Journal of Abnormal Psychology
2014, Vol. 123, No. 2, 463–469

0021-843X/14/$12.00 DOI: 10.1037/a0036436

BRIEF REPORT

Low Implicit and Explicit Aversion Toward Self-Cutting Stimuli Longitudinally Predict Nonsuicidal Self-Injury

Joseph C. Franklin
Harvard University

Megan E. Puzia
Warren Alpert Medical School of Brown University

Kent M. Lee and Mitchell J. Prinstein
University of North Carolina at Chapel Hill

There is a pressing need to improve the ability to identify individuals at risk for nonsuicidal self-injury (NSSI; e.g., cutting or burning oneself); unfortunately, beyond prior NSSI, there are few powerful longitudinal predictors of NSSI. The present study addressed this limitation by investigating the ability of a novel factor—low aversion to self-cutting stimuli—to longitudinally predict NSSI in 49 individuals with a history of self-cutting. Results revealed that both low implicit and explicit aversion to self-cutting stimuli were significantly associated with future NSSI (*r*s = .32–.51), and that these associations were unique from several other theoretically important predictors, including prior NSSI, number of NSSI methods, implicit identification with self-cutting, self-prediction of future NSSI, emotion dysregulation, and therapy status. These findings are consistent with the notion that instinctive barriers (e.g., aversion to NSSI stimuli, pain) dissuade most people from engaging in NSSI, and that the erosion of these barriers may facilitate NSSI.

Keywords: nonsuicidal self-injury, affect, longitudinal, implicit processes, emotion

Nonsuicidal self-injury (NSSI) is the direct and intentional destruction of one's own body tissue in the absence of suicidal intent (e.g., cutting or burning one's skin; Nock, 2010). Millions of people engage in these behaviors each year (Klonsky, 2011), with especially high rates in adolescent, young adult, and clinical populations (e.g., 15% to 60%; see Nock, 2010). Although NSSI itself is a concerning behavior, it is most alarming because of its strong association with suicidal self-injury. In fact, recent evidence indicates that NSSI is a stronger longitudinal predictor of future suicidal self-injury than prior suicidal self-injury (e.g., Wilkinson, Kelvin, Roberts, Dubicka, & Goodyear, 2011). Given its prevalence and dangerousness, there is an urgent need to identify individuals at-risk for engaging in NSSI. Unfortunately, the nascent literature on the longitudinal prediction of NSSI has produced few powerful and consistent predictors of NSSI.

Perhaps the most effective known predictor of NSSI is prior NSSI, which is moderately correlated with future NSSI and tends to wipe out most other effects when simultaneously entered with other variables (e.g., Chapman, Derbidge, Cooney, Hong, & Linehan, 2009; Tuisku et al., in press). This highlights the need for additional factors that powerfully predict future NSSI. Several studies have tested the hypothesis that depression represents such a factor; however, as a whole, this literature reveals that depression often is weakly and inconsistently associated with future NSSI. Some studies have obtained relatively small but significant effects (e.g., Guerry & Prinstein, 2010; You, Lin, & Leung, 2013); others have found that this effect disappears when controlling for factors such as prior self-injury and instability of rumination (e.g., Selby, Franklin, Carson-Wong, & Rizvi, 2013; Wilcox et al., 2012); and still others have found no effect of depression (e.g., Glenn & Klonsky, 2011; Tuisku et al., in press). Evidence for the predictive ability of factors related to emotion dysregulation is stronger, but these effects also tend to be weak compared with prior self-injury (e.g., Wilcox et al., 2012; You et al., 2013). Taken together, this literature suggests the need for more effective NSSI predictors. Ideally, such predictors would be powerful, easy to assess, unique from traditional factors such as emotion dysregulation, and able to predict above and beyond prior self-injury. The primary goal of the present study was to evaluate a novel factor that recent theory and research suggest may meet these criteria—low aversion to self-cutting stimuli.

Given that affective reinforcement (i.e., feeling better after NSSI) is the primary reason that most people give for engaging in NSSI (Klonsky, 2007; Nock & Prinstein, 2005), this factor has received attention as a potential risk factor for NSSI. However, an

Joseph C. Franklin, Department of Psychology, Harvard University; Megan E. Puzia, Department of Psychiatry, Warren Alpert Medical School of Brown University; Kent M. Lee and Mitchell J. Prinstein, Department of Psychology, University of North Carolina at Chapel Hill.

