



Non-suicidal self-injury prospectively predicts interpersonal stressful life events and depressive symptoms among adolescent girls



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ABSTRACT

Non-suicidal self-injury (NSSI) is the deliberate self-harm of one's tissue, engaged in without lethal intent, and occurs frequently among late adolescents. Although research has indicated that NSSI predicts depression, the potential psychosocial mechanisms through which engagement in NSSI makes one susceptible to future depressive symptoms remain unclear. The present study examined whether NSSI increases the risk of experiencing stressful life events, which, in turn, heightens the risk for subsequent depressive symptoms. Drawn from a sample specifically selected for adolescents at high and low risk for developing bipolar spectrum disorders, a total of 110 late-adolescents (mean age = 18.74, SD = .69; 73% female) were administered measures of lifetime and past year engagement in NSSI and current depressive symptomatology. Approximately 6 months later, they completed a measure of depressive symptoms and a questionnaire and interview assessing life events that occurred over the 6-month interval. Results suggest that the frequency of lifetime and past year NSSI predicted the occurrence of interpersonal stressful life events beyond the effects of initial depressive symptoms, but only for late adolescent girls. Results further suggest that higher levels of interpersonal stressful life events mediated the relationship between NSSI frequency and prospective increases in depressive symptoms among girls.

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1. Introduction

Non-suicidal self-injury (NSSI) is the deliberate self-harm of one's tissue, engaged in without lethal intent (Nock et al., 2006). Up to 38% of individuals in college samples engage in these behaviors (Gratz et al., 2002; Whitlock et al., 2006). NSSI is one of the strongest predictors of both suicidal ideation and suicidal behaviors (Hamza et al., 2012; Klonsky et al., 2013; Wilcox et al., 2012; Wilkinson et al., 2011). Given these statistics, it is surprising that few studies have explored the potential psychosocial mechanisms through which engagement in NSSI makes one more susceptible to negative psychological states, such as depression, that may lead to suicide-outcomes. In particular, it is possible that NSSI may increase the risk of experiencing stressful life events, which, in turn, heighten the risk for subsequent depression.

Considerable research has documented that stressful life events increase the risk of most forms of psychopathology. In particular, stressful life events are predictive of first onset of major depressive disorder (Kendler et al., 1999), suicidal ideation (Fergusson et al.,

2000; Joiner and Rudd, 1995), and suicidal behaviors (de Wilde et al., 1992; Cohen-Sandler et al., 1982). In addition, several studies indicate that individuals who attempted suicide experienced significantly more stressors in the previous year than control individuals (for a review, see Adams et al. (1994)), particularly stressors that were interpersonal in nature. More recently, this framework has been applied to non-suicidal self-injurious behaviors as well, with research finding that higher rates of stressful life events are associated with greater NSSI (Guerry and Prinstein, 2010; Hankin and Abela, 2011; Liu et al., 2014). Thus, identifying factors that increase the risk of experiencing stressful life events, and specifically interpersonal stressors, is important for programs aimed at better understanding and preventing the development of psychopathology.

Although the relationship between stress and psychopathology is well-documented, recent research has begun to examine the transactional relationships between stress and psychological disorders. The transactional perspective proposes that individuals not only react to their environmental stressors, but also actively select, process, and contribute to their social contexts (Coyle, 1976; Caldwell et al., 2004). Specifically, research and theory have demonstrated that individuals have certain characteristics or behaviors that lead to the experience of more interpersonal stressors (Hammen, 1991). In this sense, although stressors may predict

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NSSI (as has been previously demonstrated; Liu, 2014), NSSI also may contribute to the occurrence of subsequent stressful life events.

In particular, given that NSSI is often reported to be a social communication device (e.g., Nock, 2008), NSSI may specifically contribute to stressful life events that involve interpersonal relationships. Although the majority of self-injurers indicate that they engage in NSSI for intrapersonal reasons, a significant portion of self-injurers endorse interpersonal motives (Laye-Gindhu and Schonert-Reichl, 2005; Muehlenkamp et al., 2013; Nixon and Heath, 2008; Nock and Prinstein, 2004; Zetterqvist et al., 2013). For example, among a sample of community adolescents, self-injurers endorsed social-reinforcement motives almost as often as they endorsed automatic-reinforcement motives for NSSI (Lloyd-Richardson et al., 2007). Moreover, although NSSI is often hidden from others, among a sample of over 14,000 college students, 77.4% of self-injurers indicated that at least one other person knew about their NSSI (Whitlock et al., 2011). That others have knowledge about an individuals' self-injury may directly trigger relationship problems (Favazza, 1998; Gratz, 2003). For example, there is ample evidence that NSSI is viewed pejoratively by the general public and often is interpreted as an attention-seeking behavior (Crouch and Wright, 2004; Gratz, 2003), which likely leads NSSI to be a highly stigmatizing behavior (Favazza, 1998; Gratz, 2003). Furthermore, for those who interpret this behavior as attention-seeking (correctly or incorrectly), it is possible that they may react to evidence of NSSI by rejecting or avoiding the self-injurer. On the other hand, for those who interpret this behavior as a sign of serious mental health issues, they may react to NSSI by becoming overly concerned (Klonsky, 2009), resulting in over-coddling or isolating the self-injurer, actions that also may induce stressors in relationships. Consequently, the direct interpersonal sequelae of NSSI might impinge on close relationships with peers or family members or prevent new relationships from forming, thus resulting in an increase of interpersonal stressors. Interestingly, there is some research indicating that NSSI may actually have positive interpersonal consequences. For instance, research suggests that some individuals may engage in NSSI implicitly or explicitly to increase caretaking behavior from their social support network, which in turn reinforces NSSI when such social rewards are attained (Nock and Prinstein, 2004). Preliminary research supports this hypothesis, finding that among young adolescents, self-injurers were more likely to exhibit an increase in closeness with fathers over an 11-month follow-up period than those without NSSI (Hilt et al., 2008). Although NSSI may elicit some positive social responses, it also may contribute to negative interpersonal stressors, such as conflicts with peers or family members.

