Acknowledgements

First and foremost, I thank the students who participated, and continue to participate, in the ACHIEVE study who make this work possible. Additionally, I am sincerely grateful to the teachers, parents, and school officials that helped organize, schedule, and administer the necessary parts of this ongoing project over the past decade.

Second, I have the utmost respect and gratitude for the members of my committee who also acted as my mentors during my undergraduate career. This thesis project, or the data on which it stands, would not have been possible without the ongoing support of my faculty advisor, Dr. Mitch Prinstein. Mitch has acted as my mentor since my first year at UNC and has not only been instrumental in my academic research but also fostered and grown my passion for psychology and aided me in creating a clear path to continue this important work. It has been an absolute honor to learn from and do research beside such an incredible person and scholar. Additionally, I thank Dr. Adam Miller, who has supported my research over the past few years and taught me countless vital lessons both inside and outside the field of psychology, without which I would not be the researcher I am today. I also thank Margaret Sheridan who helped widen my research interests over the years and played a monumental role in defending my thesis and crossing the finish line. Finally, I thank Dr. Matteo Giletta who welcomed me into his lab in Tilburg, Netherlands and offered countless hours of mentorship both on this project and others and treated me with the utmost respect as a student and colleague.

Third, I extend my gratitude to all of the members of the Peer Relations Lab, past and current, to their endless contributions to the ACHIEVE study and my own personal thesis. The Project Coordinators over the numerous years were crucial in data collection and keeping the lab fun and thriving amid the many projects and adventures. Specifically, I thank Sarah Owens for

her continual support of my research and feedback on both this thesis and any research idea I bring up. Also, I thank Ariana Rivens and Sarah Palasick for their continual interest in my work and constant availability to talk research or deal with crises.

Fourth, I thank my friends and family for keeping me sane and productive over the year that this thesis took place. I thank Lyle, Lily, Sara, and Angelo for listening to practice presentations and preparing me for the defense. I also thank my mother and sisters for their continual support and interest in both my research and academic career. Further, I thank the members of the Thesis Class for bearing through practice presentations and continually offering insightful questions that pushed me to make this project the best it can be.

Finally, I would like the acknowledge the support for this work from a Summer Undergraduate Research Fellowship from the Office of Undergraduate Research.

Abstract

Nonsuicidal self-injury (NSSI) is highly prevalent among adolescents and has been shown to predict a number of deleterious outcomes including suicidal ideation and attempts. While few existing predictors are known, interpersonal stress has been shown to longitudinally predict NSSI. Peer victimization may be a particularly relevant stressor for adolescents. While peer victimization leads to a number of outcomes, a certain cognitive bias may influence adolescents to engage in NSSI over other coping mechanisms. The self-injury version of the Implicit Association Test was used to test a moderation effect between peer victimization and NSSI. The current study used two timepoints, 12 months apart, from a larger ongoing study analyzing adolescent health risk behaviors. A sample of 797 (57.7% female) community adolescents from three high schools in a racially representative, lower-middle income area of the United States were included in the analyses. Participants completed self-report questionnaires on demographics, depressive symptoms, NSSI engagement, implicit NSSI identification, and peer-report measures on peer victimization at Time 1 and a self-report measure on NSSI engagement at Time 2. A hierarchical multiple regression was conducted while controlling for gender and depressive symptoms and revealed a significant interaction effect between peer victimization and implicit NSSI identification in predicting NSSI. Results revealed a significant positive slope for moderate and high levels of implicit NSSI identification and a negative slope for low implicit NSSI identification. These findings suggest that implicit NSSI identification may operate as a buffer against NSSI engagement following peer victimization, while typical adolescents are still likely to engage in NSSI following peer victimization. This relationship is made even more sever in the face of high implicit NSSI identification. Future directions and implications are discussed.

Introduction

Nonsuicidal self-injury (NSSI) is defined as the deliberate self-inflicted injury of bodily tissue without intent to die. NSSI is particularly pronounced among adolescents, with an average age of onset of 12 to 14 years-old (Jacobson & Gould, 2007) and prevalence rates ranging from 15% to 60% among general and clinical samples, respectively (Nock, 2010). NSSI is a significant longitudinal predictor of both internalizing (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006) and externalizing symptoms, (Bjärehed, Wangby-Lundh, & Lundh, 2012) as well as both suicidal ideation and attempts among a diverse, community sample (Guan, Fox, & Prinstein, 2012). Despite the prevalence and severity of NSSI, no specific treatments exist that solely targets NSSI and not its underlying causes or outcomes (Brausch & Girresch, 2012). Apart from depression, longitudinal risk factors predicting NSSI have been severely underexplored. Additional research is needed to better investigate the complexities surrounding NSSI and fill the gaps in the current literature.