Correspondence concerning this article should be addressed to Joseph C. Franklin, Department of Psychology, Harvard University, 1350 Massachusetts Avenue, Cambridge, MA 02138. E-mail: josephfranklin@fas.harvard.edu

accumulating literature indicates that it is natural to display increased positive affect and diminished negative affect (compared with baseline) after the removal of a physically painful stimulus (e.g., Franklin, Lee, Hanna, & Prinstein, 2013; Tanimoto, Heisenberg, & Gerber, 2004). This natural *pain offset relief* helps to explain the affective reinforcement of NSSI. Surprisingly, this pain offset relief does not distinguish between non-NSSI and NSSI groups (e.g., Franklin et al., 2010, Franklin, Puzia, et al., 2013). In contrast, what we conceptualize as the *barriers to NSSI* powerfully discriminate between these groups. For example, many people avoid NSSI because of the pain involved in these behaviors, and laboratory studies have shown that individuals who engage in NSSI often are willing to endure pain because they believe that they deserve punishment (e.g., Franklin, Aaron, Arthur, Shorkey, & Prinstein, 2012; Hooley, Ho, Slater, & Lockshin, 2010; Hooley & St. Germain, in press).

The aversion to NSSI stimuli also represents an important barrier to self-injurious behaviors. The aversion to injury and stimuli associated with injury is potent and instinctive (cf. Öhman & Mineka, 2001). Indeed, in normative samples, mutilation stimuli tend to produce the most negative affective reactions across a range of self-report and psychophysiological measures (e.g., Bradley, Codispoti, Cuthbert, & Lang, 2001). Recent theoretical (e.g., Franklin, Puzia, et al., 2013; Joiner, Ribeiro, & Silva, 2012) and cross-sectional empirical work (Glenn & Klonsky, 2010; Plener, Bubalo, Fladung, Ludolph, & Lulé, 2012), however, suggests that individuals who engage in NSSI overcome this instinctive aversion to self-injury stimuli. Recently, we found that diminished implicit and explicit aversion to self-cutting stimuli powerfully distinguished between NSSI and non-NSSI groups at baseline (*d*s = .61 to 1.23) and were strongly associated with lifetime NSSI frequency (*r*s = .42 to .46; Franklin, Lee, Puzia, & Prinstein, in press). This suggests that diminished aversion to self-cutting stimuli may longitudinally predict NSSI. Nevertheless, it should be noted that baseline group separation does not necessarily lead to longitudinal prediction. For example, an NSSI-specific version of the Implicit Association Test (IAT) distinguishes between non-NSSI and NSSI groups as baseline ($d = 1.20$; Nock & Banaji, 2007), but does not appear to prospectively predict NSSI (Glenn & Klonsky, 2011). In the present follow-up to Franklin et al. (in press), we evaluated the hypothesis that greater reductions in aversion to self-cutting stimuli would be associated with more frequent engagement in future NSSI.

To test this hypothesis, we measured implicit and explicit affective aversion to self-cutting stimuli in a sample of individuals with a history of self-cutting and then measured their NSSI frequency over the ensuing 6 months. We measured explicit aversion with a computerized survey that asked participants to rate the pleasantness/unpleasantness of self-cutting images. Because individuals may be unwilling or unable to accurately report their affective responses to self-injury stimuli (cf. Nisbett & Wilson, 1977; Nock et al., 2010), we additionally measured implicit aversion to these same self-cutting stimuli with the Affect Misattribution Procedure (AMP; Payne, Cheng, Govorun, & Stewart, 2005). To investigate the independence of these factors, we tested their abilities to predict NSSI uniquely from other theoretically important factors including prior self-injury, number of NSSI methods, self-prediction of future NSSI, implicit identification with self-cutting, emotion reactivity, and therapy status. Finally, in addition to self-cutting, we separately examined overall noncutting severe NSSI behaviors (i.e., burning, scraping, severe hitting, etc.) as an outcome variable. This allowed us to investigate whether diminished aversion to self-cutting was specific to self-cutting or applied to NSSI more broadly.

