Discriminant validity of emotion regulation and emotion reactivity and relations to non-suicidal self-injury

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Thesis

Submitted to the Faculty of the

Graduate School of Vanderbilt University

in partial fulfillment of the requirements

for the degree of

MASTER OF SCIENCE

in

Psychology

May, 2014

Nashville, Tennessee

Approved:

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Abstract

The purpose of this study was to assess convergent and discriminant validity of self-report measures of emotion reactivity and emotion regulation and examine their associations with non-suicidal self-injury (NSSI). Participants included 379 college students (79 % female), ages 18-25 (M = 18.62, SD = .88) at a private university. Participants self-administered questionnaires designed to tap emotion regulation – the Emotion Regulation Questionnaire, the Difficulties in Emotion Regulation Scale, and the Regulation of Emotions Questionnaire – and questionnaires designed to measure reactivity – the Emotion Reactivity Scale, the Affect Intensity & Reactivity Measure for Youth, and the Emotional Intensity Scale. We used the Inventory of Statements About Self-Injury to assess NSSI – 37.43% endorsed at least one lifetime incident. We computed subscale scores for all instruments and subjected them collectively to exploratory factor analysis with direct oblimin rotation and principal axis factoring. Parallel analysis and Kaiser criteria dictated the number of factors retained.

A two-factor solution emerged, accounting for 39.5% of overall variance. The factors did not reflect emotion regulation and reactivity, as expected. Instead, Factor 1 represented Negative Emotion Reactivity and Factor 2 represented Positive Emotion Reactivity. Hierarchical linear regression supported small but significant incremental utility of Factor 1 measures in predicting NSSI beyond Factor 2 measures (ΔR^2=.08, F (9, 345)=3.22, p<.01), but not vice versa. Results suggest a lack of discriminant validity among self-report measures of emotion regulation and emotion reactivity. Hierarchical regression results suggest the importance of negative emotion reactivity as a correlate of NSSI. Implications emerge for both research and practice.

Introduction

Non-suicidal self-injury (NSSI) refers to the intentional destruction of body tissue without the intent to die and is distinct from socially condoned behaviors such as tattooing or piercing (Nock, 2010). Previously associated with the severely mentally ill, researchers and clinicians alike now recognize the impact of this behavior in other populations. The prevalence of the behavior, particularly among adolescents and young adults, is striking. In their review of studies of NSSI among adolescents, Jacobson and Gould (2007) estimated lifetime prevalence rates ranging from 13.0% to 23.2% in non-clinical samples. Among college students, studies demonstrate lifetime prevalences of 17% to 38% (e.g., Hamza & Willoughby, 2013; Whitlock et al., 2011; Whitlock, Eckenrode, & Silverman, 2006). Growing evidence suggests the behavior serves primarily to regulate affect, but important questions remain about the nature of emotional vulnerabilities that put one at risk of engaging in NSSI. The present study focuses on clarifying the constructs of emotion regulation and emotion reactivity as they relate to this destructive behavior.

The widespread prevalence of NSSI raises concern both due to its direct consequences and links to other forms of psychopathology. The behavior is associated with depressive and anxiety disorders (Jacobson & Gould, 2007), externalizing disorders, substance abuse (Serras, Saules, Cranford, & Eisenberg, 2010; Nock, Joiner, Gordon, Lloyd-Richardson, and Prinstein, 2006), and disordered eating (Svirko & Hawton, 2010; Serras, Saules, Cranford, & Eisenberg, 2010; Ross, Heath, & Toth, 2009). Several studies have identified a link between NSSI and increased risk of suicidality (e.g., Hamza & Willoughby, 2013, Whitlock, Eckenrode, & Silverman, 2006, although the exact nature of and mechanisms for such a link remain unclear and may vary by characteristics of self-injury (Hamza & Willoughby, 2013; Hamza, Stewart, & Willoughby, 2012; Klonsky & Olino, 2008).

Affect regulation – defined by Klonsky (2007) as efforts to "alleviate acute negative affect or aversive affective arousal" – consistently emerges as a primary function for the behavior. In his 2007 review, Klonsky found that participants from 13 different clinical samples self-reported affect regulation as a primary motivation for the behavior. Studies among non-clinical samples show similar findings. For example, Whitlock et al. (2011) examined NSSI behavior and its functions in 11,529 college students in the United States. Among those who reported NSSI, 81% endorsed affect regulation as one of its functions. In another study among college students, "mental distress" and "coping" were the most commonly-cited motivations for engaging NSSI (Wilcox et al., 2012). Lloyd-Richardson, Perrine, Dierker, and Kelley (2007) studied functions of NSSI among a community sample of adolescents and found that 71% of those engaging in moderate to severe NSSI did so to regulate negative affect.

Theoretical models of NSSI propose emotional vulnerabilities that increase risk of adopting NSSI as an affect regulation technique. In their Experiential Avoidance Model, Chapman, Gratz, and Brown (2006) theorize that NSSI serves as a negative reinforcement strategy, allowing individuals to escape from "unwanted internal experiences." They propose that experiencing more intense emotional responses along with diminished capacity to regulate emotional arousal – along with other emotional vulnerabilities – contribute to risk for NSSI. Similarly, Nock (2010) hypothesizes that increased arousal or emotion reactivity and deficits in emotion regulation combine to form a general vulnerability that can interact with even more proximate risk factors to cause NSSI among subsets of individuals. Finally, Selby, Anestis, and Joiner (2008) offer a general model of behavioral dysregulation in which deficits in adaptive regulation skills and ruminative tendencies independently mediate the relation of distress to maladaptive behaviors. (It

should be noted, however, that the authors discuss but do not directly test NSSI as a form of behavioral dysregulation in their model.)

