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Nonsuicidal Self-Injury as a Time-Invariant Predictor of Adolescent Suicide Ideation and Attempts in a Diverse Community Sample

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Abstract

Objective—Longitudinal data on adolescent self-injury are rare. Little is known regarding the associations between various forms of self-injurious thoughts and behaviors over time, particularly within community samples that are most relevant for prevention efforts. This study examined NSSI as a time-invariant, prospective predictor of adolescent suicide ideation, threats or gestures, and attempts over a 2.5 year interval.

Method—A diverse (55% female; 51% non-White) adolescent community sample ($n = 399$) reported depressive symptoms, frequency of NSSI, suicide ideation, threats or gestures, and attempts in ninth grade (i.e., baseline) and at four subsequent time points. Generalized estimating equations and logistic regressions were conducted to reveal the associations between baseline NSSI and the likelihood of each suicidal self-injury outcome post-baseline while controlling for depressive symptoms and related indices of suicidal self-injury as competing predictors.

Results—Baseline NSSI was significantly, prospectively associated with elevated levels of suicide ideation and suicide attempts, but not threats or gestures. Neither gender nor ethnicity moderated results.

Conclusions—Above and beyond established risk factors such as depressive symptoms and previous suicidality, adolescent NSSI may be an especially important factor to assess when determining risk for later suicidality.

Keywords

nonsuicidal self-injury; suicide ideation; suicide attempts; adolescents

Self-injurious thoughts and behaviors are remarkably dangerous, yet relatively understudied phenomena (Prinstein, 2008). In particular, relatively few longitudinal data are available to understand prospective predictors of self-injury. Moreover, research studies rarely discretely identify and examine associations among the multiple types of self-injurious thoughts and behaviors that have been identified in the literature (e.g., nonsuicidal self-injury, suicide ideation, threats, gestures, attempts, etc.; Nock & Kessler, 2006; Silverman, Berman, Sanddal, O'Carroll, & Joiner, 2007). Consequently, relatively little is known regarding the predictors of self-injury beyond broad, distal factors (e.g., depressive symptoms, prior self-injury, substance use), particularly in adolescence (Nock, 2009; Prinstein, 2008).

However, a substantial body of research recently has emerged on at least one form of self-injury: nonsuicidal self-injury (NSSI). Defined as behavior that is direct, deliberate, and not socially sanctioned, NSSI causes damage to one's body tissue and is enacted without the intent to die (Nock, 2010). NSSI is remarkably prevalent, especially among adolescents. Lifetime prevalence rates in community samples range from 15.9 to 21.2% (e.g., Muehlenkamp & Gutierrez, 2004; Ross & Heath, 2002). Studies of NSSI have proliferated and gained added clinical importance for at least three reasons. First, NSSI is a proposed diagnostic category in the draft DSM-V (Selby, Bender, Gordon, Nock, & Joiner, 2011). Second, NSSI is associated concurrently with suicidal thoughts and behaviors (Andover & Gibb, 2010; Klonsky & Olino, 2008; Lloyd-Richardson, Perrine, Dierker, & Kelley, 2007; Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). Third, recent theories suggest that NSSI may be a risk factor for later suicidal thoughts and behaviors (Brent, 2011; Joiner, 2005). The latter hypothesis infrequently has been examined, however.

The present study examines NSSI as a long-term, time-invariant longitudinal risk factor for suicide ideation, threats or gestures, and attempts during an adolescent transition period associated with increased risk for suicidality. Epidemiological data suggest that suicide ideation is remarkably prevalent during the high-school aged adolescent period (13.8%; CDC, 2010). The prevalence of suicide attempts is also quite high (6.3%; CDC, 2010). Between the age groups of 10–14 to 15–19, the rate of completed suicide increases almost sevenfold (from 1.1 to 7.4 per 100,000; CDC, 2008). In addition, suicide is the third leading cause of death for children and adolescents aged 10–19 years (CDC, 2008). Less is known about the prevalence of suicide threats or gestures, sometimes defined as “self-injury in which there is no intent to die, but instead an intent to give the appearance of a suicide attempt in order to communicate with others” (Nock & Kessler, 2006, p. 616), or as “any interpersonal action, verbal or non-verbal, without a direct self-injurious component, that a reasonable person would interpret as communicating or suggesting that suicidal behavior might occur in the near future” (Silverman et al., 2007, p. 268). Self-injurious behaviors such as threats or gestures and uncompleted suicide attempts are crucial outcomes for investigation, as they place an enormous burden on emergency health care systems, cause significant distress among family and friends, and are the strongest predictors of eventual suicide (Cvinar, 2005; Joiner et al., 2005; Olfson, Gameroff, Marcus, Greenberg, & Shaffer, 2005).