A recent study examining the nuances of interpersonal motives for self-injury suggests that girls may be particularly likely to experience interpersonal stressors as a result of NSSI. The study found that females are more likely to initiate NSSI for "direct social motives" (e.g., "hoping someone would notice"), whereas males are more likely to initiate NSSI for "indirect social motives" (e.g., "being angry at someone"; Muehlenkamp et al., 2013). Using NSSI for direct social motives might influence the occurrence of interpersonal stressors more than using NSSI for indirect social motives, given the impetus underlying the behavior is to explicitly influence interpersonal relationships, which may subsequently strain them.

In addition, preliminary research suggests that engaging in NSSI acts as a risk factor for psychological and interpersonal difficulties among females only (Lundh et al., 2011a, 2011b). In a longitudinal study of community adolescents, psychological problems and depressive symptoms served as risk factors for engagement in NSSI at one-year follow up among both boys and girls. However, NSSI served as a prospective predictor of conduct

problems, emotional problems, depressive symptoms, and peer problems at follow up only among females. This research suggests that engaging in NSSI may impinge on social and emotional adjustment among females to a greater degree than it does among males. Consistent with this hypothesis, research indicates that females with a history of NSSI do not employ adaptive coping strategies, such as seeking social support and problem-solving skills, as often as those who have not engaged in NSSI (Andover et al., 2007). The fact that this relationship does not hold among males provides additional evidence that NSSI may be associated with greater interpersonal deficits more among females than among males. Therefore, it seems possible that among females in particular, engagement in NSSI may not only be associated with interpersonal deficits, but also may actually contribute to interpersonal difficulties.

1.1. *The current study*

Given evidence suggesting that NSSI likely has direct and substantial relational consequences, the current study examined whether NSSI contributes to the occurrence of stressful life events. Specifically, the present study examined whether NSSI over one's lifetime and over the past year predicted interpersonal and non-interpersonal stressful life events over a six-month follow up period, and whether this relationship would be stronger among females than males. Further, this study examined whether the occurrence of interpersonal stressors would account for the relationship between NSSI and prospective increases in depressive symptoms, and whether this mediational pathway would be significantly different for girls versus boys.

We hypothesized that NSSI (during one's lifetime and over the past year) would predict an increased number of interpersonal stressful life events, but would not predict an increased number of non-interpersonal stressors. Further, we hypothesized that this increase in interpersonal stressful life events would mediate the relationship between NSSI frequency and prospective depressive symptoms. Given research and theory that girls may be more at risk for depressive symptomatology and interpersonal difficulties following NSSI (Lundh et al., 2011a, 2011b), we hypothesized that these relationships would be true only for late adolescent females, but not males.

The current study examined these questions utilizing a sample specifically selected for adolescents at high and low risk for developing bipolar spectrum disorders (BSDs) based on high versus moderate behavioral approach system (BAS; Gray, 1991) sensitivity. The BAS is a neurobiological system proposed to regulate appetitive motivation, or goal-oriented approach behavior. Although this sample was recruited for the larger study goals of examining BAS sensitivity and the onset of bipolar disorder, an undergraduate sample selected for high and moderate BAS sensitivity is appropriate to examine the present study questions. For one, research suggests that NSSI is more likely to occur and with greater frequency among individuals with higher BAS sensitivity (Cerutti et al., 2012; Jenkins et al., 2013). Further, undergraduate individuals are exposed to significant numbers of academic and interpersonal stressors (Compas et al., 1986), as well as depressive episodes (Alloy et al., 2006). Therefore, our sample is more than adequate to test the present hypotheses.

2. Method

2.1. *Sample recruitment*

Late adolescent participants (ages 14–19) were drawn from a behavioral high-risk study investigating the differences between

individuals at low and high risk for a first onset bipolar spectrum disorder based on exhibiting high versus moderate Behavioral Approach System (BAS)/reward sensitivity (see Alloy et al., 2012). A two-phase screening process was used to select eligible participants. At Phase I, a total of 9991 participants completed self-report measures of BAS sensitivity (the Behavioral Inhibition System-Behavioral Activation System (BIS/BAS) Scales (Carver and White, 1994) and Sensitivity to Punishment/Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001) as well as a demographic questionnaire. In order to qualify as high-BAS (HBAS; high-risk), participants needed to score in the highest 15th percentile on both the BAS-Total subscale and Sensitivity to Reward (SR) subscale. In order to qualify as moderate-BAS (MBAS; low-risk), participants needed to score between the 40th and 60th percentiles on both BAS scales. Those participants who qualified for either the HBAS or MBAS groups were invited to participate in Phase II screening, in which they were administered the expanded Schedule for Affective Disorders and Schizophrenia-Lifetime (SADS-L; Endicott and Spitzer, 1978) diagnostic interview. Phase II exclusion criteria included meeting criteria for bipolar I, bipolar II, cyclothymia or bipolar not otherwise specified [NOS] with onset prior to Phase I screening, meeting criteria for any lifetime psychotic disorder, and not being able to write or speak fluent English.

