BAS sensitivity (see Alloy et al., 2012). Adolescents (ages 14–19) were recruited from Philadelphia-area public high schools and colleges. In Phase I of screening, students (N = 9,991) completed two self-report measures of BAS sensitivity. Students who scored in the highest 15th percentile on *both* measures were categorized as High BAS (HBAS), whereas those who scored between the 40th and 60th percentiles on both measures were categorized as Moderate BAS (MBAS). A random subset of adolescents screened in Phase I who met inclusion criteria for the HBAS or MBAS groups participated in Phase II of screening (see Alloy et al., 2012, for further details regarding study recruitment and eligibility). In Phase II, participants completed questionnaires assessing NSSI frequency, self-criticism, ruminative brooding, and responses to positive affect.

Study sample—The present study sample consisted of 177 adolescents (113 HBAS; 64 MBAS) who completed the Phase I and II screening assessments. The sample was 18.69 years old (SD = 0.84), 72% female, and 69.5% Caucasian, 14.1% African-American, 6.8% Hispanic/ Latino, 7.3% Asian-American, 1.7% Native American, and 0.6% Multiracial (See Table 1 for sample demographics by BAS status).

Measures

BAS sensitivity—The BIS/BAS Scale (Carver & White, 1994) and Sensitivity to Punishment Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001) were the two self-report measures used to determine group selection. A BAS total score was calculated, which has demonstrated good internal consistency (α = .80 in this study) and retest reliability (Carver & White, 1994). The SPSRQ (Torrubia et al., 2001) assesses

sensitivity to reward and punishment. We used the 24-item Sensitivity to Reward (SR) subscale, which has demonstrated good internal consistency (α = .76 in this study). and retest reliability (Torrubia et al., 2001).

Self-Criticism—The Depressive Experiences Questionnaire (DEQ; Blatt, D'Aflitti, & Quinlan, 1976) is a self-report measure used to evaluate self-criticism (e.g.,"I have a difficult time accepting weaknesses in myself") with relevance to the BAS (Stange et al., 2013a) and an association with NSSI (Glassman et al., 2007). The SC subscale has shown good internal consistency (α = .80 in this study), retest reliability, and construct validity (Blatt et al., 1976).

Positive Emotion Regulation—The Responses to Positive Affect Scale (RPAS; Feldman et al. 2008) was used to assess dampening of positive affect (e.g., "Think about things that could go wrong") because of its theoretical relevance to NSSI. The RPAS Dampening subscale has been found to have good internal consistency and construct validity (Feldman et al., 2008). In the present study, it demonstrated good internal consistency (α = . 85).

Ruminative Brooding—The Ruminative Responses Scale (Treynor, Gonzalez, & Nolen-Hoeksema, 2003) brooding subscale (RRS-BR) contains 5-items that assess brooding rumination in response to a dysphoric mood. It has demonstrated good internal consistency and test-retest reliability (Treynor et al., 2003), and had good internal consistency (α = .85) in the present study.

NSSI—The Form and Function Self-Injury Scale (FAFSI; Jenkins & Schmitz, 2012) was used to assess NSSI. The FAFSI assesses the frequency of 13 distinct forms of NSSI engaged in over the past year and over one's lifetime (e.g., cutting, burning, biting). We minimized the variability of NSSI frequency by classifying NSSI into five categories (0, 1, 2–5, 6–20, and 20+ NSSI acts) (Whitlock et al., 2013). Internal consistency of the dichotomous items was α = .77.

Statistical Analysis

To evaluate whether the emotion regulatory and cognitive styles accounted for the relationship between BAS group and NSSI frequency, we conducted mediation analyses with bootstrapping (N = 1000 bootstrap resamples and a 95% confidence interval) to assess indirect effects (Preacher & Hayes, 2008). BAS group was the predictor, lifetime and past year NSSI frequency were outcome variables, and each emotion regulatory and cognitive style served as mediators in separate analyses and in a combined analysis. We proceeded with mediation analyses when each component of the proposed mediation model was significant.

Results

Preliminary Analyses

Descriptive statistics and correlations between study variables are displayed in Tables 1 and 2. In our overall sample, 57% of late adolescents reported a positive history of NSSI. Thirty-one percent engaged in NSSI acts greater than five times over their lifetime (31% of females; 36% of males), and 12% engaged in NSSI acts greater than five times over the past year (12% of females; 16% of males). Furthermore, 15% reported engaging in over 20 acts of NSSI over their lifetime (17% of females; 11% of males) and 6% reported engaging in over 20 acts of NSSI over the past year (4% of females; 9% of males). There were no significant gender differences in frequency of NSSI over the past year ($t = 1.89$, $p > .05$) and over the lifetime ($t = 1.50$, $p > .05$).