Recent theoretical and empirical work suggests that NSSI may be associated with increased suicidal capability (Franklin, Hessel, & Prinstein, 2011; Joiner, 2005). Joiner (2005) suggests that repeated episodes of painful and provocative experiences, such as cutting or burning, may habituate those who engage in NSSI to higher levels of pain. This habituation, or “acquired capability for suicide,” may act as a vulnerability that, when combined with desire for suicide, has been found to significantly predict suicidal behaviors, including attempts and completed suicides (Anestis & Joiner, 2011; Joiner et al., 2009; Nademin et al., 2008; Van Orden, Witte, Gordon, Bender, & Joiner, 2008).

Preliminary empirical findings offer some initial support for NSSI as a concurrent correlate of suicidal thoughts and behavior. Higher frequencies of NSSI concurrently are associated with higher levels of suicide ideation and a history of suicide attempts (Andover & Gibb, 2010; Klonsky & Olino, 2008; Lloyd-Richardson et al., 2007; Nock et al., 2006).

Few studies have examined the longitudinal association among various forms of self-injury (e.g., Asarnow et al., 2011; Cooper et al., 2005; Owens, Horrocks, House, 2002; Wilkinson, Kelvin, Roberts, Dubicka & Goodyer, 2011). In some cases different forms of self-injury (i.e., suicidal vs. nonsuicidal) have not been explicitly differentiated. For example, Cooper and colleagues (2005) revealed a prospective relationship between any self-harm episode

resulting in a hospitalization (including NSSI or suicidal self-injury) and later completed suicide. Similarly, Owens and colleagues (2002) reviewed multiple studies examining the relationship between various forms of self-harm and later non-fatal or fatal self-harm; findings suggested elevated risk for suicide among self-harm patients as compared to the general population.

Some short-term longitudinal data examining associations specifically between NSSI and suicidal thoughts or behaviors in clinically-referred populations also have been reported recently. For example, NSSI has been associated with slower decreases in suicide ideation in the nine months following hospital discharge (Prinstein et al., 2008). Asarnow and colleagues (2011) and Wilkinson and colleagues (2011) revealed NSSI frequencies to be a stronger predictors of suicide attempts than were previous suicide attempts over a 24- and 28-week period, respectively.

This study aimed to offer at least five unique contributions to the literature examining putative risk associated with NSSI. First, this study used a definition of NSSI consistent with contemporary theory; thus, it was possible to examine NSSI (specifically without suicidal intent) as a predictor of suicidal thoughts and behaviors. Second, this study focused on a diverse community sample, offering findings that are most relevant for prevention efforts. Third, this study was designed to examine the long-term longitudinal prediction of suicidal thoughts and behaviors from NSSI. A two and a half year longitudinal interval was used to examine hypotheses. Fourth, multiple outcomes reflecting discrete suicidal thoughts and behaviors (i.e., suicide ideation, threats or gestures, and attempts) are examined. Last, and perhaps most importantly, this study examines NSSI as a predictor of suicidal thoughts and behaviors while controlling for depressive symptoms and related suicidality as competing predictors. This stringent examination offers a robust test of NSSI as a predictor of later suicidal thoughts and behaviors.

It was hypothesized that NSSI would be associated with a higher likelihood of suicidal thoughts over time. Although prior longitudinal research on the developmental course of suicidal ideation is rare, empirical data suggest that ideation may occur episodically, perhaps in conjunction with major depressive episodes (Prinstein et al., 2008; Williams, Crane, Barnhofer, Van der Does, & Segal, 2006). A primary aim of this study was to examine NSSI as a longitudinal predictor of clinically-significant levels of suicide ideation. Thus, data were coded to reflect severe levels of suicide ideation, and an analytic approach allowing for the examination of repeated occurrences nested within individuals was employed. It also was hypothesized that NSSI would be associated with higher occurrences of suicide threats or gestures and suicide attempts over time.