Stress has been shown to predict NSSI. General stressors have been shown to lead to first onset of NSSI among adolescents, (Voon, Hasking, & Martin, 2014) and self-injuring adolescents have been shown to experience more stressful life events in the 12 months before NSSI engagement compared to non-self-injuring adolescents (Cochrane & Robertson, 1975). Apart from general stressors, interpersonal stress, alongside negative attributional styles, has been found to be a predictor of NSSI among adolescents (Guerry & Prinstein, 2010). Another study showed that NSSI acts as a longitudinal mediator between stress and suicide attempts among a large sample of Chinese adolescents (Zhang et al., 2017). More work is needed to incorporate specific types of external stressors unique to adolescents.

For adolescents, peer victimization might be a particularly relevant predictor of adolescent NSSI, as peer victimization predicts several negative outcomes similar to NSSI, while NSSI emerges from several unique predictors. Peer victimization is developmentally salient during adolescence with studies reporting 11% to 40% being a victim of bullying (Nansel, Craig, Overpeck, Saluja, & Ruan, 2004). Studies have also shown the effects of peer victimization endure into adulthood, with bullied adolescents having higher rates of psychiatric disorders in adulthood, including suicidality even when controlling for childhood psychiatric disorders and family hardships (Copeland, Wolke, & Costello, 2013). Specifically, peer victimization has been shown to be a predictor of depression (La Greca & Harrison, 2005), rumination (Barchia & Bussey, 2010), and emotion dysregulation (McLaughlin, Hatzenbuehler, & Hilt, 2009. NSSI, similarly, has been shown to be an outcome of these same symptoms: major depressive disorder (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006), trait rumination (Nolen-Hoeksema & Morrow, 1991; Selby, Connell, & Joiner, 2010), and emotion dysregulation (Nock & Prinstein, 2004).

Further, several studies have investigated the concurrent and longitudinal relationship between peer victimization and NSSI. Concurrently, overt peer victimization (e.g., physical bullying) relates to NSSI among middle school boys, but not for girls, even while controlling for depression (Heilbron & Prinstein, 2010). Several longitudinal studies have also found promising results. One study found that a combined stress variable composed of peer, school, and family, predicted NSSI across 2.5 years among middle schoolers (Hankin & Abela, 2011). Additionally, Keenan, Hipwell, Stepp, & Wroblewski (2014) used an equifinality model of NSSI to find that peer victimization acted as a unique factor to predict NSSI among 13 and 14 year-old females.

While more research is required on the relationship between peer victimization and NSSI, there are far more victimized individuals than those engaging in harmful behaviors. Therefore, additional research on moderators is warranted in order to discover what leads a suffering adolescent to engage in coping mechanisms such as NSSI instead of alternative methods. Among Swedish junior high students, peer victimization was predictive of NSSI and was moderated by self-regulatory behaviors (Jutengren, Kerr, & Stattin, 2011). Additionally, a meta-analysis with a sample of 20,898 adolescents from 9 different studies published in the United States and several European countries found a concurrent relationship between peer victimization and NSSI among adolescents (van Geel, Goemans, & Vedder, 2015). They also reported age as a significant moderator, such that younger children victimized by peers went on to engage in more NSSI than older adolescents who experienced peer victimization. Peer victimization as a predictor might be especially sensitive for those with particular cognitive biases. One such bias might be implicit attitudes that are favorable towards NSSI, such that those with stronger self-associations between themselves and cutting may engage in more cutting following peer victimization. Assessing implicit attitudes is particularly profound when studying NSSI, as participants are often hesitant to confess NSSI engagement in explicit measures (e.g., surveys, interviews).

