

## BRIEF REPORT

# The Link Between Nonsuicidal Self-Injury and Acquired Capability for Suicide: A Longitudinal Study

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Despite recent findings that nonsuicidal self-injury (NSSI) is a strong predictor of suicide attempts, little empirical attention has been given to the mechanism through which NSSI increases suicide risk. The present 2-wave longitudinal study represents the first critical test of Joiner's (2005) hypothesis that NSSI is linked to lower pain sensitivity and fear of death over time (i.e., NSSI leads to acquired capability for suicide). Undergraduate students ( $N = 782$ ) at a midsized Canadian university completed measures of NSSI and acquired capability for suicide at 2 time points (1 year apart). Path analyses revealed that higher frequency of NSSI engagement in the past year was associated with greater acquired capability for suicide 1 year later, and that this link was unidirectional. This study provides the first longitudinal evidence that a potential mechanism for the link between NSSI and suicide attempts may be acquired capability for suicide, and suggests that targeting NSSI engagement could help to prevent individuals from acquiring the ability to enact more lethal forms of self-injury.

### General Scientific Summary

This study provides the first longitudinal evidence that a potential mechanism for the link between nonsuicidal self-injury and suicide attempts may be acquired capability for suicide (i.e., lower pain sensitivity and fear of death). This finding suggests that targeting nonsuicidal self-injury engagement could help to prevent individuals from acquiring the ability to enact more lethal forms of self-injury.

**Keywords:** nonsuicidal self-injury, acquired capability for suicide, pain sensitivity, fear of death, longitudinal

Nonsuicidal self-injury (NSSI; the direct and deliberate destruction or alteration of bodily tissue in the absence of suicidal intent, such as self-cutting, hitting, and burning; American Psychiatric Association, 2013) is prevalent not only among clinical samples (e.g., Jacobson, Muehlenkamp, Miller, & Turner, 2008), but also is a burgeoning health concern among community samples (e.g., Klonsky & Glenn, 2009; Whitlock et al., 2013). In fact, university students have a high risk for NSSI, with 15% to 19% of students reporting NSSI use while in university (Hamza & Willoughby, 2014; Whitlock, Eckenrode, & Silverman, 2006). Moreover, close to 40% of individuals who engage in NSSI report first-time NSSI engagement during the university years (Heath, Toste, Nedecheva, & Charlebois, 2008). Given these statistics, the Mental Health Commission of Canada issued a report in January 2015 suggesting

that NSSI use among university students is an area of tremendous concern.

Although NSSI has been explicitly differentiated from suicide attempts on the basis of nonlethal intent in the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association, 2013)*, these two forms of self-injurious behavior commonly co-occur among both clinical and community-based samples, and engaging in NSSI is associated with risk for suicide attempts (Hamza, Stewart, & Willoughby, 2012; Jacobson et al., 2008; Klonsky, May, & Glenn, 2013). Indeed, NSSI has been found to predict greater suicide attempts over time in several longitudinal studies (e.g., Asarnow et al., 2011; Whitlock et al., 2013; Wilkinson, Kelvin, Roberts, Dubicka, & Goodyer, 2011). Furthermore, NSSI has been found to be a *better* predictor of suicide attempts than many other risk factors (e.g., depressive symptoms, family function) as well as a past history of suicide attempts in some studies (Whitlock et al., 2013; Wilkinson et al., 2011). The mechanism underlying the association between NSSI and suicide attempts, however, remains poorly understood.

One compelling theory that has been proposed to account for the link between NSSI and suicide attempts is Joiner's (2005) Interpersonal Theory of Suicide. According to Joiner, in order to attempt or die by suicide, individuals must not only desire to end