As hypothesized, NSSI lifetime and past year frequency, as well as brooding, dampening, and self-criticism, were each higher in the HBAS group than the MBAS group. Brooding, dampening, and self-criticism also were significantly positively correlated with NSSI lifetime and past year frequency, and were each significantly positively correlated with one another.

Predicting Lifetime NSSI Frequency

Bootstrapping analyses (Table 3) indicated the presence of significant indirect effects of BAS group on lifetime NSSI frequency for self-criticism, but not for dampening and brooding. When these variables were simultaneously entered into one model, the indirect effect of BAS group on lifetime NSSI frequency remained significant for self-criticism, and dampening and brooding remained non-significant.

Predicting Past Year NSSI Frequency

There were significant indirect effects of BAS group on past year NSSI frequency for self-criticism and dampening, but not for brooding. When these potential mediators were entered into one model simultaneously, the indirect effect of BAS group on past year NSSI frequency remained significant for self-criticism, but dampening and brooding were not significant.

Discussion

The goal of this study was to determine whether high BAS sensitivity serves as a vulnerability for non-suicidal self-injurious behaviors. We also examined potential mediators of the relationship between the BAS and NSSI, a novel contribution to the literature, as no studies to our knowledge have attempted to explain *why* heightened approach motivation may lead to greater NSSI frequency. Results indicated that self-criticism and positive emotion dampening mediated the relationship between BAS and last year NSSI frequency, and that self-criticism mediated the relationship between the BAS and lifetime NSSI frequency.

BAS Sensitivity and Frequency of NSSI

Consistent with prior studies (Cerutti et al., 2012; Jenkins et al., 2013), BAS hypersensitivity was predictive of last year and lifetime frequency of NSSI. Furthermore, BAS hypersensitivity may make individuals more susceptible to the effects of NSSI's positively and negatively reinforcing characteristics, thereby playing a significant role in NSSI continuation (and therefore, frequency). These results are in line with research investigating the reinforcement qualities of other maladaptive behaviors including alcohol use (Wardell, Read, Colder, & Merrill, 2012). Indeed, 66% of the HBAS group engaged in at least one act of NSSI over their lifetime, whereas only 41% of the MBAS group reported a positive history of any NSSI. The divergence between HBAS and MBAS groups appears to amplify as NSSI frequency increases, suggesting that BAS hypersensitivity may play a greater role as NSSI severity increases.

Research suggests that those who engage in over five NSSI acts experience significantly more psychopathology and suicide risk than those who engage in fewer than five acts (Whitlock et al., 2013; You, Leung, Fu, & Lai, 2011). That the divergence in likelihood of engaging in NSSI between groups expands at greater severity levels of NSSI demonstrates that BAS hypersensitivity may confer higher risk for exhibiting a clinical presentation of NSSI. Thus, our behavioral high-risk design allowed us to replicate and extend previous research (Cerutti et al., 2012; Jenkins et al., 2013) demonstrating a relationship between heightened approach motivation and NSSI. It is important to note that our results were significant despite being based on a rather conservative test of our hypothesis, given that we compared a high BAS group to a moderate BAS group, as opposed to a low BAS group. Our analyses suggest that BAS hypersensitivity may be an important part of the phenotypic definition of the proposed NSSI Disorder.

Mediators of the BAS and NSSI Frequency

Consistent with hypotheses, we found that brooding, dampening, and self-criticism were significantly higher in the HBAS than the MBAS group (see also Stange et al., 2013), and were significantly positively associated with NSSI frequency over the lifetime and past year. These correlational findings support prior work suggesting that both self-criticism and brooding are positively related to NSSI (Armey & Crowther, 2008; Claes et al., 2010; Glassman et al., 2007). However, our study is the first to find evidence for a relationship between NSSI and the positive emotion regulatory style of dampening, which highlights response to positive affect as an original target for intervention.

These results indicate potential mechanisms through which BAS status may lead to NSSI. The FFM suggests that NSSI is a product of multiple positive and negative reinforcement pathways (Nock, 2010). Although cross-sectional, our findings suggest that BAS hypersensitivity may lead to emotional and cognitive dysregulation via dampening and self-criticism, thereby increasing susceptibility to NSSI's automatic positive and negative reinforcement.