The Implicit Associations Task (IAT) was developed to assess individual's self-associations with certain constructs and has shown to be a valid measure in predicting suicide and self-harm specifically (Cha et al., 2016; Glenn & Klonsky, 2011). In children ages 6-11, the IAT has been found to be significantly predictive, regardless of lag-time between assessments, suggesting it better suited to assess trait-like associations (Rae & Olson, 2018). The IAT self-injury version (SI-IAT) was developed to assess how much individuals identified with NSSI and is longitudinally associated with suicidal ideation (Nock & Banaji, 2007). Several follow-up

studies have further investigated the nuances of the SI-IAT. One study found concurrent predictions of NSSI using the SI-IAT while another found no longitudinal support for implicit association, while low aversion to self-cutting did significantly predict NSSI (Glenn & Klonsky, 2011; Franklin, Puzia, Lee, & Prinstein, 2014). In one study among inpatient adolescents, the SI-IAT predicted NSSI in 2-week periods for cutting only, but not 3, 6, or 12-months later (Cha et al., 2016). Additionally, the study found that explicit measures predicted cutting behavior, and cited that a combination of implicit and explicit measures would be most efficacious in assessing short-term NSSI. Most importantly, however, was a longitudinal, long-term study conducted on a large sample of community adolescents and found that the SI-IAT predicted NSSI engagement 12 months later (Glenn et al., 2016). Beyond this critical finding, the study also reported that self-identification with NSSI was related to both severity and frequency of NSSI engagement. Further, self-identification was stronger for those that had recently engaged in NSSI or were at risk of continued engagement. Perhaps most importantly, they reported that self-identification with NSSI might lead to a reciprocal pattern of engagement, such that those that engage in NSSI have stronger self-association with NSSI, which then predicts further NSSI engagement. While these existing studies highlight the validity of the IAT, none have yet paired it with explicit stressors, such as peer victimization, in order to predict NSSI.

The current study builds directly upon previous research within both the field of peer victimization and NSSI. We hypothesized that the relationship between peer victimization and NSSI would be moderated by the SI-IAT, such that those with greater implicit NSSI identification would engage in NSSI more following peer victimization.

Method

Participants

Participants were 797 adolescents (57.7% female) drawn from 7th and 8th grade classes from three rural, low-income middle schools in southeastern United States. Average age at baseline was 13.14 years (*SD* =0.7 years). The ethnic composition 47.4% Caucasian, 25.1% Hispanic, 20.7% African American, 0.9% Asian, and 5.9% mixed race/other ethnicity. 67% were eligible for free or reduced-price lunch.

Procedure

This study was part of a larger, ongoing study examining adolescent peer relationships and health-risk behaviors. All 7th and 8th grade students were recruited (*n* =1,463) and out of 1,205 families (82.4% who returned consent forms), 900 of them (74.7%; 61.5% of total population) consented to participate in the study. Measures for the current study were only available at the second (Time 1) and third (Time 2) waves of data collection. Of the 900 students who originally consented to participate, a total of 86.6% (*N* =780) participated at Time 1, and of these, 84.1% (*N* =757) were retained at Time 2. Attrition for Time 1 was for a variety of reasons: absent (*N*=17), withdrew from school (*N*=22), moved (*N*=33), disciplinary issues (*N*=1), withdrew from study (*N*=6), became homeschooled (*N*=1), deceased (*N*=1), or other reason (*N*=7). Similarly, participants were absent for Time 2 for a variety of reasons: absent (*N*=3), withdrew from school (*N*=5), declined participation (*N*=5), moved (*N*=29), disciplinary issues (*N*=1), missing (*N*=2), withdrew from study (*N*=6), became homeschooled (*N*=4), unknown reason (*N*=4), or deceased (*N*=1). Concerning study measures, 735 had valid NSSI data at T1 and 751 at T2, 742 had valid SMFQ data, 710 had valid IAT data, and 798 had valid peer victimization data. Total attrition between the two time points was 24.3% (*N*=211). Between the two time points, a chi-squared test of independence was conducted to examine the relationship between gender and attrition and

significant results were found: X^2 (1, *N*=757) =7.280, *p* =.007. Males were overrepresented in students who did not have data available for our analyses. Participants who did not complete Time 2 measures reported lower levels of Time 1 depression (*M*=.348, *SD*=.420) as compared to those who were retained in the sample (*M*=.473, *SD*=.507), t(118.173) =2.521 *p* =.013. Additionally, participants who dropped out were marginally significantly less likely to report implicit NSSI identification (*M* =-.062, *SD* =.422) as compared to those retained (*M*=.046 *SD*=385), t(708) =1.951, *p* =.051. Analyses suggested that data were missing at random and were imputed with expectation-maximation approach. Little's analysis examining missingness at random revealed no significant pattern of the existing data, with a chi-squared =45.577 (df =31; p =.044).