Method

Participants

Participants consisted of 58 individuals recruited from campus, community, and hospital advertisements that offered $75 for participation in a study related to self-cutting. Participants were offered an additional $10 for completion of a follow-up survey about NSSI 6 months after their lab visit. A total of 49 (36 women) participants completed the follow-up portion of the study. Power analyses based on other longitudinal NSSI studies indicated that this sample size would be sufficient to detect medium-to-large effects. We have reported baseline findings on the total sample elsewhere (Franklin et al., in press); the present data are based only on the follow-up sample. There were no significant differences between individuals who did and did not complete the follow-up on any baseline or demographic variable (all *p*s >.20). The present sample had an average age of 24.37 ($Mdn = 21.00$; $SD = 8.28$) and an ethnic composition of 61.2% Caucasian American, 8.2% African American, 16.3% Asian American, 4.1% Hispanic American, and 10.2% mixed/other. There were no significant effects of ethnicity on any measure in the present study (all *p*s >.20). All participants reported a history of self-cutting as assessed by the Self-Injurious Thoughts and Behaviors Interview (SITBI; Nock, Holmberg, Photos, & Michel, 2007). Self-cutting was selected as a required behavior because it is the most common NSSI behavior (e.g., Nock & Prinstein, 2005), it is an unambiguously severe NSSI behavior (see Lloyd-Richardson, Perrine, Dierker, & Kelley, 2007), and we specifically examined implicit and explicit aversion to self-cutting stimuli. The mean number of lifetime self-cutting episodes was 127.27 ($Mdn = 30$; $SD = 432.48$; range = 1–3,000). The mean number of months since the last self-cutting episode was 11.56 ($Mdn = 0$; $SD = 28.29$; range = 0–162).

Measures

SITBI. The SITBI (Nock et al., 2007) is a structured interview that measures the presence, frequency, and characteristics of various types of self-injurious thoughts and behaviors. The SITBI has strong interrater reliability (average K = .99; $r = 1.0$) and test–retest reliability (average K = .70; intraclass correlation coefficient = .44) over a 6-month interval (Nock et al., 2007). In the present study, we employed the NSSI module of the SITBI, which has shown strong construct validity, converging with other measures of NSSI (average K = .87). For the present study, we were interested in several variables: (a) the frequency of self-cutting during the 6 months before and after the laboratory visit; (b) the frequency of other (i.e., noncutting) severe NSSI behaviors during the 6 months before and after the laboratory visit; (c) self-prediction of future NSSI on a 0 (*definitely not*) to 4 (*definitely so*) scale assessed during the laboratory visit; (d) the number of severe NSSI methods before and after the laboratory visit; and (e) therapy

status (i.e., any type of psychosocial or pharmacological treatment) during the 6 months after the laboratory visit.

The category "other severe NSSI behaviors" included burning, scraping, and any other NSSI behaviors that caused substantial tissue damage (e.g., severe self-hitting). This categorization is consistent with prior studies showing that, compared with minor NSSI behaviors (e.g., lip-biting, skin picking), these severe NSSI behaviors are associated with greater likelihood of psychopathology, suicidal thoughts and behaviors, and hospitalizations (e.g., Lloyd-Richardson et al., 2007). For the 6-month follow-up, an online survey version of the NSSI module of the SITBI was created. The common variable between the baseline and follow-up SITBIs, lifetime NSSI frequency, showed high test–retest reliability (r = .85).

Emotion Reactivity Scale (ERS). The ERS (Nock, Wedig, Holmberg, & Hooley, 2008) measures emotion reactivity, which has been defined as a component of emotion regulation that specifically involves emotional sensitivity, intensity, and persistence (see Nock et al., 2008). The ERS is a 21-item self-report questionnaire that displays strong internal consistency (α = .92 in the present study), convergent and discriminant construct validity, and criterion-related validity (Nock et al., 2008). The ERS has been shown to mediate the association between psychopathology and self-injury (Nock et al., 2008). Accordingly, in the present study the ERS served to specify that any predictive effects of diminished aversion to self-cutting stimuli were not because of more general emotional and psychopathological correlates of NSSI.

Picture stimuli. The self-cutting pictures included in the affective measures were developed specifically for the present study with a combination of digital art and theatrical makeup techniques. These were 12 images that depicted various features of a self-cutting episode (see Figure 1 for an example of four of these images). Post hoc analyses revealed that all self-cutting picture subtypes (e.g., blood vs. no blood) were similarly related to future self-injury. We also included 12 general unpleasant images from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005). These included images of spiders, snakes, and impending attack (e.g., gun pointed at camera).

Explicit affective ratings. Explicit affect toward the images noted above was assessed with a computerized self-report survey. On each trial, a picture was presented and participants were asked to rate it on a scale of 0 (*extremely unpleasant*) to 5 (*neutral*) to 9 (*extremely pleasant*). This measure was self-paced: after participants made their ratings on a given trial, they clicked on a button to move on to the next trial. Explicit ratings displayed excellent internal consistency (α = .95 for self-cutting images; α = .89 for unpleasant images).