The finding that only self-criticism remained a significant mediator when emotion regulatory and cognitive styles were entered simultaneously in lifetime and last-year NSSI

frequency models is consistent with prior findings in the literature, suggesting that self-criticism is a potent vulnerability for NSSI onset and frequency (You, Lin, & Leung, 2014; Cohen et al., 2014; Glassman et al., 2007). Our findings further highlight the strength of the relationship between self-criticism and NSSI beyond the impact of other cognitive and emotional vulnerabilities. It is possible that self-criticism leads to negative affect, and NSSI is subsequently employed as a negative affect regulation strategy. Alternatively, self-criticism may lead to unclear thinking and decreased information processing abilities, which may be relieved through engaging in NSSI (Franklin et al., 2010). Furthermore, other research has found that self-criticism may cause individuals to desire self-punishment, and a portion of individuals engaging in NSSI have confirmed this motivating factor (Klonsky, 2007).

Clinical Implications

This study has important clinical implications. First, clinicians may benefit from assessing hypersensitive BAS to determine late adolescents' level of risk for NSSI. Further, it may be important to target BAS sensitivity in both pharmacotherapy and psychotherapy. Drugs developed to reduce NSSI may benefit from targeting the incentive-reward motivation neural network involving dopaminergic activity between the limbic system and the frontal cortex, which is theorized to be a biological mechanism underlying the BAS (Depue & Iacono, 1989). Cognitive behavioral therapies for NSSI (e.g., Newman, 2009) may benefit from addressing self-criticism. Indeed, recent research indicates a brief cognitive intervention aimed at improving self-worth can reduce pain endurance among those with a history of NSSI compared to controls (Hooley & St. Germain, 2013). These findings suggest that self-criticism may be malleable and thus, a rich target for intervention. Psychosocial treatments for NSSI may further benefit from addressing the maladaptive emotion regulation strategy of dampening.

Strengths, Limitations, and Future Directions

Overall, this study benefitted from several strengths, including its employment of a behavioral high-risk design, its use of two measures to determine BAS sensitivity, and the comparison of several constructs hypothesized to account for the relationship between BAS sensitivity and NSSI. However, this study was limited by its cross sectional design, prohibiting the determination of the direction of relationships in our mediation models. Furthermore, this study was limited by the use of self-report measures, which inherently may be influenced by social desirability and memory biases.

In summary, the current investigation indicates that individuals with BAS hypersensitivity are likely to have a positive NSSI history and to have engaged in more acts of NSSI in the last year and over their lifetimes. Moreover, our mediation results support a growing body of research suggesting the centrality of self-criticism as a risk factor for NSSI, and further suggest that its strong link with both BAS sensitivity and with NSSI may partially explain the relationship between this biobehavioral vulnerability and self-injury. Our findings further suggest that BAS hypersensitivity may be related to NSSI frequency through its role in increasing cognitive and emotional dysregulation, leading one to desire the intrapersonally negative and positive reinforcing qualities of NSSI. However, given that

BAS hypersensitivity remained a significant predictor of lifetime NSSI frequency even after accounting for self-criticism as a mediator, the impact of BAS dysregulation and its close association with reinforcement sensitivity is worth further evaluating in its own right. BAS sensitivity may be a rich target for clinical intervention, in addition to targeting adolescents' dysfunctional cognitive style of self-criticism and emotion regulation pattern of dampening.

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References

Alloy LB, Abramson LY. The role of the behavioral approach system (BAS) in bipolar spectrum disorders. Current Directions in Psychological Science. 2010; 19:189–194. [PubMed: 20606725]

Alloy LB, Abramson LY, Walshaw PD, Gerstein RK, Keyser JD, Whitehouse WG, Harmon-Jones E. Behavioral approach system (BAS)–relevant cognitive styles and bipolar spectrum disorders: Concurrent and prospective associations. Journal of Abnormal Psychology. 2009; 118:459–471. [PubMed: 19685944]

Alloy LB, Bender RE, Whitehouse WG, Wagner CA, Liu RT, Grant DA, Abramson LY. High Behavioral Approach System (BAS) sensitivity, reward responsiveness, and goal-striving predict first onset of bipolar spectrum disorders: A prospective behavioral high-risk design. Journal of Abnormal Psychology. 2012; 121:339. [PubMed: 22004113]