In total, 9991 adolescents were screened for the study and a total of 776 qualified for HBAS status and 404 qualified for MBAS status. The study's goal sample size was 200 HBAS and 150 MBAS participants. As a result, all qualifying participants were invited to participate in the study. Of the 776 individuals contacted to participate in Phase II of screening, a total of 244 HBAS (31.4%) and 146 MBAS (36.1%) students successfully participated in Phase II of screening. However, 22 participants were excluded due to meeting criteria for a BSD or a Hypomanic episode with onset prior to their Phase I BAS screening, 7 were excluded for meeting criteria for a psychotic disorder or exhibiting psychotic symptoms, and 5 were excluded because of poor English fluency. The measure of NSSI was added mid-way through Time 1 data collection, and therefore, only half of participants completed the NSSI measure ($N=177$). Although a total of 177 participants completed the study at the Time 1 assessment, only 110 (62% retention) returned for the completion of the follow-up measures. There were no significant differences between those included in the present study and those who only completed the Time 1 assessment. In addition, the sample included in the present study was slightly older than participants included in the larger study ($t=8.05$, $p<.001$).

2.2. Participants

A total of 110 late adolescents (mean age=18.74, $SD=.69$) participated in the present study. Of the participants, 73% identified as female, 67% as Caucasian, 18% as African American, 11% as Asian, and 4% as Other. Additionally, 64% of the sample was categorized as High BAS. At Time 1, 51% of the sample ($N=56$) reported a history of NSSI. Of those with a positive NSSI history, 14% reported engaging in the behavior one time, 54% reported engaging in the behavior two to four times, and 32% reported engaging in the behavior over five times in their lifetime. Of those with a positive NSSI history, 21% reported engaging in the behavior one time in the past year, 36% reported engaging in the behavior two to four times in the past year, and 11% reported engaging in the behavior over five times in the past year. Among those with a positive history of NSSI, the average number of NSSI methods reported was 2.78 ($SD=1.94$). Consistent with research demonstrating that NSSI more frequently occurs during mid-adolescence (Rodham and Hawton, 2009), significantly more late adolescents reported engaging in zero acts of NSSI within the past year than over their lifetimes.

2.3. Procedure

Eligible participants from Phase I and Phase II screening assessments participated in the baseline (Time 1) assessment, in which they completed additional self-report measures assessing depressive symptoms and acts of NSSI occurring over their lifetime and in the past year. At follow-up, approximately 6 months later, participants completed an inventory of stressful life events that had occurred since the Time 1 assessment and the measure of depressive symptoms. Adolescents were then interviewed to obtain further information about the event occurrences. All participants who indicated that they engaged in any NSSI behavior within the past month underwent a risk assessment with a trained interviewer and received referral information.

2.4. Measures

2.4.1. BAS sensitivity

Two measures of BAS/reward sensitivity were used to determine individual membership in the high-BAS (HBAS; high-risk) and moderate-BAS (MBAS; low risk) groups: BIS/BAS Scale (Carver and White, 1994) and SPSRQ (Torrubia et al., 2001). The BIS/BAS Scale is a self-report questionnaire with 20 items. Each item is measured using a 4-point Likert scale (*strongly disagree* to *strongly agree*). All BAS-relevant items were summed to calculate a BAS total score. Studies have demonstrated the BIS/BAS scales to have good retest reliability and internal consistency (Carver and White, 1994). In the study sample, the internal consistency of the BAS total score was good ($\alpha=.80$). In addition, the SPSRQ (Torrubia et al., 2001) was used in conjunction with the BIS/BAS Scale to determine HBAS versus MBAS group selection and eligibility. The SPSRQ is a self-report questionnaire employed to measure one's sensitivity to reward and punishment. Previous research has found the 24-item Sensitivity to Reward (SR) subscale to exhibit good retest reliability and internal consistency (Torrubia et al., 2001). The SR subscale demonstrated an internal consistency of .76 in the current sample. Individuals who scored in the top 15th percentile on both the BAS-Total (BAS-T) of the BIS/BAS Scales and the SR scale of the SPSRQ composed the high-BAS (HBAS) group and those who scored between the 40th and 60th percentiles on both of these measures composed the moderate BAS (MBAS) group. Thus, BAS sensitivity was dichotomized based on group status.

2.4.2. Depressive symptoms

The Beck Depression Inventory-II (BDI-II; Beck et al., 1996a) is a 21-item self-report questionnaire assessing cognitive, affective, motivational, and somatic depressive symptoms experienced over the previous 2 weeks. All items are scored using a 0–3 point Likert scale. Scores are summed for all items with higher scores signifying more severe depression. The BDI-II has demonstrated strong psychometric support, including good internal consistency, test-retest reliability ($r=.93$), concurrent validity, and convergent validity (Beck et al., 1996a, 1996b). In the current sample, the BDI-II demonstrated good internal consistency at Time 1 (.90) and follow-up (.88).

2.4.3. Presence/frequency/methods of NSSI

The Form and Function Self-Injury Scale (FAFSI; Jenkins and Schmitz, 2012) is a self-report questionnaire administered to measure engagement in NSSI. The FAFSI assesses one's engagement in 13 methods of NSSI (e.g., cutting, burning, hitting, biting self, and an 'other' category prompting participants to fill-in). For each NSSI method that a participant endorses, they are asked to report the number of times they engaged in that behavior over their lifetime and over the past year. Fifty-one percent of the present sample reported engaging in at least one act of NSSI

during their lifetime and 34% during the past year. Among those who reported a positive history of NSSI, there was great variability in frequency of acts. In order to reduce this variability, we classified number of acts of NSSI over one's lifetime and over the past year into one of five frequency categories (0, 1, 2–5, 6–20, and 20+ NSSI acts; Whitlock et al., 2013). In addition, we also computed a dichotomous variable to indicate presence (which included those who engaged in repeated NSSI (two or more acts) and absence of repeated NSSI (those who did not engage in NSSI or only engaged in NSSI one time). These distinctions were made based on research that have found repetitive NSSI to be associated with significantly greater psychopathology than single acts of NSSI (Muehlenkamp et al., 2011). In the current sample, the dichotomous items demonstrated good internal consistency ($\alpha=.75$).