Significant work remains to test the nuances of each these models and their capacity to predict NSSI. Conceptually though, each model share an emphasis on (1) increased negative affect and higher intensity of this affect – what can more generally be termed emotion reactivity; and (2) deficits in emotion regulation, in characterizing risk factors for NSSI. These constructs thus represent important targets of empirical investigation. Emotion reactivity typically refers to characteristics of experiences emotions outlined by Davidson (1998) – threshold for response, its intensity, and duration. Determining a consensus definition for emotion regulation, in contrast, has proved challenging. Some researchers focus on the capacity for emotions to regulate physiology, behaviors, etc., while others emphasize ways in which individuals influence their emotions (Cole, Martin, & Dennis, 2004). Even among the latter group, differences emerge. For example, Gratz and Roemer (2004) define emotion regulation as encompassing awareness, understanding, and acceptance of emotions, along with capacity to control behaviors and pursue one's goals when experiencing negative emotions and use situationally appropriate strategies to modulate one's emotional responses. Conversely, Gross' (1998) definition emphasizes the processes people use to influence what and when they have particular emotions and how they experience and express these. His definition distinguishes between antecedent-focused strategies (before an emotion is generated) and response-focused strategies (after the emotion is generated). Emotion reactivity and emotion regulation may be intertwined, as Davidson (1998) notes, "rarely does an emotion get generated in the absence of recruiting associated regulatory processes."

The literature offers several examples of the independent contributions of emotion regulation and emotion reactivity to NSSI risk. For example, Gratz and Roemer (2004) found

higher scores on a measure of deficits in emotion regulation significantly discriminated between college students who self-injured and those who did not. Among a sample of female undergraduates, such deficits significantly discriminated among those with a history of NSSI and those with no such history (Gratz & Roemer, 2008). Heath, Toste, Nedecheva, and Charlebois (2008) also replicated this effect. Hasking, Momeni, Swannell, and Chia (2008) examined specific emotion regulation strategies and found a significant difference in those used by individuals with a history of NSSI and those who have not engaged in the behavior. Prior research shows that self-injurers score higher than those who do not self-injure on self-report measures of emotion reactivity than individuals who do not self-injure (e.g., Glenn, Blumenthal, Klonsky, & Hajcak, 2011; Nock, Wedig, Holmberg, & Hooley, 2008) and report significantly more intense affect (Gratz, 2006). Physiological evidence of heightened reactivity is mixed – Nock and Mendes (2008) found greater skin conductivity among adolescent self-injurers compared to those who did not self-injure, while Glenn et al. (2011) found no difference in the magnitude of startle response elicited by emotional images among young adult self-injurers and controls.

Despite evidence for the importance of both emotion reactivity and regulation to NSSI, few studies have examined the two constructs simultaneously to assess their individual contributions to NSSI. Turner, Chapman, and Layden (2012) found significant associations between limited access to emotion regulation strategies, use of suppression, and emotional intensity and NSSI among those who report using the behavior for affect regulation. Their study only included individuals with a lifetime history of the behavior, precluding comparisons with individuals who have never engaged in NSSI. Gratz and Roemer (2008) administered measures of affect intensity and emotion dysregulation in tandem and demonstrated significant relations to NSSI for

each. However, their sample was restricted to female undergraduates in a commuter university and may not be generalizable to other samples of young adults. Nor is it clear that their measurement of emotion dysregulation would necessarily correspond to measures of specific emotion regulation strategies. Finally, Jenkins and Schmitz (2012) examined the relation of both emotion dysregulation and emotion reactivity to lifetime acts of NSSI in a sample of college students. They showed a significant relation for direct effects of emotion dysregulation on NSSI but found no evidence of a significant relation for indirect effects of emotion reactivity and NSSI. These conclusions could be problematic, however, insofar as (1) they derive path analysis with fallible measures, which can introduce additional error to a model (Cole & Preacher, 2013); (2) they emerged after post-hoc model modifications that may have capitalized on chance, and (3) they resulted from a model that did not allow for the possibility of a direct path from emotion reactivity to increased lifetime acts of NSSI.

Theoretical models and clinical treatment of NSSI necessitate clear understandings of the interrelation of emotion regulation and emotion reactivity and the relation of each to the behavior. We thus have two broad aims in the present study. First, we aim to clarify the convergent and discriminant validity of emotion regulation and emotion reactivity as measured by commonly used instruments within NSSI research. We focus exclusively on self-report measures due to their ubiquity and in an effort to control for variation by type of measurement (ie, physiological vs. self-report). Second, we aim to examine the incremental contribution of each construct to lifetime risk of NSSI among a sample of older adolescents and young adults.

Methods

Participants and Procedure

The sample consists of 379 participants recruited from the undergraduate research pool at a mid-sized private university. Average age of participants was 18.62 (*SD* = .88), and 299 participants were women (79.1%). The sample was predominantly Caucasian (76.3%), Asian American (14%), and African American (9.8%). Participants self-reported race/ethnicity and could select multiple options.

Participants independently completed the battery of questionnaires online. Those reporting elevated depressive symptoms and/or who reported they wanted help stopping self-harm behaviors received referrals to the university psychological services and counseling center. All participants received research credit in exchange for their participation.

Measures

Emotion Regulation. We selected three measures designed to tap aspects of emotion regulation so that we could examine cross-measure convergence for this construct. The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) assesses the extent to which respondents use cognitive reappraisal or suppression strategies to regulate emotions. The ERQ includes six questions regarding participants' use of reappraisal and four for suppression. Respondents indicate the extent to which each statement represents them on a 1 (strongly disagree) to 7 (strongly agree) Likert scale. In validation studies among undergraduates, Cronbach's alphas averaged .79 for the reappraisal scale and .73 for the suppression scale, and test-retest reliability for each scale was .69 (Gross & John, 2003). See Table 3 for sample items and Cronbach's alphas for this and all other emotion regulation and reactivity measures used in the study.

The Regulation of Emotions Questionnaire (REQ; Phillips & Power, 2007) consists of 19 examples of possible emotion regulation techniques. Respondents read the stem "when I'm

upset" and then endorsed the frequency with which they use each technique on a 1 (not at all) to 5 (always) scale. Factor analysis showed the REQ consists of four scales: internal-dysfunction regulation strategies (e.g., "I keep the feeling locked up inside"), internal-functional regulation strategies (e.g., "I put the situation into perspective"), external-dysfunction strategies ("I bully other people"), and external-functional strategies ("I ask others for advice"). Among participants ages 12-19, the measure showed correlations in the anticipated directions with measures of emotional problems and conduct issues. Phillip and Powers (2007) did not calculate test-retest reliability for the measure but found Cronbach's alphas for each scales ranging from .66 to .76. Internal consistency in our sample was somewhat lower, as table 3 indicates.