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their life (i.e., they exhibit suicidal ideation) but also be able to overcome the basic self-preservation instinct (i.e., they must have acquired a *capability for suicide*; see Van Orden, Witte, Gordon, Bender, & Joiner, 2008 for cross-sectional support for this hypothesis; also Smith, Cukrowicz, Poindexter, Hobson, & Cohen, 2010). Acquired capability for suicide is thought to develop over time through repeated painful and provocative experiences (PPE), such as experiencing abuse, being in the military, and participating in contact sports. Repetitive engagement in NSSI behaviors also is thought to be an important PPE that increases acquired capability for suicide by desensitizing individuals to the fear and pain associated with more lethal self-injury over time (Joiner, Ribeiro, & Silva, 2012). Consistent with this hypothesis, recent *cross-sectional* research indicates that individuals who engage in NSSI have greater levels of self-reported acquired capability for suicide than noninjurers (Franklin, Hessel, & Prinstein, 2011). Moreover, individuals engaging in NSSI demonstrate lower pain sensitivity on lab-based tasks (e.g., cold-pressor, pressure algometer) compared with noninjurers (e.g., Hamza, Willoughby, & Armiento, 2014; St. Germain & Hooley, 2013), and lower pain sensitivity also has been associated with fearlessness toward death (Franklin et al., 2011).

These initial findings of a cross-sectional association between NSSI and acquired capability for suicide are consistent with Joiner's (2005) theory, but it is not clear from these studies whether NSSI leads to decreased pain sensitivity and fear of death over time or whether people with lower pain sensitivity are more likely to engage in NSSI over time than people with higher pain sensitivity (i.e., a self-selection effect), perhaps because they find these behaviors less aversive (Nock, 2010). These competing explanations also could be true with fear of death. The use of a longitudinal design, therefore, is critical to test Joiner's directional hypothesis that NSSI leads to decreases in pain sensitivity and fear of suicidal self-injury over time.

The present two-wave longitudinal study represents the first critical test of Joiner's (2005) hypothesis of the link between NSSI and acquired capability for suicide over time. On the basis of previous research, we hypothesized that individuals with more frequent engagement in NSSI would report greater acquired capability for suicide (i.e., lower pain sensitivity and fear of death) over time than individuals with less frequent or no NSSI engagement. We anticipated that the direction of effects only would be unidirectional, from NSSI to acquired capability for suicide, although we also directly tested for bidirectionality. Similar to Joiner's theory that acquired capability for suicide is unlikely to lead to a suicide attempt unless that individual also actively desires to end their own life (i.e., has suicide ideation), we did not expect that having an elevated acquired capability for suicide would lead an individual to seek out engagement in NSSI without that individual experiencing psychological distress (see Armeij, Crowther, & Miller, 2011; Muehlenkamp et al., 2009, and Nock, Prinstein, & Sterba, 2010 for research indicating an association between psychosocial distress and NSSI). In fact, two recent studies found that individuals who engage in NSSI did not report more engagement in other painful life events (e.g., getting tattoos, playing contact sports, getting into fights) than noninjurers (Franklin et al., 2011; Hamza et al., 2014). If individuals with high pain thresholds were more likely engage in painful behaviors, it would be expected that

self-injurers should also report more painful life events in general than noninjurers.

We also predicted that the relationship between NSSI and acquired capability for suicide would remain significant even when controlling for suicidal ideation (consistent with Joiner's (2005) theory that the pathway from NSSI to acquired capability for suicide is independent of suicidal ideation). Indeed, Joiner (2005) suggests that individuals who have an acquired capability for suicide do not necessarily have the desire to end their own life (in which case a suicide attempt is unlikely to occur).

A strength of the present study is that we examined the association between NSSI and acquired capability for suicide in a non-clinical population. According to Franklin, Hessel, and Prinstein (2011), the relationship between NSSI and acquired capability for suicide "may be even stronger and more cleanly observed in a nonclinical population because it is less tainted by factors associated with desire for suicide" (p. 363; see also Anestis, Bender, Selby, Ribeiro, & Joiner, 2011). Finally, beyond suicidal ideation, we also controlled for other potential "third variables," such as sex, parental education, age, whether participants were born in Canada or not, anxiety symptoms, and borderline personality disorder (BPD; see Hamza et al., 2012).