The study was reviewed and approved by the university's institutional review board and parental permission and child assent were both collected prior to study initiation at baseline. Participants completed measures in groups of roughly 30 with dividers between participants and privacy filters on computer screens. Participants were compensated with a $10 gift card. Data were collected using a computer program (CASI) which has been shown to reduce social desirability and increase the validity of responses (Turner et al., 1998). The SI-IAT and sociometric nominations were administered on the same computers as the CASI.

Measures

Nonsuicidal self-injury. At both time points 6 common NSSI behaviors were assessed (Lloyd-Richardson, Perrine, Dierker, & Kelley, 2007; Nock & Prinstein, 2005) using the question "In the past year how many times have you engaged in the following self-harm behaviors on purpose?" with the following options of: cutting/carving, burning, hitting,

scraping/picking skin to the point of bleeding, biting, inserting objects under skin/ nails. The scale was 'Never', '1-2 times', '3-5 times', '6-9 times', or '10 or more times.' This method has been used in previous studies to validly assess NSSI methods in adolescents. Internal consistency within the current sample was .780 and .787 at Times 1 and 2 respectively. Data regarding the frequencies of NSSI were non-normally distributed, with skewness of 2.498 (*SE*=.090) at T1 and 2.712 (*SE*=.089) at T2. Therefore, a log transformation was applied.

Implicit Associations with NSSI. Implicit associations were measured using the SI-IAT (Nock & Banaji, 2007), a computerized behavioral task that assesses self-associations with self-injury. During the task, participants are presented with an image or phrase in the middle of the screen with the phrase 'Cutting' and 'Not Cutting' on either side and 'Me' and 'Not Me' also on the sides, paired with the 'Cutting' words. The four are paired such that one reads 'Cutting' or 'Me' while the other side reads 'Not Cutting' or 'Not Me' and vice versa, across 4 trials. Participants were tasked with classifying the middle image or phrase with either side, either 'Me' or 'Not Me' and 'Cutting' or 'Not Cutting' using the E and I keys on a keyboard to indicate left and right options, respectively. The score was found using a difference, or D, score (Greenwald, Nosek, & Banaji, 2003) calculated by subtracting reaction times on trials when 'Cutting' and 'Me' are paired on the same side of the screen from reaction times on trials when 'Cutting' and 'Not Me' are paired. Implicit-association with self-injury is evident with faster reaction time when 'Cutting' and 'Me' are paired (positive D score). The measure takes approximately 5 minutes to complete and was used at baseline. This measure has been frequently used to assess implicit NSSI identification in prior research (Glenn et al., 2016).

Peer Victimization. Peer victimization was assessed using sociometric nominations at Time 1. Students were presented with lists of fellow classmates of whom they could nominate an

unlimited amount of peers, both boys and girls, in both relational and overt peer victimization (Crick & Grotpeter, 1996) Overt peer victimization was assessed using the item, "Who gets threatened or physically hurt by others?" and relational peer victimization was assessed using the item, "Who gets left out of activities, ignored by others because one of their friends is mad at them, gossiped about, or has mean things said behind their backs?" Lists of students were counterbalanced to account for any order effects on nominations. The number of nominations was standardized within school and grade, leading to each participant receiving a standardized overt and relational peer victimization score. Higher peer victimization scores indicated increased peer victimization compared to peers. These two items were combined into a composite measure for analyses, as the correlation between the two was high (.822, $p < .0001$). In past research, sociometric nomination to assess peer victimization has been strongly supported to reliably and validly assess indicators without inducing self-report bias (e.g., Coie & Dodge, 1983).

Depression symptoms. Depression symptoms were measured using the Short Mood and Feelings Questionnaire (Angold et al., 1995). This self-report measure included 13 items assessing mood symptoms in the past two weeks (scale: 0 for *not true*, 1 for *sometimes*, and 2 for *true*). Example items include, "I felt miserable or unhappy" and "I found it hard to think properly or concentrate." Scores were computed into means and higher scores indicated higher levels of depressive symptoms. Good psychometric properties have been reported for the SMFQ as a reliable and valid measure of depressive symptoms among adolescents (Angold, Erkanli, Silberg, Eaves, & Costello, 2002). Internal consistency was .934.

Data Analysis Plan

A multiple regression model was used to examine prospective predictors of NSSI, including main effects of peer victimization and implicit NSSI identification, as well as a hypothesized moderated interaction effect. Variables were centered and a reduced model of the regression was run to assess suppression effects. Post-hoc probing was completed using Preachcer's (2006) guidelines for post-hoc probing of significant moderational effects to assess the nature of this interaction. This include a recomputation of a "reduced" regression model, centering of variables for a computation of slope estimates, and examining the significance of these slopes at different levels of the moderator variable (low, moderate, and high levels of implicit NSSI identification).