AMP. The AMP (Payne et al., 2005) is a brief computer-based task that measures implicit affect. On each trial of the AMP, the computer flashes an emotionally valenced picture for 75 ms, a blank screen for 125 ms, a Chinese symbol for 100 ms, and finally a gray screen that remains until the participant presses a key. Participants were excluded if they indicated that they could read these symbols. In this forced-choice task, participants were instructed to press one key (i.e., 'p') if they judged the Chinese symbol to be more pleasant than the average symbol and another key (i.e., 'q') if they judged it to be less pleasant that the average symbol (see Payne et al., 2005). Participants were instructed to use their "gut feelings" to make their judgments and to ignore the initial emotionally valenced images. Despite this latter instruction, evaluations tend to be strongly influenced by the valence of the picture, with more pleasant pictures generating more pleasant evaluations of subsequent Chinese symbols (Payne et al., 2005). The dependent variable for the AMP was the proportion of trials on which a positive evaluation occurs to the total number of trials within a given picture category. We created a version of the AMP specifically for the present study that included the images noted above. AMP responses displayed high internal consistency within categories (α = .91 for self-cutting; α = .88 for unpleasant).

The identity version of the self-cutting IAT. The IAT (Nock & Banaji, 2007) is a brief computer-based task that measures

Figure 1. Four of the 12 self-cutting images used in the present study. These images were designed to depict various aspects and stages of a self-cutting episode.

implicit associations. The identity version of the self-cutting IAT assesses the strength of the association that participants hold between themselves and self-cutting (Nock & Banaji, 2007). The format and stimuli for this task were identical to those of Nock and Banaji (2007). Specifically, there were five blocks. During the three practice blocks, two words were displayed at the top of the screen (either me and not me; or cutting and no cutting). During the two experimental blocks, four words were displayed at the top of the screen: (a) one of these blocks paired me/cutting and not me/no cutting at the top of the screen; (b) the other block paired not me/cutting and me/no cutting at the top of the screen. On each trial, a stimulus appeared in the center of the screen and participants were instructed to correctly sort this stimulus into one of the categories at the top of the screen by pressing either 'e' (if the correct category was in the left-hand part of the screen) or 'i' (if the correct category was in the right-hand part of the screen). For any block that included me/not me, these stimuli included self- and other-related words; for any block that included cutting/no cutting, these stimuli included cutting-related images and images of noninjured skin. Reaction time was recorded for each trial on which a correct classification was made. If an incorrect classification was made, the trial was repeated. Consistent with recommendations (see Nock & Banaji, 2007), the strength of association between cutting and oneself was quantified by taking a standardized difference score (i.e., response latencies for the me/cutting block subtracted from the not me/cutting block, divided by the *SD* for all five blocks) for each participant. Positive difference scores reflected stronger associations. This measure showed high internal consistency in the present study ($\alpha = .93$).

Procedure

Participants arrived at the laboratory and completed an informed consent form. Participants then completed the SITBI and ERS, followed by the self-cutting versions of the AMP, IAT, and explicit affective ratings survey. At the conclusion of the study, participants were compensated and informed about the optional follow-up survey. Six months after their lab visit, participants received a link to the follow-up survey about NSSI behaviors. Upon completion of this survey, participants were compensated again.

Data Analytic Plan

First, we calculated descriptive statistics for all measures. Second, we examined zero-order Pearson product–moment correlations among all variables (we note that rank-order correlations produced very similar results). Third, we employed Poisson regression models to investigate the ability of theoretically relevant variables to uniquely predict future self-cutting and future noncutting severe NSSI behaviors.

Results

Zero-Order Correlations

Descriptive statistics and zero-order correlations among variables are presented in Table 1. Of note, diminished implicit and explicit aversion toward self-cutting stimuli were both associated with future self-cutting and future noncutting severe NSSI behaviors. Self-prediction of future NSSI, number of NSSI methods, therapy status, and prior NSSI also were prospectively associated with NSSI behaviors. It is interesting that affect toward general unpleasant images, implicit identification with self-cutting, and emotion dysregulation were not significantly associated with future NSSI (Table 1).

Prepost Self-Injury Patterns

Results indicated that there were significant overall reductions in both self-cutting, $F(48) = 16.60$, $p < .001$ and noncutting severe NSSI behaviors, $F(48) = 10.64$, $p = .002$ between the 6 months before the laboratory visit and the 6 months after the laboratory visit.