The Difficulties in Emotion Regulation Scale (DERS, Gratz & Roemer, 2004) is a 36-item questionnaire that assesses deficits in emotion regulation. The instrument was validated in a sample of undergraduates and produces six scales: (1) nonacceptance of emotional responses; 2) difficulties in engaging in goal-directed behaviors; 3) impulse control difficulties; 4) lack of emotional awareness; 5) limited access to emotion regulation strategies; and 6) lack of emotional clarity. Many of the items begin with the stem "when I'm upset…" and respondents indicate the extent to which a particular behavior or cognition is true for them on a 1 (almost never) to 5 (almost always) scale. A few of the items describe adaptive responses to emotion – these are reverse-scored, so higher scores on any scale indicate increased difficulties. The Cronbach's alpha for each scale exceeded .80, and the instrument showed excellent test-retest reliability (Gratz & Roemer, 2004). In studies of undergraduate females, self-harmers showed significantly higher scores on the DERS than those who did not engage in self-harm (Gratz & Roemer, 2008).

Emotion Reactivity. We selected three measures of emotion reactivity to establish cross-measure convergence for this construct as well. The Emotion Reactivity Scale (ERS; Nock, et

al., 2008) instructs the respondent to consider how they experience emotion (but does not specify a particular emotional state they should envision). They then rate their agreement with 21 statements on a 1 (not at all like me) to 5 (completely like me) scale. The ERS assesses three areas of emotion reactivity – how readily individuals react, the intensity of their emotional arousal, and the duration of their emotional response. Factor analysis of the ERS indicates these three areas still reflect a single underlying factor of overall reactivity (Nock, et al., 2008). The ERS showed high internal consistency in an adolescent validation sample (Cronbach's alpha=.94), and the scale has been used successfully in studies of college-age participants as well (Glenn et al., 2011).

The Affect Intensity and Reactivity Measure Adapted for Youth (AIR-Y; Jones, Leen-Feldner, Olatunji, Reardon, & Hawks, 2009) is a 40-question measure that assesses respondents' perceptions of how strongly they experience positive and negative emotions. The scale was adapted from the Affect Intensity Measure (Larsen, 1984). The AIR-Y differs from the original measure only through simplified vocabulary (e.g., "really, really happy" for "euphoric"). Respondents rate their agreement with statements about the physical, cognitive, and affective components of emotion, using a 1 (never) to 6 (always) scale. Factor analysis produced a three-factor structure for the AIM (Bryant, Yarnold, & Grimm, 1986). Scale scores are calculating by averaging responses that comprise the scale. The AIR-Y follows the same structure with three scales: Positive Affectivity (how intensely and how readily participants experience positive affect), Negative Reactivity (how readily participants experience negative affect), and Negative Intensity (how intensely participants experience negative affect). Cronbach's alphas for these scales were .90, .70, and .73, respectively, in a community-based sample of adolescents (Jones et al., 2009). The measure showed adequate test-retest reliability.

The Emotional Intensity Scale (EIS; Bacharowski & Braaten, 1994) is a 30-item measure that assesses the intensity of emotional experiences. Respondents are asked to imagine themselves in 14 positive situations and 16 negative situations and select one of five responses that best indicates the intensity with which they would feel the emotion. It was validated in a sample of undergraduates and showed strong internal consistency and test-retest reliability.

Present affect. We measured present affect using the Positive and Negative Affect Scales (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS is a commonly-used, well-validated measure that assesses the extent to which respondents have experienced 12 positive and 12 negative affective states over a particular time period (the previous month, in the present study). Respondents endorse the extent to which they experienced each affect during the in the specified time period on a Likert scale, ranging from 1 (not at all) to 5 (extremely). The PANAS has high test-retest reliability and internal consistency (Watson et al., 1988). In the present sample, Cronbach's alphas were .85 and .83 for the positive and negative scales.

Depressive symptoms. We used the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996), a commonly used, well-validated measure designed to assess severity of depressive symptoms in a variety of populations. It asks respondents to rate their experience of 21 different depressive symptoms over the past two weeks on a 0 to 3 scale. We removed the suicidality question on the BDI-II, leaving a remainder of 20 items. The measure has been independently validated in a university population and showed strong internal consistency (Cronbach's alpha=.91) and reliability (Dozois, Dobson, & Ahnberg, 1998). In the present sample, Cronbach's alpha was .89.

Non-suicidal self-injury. The Inventory of Statements About Self-Injury (ISAS; Klonsky & Olino, 2008) is a two-part instrument that assesses respondents' experience with self-

injury behaviors and reasons for engaging in those behaviors. The first section asks respondents to estimate the number of times they engaged in any of 12 different self-harm behaviors. Respondents also report the age at which they began self-harming, the amount of time that elapses between urges to self-harm and the behavior, and whether the individual would like to stop harming themselves. Klonsky and Olino validated the measure among college students who endorsed at least one lifetime experience with NSSI and found high internal consistency for Section 1 (Cronbach's alpha = .84) and strong test-retest reliability. The second section asks individuals to endorse reasons for engaging in the self-injurious behaviors on a 0 (not relevant) to 2 (very relevant) scale. It assesses 13 functions, using three questions per function (Klonsky & Glenn, 2009). Cronbach's alpha for the affect regulation scale in the present sample was .81.