Past research has suggested adolescent girls and Latino Americans are more likely than adolescent boys and non-Latino Americans to report suicide ideation, attempts, and depressive symptoms (CDC, 2010). However, there are few extant theories suggesting that the magnitude of the association between NSSI and suicidal thoughts and behaviors may vary with respect to gender or ethnicity. Therefore, each of these demographic variables was explored as a moderator of hypothesized associations for descriptive purposes.

Method

Participants

A total of 399 ninth-grade adolescents (54.8% girls) participated in the study. The ethnic distribution of the sample was 49.2% Caucasian, 22.7% African American, 19.3% Latino American (of which 64% were from Mexico, and 8% each were from Puerto Rico, Honduras, and El Salvador), and 8.8% Other/Mixed Ethnicity within a city of lower-class

socioeconomic status. According to school records, approximately 67% of students in this district were eligible for free or reduced-price lunch. Approximately 19% of adolescents reported that their parents were never married; 32% reported that their parents had separated or divorced. The majority of adolescents reported that they lived in a household with two adults (47% with two biological parents; 30% with a parent and a step-parent, grandparent, or other relative); 23% reported living in a single-parent household.

Procedures

All students in ninth grade from three rural high schools in a single county were recruited for participation ($N = 712$), with the exception of students in self-contained special education classes. A letter of consent initially was distributed to each adolescent's family followed by a series of reminders and additional letters distributed by school and research personnel. Response forms included an option for parents to grant or deny consent; adolescents were asked to return their signed response forms regardless of their parents' decision. Numerous adolescent-, teacher-, and school-based incentives were used to ensure the return of these consent forms (i.e., candy for each returned consent form; \$30 gift card raffles during each week of recruitment; one \$300 gift card grand prize raffle). Consent forms were returned by 75% of families ($n = 533$); of these, 80% of parents gave consent for their child's participation ($n = 423$). Data were unavailable for 24 participants due to changing schools ($n = 18$), student absenteeism on the days of testing ($n = 2$), or declining to participate ($n = 4$), yielding a Time 1 sample of 399 (56% of total population). Adolescent assent was requested at the start of data collection, following written and verbal descriptions of the study procedures. All procedures were approved by the university human subjects committee.

Measures were administered in the spring of ninth grade and then every six months for a total of five time points (until the spring of 11th grade). Retention varied between 90–99% between adjacent time points. Retention between Times 1 and 5 was 77%; 67% of attrition was due to students withdrawing from school. Attrition analyses revealed no significant differences on any study variable between adolescents who participated at one versus all time points, with one exception: Latino American adolescents were less likely to have complete data than non-Latino American adolescents, $\chi^2(1) = 6.06, p = .01$. All 399 cases were used in analyses; maximum likelihood methods were used to account for missing data. Generalized Estimating Equations used all available data from the full sample ($n = 399$). Analyses conducted with only available data revealed an identical pattern of findings.

Measures

All measures were administered in adolescents' classrooms or school auditoriums. Measures were completed in a group setting, and researchers ensured that participants had sufficient privacy to complete questionnaires confidentially (e.g., participants were placed several seats and rows apart). Measures of suicide ideation, threats or gestures, and attempts were administered at all five time points. Measures of depressive symptoms and NSSI were administered at Time 1.

Nonsuicidal self-injury (NSSI)

Adolescents reported the frequency that they engaged in six types of nonsuicidal self-injurious behaviors (i.e., cut/carved skin, hit self, burned skin, inserted objects under skin, scraped/picked skin, bit self) without intending to die, in the past year (Prinstein et al., 2008). The anchors for this scale were adapted from the aforementioned study to allow more accurate reporting (1 = Never, 2 = 1–2 times, 3 = 3–5 times, 4 = 6–9 times, 5 = 10 or more times). Prior research supports the concurrent validity of this assessment through significant associations with other measures of NSSI (Prinstein et al., 2008).