2.4.4. Stressful life events

Stressful life events were documented by combining information attained through the administration of a self-report and an interview measure. The Life Events Scale (LES; Alloy and Clements, 1992; Francis-Raniere et al., 2006) is a self-report questionnaire inquiring about a wide range of positive and negative life events covering common areas applicable to late adolescents (e.g., peer and familial relationships, academics, finances). Participants were asked to indicate whether any of the events occurred over the previous six months. Of the 193 events, 135 were consensus-based a priori classified as negative life events. In turn, the negative life events were a priori determined to be interpersonal ($N=78$) or non-interpersonal ($N=57$). An example of a non-interpersonal negative life event assessed is, "Did poorly on or failed an exam or major project in an important class (i.e., grade less than C)," whereas an example of an interpersonal negative life event is, "Significant fight or argument with family member that led to a serious consequence (e.g., you or family member crying; name calling; being grounded; etc.)." Previous studies have reported the LES to exhibit strong reliability and validity (Francis-Raniere et al., 2006; Safford et al., 2007).

After completing the LES, participants were subsequently administered the Life Events Interview (LEI) by a trained interviewer blind to the participant's history of NSSI. The LEI serves as a check on the reliability and dating of events reported in the LES. The LEI uses manualized, event-specific criteria probes to maintain consistency across interviewers. Interviewers are trained to ask questions to determine whether each event met a priori determined event-specific criteria in order to reduce problems related to subjective report biases and to sustain adequate inter-rater reliability. Any event endorsed on the LES that did not meet all a priori determined criteria on the LEI was disqualified and was not included in analyses. For example, events were disqualified if the event was reported to have occurred prior to the 6-month follow-up period or if the detail provided during the interview did not meet criteria (e.g., the event is a fight or conflict with a friend, and the participant reports that there was a minor disagreement with no negative consequences). The stress variables generated from the LEI (interpersonal and non-interpersonal events) were calculated by counting the number of types of events experienced during the follow-up period, as opposed to the frequency of each event.

A combination of the LES and LEI interview is employed in order to bolster the validity of life event reporting. The LES–LEI event-dating demonstrates good inter-rater reliability (Francis-Raniere et al., 2006; Safford et al., 2007). Furthermore, research indicates that utilizing this combined method of data collection results in participants recalling 100% of major life events listed in a daily diary over a one-month long period of time (Francis-Raniere et al., 2006). In addition, based on 40 LEIs reviewed, the average inter-rater reliability for the dating of life events was .89 (see Francis-Raniere et al. (2006)).

2.5. Statistical analyses

To examine whether sex moderated the effects of NSSI on the prediction of stressful life events, four hierarchical multiple linear regressions were conducted with past year and lifetime NSSI each serving as the independent variable crossed with interpersonal and non-interpersonal stressful events each serving as the dependent variable. To examine the effects of NSSI independent of depressive symptoms and BAS group status, we included BAS status and initial levels of depressive symptoms as covariates in all analyses in Step 1. We also controlled for age in Step 1 because adolescents ranged from ages 14–19, which might influence lifetime history of NSSI. Lifetime and last year NSSI were each entered as the main predictors (with sex) in Step 2 of separate analyses. Thus, the main effects of sex and NSSI in the past year or lifetime were entered in Step 2, and the interaction term between sex and NSSI in the past year or over the lifetime was entered in Step 3 of the regression analysis. NSSI over the lifetime and last year were centered prior to creating the interaction terms. Further, supplementary analyses were conducted to examine whether NSSI as a dichotomous variable (repeat NSSI presence vs. absence) during the last year or lifetime interacted with sex to predict the occurrence of interpersonal stressors.

To examine our second hypothesis that girls with greater NSSI over the past year and lifetime would experience greater increases in depressive symptoms through greater interpersonal (but not non-interpersonal) stressors, we conducted moderated mediational analyses using the SPSS Process Macro with bootstrapping (Preacher and Hayes, 2008). Prior to conducting this analysis, we examined NSSI (lifetime and last year) as predictors of depressive symptoms, controlling for initial depressive symptoms, age, and BAS status. We then conducted the moderated mediational analyses to determine whether the occurrence of interpersonal stressful life events mediated the relationship between NSSI (lifetime and past year) and increases in depressive symptoms among girls, but not boys.¹

3. Results

3.1. Descriptive analyses

Descriptive statistics for the overall sample and by sex are presented in Table 1. Analyses were conducted to determine whether primary outcome variables were associated with sex. Analyses of variance (ANOVA) revealed that there were no significant differences between girls and boys in the frequency of NSSI over the past year ($F(109)=1.21, p=.27$) or lifetime ($F(109)=1.39, p=.24$). However, girls were more likely to have the presence of any NSSI compared to boys ($\chi^2(1)=6.02, p=.01$). In terms of sex differences in type of NSSI endorsed, girls were more likely to engage in cutting ($\chi^2(1)=5.53, p=.02$), and burning oneself ($\chi^2(1)=5.30, p=.02$), but boys were more likely to engage in banging one's head or body part against a hard object to self-harm ($\chi^2(1)=4.56, p=.03$) or hitting or punching oneself ($\chi^2=5.40, p=.02$). There were no other sex differences in types of NSSI. Girls also were more likely than boys to have greater depressive symptoms at follow-up ($t=2.59, p=.01$).

Table 2 presents correlations for all primary study variables. As expected, lifetime NSSI was significantly positively correlated with NSSI in the last year, and both were significantly positively

¹ We also examined BAS status in a two-way interaction with NSSI and a three-way interaction with sex and NSSI to determine whether BAS sensitivity exacerbated the relationship between NSSI and interpersonal events. However, our results indicated that these interactions were non-significant.

Table 1
Descriptive statistics and sex differences in study variables.