Results

Descriptive Statistics

Table 1 shows the proportion of participants endorsing each of the 12 self-injury types queried on the ISAS along with the mean and standard deviation of estimated episodes. In total, 37.43 % of participants endorsed engaging in some form of NSSI over their lifetimes – this is slightly higher than previously reported college samples, but still within the range of lifetime prevalence reported among similar samples using the ISAS (Klonsky & Olino, 2008). Sixty-five percent reported harming themselves within the year preceding the study. As Table 1 shows, interfering with wound picking was the most frequent NSSI form endorsed, whereas more severe methods (e.g., carving or burning the skin) were much rarer. Table 2 shows self-reported functions of NSSI – affect regulation was the most highly endorsed function for the behavior in our sample. Affect regulation score also had the highest correlation with total NSSI. Levels of depressive symptoms were comparable to those reported among other college samples, based on the BDI-II (M = 7.92, SD = 7.19).

Data Reduction

Previous research using the ISAS has summed estimated number of episodes across self-injury types (Klonsky & Olino, 2008). In our sample, however, participants reported wide variation in number of episodes for each method, resulting in highly positively skewed distributions of total NSSI behavior (M = 373.96, SD = 5316.73, skewness = 18.56, SE of skewness = .13) Study goals included examining the incremental utility of emotion regulation and reactivity in statistically predicting NSSI. Accordingly, we rescaled the data in a manner to allow for regression analysis and preserve meaningful differences across NSSI type (see Latimer, Covic, & Tennant , 2012, for a hierarchical model of self-harm behaviors). Participants received

a "0," "1," or "2," for each NSSI behavior based on whether their reported number of episodes for that behavior was below the 80th percentile, in the 80-90th percentile, or above the 90th percentile for episodes of that *same* behavior reported across the sample. (We selected the 80th percentile as our starting point as it most consistently captured the distinction between participants reporting no instances of each behavior and one or more instances of each behavior across the types of NSSI queried.) The rescaled scores for each NSSI behavior composed the participant's total NSSI score, which we used in the regression analysis (below). Internal consistency for this new scale was adequate (Cronbach's alpha = .78). The distribution of total NSSI behavior using this rescaling method measurably reduced data dispersion (M = 1.81, SD = 3.30, skewness = 2.19, SE of skewness = .13).

Convergent and Discriminant Validity of Emotion Regulation and Reactivity

We used exploratory factor analysis to assess convergent and discriminant validity of the emotion regulation and emotion reactivity measures. Because some of the instruments produce individual subscale scores only (e.g., the ERQ), we elected to analyze each measure according to its published subscales. Table 4 shows the results of this exploratory factor analysis using principal axis factoring with direct oblimin rotation. Parallel analysis (Horn, 1965) and the Kaiser criterion supported either a two- or three-factor model (Zwick & Velicer, 1986). We selected the more parsimonious two-factor model, as it accounted for comparable amounts of variance as the more complicated model (39.50 % versus 45.45 %) while still providing meaningful factors. Subscales with loadings greater than .40 are highlighted for interpretation.

Contrary to expectation, model results supported emergence of factors based on negative and positive affect rather than emotion regulation and reactivity. Factor 1 represents negative

emotion reactivity and dysregulation. Its largest factor loadings accrued from subscales spanning five different measures, suggesting strong cross-measure convergence. The DERS – Strategies subscale, which reflects doubt in one's ability to regulate emotions (Gratz & Roemer, 2004), serves as the hallmark item of Factor 1, with a loading of .87. A second DERS subscale related to inability to control impulses when upset, along with two measures of emotion reactivity (the ERS and the AIR-Y Negative Intensity subscale) also loads strongly on this factor. The negative emotion subscale from the EIS and REQ Internal Dysfunction scale, and three additional DERS subscales (reflecting nonacceptance of emotions, inability to pursue goals while upset, and lack of clarity about one's emotion experience) compose the remainder of Factor 1. Negative subscales converge to a unified factor and did not support discriminant validity of self-report emotion regulation and reactivity measures.

Factor 2, in contrast, reflects positive emotion reactivity, along with adaptive, or functional, aspects of emotion regulation. Positive subscales of the EIS and AIR-Y load most strongly on this factor, reflecting the intensity of positive emotional responses to specific situations (EIS) and overall positive affectivity (AIR-Y). They are followed by the REQ External Functional subscale, which taps into a person's tendency to use adaptive, externally focused forms of emotion regulation strategies like talking to friends when upset, and the DERS Awareness subscale (reverse coded, so lower scores represent higher awareness of one's emotions). The ERQ Suppression subscale loads negatively on this factor, indicating less use of suppression aligns with increased positive reactivity. The AIR-Y Negative Intensity and Reactivity subscales also loaded on this factor. Table 6 shows the zero-order correlations of each instrument subscale, along with their correlations with total NSSI and scores on the Affect

Regulation scale of the ISAS-Functions measure (completed only by those with a lifetime history of NSSI).

Incremental Utility of Negative Emotion Reactivity/Dysregulation and Positive Emotion Reactivity in Prediction of NSSI

The factor analysis did not produce clear evidence for discriminant validity of emotion regulation and emotion reactivity as separate constructs in the selected measures. We revised our goals to assess the incremental utility in statistically predicting NSSI for the factors indicated by the EFA in statistically predicting NSSI. Table 7 shows hierarchical regression results using first total NSSI and then ISAS Affect Regulation scores as dependent variables. Factor 1 and Factor 2 subscales are entered as separate steps. (See appendix for hierarchical regression results using emotion regulation and emotion reactivity measures, as designated by original authors, entered as separate steps).

Taken together, the subscales composing Factor 1 contributed significantly to statistical prediction of NSSI, (ΔR^2 = .08), $F(9,345) = 3.22$, $p < 01$. Of the individual subscales, only DERS-Strategies was significant (β = .21, t = 2.18, p = .03). The subscales composing Factor 2 did not significantly improve the model, (R^2= .08), $\Delta F(6, 339) = .42$, p = .87. Nor were any of the Factor 2 subscales significant individually. Reversing the step-entry order (i.e., entering the subscales of Factor 2 as step 1) did not change the results, as shown in table 7.