Suicide ideation, threats or gestures, and attempts

Suicide ideation was assessed using an adaptation of a 15-item measure (Heilbron & Prinstein, 2010). The version of the measure employed in the present study included the same eight items assessing thoughts about suicide (e.g., “I thought about death”; “I thought about how I would kill myself”; “I thought that killing myself would solve my problems”) interspersed with seven filler items from the Reasons for Living scale (RFL; Linehan, Goodstein, Nielsen, & Chiles, 1983). Suicide ideation within the past year was assessed at baseline, and ideation within the past six months was assessed at each follow-up time point. This composite measure included suicide ideation items drawn from the Suicidal Ideation Questionnaire (SIQ; Reynolds, 1988), and the NIMH-DISC-IV (Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000). Each item is scored on a five-point scale ranging from 1 (*Never*) to 5 (*Almost every day*); higher scores are indicative of higher frequencies of suicide ideation. Internal consistency (α) across all time points ranged between 0.83 and 0.94.

Suicide threats or gestures were measured with a single item added to the above instrument (“I tried to make someone believe that I might end my life, but I didn’t do it”). Adolescents responded to this item using the same five-point scale.

Suicide attempts also were assessed with a binary item asking whether adolescents “have tried to kill themselves” in the past year (at baseline) and the past six months (at each follow-up time point). Two indices were computed, representing the presence of a recent suicide attempt at baseline and the presence of at least one suicide attempt between Times 2 through 5.

Depressive symptoms

Depressive symptoms were assessed using the Mood and Feelings Questionnaire (MFQ), a 33-item self-report measure designed to assess criteria for depression in children and adolescents ages 8–18 (Costello & Angold, 1988). MFQ items include statements such as “I felt miserable or unhappy,” “I cried a lot,” and “I thought bad things would happen to me.” Each item is scored on a three-point scale: “mostly true,” “sometimes true,” or “not true” for the individual over the past two weeks. Higher scores are indicative of higher levels of depressive symptoms. In the present study, internal consistency was excellent ($\alpha = .93$).

Data Analysis

Three sets of analyses were conducted to examine study hypotheses. Descriptive statistics first were conducted to examine frequencies, gender and ethnic differences, and correlations among continuous primary variables across all five time points.

Second, generalized estimating equations (GEE) were used to account for clustered within-person observations in analyses predicting the occurrence of suicide ideation and threats or gestures. As may be expected based on previous research, inspection of data for suicide ideation and threats or gestures revealed that neither construct was best characterized by linear growth over time (Prinstein et al., 2008; Williams et al., 2006). In other words, it was rare for individuals to report gradual, linear increases (or decreases) in the frequency of suicide ideation or threats or gestures across the five time points of the study. Rather, suicide ideation and threats or gestures each occurred in a sporadic manner, with intermittent peaks usually surrounded by periods of low or absent suicidality. Thus, a binary logistic outcome was modeled with an autoregressive correlation matrix structure. This procedure allowed for multiple occurrences (i.e., elevated ideation, threats/gestures) within individuals. Analyses revealed no association between time and elevated levels of ideation or threats/gestures, suggesting no change in the hazard as a function of elapsed time.

Because the literature currently offers no consistent data to suggest a meaningful cutoff score indicating “elevated” suicide ideation, occurrences of elevated ideation were computed in two ways. First, based on clinical judgment, it was determined that any adolescent reporting a frequency of suicide ideation “at least once per week” or “almost every day” would be of strong clinical concern. Thus, within each time point, adolescents who reported a score of 4 or 5 on any suicide ideation item were defined as having elevated suicide ideation. This yielded a total of approximately 8% of the sample with elevated ideation at each time point. Notably, recent data suggest that 13.8% of high school aged adolescents report “seriously considered attempting suicide” within a one year interval (CDC, 2010). Thus, our estimate was conservative. A second computation for determining elevated suicide ideation occurrences was statistically-based. A single grand mean and standard deviation of suicide ideation scores across person and time were computed. Scores one standard deviation above this grand mean were coded to reflect elevated suicide ideation. Between 5–9% at each time point exceeded this cutoff score. All analyses below were conducted twice, using each cutoff score, respectively. The pattern of findings was identical. To offer more utility for clinical purposes, analyses using the former approach for establishing elevated suicide ideation scores are presented below.

A similar procedure was used to dichotomize suicide threat or gesture scores. Any suicide threat or gesture is of clinical concern. Thus, any response indicating that adolescents engaged in a suicide threat or gesture more often than “never” was included as an “occurrence.” A range of 2–7% of adolescents reported an occurrence of suicide threat or gesture at each time point.