Results

Means and standard deviations for all primary variables are presented in Table 1. T-tests examining gender differences revealed greater levels of NSSI for girls as compared to boys at both Time 1 and Time 2, and greater implicit NSSI identification and depressive symptoms for girls as compared to boys at Time 1 only.

Pearson correlations were conducted to examine bivariate associations among all study variables (see Table 2). Associations among NSSI and depressive symptoms, implicit NSSI identification, and peer victimization were all significant with both NSSI at Time 1 and Time 2. Depressive symptoms were also significantly associated with implicit NSSI identification and peer victimization. However, implicit NSSI identification was not significantly associated with peer victimization. NSSI showed high levels of stability over time.

A hierarchical multiple regression was conducted to examine longitudinal relationships between NSSI and implicit NSSI identification. Implicit NSSI identification was examined to elucidate its moderating role between peer victimization and NSSI. Using Time 2 NSSI as the

dependent variable, Time 1 NSSI was entered on an initial step, followed by gender and depressive symptoms on a second step. The main effects of implicit NSSI identification and peer victimization were entered on a third step, followed by an interaction term on a fourth step to examine implicit NSSI identification as a possible moderator of peer victimization. All results are presented in Table 3.

Results revealed a significant main effect of gender and depressive symptoms (see step statistics). Regarding the moderating role of implicit NSSI identification, results revealed a significant interaction effect. Preacher's (2006) criteria were utilized to reveal the nature of this interaction effect. Results revealed a significant slope for the prospective association between peer victimization and NSSI under conditions of average implicit NSSI identification, b =0.01, p <0.05, as well as conditions of high implicit NSSI identification, (+1 SD) b =0.02, p <.001. However, there was not a significant slope under conditions of low implicit NSSI identification, (-1 SD) b =-0.01, p =.08 suggesting that higher levels of peer victimization were associated with increased NSSI, after controlling for initial NSSI, only when combined with average or higher levels of implicit NSSI identification.

Discussion

The findings presented in this paper are the first to show that implicit NSSI identification significantly moderates the relationship between peer victimization and NSSI engagement. NSSI is highly prevalent among adolescents and has been shown to be a predictor of a number of deleterious outcomes, including suicidal ideation and attempts (Guan, Fox, & Prinstein, 2012). Previous research has examined this construct and found significant results on the predictive value of interpersonal stressors. However, while several studies have previously examined NSSI

in the context of peer victimization, no studies have investigated the relationship between NSSI, peer victimization, and cognitive biases, such as implicit NSSI identification. These findings successfully offer a combination of implicit measures and sociometric data in a large, community sample of adolescents. Further, the constructs were examined in a prospective, 12-month longitudinal fashion, offering long-term predictive value that could be implemented in clinical settings and provides the basis for future research.

Consistent with our hypothesis, implicit NSSI identification was relevant in attenuating NSSI following peer victimization for adolescents with low levels of implicit NSSI identification, but not with average or high levels of implicit NSSI identification. While the relationship between peer victimization and NSSI has been substantially elucidated, these findings shed light onto how implicit NSSI identification plays a unique role in moderating this relationship. Those with low levels of implicit NSSI identification were not significantly likely to engage in NSSI following peer victimization. These individuals were far less likely than average to make any associations between themselves and NSSI, especially in the face of extreme stress. It could be that they found the idea of NSSI aversive or engaged in alternative coping methods outside of NSSI. These findings might suggest that different types of barriers may be present in certain individuals, contributing to a particular aversion to NSSI in general (Hooley & Franklin, 2017). Interestingly, even those with average levels of implicit NSSI identification still formed the link between NSSI and peer victimization under typical conditions, suggesting that implicit NSSI identification may act as a buffer and not a negative cognitive bias. High levels of implicit NSSI identification made the relationship even more toxic in the event of this combination of interpersonal stress and implicit NSSI identification.