## Method

### Participants

The current sample was drawn from a larger sample of 1,132 (70.5% female) first-year undergraduate students ( $M$  age = 19.11,  $SD$  = 1.05) from a midsized Canadian university who completed a survey about aspects of their life annually (during February–March) for 5 years. In total, 87.5% of the participants were born in Canada, and the most common ethnic backgrounds reported other than Canadian were British (19%), Italian (16.8%), French (9.5%) and German (9%), which is consistent with the broader demographics for the region (Statistics Canada, 2006). Data on socioeconomic status indicated mean levels of parental education falling between "some college, university, or apprenticeship program" and "completed a college/apprenticeship/technical diploma." As not all of the study measures were included in the first three waves of the study, only data from the fourth and fifth waves were analyzed in the present study—these waves were completed by 782 students. Participants in this reduced sample did not differ at baseline from the 350 participants who did not complete the fourth and fifth waves on nonsuicidal self-injury, suicidal ideation, parental education, and whether they were born in Canada (all  $ps$  > .05), but they were more likely to be female, younger, and have higher anxiety scores (all  $ps$  < .05). Given that our analyses on the 782 students are based on two time points, we refer to these two waves as Time 1 and Time 2 throughout the rest of the article.

### Procedure

Students were invited to participate in the survey starting in first-year university. The study was advertised by way of posters, e-mails, classroom announcements, website posting, and residence visits. Students could participate regardless of academic major, and were given monetary compensation or course credit for their participation. Only students who completed the first wave were

invited (by e-mail and/or phone) to participate again in the next four waves (each assessment was one year apart). The University Ethics Board approved the study and all participants provided consent. Although asking young adults about self-injury does not have iatrogenic effects (e.g., Muehlenkamp, Walsh, & McDade, 2010; Reynolds, Lindenboim, Comtois, Murray, & Linehan, 2006) or lead to increased distress (Gould et al., 2005), to ensure the safety of our participants a full debriefing was provided at the end of the survey and a list was given of available mental resources and researcher contact information. Participants also were given the opportunity during the survey to provide their contact information so that they could be contacted by a mental health professional if they were experiencing any distress.

### Missing Data Analysis

Missing data occurred within each assessment time point because some students did not finish the entire questionnaire (average missing data = 1.50%), and because some students did not complete both waves of the survey (11.89%). Missing data analysis revealed that the missing data were not dependent on the values of the study measures ( $p > .05$ ). Thus, missing data were estimated using the full information maximum likelihood (FIML) estimation method. FIML retains cases that are missing survey waves, thus avoiding the biased parameter estimates that can occur with pairwise or listwise deletion (Schafer & Graham, 2002).

### Measures

**Demographics.** Age, sex, whether the participant was born in Canada or not, and parental education (one item per parent using a scale of 1 = *did not finish high school* to 6 = *professional degree*, averaged for participants reporting on both parents;  $r = .40$ ) were assessed at Time 1.

**Nonsuicidal self-injury (NSSI).** Participants completed the Inventory of Statements about Self-Injury (ISAS, Klonsky & Glenn, 2009) at both Time 1 and Time 2 to specify whether they had engaged in self-injury. A list of seven self-injurious behaviors that involved tissue damage (e.g., cutting, burning, head banging, biting, severe scratching to the point of bleeding, preventing wounds from healing, and rubbing skin against a rough surface) was provided. Participants were asked to indicate how many times they had intentionally engaged in each of the behaviors listed, without lethal intent, in the past year using the following seven categories: 1 = I have engaged in NSSI at some point in lifetime but not in the past year, 2 = 1 incident, 3 = 2–4 incidents, 4 = 5–10 incidents, 5 = 11–50 incidents, 6 = 51–100 incidents, 7 = more than 100 incidents (see Heath et al., 2008, and Hamza & Willoughby, 2014). The number of methods that participants engaged in was calculated by totaling the different types of NSSI behaviors participants endorsed. The ISAS has been shown to have good reliability and validity in previous research (Klonsky & Glenn, 2009).