We next conducted the hierarchical regression using the ISAS Function-Affect Regulation score (reflecting how much individuals who engage in NSSI do so to regulate affect) as the dependent variable. Again, the step consisting of Factor 1 subscales contributed significantly to the prediction of the Affect Regulation score, (ΔR^2 = .17), $\Delta F(9, 122) = 2.79$, p < .01, but Factor 2 subscales did not, (ΔR^2 = .05), $\Delta F(6, 116) = 1.28$, p < .01. Of the individual

subscales in the full model, DERS-Strategies (β = .46, t = 3.15, p < .01) and AIR-Y Negative Reactivity (β = .25, t = 2.19, p = .03) were significant. The DERS-Clarity subscale was marginally significant in the full model (β = .22, t = 2.00, p = .05) but was nonsignificant when Factor 1 subscales were tested alone (β = .12, t = 1.34, p = .18).

Discussion

Our overarching goals were two-fold: (1) clarifying the convergent and discriminant validity of emotion regulation and emotion reactivity as measured by self-report instruments and (2) assessing the incremental utility of these constructs in predicting NSSI. Results did not support the convergent and discriminant validity of these measures. Instead, two factors characterized by emotional valence emerged. Factor 1 reflected negative emotion reactivity, on which measures of both negative emotion reactivity and emotion regulation deficits loaded. Factor 2 reflected positive emotion reactivity, on which indicators of both positive emotion reactivity and adaptive emotion regulation loaded. Only the first factor contributed significantly to the statistical prediction of NSSI. Details and implication about six specific findings appear below.

First, the results suggest that self-report measures of emotion reactivity and emotion regulation did not demonstrate the expected discriminant and convergent validity. Instruments designed to measure reactivity (e.g., the ERS[1]), negative emotional intensity (e.g., the EIS-Negative), and emotion regulation deficits (e.g., the DERS) loaded strongly onto the first factor. Examination of the content of the subscales comprising this factor revealed that items primarily reflected the tendency to experience overwhelming strong negative emotion. Items from emotion reactivity subscales focused on the experience of strong negative emotion (e.g., "I often get so upset it's hard for me to think straight." Items from the regulation subscales described being so overwhelmed by negative emotions that one could not implement emotion regulation methods or maintain self-control (e.g., "When I'm upset, I believe that there is nothing I can do to make myself feel better" and "When I'm upset, I have difficulty controlling my behaviors"). Also loading on this factor was a measure of rumination (e.g. "I dwell on my thoughts and feelings" — the REQ-Internal Dysfunctional subscale), assessing a maladaptive response to negative

emotion (Nolen-Hoeksema, 2000). The convergence of measures designed to assess negative emotion reactivity, emotion regulation deficits, and maladaptive regulation techniques suggests that individuals may regard the inability to control one's negative emotions (emotion dysregulation) and the tendency to ruminate about emotions as part of the phenomenology of a strong negative emotional experience, at least when evaluated by self-report measures. Previous scholars have remarked on similar cross-construct conflation in the coping literature. For example, Stanton, Danoff-Burg, Cameron, and Ellis (1994) argued certain measures of emotion-focused coping, defined as efforts to regulate "affect surrounding a stressful experience," are confounded with measures of the very affect that the coping behaviors are intended to regulate.

We note that the current results reflect a conflation of negative emotion reactivity and regulation in the responses of individuals only on self-report measures. Glenn et al. (2011) noted the divergence of self-reported emotional reactivity from physiological measures (startle response). Researchers have documented similar divergence of self-report and physiological measures in the study of anxiety (Mauss, Wilhelm, & Gross, 2004). Neuroimaging work has demonstrated differential activation in social anxiety patients versus healthy controls in areas of the brain governing emotional response (e.g., the limbic system) and those involved in cognitive control (e.g., dorsolateral prefrontal cortex) (Goldin, Manber, Hakimi, Canli, & Gross, 2009). Activations of these systems may occur with such synchrony that individuals cannot phenomonologically distinguish between the experience of reactivity and regulation. Self-reports of strong negative reactivity may therefore reflect heightened activation of neural networks governing reactivity, low activation of areas controlling emotion regulation, or some combination of the two.

Second, Factor 2 represented positive emotion reactivity. Examination of the subscales loading onto Factor 2 revealed items assessing positive affect, high activation, and engagement. Representative items from these subscales included, "When I'm happy, I feel like I'm bursting with joy" (from the AIR-Y Positivity subscale) and "Something wonderful happens to me — I feel extremely joyful" (from the EIS-Positive subscale). Also loading on Factor 2 were emotion regulation items assessing awareness of one's emotions, emotion suppression (which loaded in the negative direction), and talking to others about one's emotions. This suggests that healthy emotion regulation is part of the individual's phenomenological experience of positive emotional. In a similar vein, Gross and Levenson (1997) found that emotional inhibition was associated with low levels of self-reported positive affect. Our results echo this finding, as individuals who reported high emotional awareness and low levels of suppression tended to report increased positive reactivity as well. Again we hasten to add that these results pertain to *self-reported* positive emotional reactivity and regulation. Had other assessment methods been used that did not rely so heavily on self-perceptions, greater discriminant validity may have become evident.

Third, we found little correlation between Factor 1 and Factor 2. This is in keeping with previous work documenting the orthogonality of negative and positive affect (e.g., Watson & Tellegen, 1985) and the conceptualization of positive and negative reactivity as reflecting different components of temperament (Rothbart, 1989). Similarly, our two factors would seem to reflect relatively orthogonal processes as well. Individuals could conceivably be high on both positive and negative reactivity, low on both, or high on one and low on the other.

Our fourth finding pertains to the DERS. All DERS subscales except Lack of Awareness loaded onto Factor 1, reflecting ineffectual responses to negative emotions. The DERS was

designed in light of Gratz's (2002) definition, which emphasizes acceptance of emotions and the ability to act productively and modulate one's responses when experiencing negative emotions. The inability to do these things (as measured by five of the DERS subscales) is part of a strong and uncontrolled negative emotional experience (possibly explaining the loadings of the DERS scales onto Factor 1). The discrepancy between the Lack of Awareness subscale and other DERS subscales has been previously reported. In their confirmatory factor analysis of the DERS, Bardeen, Fergus, and Orcut (2012) also noted the discrepancy between the Lack of Awareness subscale and other subscales of the DERS. Growing evidence about the divergence of the Lack of Awareness subscale strongly suggests that researchers should use caution when interpreting total scores from the measure. In the future, researchers might consider omitting the Lack of Awareness subscale altogether when summing DERS scores.