Table 1
Descriptive Statistics and Zero-Order Among Major Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Implicit cutting	—												
2. Implicit unpleasant	.43***	—											
3. Explicit cutting	.56***	.27*	—										
4. Explicit unpleasant	.15	.30*	.27*	—									
5. IAT cutting	−.07	−.06	.14	.02	—								
6. Self-prediction	.57***	.19	.39**	.30*	.01	—							
7. Number of methods	−.06	−.11	−.13	−.03	.15	.17	—						
8. ERS score	.12	−.01	.19	.07	.12	.44***	.37**	—					
9. Therapy	.18	−.22	.25*	−.08	.19	.17	.12	.12	—				
10. Cutting–Pre	.22	−.21	.18	.08	.11	.19	.04	−.06	.31*	—			
11. Cutting–Post	.34**	−.11	.32*	.07	.14	.19	.14	.03	.35**	.60***	—		
12. Other NSSI–Pre	.40**	−.04	.31*	.23	−.11	.38**	.38**	.28*	.12	.29*	.35**	—	
13. Other NSSI–Post	.51***	.13	.43***	.22	−.05	.39**	.35**	.14	.21	.20	.62***	.71***	—
M	.38	.35	3.23	2.66	.07	2.01	1.69	56.70	.37	5.06	1.53	7.23	3.41
SD	.28	.24	2.43	2.58	.48	1.44	.89	17.54	.49	7.45	3.39	11.22	6.08
Skewness	.30	.18	.96	.93	.21	−.02	1.02	.90	.57	3.17	3.94	2.05	2.58

Note. IAT = Implicit Association Test; ERS = Emotion Reactivity Scale; NSSI = nonsuicidal self-injury.
** $p < .01$. *** $p < .001$.

Unique Predictors of Future NSSI

The Poisson regression model for the prediction of self-cutting indicated that several variables were unique predictors (Table 2). Specifically, prior self-cutting, the number of NSSI methods, and implicit/explicit affect toward self-cutting images each significantly uniquely predicted the frequency of future self-cutting. Implicit identification with self-cutting, self-prediction of future NSSI, emotion reactivity, and therapy status were not significant unique predictors of self-cutting. Similarly, a separate Poisson regression model revealed an identical prediction pattern for noncutting severe NSSI behaviors, with the exception that therapy status was an additional significant predictor in this model (Table 2).

Discussion

There is an urgent need to improve the identification of individuals at-risk for NSSI and to advance knowledge about the mechanisms that drive NSSI. Consistent with previous studies (e.g., Glenn & Klonsky, 2011), results revealed that prior NSSI frequency and number of NSSI methods were strong predictors of future NSSI. Adding to mixed evidence from previous studies (e.g., Tuisku et al., in press; Wilcox et al., 2012), our index of emotion dysregulation (ERS scores) was not prospectively associated with NSSI. Similarly, replicating the findings of Glenn and Klonsky (2011), results indicated that implicit identification with self-cutting did not predict NSSI. Taken together, these findings suggest: (a) prior NSSI is a robust predictor of NSSI; and (b) factors such as emotion dysregulation and implicit identification with self-cutting cross-sectionally differentiate NSSI and non-NSSI groups, but may not play active roles in maintaining NSSI behaviors.

In accordance with the primary hypothesis of the present study, results revealed that low aversion to self-cutting stimuli was a strong and independent predictor of NSSI. Specifically, it predicted uniquely from other theoretically important factors including prior self-injury, number of NSSI methods, self-prediction of future NSSI, implicit identification with self-cutting, emotion reactivity, and therapy status. It is interesting that implicit and explicit diminished aversion predicted independently from one another (Table 2). The present results are consistent with the idea that the instinctive aversion to self-cutting stimuli is an important barrier to NSSI, and greater reductions in this barrier are associated more frequent future NSSI. We hypothesize that pain offset relief conditioning may be one of the primary mechanisms that erodes this aversion barrier. Specifically, because pain offset relief occurs during NSSI (see Franklin, Puzia, et al., 2013), it is possible that stimuli present during this time (e.g., knives, blood, wounds) become paired with relief, gradually diminishing the aversion to these stimuli (cf. Andreatta, Mühlberger, Yarali, Gerber, & Pauli, 2010). This would suggest that the opposing conditioning process—aversive conditioning—may reestablish the instinctive aversion to NSSI stimuli. Rebuilding this barrier may reduce the likelihood of future NSSI. Given that currently there are no empirically supported treatments for NSSI despite attempts with nearly all traditional interventions (Nock, 2010), future studies may benefit from testing these conditioning and counterconditioning hypotheses with experimental and longitudinal studies.