	Girls (N=80)	Boys (N=30)
Age	18.73 (.69)	18.77 (.68)
Race	62% Caucasian 22% African American 14% Asian/Pacific Islander 2% Other	80% Caucasian 10% African American 7% Asian/Pacific Islander 3% Biracial
High BAS	64%	63%
T1 BDI	7.70 (7.79)	5.35 (5.18)
T2 BDI	7.80 (7.79)**	5.50 (5.20)**
Int stressors	7.21 (6.66)	5.40 (4.77)
Non-Int stressors	7.15 (3.84)	6.07 (4.27)
NSSI-L	55% None 7% 1 time 6% 2–5 times 13% 6–20 times 19% 20+ times	33% None 7% 1 time 27% 2–5 times 23% 6–20 times 10% 20+ times
NSSI-LY	70% None 10% 1 time 6% 2–5 times 9% 6–20 times 5% 20+ times	53% None 13% 1 time 20% 2–5 times 7% 6–20 times 7% 20+ times

Note. BAS=Behavioral Approach Status Group; BDI=Beck Depression Inventory; Int=Interpersonal; NSSI-L=Lifetime Non-Suicidal Self-Injury; NSSI-LY=Last Year Non-Suicidal Self-Injury; Means and standard deviations are presented in the table unless otherwise noted.

* $p < .05$, ** $p < .01$, *** $p < .001$.

correlated with interpersonal stressful events at follow-up and depressive symptoms at baseline and follow-up. However, only lifetime NSSI was correlated with non-interpersonal events at follow-up. Sex was only significantly correlated with depressive symptoms at follow-up. In addition, interpersonal stressors were correlated with non-interpersonal stressors and depressive symptoms at follow-up, and non-interpersonal stressors were significantly positively correlated with baseline and follow-up depressive symptoms.

3.2. Prospective analyses

As hypothesized, there was a significant main effect of lifetime NSSI on interpersonal stressors, but not on non-interpersonal stressors. However, sex significantly interacted with lifetime NSSI to predict higher levels of interpersonal stressors (Table 3, top half), but not non-interpersonal stressors (Table 3, bottom half). The nature of this interaction was such that lifetime NSSI predicted higher levels of interpersonal stressors among girls ($t=4.07$, $p < .001$), but not among boys ($t = -.45$, $p = .65$; Fig. 1). Contrary to

Table 2
Bivariate correlations between study variables.

	1	2	3	4	5	6	7
1. Sex (female)	–						
2. T1 BDI	.15	–					
3. NSSI-L	-.11	.31***	–				
4. NSSI-LY	-.11	.34***	.79***	–			
5. Int stress	.13	.14	.34***	.19*	–		
6. Non-Int stress	.12	.18	.20*	.12	.69***	–	
7. T2 BDI	.20*	.56***	.35***	.29***	.47***	.36***	–

Note. T1=Time 1 (baseline); T2=Time 2 (follow-up); BDI=Beck Depression Inventory; NSSI-L=Lifetime Non-Suicidal Self-Injury; NSSI-LY=Last Year Non-Suicidal Self-Injury; Int=Interpersonal. Sex coded as 0=male, 1=female.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3

Regression step	Variable	β	t	ΔR^2	Δf^2	
Interaction between Lifetime NSSI and Sex on Interpersonal Stress at Follow-up	Step 1	T1 BDI	.12	1.20	.04	.06
		BAS	.17	1.79		
		Age	< .01	.04		
Step 2	Sex	.17	1.79	.10**	.12**	
	NSSI-L	.33	3.35***			
Step 3	NSSI-L \times sex	.50	2.34*	.04*	.05*	
Interaction between Lifetime NSSI and Sex on Non-Interpersonal Stress at Follow-up	Step 1	T1 BDI	.15	1.71	.08*	.08*
		BAS	.19	2.05*		
		Age	.09	1.06		
Step 2	Sex	.12	1.33	.02	.02	
	NSSI-L	.11	1.11			
Step 3	NSSI-L \times sex	.41	1.97	.03	.03	

Note. Coefficients represent the effect in each step. T1=Time 1 (baseline); BDI=Beck Depression Inventory; BAS=Behavioral Approach System; NSSI-L=Lifetime Non-Suicidal Self-Injury. Sex is coded as 0=male, 1=female.

* $p < .05$, ** $p < .01$, *** $p < .001$.

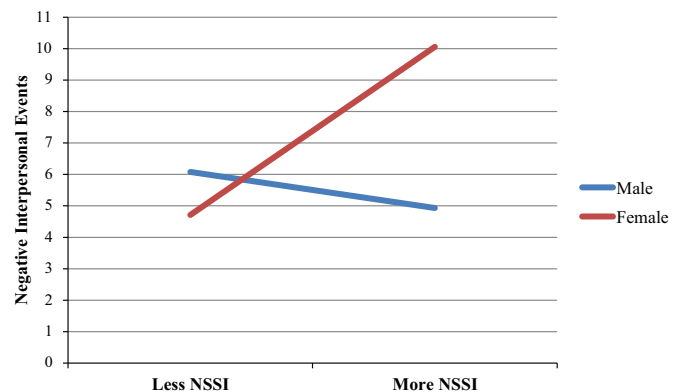


Fig. 1. Lifetime NSSI predicts more interpersonal stressors among girls.

hypotheses, there was not a main effect of last year NSSI on either interpersonal or non-interpersonal stressors at follow-up. However, this was qualified by a significant interaction between sex and last year NSSI predicting higher levels of interpersonal stressors (Table 4, top half), but not non-interpersonal stressors (Table 4, bottom half). Significant interactions were probed for each gender and at one standard deviation above and below the mean for both lifetime and last year NSSI (Aiken and West, 1991). This interaction was such that NSSI over the past year predicted higher levels of negative interpersonal events among adolescent girls ($t=2.18$, $p=.03$), but not among boys ($t = -.88$, $p=.38$; Fig. 2).