These findings are especially relevant due to the alarmingly high prevalence rates of NSSI among adolescent samples (Nock, 2010), especially in the growing prominence of technological communication and mass-media (Whitlock, Powers, & Eckenrode, 2006). While NSSI is highly prevalent in adolescent samples, no treatment has been yet studied that exclusively and effectively targets NSSI, and not its underlying causes (e.g., depression, hopelessness) or outcomes (e.g., hospitalizations) (Brausch & Girresch, 2012). Further, NSSI is a symptom of a number of different disorders and suicidal ideation and attempts, and often is viewed as a cry for help before more severe actions are taken. Because of this, additional research is necessary on the topic, especially that which targets implicit cognitions of adolescents who may not be prepared to openly report engagement or ideation.

This study provides the opportunity for future research to further investigate these topics and build upon certain limitations. First, while this study successfully incorporated prospective longitudinal data, only two timepoints were utilized. Future research could investigate short term timepoints using months or even weeks between timepoints to better observe the course of implicit NSSI identification and engagement. Smaller timescales would also offer the ability to assess state implicit identification rather than overall trait identification. Second, the current sample was quite large and allowed for substantial analyses to be conducted, however, clinical diagnoses were not collected so findings may differ among a more severe or clinical sample. Third, while the study combined implicit, sociometric, and self-report data, the measure of assessing NSSI was limited to only the past calendar year and ranged from 1-10+ times. This measure could be improved upon by incorporating severity, frequency, and recency of engagement to better analyze NSSI engagement. Additionally, the SI-IAT only shows images of cutting and our analyses only included the cutting variable of our overall NSSI composite score.

Further research could build upon this by developing an IAT version that assesses all forms of NSSI and does not merely target cutting specifically.

Future research could move beyond this study by investigating alternative risk factors apart from peer victimization. Alternative forms of interpersonal stress, such as romantic or familial conflict, could all be unique predictors of NSSI. Specific forms of peer victimization could also be investigated, as this work only investigated a composite measure of overt and relational victimization. Additionally, alternative moderators could be investigated. Other implicit measures could be utilized, such as eye tracking or physiological responses, or explicit measures could be incorporated, such as surveys and questionnaires.

Overall results showed how imperfect cognitions concerning implicit NSSI identification played a significant role in predicting NSSI engagement following interpersonal stress. These findings may have useful clinical implications for detecting and preventing NSSI engagement, however, further research can build upon these findings in a number of ways.

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Table 1.

Means (and standard deviations) for Primary Variables at Time 1 and Time 2

	Boys	Girls	*t* (797)
Time 1			
Nonsuicidal Self-Injury	.032 (.079)	.074 (.122)	-5.82**
Implicit Association Task	-.003 (.346)	.077 (.375)	-.3.14*
Depressive Symptoms	.301 (.358)	.591 (.533)	-9.14**
Peer Victimization	.086 (.966)	.033 (1.062)	<1
Time 2			
Nonsuicidal Self-Injury	.028 (.075)	.074 (.129)	-6.33**

* $p < .05$; ** $p < .001$; *** $p < .000$

Table 2.

Bivariate Associations Among Primary Variables

	NSSI T1	NSSI T2	Depressive Symptoms	SI-IAT	Peer Victimization
Nonsuicidal Self-Injury Time 1	-				
Nonsuicidal Self-Injury Time 2	.611**	-			
Depressive Symptoms	.469**	.391**	-		
Implicit Association Task	.184**	.161**	.125**	-	
Peer Victimization	.153**	.130**	.117**	-.014	-

* $p < .05$; ** $p < .001$; *** $p < .000$

Table 3.

Longitudinal Prediction of Time 2 Nonsuicidal Self-Injury by Peer Victimization, Depressive Symptoms, Implicit Associations Task, and Gender (*n* =797)

	Time 2 Nonsuicidal Self-Injury				
	Step Statistics			Final Statistics	
Predictors	ΔR^2	b (se b)	b	b (se b)	b
Step 1	.369***				
Time 1 Nonsuicidal Self-Injury		.628 (.029)	.607***	.542 (.033)	.524***
Step 2, Main effects	.018***				
Gender (female)		.016 (.006)	.071*	.016 (.006)	.073*
Depressive Symptoms		.026 (.007)	.115***	.024 (.007)	.107**
Step 3, Main effects	.002				
Implicit Association Task		.011 (.009)	.037	.012 (.008)	.040
Peer Victimization		.003 (.003)	.027	.004 (.003)	.034
Step 4, Two-way interactions	.015***				
IAT x Peer Victimization		.042 (.009)	.125***	.042 (.009)	.125***
Total R^2	.405***				

* $p < .05$; ** $p < .01$; *** $p < .000$; IAT = Implicit Association Test