**Acquired capability for suicide.** A 5-item shortened version of the Acquired Capability for Suicide Scale (ACS; Van Orden et al., 2008) was used to assess an individual's fearlessness about death and pain sensitivity (e.g., "Things that scare most people don't scare me" and "I can tolerate more pain than most people." At both time periods, participants rated each item on a 5-point

scale ranging from 1 = *not at all like me* to 5 = *very much like me*. The ACS questionnaire has shown good reliability and validity in previous studies (Bender, Gordon, Bresin, & Joiner, 2011; Van Orden et al., 2008). Cronbach's alpha in the present study was .763 at Time 1 and .787 at Time 2. Higher scores indicate higher levels of acquired capability for suicide.

**Borderline personality disorder.** Borderline personality disorder was assessed at Time 1 by the presence/absence of nine symptoms (e.g., unstable relationships, moodiness) from the McLean Screening Instrument for BPD (MSI-BPD; Zanarini et al., 2003). A total score was calculated by summing the number of symptoms participants reported. Cronbach's alpha was .830. Consistent with Zanarini et al. (2003) participants with total scores on the MSI-BPD of 7 and above were identified as being at risk for BPD.

**Suicidal ideation.** Suicidal ideation in the past year was assessed at Time 1 using a question from the Suicide Behaviors Questionnaire—Revised (SBQR; Osman, 2002; "How often have you thought about killing yourself in the past year?"). This item was rated using a 5-point scale that ranged from 1 = *never* to 5 = *very often*. The SBQR has been shown to have good internal consistency and validity in previous research (Osman, 2002).

**Anxiety symptoms.** The Behavior Inhibition System (Carver & White, 1994) 7-item scale was used at Time 1 to assess symptoms related to anxiety (e.g., "If I think something unpleasant is going to happen, I usually get pretty 'worked up'"). Items were rated using a 4-point scale ranging from 1 = *very true for me* to 4 = *very false for me*. The BIS has been shown to have adequate reliability and validity in previous studies (Carver & White, 1994), and Cronbach's alpha in our sample was .783. Higher scores indicate greater anxiety symptoms.

## Results

### Preliminary Analyses

At Time 1, 20.9% of the 782 participants indicated that they had engaged in NSSI at some point during their lifetime but not in the past year, 3.9% of the participants indicated that they engaged in NSSI once in the past year, 4.3% engaged in NSSI 2–4 times, 2.1% engaged in NSSI 5–10 times, 1.6% engaged in NSSI 11–50 times, 0.4% engaged in NSSI 51–100 times, and 0.3% engaged in NSSI more than 100 times. At Time 2, 26.0% of the participants indicated that they had engaged in NSSI during their lifetime but not in the past year, 2.8% of the participants indicated that they engaged in NSSI once in the past year, 2.2% engaged in NSSI 2–4 times, 1.5% engaged in NSSI 5–10 times, 1.1% engaged in NSSI 11–50 times, 0.3% engaged in NSSI 51–100 times, and 0.4% engaged in NSSI more than 100 times. For individuals who indicated involvement in NSSI in the past year, the most commonly endorsed types of self-injury were head banging (78.1% at Time 1 and 72.1% at Time 2), cutting (45.8% at Time 1 and 36.1% at Time 2), and biting (42.7% at Time 1 and 42.6% at Time 2), with the majority reporting more than one method of NSSI (i.e., 30.2% at Time 1 and 32.8% at Time 2 reported one method; 24.0% at Time 1 and 19.7% at Time 2 two methods; 14.6% at Time 1 and 21.3% at Time 2 three methods; and 31.2% at Time 1 and 26.2% at Time 2 four or more methods of self-injury). The study measures demonstrated acceptable skewness and kurtosis with the exception of

past year engagement in NSSI, which was transformed using the square root method (recommended for count data) to correct for non-normality.