A fifth finding pertains to the ERQ, which was designed to assess aspects of emotion regulation. The ERQ Suppression subscale, which assesses a regulation strategy shown to associate with rumination and depressive symptoms (Gross & John, 2003), loaded negatively onto Factor 2; however, the ERQ Cognitive Reappraisal subscale, a strategy associated with reduced distress and overall well-being (Gross & John, 2003) did not load onto either factor. Gross' (1998) definition emphasizes the processes people use to influence what and when they have particular emotions and how they experience and express these. Interestingly, our results do not suggest that *high* levels of suppression are associated with *negative* emotion. Instead, *low* levels of suppression were associated with *positive* emotion. In other words, not suppressing one's emotions appears to be part of strong positive emotional experiences. Conversely, cognitive reappraisal was not strongly associated with either positive or negative emotional reactivity. Given the literature linking cognitive reappraisal with reduced distress, we interpret

this finding to mean that individuals perceive cognitive reappraisal as something distinct from their experience of the actual emotion, though reappraisal may modulate that emotion. Lack of converge of the ERQ-Cognitive Reappraisal scale on the current factors may indicate a third factor, reflecting strategy-focused emotion regulation.

Our sixth finding pertained to the incremental utility in statistically predicting NSSI of Factor 1 and Factor 2. Collectively, negative emotion reactivity (Factor 1) measures predicted NSSI. The DERS-Strategies subscale was primarily responsible for this relation. Previous studies using the DERS have consistently found the Strategies subscale to distinguish between those with and without histories of self-harm (Gratz & Roemer, 2004; Gratz & Roemer, 2008; Perez, Venta, Garnaat, & Sharp, 2012). Our results provide additional evidence that the inability to implement concrete strategies to down-regulate negative emotions has special relevance to NSSI.

Conversely, we did not find a significant relation between positive emotion reactivity (Factor 2) measures and NSSI. This result extends Claes, Klonsky, Muehlenkamp, Kuppens, and Vandereycken's (2010) study in which positive reactivity following NSSI correlated with increased NSSI among eating disorder patients. We speculate that positive reactivity must be experienced in connection with previous NSSI behaviors (rather than more generally) in order to influence the likelihood of engaging in NSSI.

To further clarify the relations of Factor 1 and Factor 2 to NSSI when the behavior is used as a regulatory technique, we examined the factors' relation to respondents' reports about their use of NSSI to regulate emotion. Factor 1 but not Factor 2 contributed to statistical prediction of NSSI-related affect regulation. Results supported most of those reported by Turner, Chapman, and Layden (2012) with a one exception. We did not find a significant relation

between NSSI-related affect regulation and use of emotion suppression that was reported by Turner et al. One possible explanation for this is that, compared to Turner et al., our sample included considerably fewer individuals who endorsed cutting. Emotional suppression may relate differentially to different types of self-harm behavior. Additional research in a population specifically recruited to represent various forms of self-injury would be required to test this hypothesis.

Limitations of the current study pave the way for future investigation. First, the study was cross-sectional, a factor that prevents the examination of truly prospective relations. An important direction for future research would be to administer the measures of NSSI, emotional reactivity, and emotional regulation in the context of longitudinal research designs. Second, our sample was community-based but restricted to college students at an elite university. Results may not generalize to all community settings (particularly to non-student populations). Researchers should examine the generalizability of these findings to more diverse populations. Replication among clinical samples is also necessary, as the incidence of severe NSSI behaviors in the current study was relatively low. Third, we chose deliberately to concentrate on self-report measures emotional reactivity and regulation in order to focus on the individual's experience of these phenomena; however, the limitations of self-report measures of emotion have been documented previously (Mauss & Robinson, 2009). Utilization of psycho-physiological and neuro-cognitive methods might provide evidence of discriminant validity that is masked by the exclusive use of self-report methods. Finally, to avoid respondent fatigue, we did not utilize all possible emotional reactivity and regulation questionnaires. Future research could test the generalizability of these results with other excellent measures such as the Cognitive Emotion

Regulation Questionnaire (Garnefski, Kraaij, & Spinhoven, 2001) or the arousal measures developed by Derryberry and Rothbart (1988).

Despite these limitations, this study makes an important contribution to the conceptualization of emotion regulation and emotion reactivity, particularly as these constructs are studied in the NSSI field. Clarity in our definitions of these constructs will enhance our ability to develop theory regarding cognitive and emotional vulnerabilities to this behavior. The results also suggest treatment and clinical research implications. Strong negative reactivity, particularly the inability to access strategies to reduce one's negative emotion consistently emerged as an important predictor of the behavior. Clinicians treating patients with NSSI should make emotion regulation skills and strategies for distress tolerance a central part of therapy (components of dialectical behavior therapy). Building the patient's perceived capacity to use other, more adaptive skills in moments of distress may be crucial to reducing the behavior. We did not see significant relations between use of specific strategies (e.g., cognitive reappraisal, emotion suppression) and NSSI. An important line of clinical research will be focusing on what, if any, strategies besides NSSI do self-injurers also use to modulate their emotions.

Footnotes

1 – We note that the ERS – one of the hallmark instruments on the negative emotion reactivity factor – does not explicitly instruct respondents to interpret "being 'emotional'" as negative. Our participants overwhelmingly interpreted the prompt in this fashion, as indicated by the measure's correspondence with the negative intensity subscales of the EIS and the AIR-Y.

2 – We were surprised to see the AIR-Y Negative Reactivity measure loaded onto Factor 2. Closer examination of the subscale items shows that many of them relate to capacity for empathy (eg, "Sad movies deeply touch me" and "The sight of someone who is hurt badly affects me strongly"). Bryant, Yarnold, and Grimm (1996) found a strong correlation between the Negative Reactivity of the AIM (parent measure of the AIR-Y) and a measure of empathetic concern – further evidence to support our interpretation. Individuals with high levels of positive emotion reactivity may also demonstrate stronger empathetic responses, though additional research would be necessary to confirm this.