Armey MF, Crowther JH. A comparison of linear versus non-linear models of aversive self-awareness, dissociation, and non-suicidal self-injury among young adults. Journal of Consulting and Clinical Psychology. 2008; 76:9–14. [PubMed: 18229977]

Blatt SJ, D'Afflitti JP, Quinlan DM. Experiences of depression in normal young adults. Journal of Abnormal Psychology. 1976; 85:383–389. [PubMed: 956505]

Bresin K. Five indices of emotion regulation in participants with a history of nonsuicidal self-injury: A daily diary study. Behavior Therapy. 2013; 2014; 45:56–66. [PubMed: 24411115]

Carver CS, White TL. Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS scales. Journal of Personality and Social Psychology. 1994; 67:319–333.

Cerutti R, Presaghi F, Manca M, Gratz KL. Deliberate self_harm behavior among italian young adults: Correlations with clinical and nonclinical dimensions of personality. American Journal of Orthopsychiatry. 2012; 82:298–308. [PubMed: 22880968]

Claes L, Houben A, Vandereycken W, Bijttebier P, Muehlenkamp J. Brief report: The association between non-suicidal self-injury, self-concept and acquaintance with self-injurious peers in a sample of adolescents. Journal of Adolescence. 2010; 33:775–778. [PubMed: 19910041]

Cohen JN, Stange JP, Hamilton JL, Burke TA, Jenkins A, Ong ML, Alloy LB. The interaction of affective states and cognitive vulnerabilities in the prediction of non-suicidal self-injury. Cognition and Emotion. 2014

Endicott J, Spitzer RL. A diagnostic interview: The Schedule for Affective Disorders and Schizophrenia. Archives of General Psychiatry. 1978; 35:837–844. [PubMed: 678037]

Feldman GC, Joormann J, Johnson SL. Responses to positive affect: A self-report measure of rumination and dampening. Cognitive Therapy and Research. 2008; 32:507–525. [PubMed: 20360998]

Franklin JC, Hessel ET, Aaron RV, Arthur MS, Heilbron N, Prinstein MJ. The functions of nonsuicidal self-injury: Support for cognitive–affective regulation and opponent processes from a novel psychophysiological paradigm. Journal of Abnormal Psychology. 2010; 119:850–862. [PubMed: 20939652]

Gilbert KE, Nolen-Hoeksema S, Gruber J. Positive emotion dysregulation across mood disorders: How amplifying versus dampening predicts emotional reactivity and illness course. Behaviour Research and Therapy. 2013; 51:736–741. [PubMed: 24076407]

Glassman LH, Weierich MR, Hooley JM, Deliberto TL, Nock MK. Child maltreatment, non-suicidal self-injury, and the mediating role of self-criticism. Behaviour Research and Therapy. 2007; 45:2483–2490. [PubMed: 17531192]

Gratz KL, Conrad SD, Roemer L. Risk factors for deliberate self_harm among college students. American Journal of Orthopsychiatry. 2002; 72:128–140. [PubMed: 14964602]

Gray, JA. Neural systems, emotion and personality. In: Madden, J., IV, editor. Neurobiology of learning, emotion and affect. New York: Raven Press; 1991. p. 273-306.

Gruber J, Gilbert KE, Youngstrom E, Youngstrom J, Feeny NC, Findling RL. Reward dysregulation and mood symptoms in an adolescent outpatient sample. Journal of Abnormal Child Psychology. 2013; 41:1053–1065. [PubMed: 23783771]

Hamza CA, Stewart SL, Willoughby T. Examining the link between nonsuicidal self-injury and suicidal behavior: A review of the literature and an integrated model. Clinical Psychology Review. 2012; 32:482–495. [PubMed: 22717336]

Hooley JM, St Germain SA. Nonsuicidal self-injury, pain, and self-criticism: Does changing self-worth change pain endurance in people who engage in self-injury? Clinical Psychological Science. 2014; 2:297–305.