**Primary Analyses**

The primary statistical analyses were carried out using an autoregressive cross-lagged path analysis in MPlus 7. Overall model fit was determined using the comparative fit index (CFI) and the root mean square error of approximation (RMSEA) indicators. The cut-off criteria recommended by Hu and Bentler (1999) for a well-specified model are a CFI >.95 and a RMSEA <.06, simultaneously. The model was comprised of two variables measured over 2 years: NSSI and acquired capability for suicide (see Figure). Across the two time periods we included the following paths: cross-lagged paths between NSSI and acquired capability for suicide; autoregressive paths (i.e., within variable) for NSSI and acquired capability for suicide; and concurrent associations between NSSI and acquired capability for suicide within each wave. We also included sex, parental education, age, whether participants were born in Canada or not, suicidal ideation, anxiety symptoms, and BPD as covariates. Correlations were specified among the study variables at Time 1 and the covariates (other than between age and gender as a significant correlation was not expected). Paths also were estimated among the covariates and the study variables at Time 2. Any significant paths, therefore, accounted for the correlations among the variables within a wave and controlled for previous scores on the outcome variables, covariates, and other predictors in the model (i.e., to allow for the estimation of the unique relation between study variables).

Model fit was good,  $\chi^2(1) = 1.383, p = .240, CFI = 1.000, RMSEA = .022 (.000-.101)$ . The results of the path analyses indicated that higher frequency of past year engagement in NSSI significantly predicted higher levels of acquired capability for suicide over time,  $B = .066, SE = .044, p = .029$  (see Table 1). This relationship was not found to be bidirectional; that is, higher levels of acquired capability for suicide did not predict NSSI over time,  $B = -.010, SE = .015, p = .667$ . In terms of covariates, being born in Canada was found to be a predictor of higher acquired capability for suicide,  $B = .074, SE = .088, p = .013$ .

**Discussion**

The purpose of the present study was to directly test Joiner’s (2005) theory that NSSI is a painful and provocative event that leads to a higher acquired capability for suicide (i.e., lower pain sensitivity and fear of death) over time. The theory was supported as higher frequency of past year engagement in NSSI predicted higher acquired capability for suicide over time, even after controlling for other risk factors (e.g., sex, age, anxiety). Most importantly, our study revealed a *longitudinal* link between NSSI and acquired capability for suicide. Other researchers have found that NSSI is an important risk factor in predicting suicide attempts over time (e.g., Asarnow et al., 2011; Whitlock et al., 2013), but this is the first longitudinal study focusing on the underlying mechanism that might be responsible for this relationship.

Our findings also suggest that the link between NSSI and acquired capability for suicide is unidirectional—from NSSI to acquired capability for suicide. Thus, it is not that people with lower pain sensitivity and fear of death (i.e., acquired capability for

Table 1  
*Autoregressive Cross-Lagged Model Results*

	<i>r</i>	$\beta$	95% CI	<i>B</i>	<i>SE</i>
<b>Structural paths</b>					
ACS1 → NSSI2		-.010	[-.056, .036]	-.007	.015
NSSI1 → ACS2		.066*	[.007, .125]	.096	.044
ACS1 → ACS2		.627***	[.573, .681]	.638	.034
NSSI1 → NSSI2		.825***	[.797, .852]	.783	.032
Sex → ACS2		-.048	[-.108, .012]	-.106	.068
Sex → NSSI2		.007	[-.036, .050]	.010	.032
Age → ACS2		-.009	[-.067, .049]	-.010	.033
Age → NSSI2		.003	[-.037, .043]	.002	.015
Parental education → ACS2		.038	[-.020, .096]	.028	.022
Parental education → NSSI2		-.036	[-.068, .014]	-.017	.015
Canadian born → ACS2		.074*	[.016, .133]	.219	.088
Canadian born → NSSI2		.001	[-.039, .041]	.002	.039
Suicidal ideation → ACS2		.057	[-.010, .123]	.073	.044
Suicidal ideation → NSSI2		.011	[-.037, .059]	.009	.020
Anxiety symptoms → ACS2		-.054	[-.120, .012]	-.113	.071
Anxiety symptoms → NSSI2		.024	[-.022, .071]	.033	.033
BPD → ACS2		.060	[-.002, .122]	.206	.109
BPD → NSSI2		.037	[-.007, .081]	.083	.050
<b>Correlations for primary variables</b>					
ACS1 ↔ NSSI1	.103**				
ACS2 ↔ NSSI2	.112**				

*Note.* NSSI = nonsuicidal self-injury; ACS = acquired capability for suicide; BPD = borderline personality disorder. *r* = correlation; *B* = standardized beta weights; CI = confidence interval for *B*; *B* = unstandardized beta weights; *SE* = standard error. Numbers 1 and 2 indicate Time 1 and Time 2, respectively. Correlations for covariates are not shown and are available from the first author.