In both GEE models prospectively predicting ideation and threats or gestures, respectively, analyses included occurrences post-baseline (i.e., at time points 2, 3, 4 and 5) as a dependent measure. All measures of related baseline suicidality (i.e., ideation, threats or gestures, and suicide attempts) were included as independent variables, as were dummy codes for gender (female), African American, and Latino American adolescents. In addition, main effects of baseline depressive symptoms were entered, followed by a test of baseline NSSI as an independent variable. Interactions examining gender and ethnicity as moderators initially were examined (i.e., gender \times NSSI; African-American (dummy coded) \times NSSI; Latino-American (dummy coded) \times NSSI (dummy coded); however, none reached significance and thus are not reported below. The final model for suicidal ideation is shown below; the model for threats or gestures was identical in structure.

$$\logit[P_{ideation_{it}} = 1] = \beta_0 + \beta_1 BL_{ideation}_i + \beta_2 BL_{threats}_i + \beta_3 BL_{attempts}_i + \beta_4 female_i + \beta_5 Af_Amer_i + \beta_6 Latino_i + \beta_7 BL_{depress}_i + \beta_8 BL_{NSSI}_i$$

Variables with the prefix “BL” represent baseline measures, i indicates the individual and t indicates the time point (e.g., post-baseline assessments 2, 3, 4 or 5). For each outcome variable, suicidal ideation and threats or gestures, an autoregressive working correlation structure was specified for the residuals to account for the dependence in the repeated measures.

Third, a logistic regression analysis was conducted to examine the prediction of suicide attempts. Because suicide attempts were low in frequency (i.e., between 1–9 at each time point), a single outcome variable was computed identifying adolescents who did or did not report a suicide attempt at any point between Time 2 and 5. A logistic regression analysis, using all of the same predictors described above, was conducted to examine prospective prediction of suicide attempts. Because a single measure of attempts was taken for each individual, this analysis did not require the use of GEE (or a working correlation structure) and was fitted to the data using the typical maximum likelihood estimator under the assumption of independent observations.

Results

Preliminary Analyses

Table 1 presents descriptive statistics for all study variables, as well as the results of *t*-tests and chi-squared tests examining gender differences. Results indicated that a range of 7.1–8.9% of adolescents reported elevated levels of suicide ideation and 1.5–6.9% reported engaging in suicide threats or gestures at each time point. At baseline, 29.5% reported that they had engaged in NSSI; 3.3% of adolescents reported that they had attempted suicide in the past year, and 5.2% of adolescents reported having attempted suicide across the follow-up period. Females reported significantly higher levels of baseline depressive symptoms than males as well as higher levels of baseline NSSI. No significant gender differences were found for suicide ideation, threats or gestures, or attempts at any time point. Tests of ethnic differences revealed that African Americans and Latino Americans reported significantly higher levels of baseline depressive symptoms than White/Caucasians, $t(398) = 2.51, p = .01$ and $t(398) = 2.71, p < .01$, respectively. In addition, at Time 2, significantly more Latino Americans reported engaging in a suicide threat or gesture as compared to other ethnic groups, $\chi^2(1) = 5.69, p < .05$; at Time 5, African Americans reported significantly higher levels of suicide ideation as compared to other ethnic groups, $\chi^2(1) = 8.74, p < .01$. No significant ethnic group differences were found for NSSI, suicide ideation, threats or gestures, or attempts at all other time points.

Table 2 presents correlations among continuous primary variables of depressive symptoms, NSSI, and suicide ideation. As expected, all variables were significantly positively associated across time.

Longitudinal Prediction of Suicide Ideation

Table 3 displays parameter estimates from two generalized estimating equations predicting suicide ideation and threats or gestures, respectively. Results for suicide ideation revealed that after controlling for baseline self-injurious thoughts and behaviors and depressive symptoms, African American adolescents were about a third as likely to report an occurrence of elevated suicide ideation over the follow-up period. Consistent with hypotheses, results suggested that after accounting for these other effects, each additional point in reported NSSI at baseline was associated with an over five-fold increase in the odds of a future occurrence of elevated suicide ideation. Interestingly, with this association between NSSI and later suicide ideation included, there was no significant association between baseline ideation and ideation occurrences at follow-up. In addition, no significant effects were revealed for other demographic predictors (i.e., gender, Latino American ethnicity) other measures of self-injury (i.e., baseline suicide threats or gestures, baseline suicide attempts) or baseline depressive symptoms.