Jenkins AL, Seelbach AC, Conner BT, Alloy LB. The roles of behavioural activation and inhibition among young adults engaging in self_injury. Personality and Mental Health. 2013; 7:39–55. [PubMed: 24343924]

Jenkins AL, Schmitz MF. The roles of affect dysregulation and positive affect in non-suicidal self-injury. Archives of Suicide Research. 2012; 16:212–225. [PubMed: 22852783]

Johnson SL, McKenzie G, McMurrich S. Ruminative responses to negative and positive affect among students diagnosed with bipolar disorder and major depressive disorder. Cognitive Therapy and Research. 2008; 32:702–713. [PubMed: 20360996]

Klonsky ED. The functions of deliberate self-injury: A review of the evidence. Clinical Psychology Review. 2007; 27:226–239. [PubMed: 17014942]

Lundh L, Wångby-Lundh M, Paaske M, Ingesson S, Bjärehed J. Depressive symptoms and deliberate self-harm in a community sample of adolescents: A prospective study. Depression Research and Treatment. 2011; 2011:1–11.

Newman, CF. Cognitive therapy for nonsuicidal self-injury. In: Nock, MK., editor. Understanding nonsuicidal self-injury: Origins, assessment, and treatment. Washington, DC US: American Psychological Association; 2009. p. 201-219.

Nock MK. Self-injury. Annual Review of Clinical Psychology. 2010; 6:339–63.

Nusslock R, Abramson L, Harmon-Jones E, Alloy L, Coan J. Psychosocial interventions for bipolar disorder: Perspective from the behavioral approach system (BAS) dysregulation theory. Clinical Psychology: Science and Practice. 2009; 16:449–469. [PubMed: 20161456]

Pickering, A.; Gray, JA. Advances in Individual Differences Research. Germany: PABST Science Publishers Lengerich; 2001. Dopamine, appetitive reinforcement, and the neuropsychology of human learning: An individual differences approach; p. 113-149.

Stange JP, Shapero BG, Jager-Hyman S, Grant DA, Abramson LY, Alloy LB. Behavioral Approach System (BAS)-relevant cognitive styles in individuals with high versus moderate BAS sensitivity: A behavioral high-risk design. Cognitive Therapy and Research. 2013a; 37:139–149. [PubMed: 23459574]

Stange JP, Boccia AS, Shapero BG, Molz AR, Flynn M, Matt LM, Alloy LB. Emotion regulation characteristics and cognitive vulnerabilities interact to predict depressive symptoms in individuals at risk for bipolar disorder: A prospective behavioural high-risk study. Cognition and Emotion. 2013b; 27:63–84. [PubMed: 22775344]

Torrubia R, Avila C, Molto J, Caseras X. The Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ) as a measure of Gray's anxiety and impulsivity dimensions. Personality and Individual Differences. 2001; 31:837–862.

Treynor W, Gonzalez R, Nolen-Hoeksema S. Rumination reconsidered: A psychometric analysis. Cognitive Therapy and Research. 2003; 27:247–259.

Urošević S, Abramson LY, Alloy LB, Nusslock R, Harmon-Jones E, Bender R, Hogan ME. Increased rates of events that activate or deactivate the behavioral approach system, but not events related to goal attainment, in bipolar spectrum disorders. Journal of Abnormal Psychology. 2010; 119:610–615. [PubMed: 20677850]

Wardell JD, Read JP, Colder CR, Merrill JE. Positive alcohol expectancies mediate the influence of the behavioral activation system on alcohol use: A prospective path analysis. Addictive Behaviors. 2012; 37:435–443. [PubMed: 22209025]

Whitlock J, Muehlenkamp J, Eckenrode J. Variation in nonsuicidal self-injury: Identification and features of latent classes in a college population of emerging adults. Journal of Clinical Child and Adolescent Psychology. 2008; 37:725–735. [PubMed: 18991124]

Whitlock J, Muehlenkamp J, Eckenrode J, Purington A, Baral Abrams G, Barreira P, Kress V. Nonsuicidal self-injury as a gateway to suicide in young adults. Journal of Adolescent Health. 2013; 52:486–492. [PubMed: 23298982]

You J, Leung F, Fu K, Lai CM. The prevalence of nonsuicidal self-injury and different subgroups of self-injurers in Chinese adolescents. Archives of Suicide Research. 2011; 15:75–86. [PubMed: 21294002]

You J, Lin MP, Leung F. A Longitudinal Moderated Mediation Model of Nonsuicidal Self-injury among Adolescents. Journal of Abnormal Child Psychology. 2014:1–10. [PubMed: 24272365]