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

suicide) may just be more likely to engage in NSSI over time than people with higher pain sensitivity and fear of death (i.e., a self-selection effect) because they find these behaviors less aversive. In fact, extensive research has indicated that NSSI tends to be preceded by psychosocial distress (Armey et al., 2011; Muehlenkamp et al., 2009; Nock et al., 2010), suggesting that psychosocial distress also may need to be present for the frequency of NSSI to increase over time.

At the same time, an important question that remains is *why* NSSI leads to lower pain sensitivity and fear of death over time. Joiner (2005) suggests that opponent processes may reinforce this link; that is, with repeated NSSI engagement the primary process of pain and fear of self-injury may be increasingly offset by the opponent process of relief from negative emotions, which over time should lead to less pain sensitivity and fear of death. Experimental findings testing this hypothesis, however, are mixed (e.g., Franklin, Lee, Hanna, & Prinstein, 2013). Alternatively, it may be that the link between NSSI and lower pain sensitivity and fear of death is driven by desensitization or habituation, or by a motivation for self-punishment that leads over time to greater tolerance for pain (see Hamza et al., 2014). Further research is needed to test these hypotheses.

Despite the many strengths of our study, including a large sample, the use of a longitudinal design, as well as the examination of multiple covariates, our study is not without limitations. First, although the present study included a large sample of university students, the majority of the sample participants enrolled in the study were born in Canada and of Caucasian ethnicity; therefore, the generalizability of this study to other geographical regions may be limited. Second, it would be valuable for future research to assess self-injurious behaviors and ideations in real time through techniques such as ecological moment sampling (i.e., daily diaries). Third, some of the standardized coefficients were small. However, small effect sizes are common in cross-lagged models when controlling for previous scores (autoregressive scores) and covariates, as well as accounting for the correlations among the variables within a wave (Adachi & Willoughby, 2015). Thus, small effects would be expected. Fourth, while we controlled for several important covariates (e.g., age, sex, anxiety, etc.), it is possible that other unmeasured variables (e.g., novelty-seeking) may be related to both ACS and NSSI. Fifth, the present study focused only on the NSSI to acquired capability for suicide component of Joiner's model. It is important for future research to examine Joiner's model in its entirety, particularly with a longitudinal design that examines the link between acquired capability for suicide and suicide attempts, and which seeks to confirm cross-sectional findings that higher acquired capability for suicide is a risk factor for suicide attempts only in the presence of high suicidal ideation (e.g., Smith et al., 2010; Van Orden et al., 2008). Finally, because acquired capability for suicide was measured through self-report questions, it is unclear whether this measure of pain sensitivity represents actual pain sensitivity. Future research would benefit from using a lab-based test such as a cold pressor test to help address this question.

### Conclusion

In conclusion, the present study helps to test current theory by clarifying the role of NSSI in increasing acquired capability for

suicide over time. Importantly, NSSI has been found to occur at surprisingly high rates in nonclinical adolescent and college populations (Mental Health Commission of Canada, 2015; Whitlock et al., 2013) and suicide is the second leading cause of death among youth aged 15 to 24 (Statistics Canada, 2009); thus, there is a strong need for research that investigates the mechanism through which engagement in NSSI may lead to future suicide risk. Although our study did not specifically examine the link from NSSI to suicide attempt, our findings suggest that one way individuals may acquire the ability to enact lethal self-injury is through NSSI engagement. Developing a deeper understanding of the constructs involved in the interpersonal theory for suicide can lead to better prevention methods and suicide risk assessments by clinicians. For example, targeting NSSI engagement could help to prevent individuals from acquiring the ability to enact more lethal forms of self-injury.

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