Further, supplementary analyses evaluating the presence versus absence of repeat NSSI revealed a similar pattern of results as those presented above. Specifically, there was a significant interaction between NSSI over the lifetime and past year with sex predicting the occurrence of interpersonal stressful events ($t=2.52$, $p=.01$; $t=2.04$, $p=.04$, respectively). Probing these interactions for each gender indicated that girls with NSSI over the past year experienced greater interpersonal stressors ($t=2.39$, $p=.02$), but not boys ($t = .71$, $p = .49$). Similarly, girls with NSSI over their lifetime experienced greater interpersonal stressors ($t=4.22$, $p < .001$), but not boys ($t = .29$, $p = .77$). Further, these results only held for interpersonal stressors, but not non-interpersonal stressors for both NSSI over one's lifetime ($t = 1.54$, $p = .13$) or in the past year ($t = 1.31$, $p = .19$).

Table 4

Regression step	Variable	β	t	ΔR^2	Δf^2
Interaction between Last Year NSSI and Sex on Interpersonal Stress at Follow-up					
Step 1	T1 BDI	.12	1.20	.05	.05
	BAS	.17	1.79		
Step 2	Age	< .01	.04		
	Sex	.14	1.43	.03	.03
Step 3	NSSI-LY	.14	1.35		
	NSSI-LY \times sex	.37	2.04*	.04*	.04*
Interaction between Last Year NSSI and Sex on Non-Interpersonal Stress at Follow-up					
Step 1	T1 BDI	.15	1.71	.08*	.08*
	BAS	.19	2.05*		
Step 2	Age	.09	1.06		
	Sex	.11	1.18	.01	.01
Step 3	NSSI-LY	< .01	.03		
	NSSI-LY \times sex	.28	1.62	.02	.02

Note. Coefficients represent the effect in each step. T1=Time 1 (baseline); BDI=Beck Depression Inventory; BAS=Behavioral Approach System; NSSI-LY=Last Year Non-Suicidal Self-Injury. Sex is coded as 0=male, 1=female. * $p < .05$, ** $p < .01$, *** $p < .001$.

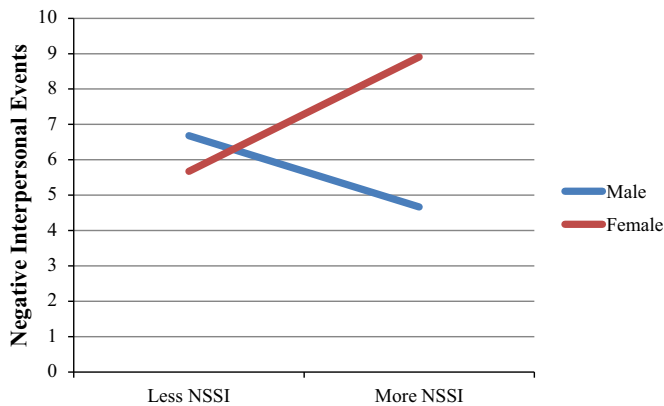
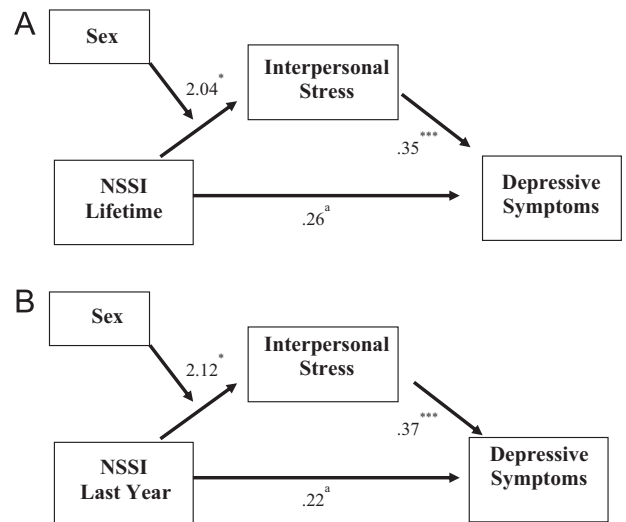


Fig. 2. Last year NSSI predicts more interpersonal stressors among girls.

3.3. Moderated mediation analyses

Prior to conducting our moderated mediation analyses, we tested the direct paths from NSSI (last year and lifetime) and depressive symptoms without stressful events in the model. Hierarchical regressions revealed that NSSI over one's lifetime significantly predicted increases in depressive symptoms ($t=2.09$, $p=.04$), controlling for initial levels of symptoms, age, and BAS status. However, NSSI over the past year did not directly predict increases in depressive symptoms ($t=.97$, $p=.33$). However, in our moderated mediation model, each path of the model was significant, such that the interaction between NSSI (last year and lifetime) and sex significantly predicted interpersonal stressful events, and interpersonal stressful events significantly predicted depressive symptoms at follow-up (Fig. 3). Consistent with hypotheses, our results indicate that lifetime NSSI significantly predicted prospective increases in depressive symptoms among adolescent girls through interpersonal stressful events (Table 5). In addition, interpersonal stressful events significantly mediated the relationship between last year NSSI and prospective levels of depressive symptoms among adolescent girls (Table 5). Further, the indirect effect of NSSI on depressive symptoms via interpersonal stressful events was significant only for adolescent girls, but not adolescent boys. Thus, adolescent girls who engaged in greater NSSI over one's lifetime and past year were significantly more



Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Note. NSSI= Non-Suicidal Self-Injury. ^a= Direct effect when the mediator is included in the model. Direct effects without the mediator are included in the text.

Fig. 3. Moderated mediation with sex moderating the relationship between NSSI and depression via interpersonal stressors.