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Table 1
Lifetime prevalence and frequency of NSSI behaviors

NSSI Behavior (n)	% Sample Endorsing Behavior	Original metric *M (SD)*	Rescaled metric *M (SD)*
Cutting (n=360)	7.78	3.05 (37.13)	.16 (.54)
Severe scratching (n=359)	11.42	2.55 (27.16)	.23 (.64)
Biting (n=360)	6.94	1.72 (13.44)	.14 (.51)
Banging or hitting self (n=361)	13.57	1.80 (8.71)	.24 (.62)
Burning (n=359)	2.23	.48 (7.94)	.04 (.30)
Interfering with wound healing (n=357)	27.73	326.14 (5298.22)	.35 (.69)
Carving (n=357)	0.56	.14 (2.64)	.01 (.15)
Rubbing skin against rough surface (n=359)	4.74	3.33 (53.04)	.09 (.43)
Pinching	15.24	6.54 (37.27)	.28 (.68)
Sticking self with needles (n=359)	2.23	.11 (.96)	.04 (.30)
Pulling hair (n=360)	11.94	30.39 (527.05)	.22 (.61)
Swallowing dangerous substances (n=347)	3.34	.17 (1.21)	.07 (.36)

Note. Response rates vary by question

Table 2
Self-reported function of NSSI

Function (n)[1]	*M (SD)*	Correlation with rescaled total NSSI score
Affect regulation (134)	2.34 (2.05)	.44**
Self-punishment (131)	1.68 (2.03)	.27**
Self-care (134)	.51 (.96)	.13
Anti-dissociation (134)	.84 (1.52)	.28**
Anti-suicide (132)	.69 (1.54)	.41**
Interpersonal boundaries (133)	.50 (1.17)	.20*
Sensation seeking (132)	.40 (.96)	.19*
Peer bonding (133)	.26 (.88)	.07
Interpersonal influence (134)	.57 (1.13)	.14
Toughness (132)	.57 (1.12)	.24**
Marking distress (133)	1.13 (1.56)	.23**
Revenge (133)	.34 (.98)	.15
Autonomy (134)	.31 (.84)	.11

Note. Response rates vary by question, answered only by participants endorsing lifetime history of NSSI

$*p < .05$; $**p < .01$

Table 3

Instrument subscale sample item, descriptive statistics and reliability

Instrument subscale	Sample item	*M (SD)*	Reliability (Cronbach's alpha)
ERS	I tend to get very emotional very easily.	30.03 (14.42)	.92
AIR Y – Negative Intensity	My feelings tend to be stronger compared to most people.	3.32 (.75)	.62
AIR Y – Negative Reactivity	Sad movies deeply touch me.	4.00 (.78)	.62
AIR Y – Positivity	When I'm happy, I feel like I'm bursting with joy.	3.78 (.69)	.89
EIS – Positive	Something wonderful happens to me. I feel extremely joyful.	50.41 (5.72)	.82
EIS – Negative	People do things to annoy me. I feel like hitting them.	52.94 (7.32)	.82
ERQ Cognitive Reappraisal	When I want to feel less negative emotion, I change the way I'm thinking about a situation.	30.21 (6.23)	.83
ERQ Suppression	I keep my emotions to myself.	14.67 (5.72)	.83
REQ Internal Dysfunctional	I dwell on my thoughts and feelings (eg, it goes round and round).	11.02 (3.10)	.63
REQ Internal Functional	I review (rethink) my thoughts or plans.	17.48 (3.12)	.63
REQ External Dysfunctional	I take my feelings out on others physically (eg, fighting, lashing out).	7.92 (2.69)	.65
REQ External Functional	I talk to someone about how I feel.	13.44 (2.96)	.54
DERS – Impulse	When I'm upset, I have difficulty controlling my behaviors.	10.82 (4.05)	.84
DERS – Strategies	When I'm upset, I believe that I'll end up feeling very depressed.	18.12 (6.68)	.90
DERS – Goals	When I'm upset, I have difficulty focusing on other things.	15.96 (4.87)	.91
DERS – Awareness	I pay attention to my feelings. (reverse)	14.09 (4.05)	.76
DERS – Clarity	I have difficulty making sense out of my feelings.	11.35 (3.68)	.85
DERS - Nonacceptance	When I'm upset, I feel ashamed of myself for feeling that way.	13.74 (5.91)	.92

Note. ERS=Emotion Reactivity Scale; AIR-Y=Affect Intensity and Reactivity Measure for Youth; EIS=Emotional Intensity Scale; ERQ=Emotion Regulation Questionnaire; REQ=Regulation of Emotions Questionnaire; DERS=Difficulties in Emotion Regulation Scale

Table 4
Factor loadings by instrument subscale

Instrument subscale	Factor 1	Factor 2
DERS – Strategies	**.87**	-.13
ERS	**.78**	.22
AIR Y – Negative Intensity	**.71**	**.49**
DERS – Impulse	**.70**	-.05
DERS – Nonacceptance	**.65**	-.09
DERS – Goals	**.64**	-.09
REQ – Internal Dysfunctional	**.64**	-.13
EIS – Negative	**.60**	**.39**
DERS – Clarity	**.47**	-.30
EIS – Positive	.14	**.64**
AIR Y – Positivity	.14	**.58**
REQ – External Functional	-.10	**.56**
DERS – Awareness	.22	**-.52**
ERQ – Suppression	.16	**-.47**
AIR Y – Negative Reactivity	.33	**.45**
REQ – External Dysfunctional	.33	-.05
ERQ – Cognitive Reappraisal	-.30	.28
REQ – Internal Functional	-.28	.29

Note. Items loading onto each factor are bolded. ERS=Emotion Reactivity Scale; AIR-Y=Affect Intensity and Reactivity Measure for Youth; EIS=Emotional Intensity Scale; ERQ=Emotion Regulation Questionnaire; DERS=Difficulties in Emotion Regulation Scale; REQ=Regulation of Emotions Questionnaire