Longitudinal Prediction of Suicide Threats or Gestures

Results for the prediction of suicide threats or gestures revealed several main effects. Females were about half as likely as male adolescents to report the occurrence of a suicide threat or gesture during the follow-up interval. Additionally, African American adolescents were approximately a third as likely to report a suicide threat or gesture during follow-up. No other significant effects were revealed.

Longitudinal Prediction of Suicide Attempts

Consistent with past research, analyses revealed that prior suicide attempts were associated with future suicide attempts. Results suggested that a suicide attempt at baseline was associated with a nearly nine-fold increase in the likelihood of a suicide attempt over the follow-up period. After controlling for this effect, and also consistent with prior work,

results suggested that being female was associated with a nearly two-fold increase in the likelihood of later suicide attempts, and each one point increase in depressive symptoms was associated with a four-fold increase in the likelihood of future suicide attempts. Interestingly, results suggested that after accounting for each of these effects, each additional unit increase in reported NSSI was associated with a seven-fold increased likelihood of future suicide attempts. No other significant effects were revealed (see Table 4). Importantly, suicide attempts were reported at each separate time point. The vast majority occurred in the first year of follow-up (of 19 attempts during the follow-up period, 8 were at Time 2, 9 at Time 3, 1 at Time 4, and 1 at Time 5). Thus, it should be noted that each of these predictors was mostly associated with the likelihood of attempts occurring within one year of the baseline assessment.

Discussion

NSSI is an important behavior to understand and prevent in adolescence in its own right. Researchers have suggested that NSSI also may be an important predictor of later suicidal behavior; however, this hypothesis has not received substantial empirical attention. The current study offers compelling evidence from a diverse community-based sample suggesting that higher frequencies of NSSI are indeed associated with significantly increased risks of suicide ideation and attempts, but not threats or gestures. These results are particularly notable given the strong theoretical overlap and moderate correlations among NSSI, depressive symptoms, and suicide thoughts and behaviors. Results offer a useful evidence-based tool for clinicians attempting to assess the risk of suicidal behavior among adolescent clients; specifically, a past history of NSSI offers an important contribution to risk assessment, above and beyond the role of prior suicidality and depressive symptoms as risk factors.

Results may be interpreted in light of several theoretical perspectives. First, as hypothesized by Joiner (2005), NSSI may be an experience that promotes adolescents' acquired capability for suicide. In other words, adolescents who engage in NSSI may develop an increased tolerance for pain and a decreased fear of death. NSSI also may promote a habituation to self-injurious behaviors, the development of more positive attributions regarding self-injury, or behavioral reinforcement through perceived social or internal rewards for self-injury. Any of these factors may mediate the association between NSSI and later suicidality (e.g., Franklin, Hessel, & Prinstein, 2011; Hooley, Ho, Slater, & Lockshin, 2010). Theories regarding acquired capability for suicidality do not specify the precise mechanism that is responsible for the link between early painful/provocative experiences and later suicidality, nor was this a focus of the present study. However, this would be an important area for further exploration.

An alternate explanation for observed results pertains to possible "third variable" factors that may be responsible for both NSSI and suicidal self-injurious thoughts/behaviors. For instance, more frequent stressful experiences or a deterioration of adaptive coping skills may be responsible both for the occurrence of NSSI and later suicidal behavior. Neither of these factors may be fully accounted for by the presence of depressive symptoms and prior suicidality in our models.

Interestingly, NSSI was not associated prospectively with the occurrence of suicide threats or gestures. Prior research has suggested that suicide ideation, threats or gestures, and attempts are discrete constructs with unique correlates (e.g., Nock & Kazdin, 2002; Nock & Kessler, 2006). The results from this study partially support this idea, perhaps suggesting that suicide threats or gestures are motivated by different processes than are suicide ideation and attempts. Among adolescents, suicide ideation and attempts do not always reflect a true

desire to die (Silverman et al., 2007). However, suicide threats or gestures, by their definition, may be even less motivated by suicidal intent. As they have been defined in the literature, suicide threats or gestures seem to be interpersonally-directed, and may be more closely associated with NSSI serving social functions rather than NSSI primarily addressing automatic, internal functions (Nock & Prinstein, 2004). As the present study measured this construct with only a single item, it also is possible that the lack of significant findings is simply due to poor validity in our measurement of threats or gestures. More comprehensive assessments of self-injurious thoughts and behaviors are needed in future work.