Table 5

Indirect effect of NSSI on depressive symptoms via interpersonal stressors.

	Indirect effect	SE	CI (lower)	CI (upper)
NSSI lifetime				
Male	-.07	.24	-.63	.33
Female	.59	.23	.23	.12
NSSI last year				
Male	-.26	.32	-.92	.39
Female	.47	.26	.06	.13

likely to experience higher levels of interpersonal stressful events, which, in turn, predicted higher levels of depressive symptoms.

4. Discussion

The present study evaluated whether NSSI in one's lifetime or in the past year predicted the occurrence of interpersonal stressors over the next six months, whether such an increase in interpersonal stressors might mediate the relationship between NSSI and prospective depressive symptoms, and whether late adolescent females were particularly vulnerable to experiencing these stressors compared to males. Consistent with our hypotheses, our results indicate that the frequency of engagement in NSSI over one's lifetime and over the past year may play important roles in predicting the occurrence of interpersonal stressful life events among adolescent females, controlling for the effects of initial depressive symptoms. Specifically, our results indicate that adolescent girls with greater NSSI may be particularly likely to experience negative interpersonal stressful events, which, in turn, contributes to increases in depressive symptoms. Thus, our findings suggest that the occurrence of interpersonal stressors may be one psychosocial mechanism through which NSSI prospectively predicts subsequent levels of depressive symptoms, particularly among late adolescent females.

The current study extends past research on the relationship

between NSSI and stressful life events, which primarily has focused on the role of stressful life events as predictors of NSSI (Guerry and Prinstein, 2010; Liu et al., 2014). However our findings suggest that this relationship may not be unidirectional. Indeed, it appears that engaging in greater NSSI may contribute to the occurrence of interpersonal stressful events among late adolescent girls. Importantly, these findings hold even when controlling for initial levels of depressive symptoms, which have been found to prospectively predict interpersonal stressful events (Hammen, 1991; for a review, see Liu and Alloy (2010)) and are highly correlated with NSSI (Nock et al., 2006). Further, our findings suggest that this relationship may be specific to interpersonal stressful life events, and that NSSI does not contribute to the occurrence of non-interpersonal stressful events. Given the provocative nature of NSSI and that many report engaging in the behavior as a social communicatory device (Laye-Gindhu and Schonert-Reichl, 2005; Lloyd-Richardson et al., 2007; Nixon and Heath, 2008), these results are not surprising and indicate that NSSI may have specific interpersonal consequences. Thus, our results indicate that NSSI, independent of current depressive symptoms, contributes to the occurrence of negative interpersonal events among late adolescent girls.

Importantly, our findings indicate that engaging in NSSI may be particularly damaging for late adolescent females. Although there is mixed evidence regarding a meaningful gender difference in the prevalence of NSSI among adolescents (e.g., Andover et al., 2010; Nock et al., 2006), our study did not find gender differences in the frequency of NSSI over the past year or lifetime. In this sense, the greater number of interpersonal stressors among girls who engage in greater NSSI is not simply a result of more engagement in NSSI among girls. Thus, our findings corroborate and extend past research demonstrating that NSSI is predictive of depressive symptoms and psychological and social difficulties more strongly among females (Lundh et al., 2011a, 2011b) by finding that NSSI may confer unique risks for the occurrence of interpersonal stressors, which, in turn, account for prospective increases in depressive symptoms among females only. Therefore, we propose that among females, engaging in NSSI may perpetuate a “vicious cycle” of stress and psychopathology. As a result, future research should examine how this “vicious cycle” can be broken through investigating the cognitive, emotional, and behavioral factors that may be responsible for stress reduction prior to and post-engagement in NSSI, as well as for NSSI remission. Furthermore, research should directly probe why this “vicious cycle” does not appear to operate among males, or rather, why it may be particularly strong among females.

There are several possible reasons why late adolescent girls may be particularly vulnerable to experiencing negative interpersonal events associated with engagement in NSSI. First, research indicates that females are more likely to engage in NSSI for direct interpersonal motivations than males (Muehlenkamp et al., 2013). Although our study did not examine the motivation or reasons for engagement in NSSI, it is possible that girls may engage in NSSI with the direct intention of evoking responses from individuals (Muehlenkamp et al., 2013), which may subsequently create more difficulties for girls than boys. Perhaps only those individuals who engage in NSSI for interpersonal (e.g., social negative/positive reinforcement) as opposed to intrapersonal motivations (e.g., automatic negative/positive reinforcement) suffer from NSSI's role in contributing to interpersonal stress. However, future research evaluating the effects of motivation for NSSI is needed to more directly test this theory. Such future research should take into account that self-reported motivations for NSSI are likely to underestimate the relevance and magnitude of social motivations for the behavior given social desirability biases (Nock, 2008).

Second, it is possible that gender differences in NSSI methods used may be partially responsible for the greater negative effects of the behavior among females. Studies have consistently reported that there are significant gender differences in NSSI methods employed, such that females are more likely to engage in self-cutting and males are more likely to engage in self-hitting (Andover et al., 2010; Whitlock et al., 2008). Consistent with these studies, our results suggest that girls were more likely to engage in self-cutting or carving using a sharp object or knife, as well as self-burning. It is possible that self-hitting may signify strength among males, and therefore be somewhat ego-syntonic and result in less stigmatization and fewer interrupted interpersonal relationships than the preferred method among females. Another possible mechanism underlying the greater difficulties experienced by females post-NSSI may be the gender difference in age of onset of this behavior. Some research has indicated that females initiate NSSI earlier than males Nolen-Hoeksema and Girgus, 1994; Andover et al., 2010). Similar to depression, it may be that earlier onset of NSSI leads to a poorer prognosis in multiple areas of functioning (e.g., Pine et al., 2002), such as the development of social skills supporting healthy interpersonal relationships.