Table 1

Demographics

	High BAS (N = 113)	Moderate BAS (N = 64)	*t* or χ^2
Age	18.55 (.12)	18.82 (.09)	−1.25
Sex	69% female	77% female	1.08
Race	69% Caucasian	72% Caucasian	11.31
	17% African American	17% African American	
	9% Asian/Pacific Islander	7% Asian/Pacific Islander	
	3% Biracial	2% Biracial	
	2% Other	2% Other	
Ethnicity	8% Hispanic	7% Hispanic	0.72
DEQ-SC	−.03 (.09)	−.54 (.12)	3.85^{***}
RRS-BR	12.75 (.35)	10.23 (.34)	5.06^{***}
RPAS-Dampening	15.67 (.54)	13.42 (.57)	3.11^{***}
NSSI-Lifetime	44% None	59% None	2.83^{**}
	7% 1 time	8% 1 time	
	11% 2–5 times	10% 2–5 times	
	19% 6–20 times	14% 6–20 times	
	19% 20+ times	9% 20+times	
NSSI-Past Year	61% None	79% None	4.25^{***}
	11% 1 time	8% 1 time	
	11% 2–5 times	10% 2–5 times	
	8% 6–20 times	3% 6–20 times	
	9% 20+ times	0% 20+ times	

Note: Standard deviations are in parentheses. DEQ-SC = Depressive Experiences Scale-Self-Criticism (Standard Scores); RRS-BR = Ruminative Responses Scale-Brooding; RPAS = Responses to Positive Affect Scale; NSSI = Non-suicidal self-injury.

$^{*}p < .05$;

$^{**}p < .01$;

$^{***}p < .01$.

Table 2

Descriptive Statistics and Correlations between Study Variables.

Variable	1	2	3	4	5	6
1. BAS group	---					
2. NSSI Lifetime Frequency	.23**	---				
3. NSSI Last Year Frequency	.17*	.79**	---			
4. Brooding	.20**	.16*	.18*	---		
5. Dampening	.14**	.17*	.22**	.46**	---	
6. Self-Criticism	.16**	.30**	.28**	.55**	.52**	---
Mean	---	1.41	0.75	11.84	14.86	−0.21
SD	---	1.60	1.24	3.67	5.39	0.98

Note: BAS = Behavioral Approach System sensitivity risk group (0 = moderate BAS, 1 = high BAS); NSSI = Non-Suicidal Self-Injury; CI = Confidence Interval.

* $p < .05$;

** $p < .01$.

Table 3

Mediation Analyses with Emotion Regulatory and Cognitive Styles Mediating Associations between BAS Group and Lifetime and Past Year Non-Suicidal Self-Injury

Model	Independent variable (*IV*)	Mediating variable (*M*)	Dependent variable (*DV*)	Effect of *IV* on *M*	Effect of *M* on *DV*	Direct effect of *IV* on *DV*	Total effect of IV on DV	Indirect effect	CI of Indirect effect
Predicting Lifetime NSSI Frequency									
1.	BAS Risk Group	Brooding	Lifetime NSSI Frequency	2.52	.05	.46	.59	.12	−.05–.31
2.	BAS Risk Group	Dampening	Lifetime NSSI Frequency	2.22	.04	.49	.59	.09*	.01–.27
3.	BAS Risk Group	Self-Criticism	Lifetime NSSI Frequency	.51	.44	.36	.59	.22*	.09–.46
4.	BAS Risk Group	Brooding	Lifetime NSSI Frequency	2.52	−.02	.48	.63	−.05	−0.24–0.14
		Dampening		2.26	.02			.05	−0.03–0.23
		Self-Criticism		.51	.26			.14*	.01–.35
Predicting Past Year NSSI Frequency									
1.	BAS Risk Group	Brooding	Past Year NSSI Frequency	2.52	.04	.54	.63	.09	−.03–28
2.	BAS Risk Group	Dampening	Past Year NSSI Frequency	2.25	.04	.54	.63	.10*	.01–.25
3.	BAS Risk Group	Self-Criticism	Past Year NSSI Frequency	.51	.30	.48	.63	.15*	.03–.35
4.	BAS Risk Group	Brooding	Past Year NSSI Frequency	2.52	−.02	.39	.59	−.05	−0.33–0.14
		Dampening		2.25	.01			.01	−0.09–0.16
		Self-Criticism		.51	.46			.24*	.07–.52

Note: BAS = Behavioral Approach System sensitivity risk group (0 = moderate BAS, 1 = high BAS); NSSI = Non-Suicidal Self-Injury; CI = Confidence Interval.

* $p < .05$.