Echoing the findings of most longitudinal self-injury studies (Glenn & Klonsky, 2011; Hazell et al., 2009; Linehan et al., 2006; You et al., 2013), results indicated that overall self-injury frequency significantly decreased between the 6 months' prelaboratory visit and the 6 months' postlaboratory visit. The most likely explanation for this pattern is that self-injury studies (including the present study) usually

Table 2
Poisson Regression Models for the Prediction of Self-Injury 6 Months' Postbaseline

Predictors	*B* (*SE*)	Wald χ^2	Odds ratio (95% confidence interval)
Prediction of self-cutting			
Cutting–Pre	**.07 (.01)**	**30.67*****	**1.07 (1.04–1.10)**
Implicit cutting	**1.87 (.62)**	**9.08****	**6.50 (1.92–21.97)**
Explicit cutting	**.22 (.09)**	**6.23****	**1.25 (1.05–1.48)**
IAT Cutting	.39 (.33)	1.39	1.48 (.77–2.83)
Self-prediction	−.13 (.12)	1.10	.88 (.70–1.15)
Number of methods	**.54 (.17)**	**10.42*****	**1.71 (1.24–2.37)**
ERS Score	.00 (.01)	.07	1.00 (.98–1.02)
Therapy	.44 (.31)	1.97	1.56 (.84–2.88)
Omnibus $\chi^2(8) = 113.49$, $p < .001$			
Prediction of noncutting severe NSSI behaviors			
Other NSSI–Pre	**.05 (.01)**	**35.95*****	**1.05 (1.03–1.06)**
Implicit cutting	**1.31 (.46)**	**7.95****	**3.69 (1.49–9.16)**
Explicit cutting	**.21 (.06)**	**13.96*****	**1.10 (1.05–1.37)**
IAT cutting	−.05 (.21)	.05	.96 (.63–1.45)
Self-prediction	−.04 (.09)	.20	.96 (.80–1.15)
Number of methods	**.64 (.11)**	**34.76*****	**1.89 (1.53–2.33)**
ERS; Score	−.01 (.01)	2.20	.99 (.98–1.00)
Therapy	**.55 (.18)**	**9.28****	**1.73 (1.22–2.46)**
Omnibus $\chi^2(8) = 249.79$, $p < .001$			

Note. Bolded items represent significant effects.
** $p < .01$. *** $p < .001$.

attempt to recruit individuals with recent and frequent self-injury (e.g., multiple NSSI episodes within the past 6 months). Many of these episodes may be driven in part by acute stressors that resolve within a few months, leading to fewer NSSI episodes during follow-up intervals. Future studies are needed to directly investigate why this overall decreased self-injury pattern occurs.

The present results should be interpreted in accord with the limitations of the present study. First, future studies may benefit from employing larger sample sizes, other populations, and additional predictors (e.g., sexual orientation, Wilcox et al., 2012; self-criticism, Hooley & St. Germain, in press). Second, the present measures only gauged aversion to self-cutting stimuli; future studies may benefit from including a wider range of stimuli (e.g., burning, death/suicide related). The fact that low aversion to self-cutting stimuli strongly predicted noncutting behaviors (see Tables 1 and 2) suggests the possibility that low aversion to a given form of self-injury (e.g., cutting) may be concatenated with low aversion to several other forms of self-injury, including suicidal self-injury. This may help to explain the link between NSSI and suicidal self-injury (cf. Joiner et al., 2012); future studies should investigate this possibility. Third, to investigate the discriminant predictive validity of low aversion to self-cutting stimuli, future studies should examine whether this factor predicts other dysregulated behaviors (e.g., substance use, purging) or only NSSI. Fourth, the measures in the present study were not counterbalanced, leaving open the possibility that later measures (i.e., IAT, explicit ratings) may have been influenced by earlier measures (i.e., AMP). Fifth, the present study examined NSSI within a 6-month window. This window is comparable to that of most other longitudinal NSSI studies, but future investigations may benefit from including a longer window and measuring NSSI at multiple time points (cf. Guerry & Prinstein, 2010).

The present study established that low aversion to self-cutting stimuli is a strong and robust longitudinal predictor of NSSI. Future studies should investigate the mechanisms that reduce this and other barriers to NSSI, and aim to design novel interventions that rebuild these barriers (cf. Franklin et al., in press; Hooley & St. Germain, in press).