Although our study reflects a novel contribution to the field on the negative interpersonal effects of NSSI among females, it highlights the need for future research on the consequences of NSSI engagement and the pathways through which NSSI may confer greater risk for subsequent psychopathology. Extant research suggests that NSSI might have positive social consequences for young adolescents (i.e. increasing closeness with fathers), which may in turn reinforce self-injury (Hilt et al., 2008). It is possible that resolving interpersonal stressors following NSSI may contribute to the strengthening of some relationships. It is also possible that NSSI might have positive social consequences only among young adolescents, in cases where the self-injury has more recently started, as opposed to among late adolescents, in which friends and romantic partners, rather than mothers and fathers, make up one's close social support network. In addition, it is possible that NSSI may have both positive and negative consequences. It will be important to consider whether this process of positive reinforcement might protect individuals with self-injury from interpersonal stress, or rather, might contribute to stress after social supports become frustrated with this maladaptive form of communication. Future research should investigate these possibilities among both early and late adolescents.

Another important avenue for investigation will be to examine whether NSSI's role in contributing to prospective increases in depressive symptoms via increases in interpersonal stress may be a mechanism linking NSSI with future suicidal ideation (SI) and behavior (SB) among females. Understanding the transactional relationships between stress and NSSI and its relationship with later SI and SB will aid researchers in building a comprehensive theoretical framework for the development and maintenance of NSSI and SI/SB. The present research may benefit from integrating the role of stress generation into the current theories in order to amplify their explanatory power and minimize weaknesses. For example, although the Third Variable Theory holds that stress is one of the multiple shared risk factors for NSSI, SI, and SB and explains their correlational relationships, it does not acknowledge the possibility that engaging in NSSI may actually generate stress, thereby augmenting this risk factor for SI/SB. The Third Variable Theory could be amended to incorporate stress generation as a mechanism that explains the predictive relationship between NSSI and SI/SB after controlling for well-known risk factors of both forms of self-injurious behavior. With knowledge of causal pathways between NSSI and SI/SB, clinicians can better tailor treatments to prevent or ameliorate the occurrence of stress and the development of suicide risk after the onset of NSSI.

Research to date has focused primarily on the immediate affective consequences of NSSI, with little research on its long-term affective consequences, very little research on its long-term psychopathological consequences, and no research on its long-term stress-related consequences. This study highlights the possibility that NSSI may have a lasting negative effect on one's psychological health and environment, and underscores the importance of conducting research to determine the scope of NSSI's impact over time.

4.1. Limitations

Although many studies have delved into the psychosocial precursors of NSSI, the psychosocial effects of the behavior have remained largely understudied. Therefore, the results of the present investigation serve as a rather novel addition to the understanding of this detrimental, yet widespread behavior. Furthermore, results should be interpreted in light of the rather extensive measurement of a primary outcome variable, stressful life events. Our study benefited from a multi-method assessment of stressful life events, as participants first reviewed 193 stressful life events and subsequently underwent an in-person detailed life events interview to determine whether events met pre-determined qualifications made to reduce biased reporting and increase inter-rater reliability.

Despite the strengths of our study, it is important to note several limitations of the current investigation. First, this study relied solely on a self-report measure of one of the main variables of interest, NSSI. Future studies would benefit from a multi-method assessment of NSSI to better validate our findings. However, research has shown that individuals often feel more comfortable disclosing sensitive information such as history of non-suicidal self-injurious thoughts and behaviors on self-report measures than in interview format (Greist et al., 1973). Second, our sample size was limited, particularly our sample of self-injuring adolescent males. Note that for recent self-injuring boys, we found a rather large beta coefficient (.40) that was not significant in the moderation analyses. In addition to the need to replicate all study analyses among different age groups and in clinical populations, future studies should recruit a greater proportion of boys to test whether NSSI may be related to greater interpersonal stressors among boys in addition to girls. Third, our sample was drawn from a behavioral high-risk study based on BAS-status (top 15% or 40–60th percentile). Including participants with a restricted range of BAS scores in our analyses likely hampers the generalizability of our findings, as we are unable to determine whether these relationships hold for the 65% of individuals who would not meet study inclusion criteria due to BAS scores outside of the specified ranges. Still, we believe that we have accounted for some of the impact of this pre-selection criterion by conducting moderation analyses to determine the effect of BAS-status. These moderation analyses indicated that BAS status did not moderate any of the study relationships. Given that in addition, we found no significant interactions between gender, BAS, and stress, we decided to control for BAS-status in our analyses. As a result of these null moderation analyses, and that we controlled for BAS-status in our analyses, we believe that our findings may be generalizable to other samples not specifically recruited for BAS risk. However, we recognize that the results of this study should be replicated among a sample with a greater range of BAS scores to increase confidence in our findings.

Importantly, there are likely third variables that we did not explore that may account for the relationship between NSSI and interpersonal stress. For example, NSSI is associated with self-reported impulsivity (Glenn and Klonsky, 2010), borderline personality disorder symptoms (Muehlenkamp et al., 2011), and other co-

occurring psychopathology (Nock et al., 2006), which may account for some aspects of the relationship between NSSI and interpersonal stressors. Thus, future studies should explore these explanations to determine whether there is a unique association between NSSI and interpersonal stressors. In addition, we did not control for baseline experience of stress in our analyses. Future studies should explicitly control for baseline stress in order to make claims about NSSI's role in prospectively predicting interpersonal stress, which will be important in examining the transactional nature of stress and NSSI. Although the present study only examined NSSI as a predictor of stressors and depressive symptoms, there is likely a cyclical relationship between NSSI and stress. Thus, future research is needed to evaluate the transactional nature of NSSI, stressors, and psychopathology, which would provide crucial information regarding the dynamics between these processes.

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