Results regarding gender and ethnicity as main effects or moderators of findings were presented. As demonstrated in prior research, being female was related to an increased risk of future suicide attempts (CDC, 2010). Also consistent with prior research, our results suggested that African American adolescents were at less risk of future suicide ideation and threats or gestures (e.g., Joe, Baser, Breeden, Neighbors, & Jackson, 2006). No findings suggested that demographic factors moderated the association between NSSI and future self-injurious thoughts and behavior. Combined with emerging evidence suggesting consistency in the frequency of NSSI across gender, ethnicity, and multiple cultures (Giletta, Scholte, Engles, Ciairano, & Prinstein, in press), results suggest that NSSI is a phenomenon that may present similar risks across multiple populations of youth. However, as these analyses were exploratory, replication is needed to better explain the role of gender and ethnicity as moderators of suicidal behaviors over time.

In our analyses, baseline ideation was not a significant predictor of later ideation in the presence of all other predictors (e.g., NSSI, depressive symptoms, gender). One interpretation of this counterintuitive result is that suicidal thoughts may be episodic in nature (Prinstein et al., 2008; Williams et al., 2006); thus, stability in these constructs may not be expected across time across all possible time points. This finding should be replicated before drawing concrete conclusions.

Overall, results offer empirical evidence for the importance of NSSI as a construct that has predictive value in assessing risk for adolescent suicide ideation and attempts. Future research on this topic would benefit from addressing some of the limitations in this study. First, the generality of results may be compromised by the relatively low participation rate recruited and retained in this sample. Although the sample compares quite favorably to other low-income, ethnically-diverse longitudinal samples, the overall rate of participation nevertheless limits confidence in applying these results to all populations. Second, we assessed all self-injurious thoughts and behaviors using adolescent self-report, and two constructs were measured using single-item indices. While this method allowed us to assess a large number of adolescents, future studies also could include parent-report of adolescents' self-injury, as well as more thorough instruments examining multiple self-injury constructs. Too often in the literature, self-injury is assessed in a brief, cursory manner that does not allow for a careful delineation of the different forms of self-injury that have been identified as discrete constructs in past research (e.g., Nock & Kazdin, 2002; Nock & Kessler, 2006). Third, results regarding significant associations over time do not imply causal links between NSSI and these other self-injurious outcomes. This is a common limitation for studies of this type.

In a relatively brief period of time, NSSI has become a widely prevalent behavior, particularly among adolescents (Nock, 2010). Accordingly, the study of NSSI has become a burgeoning research area. Results from this study suggest that NSSI may be a notable risk factor for future suicide ideation and attempts during a developmental period known to be associated with heightened risk for self-injury. Understanding why some adolescents who

engage in NSSI are at risk for suicidal self-injury, while others are not, will be an important direction for research and clinical efforts.