References

Andreatta, M., Mühlberger, A., Yarali, A., Gerber, B., & Pauli, P. (2010). A rift between implicit and explicit conditioned valence in human pain relief learning. *Proceedings of the Royal Society B: Biological Sciences, 277,* 2411–2416. doi:10.1098/rspb.2010.0103

Bradley, M. M., Codispoti, M., Cuthbert, B. N., & Lang, P. J. (2001). Emotion and motivation I: Defensive and appetitive reactions in picture processing. *Emotion, 1,* 276–298. doi:10.1037/1528-3542.1.3.276

Chapman, A. L., Derbidge, C. M., Cooney, E., Hong, P. Y., & Linehan, M. M. (2009). Temperament as a prospective predictor of self-injury among patients with borderline personality disorder. *Journal of Personality Disorders, 23,* 122–140. doi:10.1521/pedi.2009.23.2.122

Franklin, J. C., Aaron, R. V., Arthur, M. S., Shorkey, S. P., & Prinstein, M. J. (2012). Nonsuicidal self-injury and diminished pain perception: The role of emotion dysregulation. *Comprehensive Psychiatry, 53,* 691–700. doi:10.1016/j.comppsych.2011.11.008

Franklin, J. C., Hessel, E. T., Aaron, R. V., Arthur, M. S., Heilbron, N., & Prinstein, M. J. (2010). The function of nonsuicidal self-injury: Support for cognitive-affective regulation and opponent processes from a novel psychophysiological paradigm. *Journal of Abnormal Psychology, 119,* 850–862. doi:10.1037/a0020896

Franklin, J. C., Lee, K. M., Hanna, E. K., & Prinstein, M. J. (2013). Feeling worse to feel better: Pain offset simultaneously stimulates positive affect and diminishes negative affect. *Psychological Science, 24,* 521–529. doi:10.1177/0956797612458805

Franklin, J. C., Lee, K. M., Puzia, M. E., & Prinstein, M. J. (in press). Recent and frequent nonsuicidal self-injury is associated with diminished implicit and explicit aversion to self-cutting stimuli. *Clinical Psychological Science*.

Franklin, J. C., Puzia, M. E., Lee, K. M., Lee, G. E., Hanna, E. K., Spring. V. L., & Prinstein, M. J. (2013). The nature of pain offset relief in nonsuicidal self-injury: A laboratory study. *Clinical Psychological Science, 1,* 110–119. doi:10.1177/2167702612474440

Glenn, C. R., & Klonsky, E. D. (2010). The role of seeing blood in non-suicidal self-injury. *Journal of Clinical Psychology, 66,* 466–473.

Glenn, C. R., & Klonsky, E. D. (2011). Prospective prediction of nonsuicidal self-injury: A 1-year longitudinal study in young adults. *Behavior Therapy, 42,* 751–762. doi:10.1016/j.beth.2011.04.005

Guerry, J. D., & Prinstein, M. J. (2010). Longitudinal prediction of adolescent nonsuicidal self-injury: Examination of a cognitive vulnerability-stress model. *Journal of Clinical Child and Adolescent Psychology, 39,* 77–89. doi:10.1080/15374410903401195

Hazell, P. L., Martin, G., McGill, K., Kay, T., Wood, A., Trainor, G., & Harrington, R. (2009). Group therapy for repeated deliberate self-harm in adolescents: Failure of a replication of a randomized trials. *Journal of the American Academy of Child and Adolescent Psychiatry, 48,* 662–670.

Hooley, J. M., Ho, D. T., Slater, J., & Lockshin, A. (2010). Pain perception and nonsuicidal self-injury: A laboratory investigation. *Personality Disorders: Theory, Research, and Treatment, 1,* 170–179. doi:10.1037/a0020106

Hooley, J. M., & St. Germain, S. A. (in press). Non-suicidal self-injury, pain, and self-criticism: Does changing self-worth change pain endurance in people who engage in self-injury? *Clinical Psychological Science*.

Joiner, T. E., Ribeiro, J. D., & Silva, C. (2012). Nonsuicidal self-injury, suicidal behavior, and their co-occurrence as viewed through the lens of the interpersonal theory of suicide. *Current Directions in Psychological Science, 21,* 342–347. doi:10.1177/0963721412454873

Klonsky, E. D. (2007). The functions of deliberate self-injury: A review of the evidence. *Clinical Psychology Review, 27,* 226–239. doi:10.1016/j.cpr.2006.08.002

Klonsky, E. D. (2011). Non-suicidal self-injury in United States adults: Prevalence, sociodemographics, topography and functions. *Psychological Medicine, 41,* 1981–1986. doi:10.1017/S0033291710002497

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2005). *International affective picture system (IAPS): Affective ratings of pictures and instruction manual* (Report No. A-6). Gainesville, FL: University of Florida.

Linehan, M. M., Comtois, K. A., Murray, A. M., Brown, M. Z., Gallop, R. J., . . . Lindenboim, N. (2006). Two-year randomized controlled trial and follow-up of dialectical behavior therapy vs therapy by experts for suicidal behaviors and borderline personality disorder. *Archives of General Psychiatry, 63,* 757–766.