Table 5
Pearson correlations for instruments with NSSI, Affect Regulation

Instrument	Total NSSI (n=358)	Affect Regulation (n=134)
ERQ Cognitive Reappraisal	-.04	-.10
ERQ Suppression	.01	.08
DERS-Nonacceptance	.16**	.20*
DERS-Impulse	.15**	.20*
DERS-Strategies	.24**	.37**
DERS-Clarity	.03	.20*
DERS-Awareness	-.01	.02
DERS-Goals	.17**	.10
REQ Internal Functional	-.10	-.13
REQ External Dysfunctional	.04	-.10
REQ External Functional	-.04	-.13
REQ Internal Dysfunctional	.20**	.19*
EIS Positive	.01	.02
EIS Negative	.12*	.21*
AIR-Y Positivity	-.03	.03
AIR-Y Negative Intensity	.07	.23*
AIR-Y Negative Reactivity	.04	.21*
Emotion Reactivity Scale	.16**	.27**
Beck Depression Inventory-II	.14**	.24**
PANAS Positive	-.12*	-.04
PANAS Negative	.08	.09

Note. ERQ=Emotion Regulation Questionnaire; DERS=Difficulties in Emotion Regulation Scale; REQ=Regulation of Emotions Questionnaire; EIS=Emotional Intensity Scale; AIR Y=Affect Intensity and Reactivity Measure for Youth; PANAS=Positive and Negative Affect Scales
*$p < .05$; **$p < .01$

Table 6

Model and Change Statistics for Hierarchical Regression of Total NSSI, Affect Regulation on Factor 1 & Factor 2 Scales

Step	Predictor	Model statistics			Change statistics		
		R^2	Test	*p*	ΔR^2	Test	*p*
Dependent variable = Total NSSI (n = 354)							
Analysis 1: Factor 1 (Negative emotion reactivity) entered before Factor 2 (Positive emotion reactivity)							
1	Factor 1[a]	.08	F(9, 345)	< .01*			
2	Factor 2[b]	.08	F(15, 339)	.01*	.01	F(6, 339)	n.s.
Analysis 2: Factor 2 entered before Factor 1							
1	Factor 2	.01	F(6, 348)	n.s			
2	Factor 1	.08	F(15, 339)	.01*	.08	F(9, 339)	< .01*
Dependent variable = Affect Regulation (n = 130)							
Analysis 3: Factor 1 entered in step 1							
1	Factor 1	.17	F(9, 122)	.01*			
2	Factor 2	.22	F(15, 116)	.01*	.05	F(6, 116)	n.s.
Analysis 4: Factor 2 entered in step 1							
1	Factor 2	.07	F(6, 125)	n.s.			
2	Factor 1	.22	F(15, 116)	.01*	.15	F(9, 116)	.012*

Note. [a]Factor 1 subscales: ERS, AIR-Y Negative Intensity, EIS – Negative, DERS Nonacceptance, DERS Impulse, DERS Clarity, DERS Strategies, DERS Goals, REQ – Internal Dysfunctional
[b]Factor 2 subscales: AIR-Y Positivity, AIR-Y Negative Reactivity, EIS – Positive, ERQ – Suppression, DERS Awareness, REQ External Functional
**p < .05; **p < .01*

Appendix

Table 7 shows the incremental contribution in predicting both NSSI and affect regulation score of measures designed to assess emotion regulation and those designed to assess emotion reactivity (as designated by the authors). Taken together, measures of emotion regulation but not measures of emotion reactivity contributed to the statistical prediction of total NSSI. Of the individual subscales from measures designated as emotion regulation instruments, only the DERS-Strategies contributed significantly to the statistical prediction of total NSSI (β = .20, t = 2.14, p = .03.)

We obtained similar results when examining Affect Regulation scores as the dependent variable. Measures of emotion reactivity collectively contributed to affect regulation only when entered in the model alone. Taken together, those measures designated as emotion regulation contribute significantly to the statistical prediction of affect regulation score regardless of when entered in the model. Of the individual subscales, the DERS-Strategies was significant (β = .43, t = 2.97, p < .01). The REQ-External Dysfunction was marginally significant, but in the negative direction, such that less externalizing behavior associated with increased tendency to use NSSI to regulate one's affect (β = -.20, t = -2.01, p = .05).

Table 7

Model and Change Statistics for Hierarchical Regression of Total NSSI and Affect Regulation Scores on Emotion Regulation & Emotion Reactivity Scales

Step	Predictor	Model statistics			Change statistics		
		R^2	Test	*p*	ΔR^2	Test	*p*
Dependent variable = Total NSSI (n = 352)							
Analysis 1: Regulation measures entered as step 1							
1	Regulation measures[a]	.08	F(12, 340)	< .01*			
2	Reactivity measures[b]	.09	F(18, 334)	.02*	.01	F(6, 334)	n.s.
Analysis 2: Reactivity measures entered as step 1							
1	Reactivity measures	.03	F(6, 346)	n.s.			
2	Regulation measures	.09	F(18, 334)	.02*	.06	F(12, 334)	.04*
Dependent variable = Affect Regulation score (n = 130)							
Analysis 3: Regulation measures entered as step 1							
1	Regulation measures	.22	F(12, 118)	< .01*			
2	Reactivity measures	.25	F(18, 112)	.01*	.04	F(6, 112)	n.s.
Analysis 4: Reactivity measures entered as step 1							
1	Reactivity measures	.10	F(6, 124)	.03*			
2	Regulation measures	.25	F(18, 112)	.01*	.15	F(12, 112)	.04*

Note. [a]Emotion regulation measures (as denoted by authors): DERS (Nonacceptance, Impulse, Clarity, Strategies, Goals, Awareness subscales), ERQ (Cognitive reappraisal, Suppression subscales), REQ (Internal Functional, Internal Dysfunctional, External Functional, External Dysfunctional subscales)
[b]Emotion reactivity and intensity measures (as defined by authors): ERS, AIR-Y (Positivity, Negative Intensity, Negative Reactivity subscales), EIS (Positive, Negative subscales)
**p < .05; **p < .01*