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Table 1

Descriptive Statistics and Tests of Gender Differences for All Primary Variables

Variables	Total	Females	Males	Statistics
Suicide Ideation, <i>M</i> (<i>SD</i>)				
Time 1	1.17 (.40)	1.18 (.43)	1.15 (.38)	$t(374) = 0.61$
Time 2	1.18 (.42)	1.21 (.49)	1.13 (.31)	$t(374) = 1.96$
Time 3	1.21 (.60)	1.23 (.64)	1.19 (.56)	$t(374) = 0.64$
Time 4	1.14 (.38)	1.17 (.47)	1.10 (.22)	$t(374) = 1.56$
Time 5	1.11 (.36)	1.14 (.47)	1.08 (.17)	$t(374) = 1.50$
Elevated Suicide Ideation, <i>n</i> (%)				
Time 1	33 (8.9%)	18 (54.5%)	15 (45.4%)	$\chi^2(1) = 0.00$
Time 2	30 (8.5%)	18 (60.0%)	12 (40.0%)	$\chi^2(1) = 0.28$
Time 3	26 (8.2%)	16 (61.5%)	10 (38.5%)	$\chi^2(1) = 0.46$
Time 4	24 (8.2%)	13 (54.2%)	11 (45.8%)	$\chi^2(1) = 0.00$
Time 5	20 (7.1%)	13 (65.0%)	7 (35.0%)	$\chi^2(1) = 1.17$
Suicide Threats/Gestures, <i>n</i> (%)				
Time 1	19 (5.1%)	10 (52.6%)	9 (47.4%)	$\chi^2(1) = 0.04$
Time 2	13 (3.6%)	10 (76.9%)	3 (23.1%)	$\chi^2(1) = 2.53$
Time 3	23 (6.9%)	13 (56.5%)	10 (43.5%)	$\chi^2(1) = 0.00$
Time 4	8 (2.7%)	7 (87.5%)	1 (12.5%)	$\chi^2(1) = 3.71$
Time 5	6 (1.5%)	5 (83.3%)	1 (16.7%)	$\chi^2(1) = 2.16$
Suicide Attempts, <i>n</i> (%)				
Time 1	12 (3.3%)	8 (66.7%)	4 (33.3%)	$\chi^2(1) = 0.70$
Times 2 through 5	19 (5.2%)	15 (78.9%)	4 (21.0%)	$\chi^2(1) = 3.90$
Depressive Symptoms, <i>M</i> (<i>SD</i>)				
Time 1	.33 (.30)	.37 (.30)	.27 (.29)	$t(374) = 3.19^*$
NSSI, <i>M</i> (<i>SD</i>)				
Time 1	1.11 (.20)	1.13 (.23)	1.08 (.17)	$t(374) = 2.17^*$

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

Table 2

Bivariate Associations among Continuous Primary Variables

Variable	Depressive Symptoms	NSSI	Suicide Ideation				
			Time 1	Time 2	Time 3	Time 4	Time 5
Depressive Symptoms - Time 1	-						
NSSI - Time 1	.50**	-					
Suicide Ideation - Time 1	.54**	.36**	-				
Suicide Ideation - Time 2	.24**	.29**	.17**	-			
Suicide Ideation - Time 3	.22**	.22**	.24**	.43**	-		
Suicide Ideation - Time 4	.19**	.23*	.14**	.41**	.24**	-	
Suicide Ideation - Time 5	.25**	.21**	.17**	.32**	.31**	.40**	-

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

Table 3

Generalized Estimating Equation Results Predicting Suicide Ideation and Threats or Gestures During Follow-Up from Demographic Variables, Baseline Suicidal Thoughts and Behaviors, Depressive Symptoms, and NSSI

Parameter	Ideation			Threats or Gestures		
	b	95% CI	Exp (b)	b	95% CI	Exp (b)
Gender (female)	-0.10	(-0.63, 0.43)	0.90	-0.81*	(-1.60, -0.03)	0.44
African American (1)	-0.98*	(-1.59, -0.37)	0.38	-0.95*	(-1.86, -0.04)	0.39
Latino American (1)	0.02	(-0.92, 0.96)	1.02	-0.90	(-1.90, 0.10)	0.41
Suicide Ideation, Time 1	0.16	(-0.64, 0.96)	1.18	-0.87	(-1.88, 0.14)	0.42
Suicide Threat/Gesture, Time 1	-0.24	(-0.93, 0.45)	0.79	0.45	(-0.11, 1.01)	1.57
Suicide Attempt, Time 1	0.18	(-1.19, 1.55)	1.20	0.82	(-0.64, 2.27)	2.26
Depressive Symptoms, Time 1	0.11	(-0.85, 1.07)	1.12	0.99	(-0.52, 2.49)	2.68
NSSI, Time 1	1.70**	(0.75, 2.66)	5.48	1.01	(-0.40, 2.42)	2.74

* $p < .05$;

** $p < .001$

Table 4

Logistic Regression Results Predicting Suicide Attempts During Follow-Up from Demographic Variables, Baseline Attempts, Depressive Symptoms, and NSSI

Parameter	Attempts		
	b	se	Exp (b)
Gender (female)	0.64 *	0.32	1.89
African American (1)	0.47	0.34	1.60
Latino American (1)	-0.13	0.40	0.88
Suicide Ideation, Time 1	-0.57	0.33	0.56
Suicide Threat/ Gesture, Time 1	-0.35	0.35	0.71
Suicide Attempt, Time 1	2.18 **	0.46	8.86
Depressive Symptoms, Time1	1.40 *	0.58	4.05
NSSI, Time 1	1.95 **	0.54	7.03

* $p < .05$;

** $p < .001$