Lloyd-Richardson, E. E., Perrine, N., Dierker, L., & Kelley, M. L. (2007). Characteristics and functions of non-suicidal self-injury in a community sample of adolescents. *Psychological Medicine, 37,* 1183–1192. doi:10.1017/S003329170700027X

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review, 84,* 231–259. doi:10.1037/0033-295X.84.3.231

Nock, M. K. (2010). Self-injury. *Annual Review of Clinical Psychology, 6,* 339–363. doi:10.1146/annurev.clinpsy.121208.131258

Nock, M. K., & Banaji, M. R. (2007). Assessment of self-injurious thoughts using a behavioral test. *The American Journal of Psychiatry, 164,* 820–823. doi:10.1176/appi.ajp.164.5.820

Nock, M. K., Holmberg, E. B., Photos, V. I., & Michel, B. D. (2007). Self-injurious thoughts and behaviors interview: Development, reliability, and validity in an adolescent sample. *Psychological Assessment, 19,* 309–317. doi:10.1037/1040-3590.19.3.309

Nock, M. K., Park, J. M., Finn, C. T., Deliberto, T. L., Dour, H. J., & Banaji, M. R. (2010). Measuring the suicidal mind: Implicit cognition predicts suicidal behavior. *Psychological Science, 21,* 511–517. doi:10.1177/0956797610364762

Nock, M. K., & Prinstein, M. J. (2005). Contextual features and behavioral functions of self-mutilation among adolescents. *Journal of Abnormal Psychology, 114,* 140–146. doi:10.1037/0021-843X.114.1.140

Nock, M. K., Wedig, M. M., Holmberg, E. B., & Hooley, J. M. (2008). The emotion reactivity scale: Development, evaluation, and relation to self-injurious thoughts and behaviors. *Behavior Therapy, 39,* 107–116. doi:10.1016/j.beth.2007.05.005

Öhman, A., & Mineka, S. (2001). Fears, phobias, and preparedness: Toward an evolved module of fear and fear learning. *Psychological Review, 108,* 483–522. doi:10.1037/0033-295X.108.3.483

Payne, B. K., Cheng, C. M., Govorun, O., & Stewart, B. D. (2005). An inkblot for attitudes: Affect misattribution as implicit measurement. *Journal of Personality and Social Psychology, 89,* 277–293. doi:10.1037/0022-3514.89.3.277

Plener, P. L., Bubalo, N., Fladung, A. K., Ludolph, A. G., & Lulé, D. (2012). Prone to excitement: Adolescent females with non-suicidal self-injury (NSSI) show altered cortical pattern to emotional and NSS-related material. *Psychiatry Research: Neuroimaging, 203,* 146–152. doi:10.1016/j.pscychresns.2011.12.012

Selby, E. A., Franklin, J., Carson-Wong, A., & Rizvi, S. L. (2013). Emotional cascades and self-injury: Investigating instability of rumination and negative emotion. *Journal of Clinical Psychology, 69,* 1213–1217. doi:10.1002/jclp.21966

Tanimoto, H., Heisenberg, M., & Gerber, B. (2004). Event timing turns punishment to reward. *Nature, 430,* 983. doi:10.1038/430983a

Tuisku, V., Kiviruusu, O., Pelkonen, M., Karlsson, L., Strandholm, T., & Marttunen, M. (in press). Depressed adolescents as young adults: Predictors of suicide attempt and non-suicidal self-injury during an 8-year follow-up. *Journal of Affective Disorders*.

Wilcox, H. C., Arria, A. M., Caldeira, K. M., Vincent, K. B., Pinchevsky, G. M., & O'Grady, K. E. (2012). Longitudinal predictors of past-year non-suicidal self-injury and motives among college students. *Psychological Medicine, 42,* 717–726. doi:10.1017/S0033291711001814

Wilkinson, P., Kelvin, R., Roberts, C., Dubicka, B., & Goodyear, I. (2011). Clinical and psychosocial predictors of suicide attempts and nonsuicidal self-injury in the Adolescent Depression Antidepressants and Psychotherapy Trial (ADAPT). *The American Journal of Psychiatry, 168,* 495–501. doi:10.1176/appi.ajp.2010.10050718

You, J., Lin, M. P., & Leung, F. (2013). Why do adolescents begin and stop nonsuicidal self-injury? A one-year follow-up study. *International Journal of Psychology and Behavioral Sciences, 3,* 86–94.

Received July 24, 2013
Revision received February 11, 2014
Accepted February 19, 2014 ■