

Assessment of Non-Suicidal Self-Injury: Development and Initial Validation of the Non-Suicidal Self-Injury Assessment Tool (NSSI-AT)

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Abstract

Research tools for assessing non-suicidal self-injury (NSSI) epidemiology in community populations are few and either limited in the scope of NSSI characteristics assessed or included as part of suicide assessment. Though these surveys have been immensely useful in establishing the presence of NSSI and in documenting basic epidemiological characteristics, they have been less useful in describing secondary NSSI features such as NSSI context, habituation or perceived life impact. The aim of the current study was to examine the reliability of the test scores and validity of test score interpretations in a university population for the NSSI-Assessment Tool (NSSI-AT), a web-based measure of NSSI designed to assess primary (such as form, frequency, and function) and secondary (including but not limited to NSSI habituation, contexts in which NSSI is practiced, and NSSI perceived life interference, treatment, and impacts) NSSI characteristics for research purposes. Data for these analyses were drawn from three samples, all of which were originally part of a 2007 study of randomly selected students from 8 Northeast and Midwest public and private universities who participated in a web-based study entitled the *Survey of Student Wellbeing*. Overall, results provide support for the reliability of NSSI-AT test scores (as assessed by test-retest) and validity of NSSI-AT test score interpretations for the behavior and frequency modules (as assessed using concurrent, convergent and discriminant evidence) in this population. Implications for research as well as next steps are discussed.

Keywords (5): College; Non-suicidal self-injury; Measurement; Self-injurious behavior; Validation

Rates of non-suicidal self-injury (NSSI) among youth and young adults are high and of concern within both clinical and community populations (see Jacobson and Gould (2007) and Rodham and Hawton (2009) for reviews). Defined as behaviors in which an individual intentionally harms the body without overt suicidal intent and for reasons that are not socially sanctioned (International Society for the Study of Self Injury, 2007), NSSI typically entails behaviors such as cutting, burning, scratching, and self-battery (Lloyd-Richardson, Perrine, Dierker, & Kelley, 2007; Walsh, 2012; Whitlock et al., 2011). Lifetime prevalence estimates of NSSI are quite variable and range from 12% to 46% in adolescent and young adult populations (Gratz, Conrad, & Roemer, 2002; Heath, Toste, Nedecheva, & Charlebois, 2008; Lam, Peng, Mai, & Jing, 2009; Lloyd-Richardson et al., 2007; Polk & Liss, 2007; Whitlock et al., 2011; You, Van Orden, & Conner, 2011). Whether this wide range reflects actual variation in rates of NSSI or lack of consistency in the way it is measured is unclear, but merits exploration, since such wide prevalence ranges reduce confidence in overall estimates of NSSI in the absence of meaningful theory to explain the vast differences.

Research tools for assessing NSSI epidemiology in community populations are few and either limited in the scope of NSSI characteristics assessed or included as part of suicide assessment. In order to understand NSSI apart from suicidal thoughts and behaviors (STB), most studies of NSSI in community populations of youth and adults rely on one of two measures, for which at least some psychometric data are available: the Deliberate Self Harm Inventory (DSHI; Gratz, 2001) and the Functional Assessment of Self-Mutilation (FASM; Lloyd, Kelley, & Hope, 1997). Both the DSHI and the FASM include measures intended to assess primary NSSI characteristics (specific NSSI behaviors, frequency, and severity), with the FASM including information on the length of time respondents contemplated the behavior before injuring,

whether NSSI was performed under the influence of drugs or alcohol, and the degree of physical pain experienced during the act. The FASM also includes a section designed to assess NSSI function that has been widely used and tested in several studies (Lloyd-Richardson et al., 2007; Nock & Prinstein, 2004; Yates, Tracy, & Luthar, 2008). The Inventory of Statements About Self-Injury (ISAS; Glenn & Klonsky, 2011; Klonsky & Glenn, 2009; Klonsky & Olino, 2008) has emerged more recently and also includes several items intended to measure primary NSSI characteristics, including a comprehensive section on function. In addition to these assessment tools, measures intended to assess NSSI as part of a continuum of self-injurious behavior are also used (Self-Harm Behavior Questionnaire (SHBQ), Gutierrez, Osman, Barrios, & Kopper, 2001; Self-Injurious Thoughts and Behaviors Interview (SITBI), Nock, Holmberg, Photos, & Michel, 2007; Suicide Attempt Self-Injury Interview (SASSI), Linehan et al., 2006), but contain only a single (SHBQ) or small number (SITBI) of items specific to NSSI. The SASSI (Linehan et al., 2006) does contain several primary characteristic items related to NSSI, but is designed primarily to be administered in person and has been most often used in clinical populations.

These existing surveys have been immensely useful in establishing the presence of NSSI and in documenting basic epidemiological characteristics such as frequency, function, and whether medical treatment was needed (as a proxy for injury severity). Such measures have been less useful, however, in robustly describing forms and functions as reported by those who self-injure, including the contexts within which NSSI is practiced (e.g., social contexts), variation in NSSI habituation and perceived life interference, and impacts of NSSI. However, because these additional dimensions offer information of use in understanding the broader context within which NSSI occurs, the full range of experiences measured by the NSSI-Assessment Tool (NSSI-AT) are useful in identifying the biopsychosocial dimensions of NSSI commonly noted as

important in clinical settings (Walsh, 2012). Similarly, mapping the psychosocial contours of NSSI is likely to be useful in intervention and prevention efforts since these efforts must often take into consideration contextual and subjective experience factors broader than those captured by measures aimed at assessing diagnostic-equivalent (since NSSI is not yet a formal diagnosis) thresholds and types. And, although the development of standardized self-injury continuums have allowed for greater clarity in conceptualizing the relationship of NSSI to STB, as Nock et al. (2007) noted, such efforts have resulted in measures useful in assessing self-injury broadly conceived, but also tend to conflate NSSI (sometimes called “parasuicide”) with suicidal behavior. Thus, measures that investigate the relationship with STB, but which allow for the careful delineation of the two behaviors, are needed. Moreover, few existing measures include domains of experience and language grounded in the discourse of those who practice NSSI.

The aim of the current study was to examine the reliability of scores on a number of (NSSI-AT) questions and modules as well as the validity of NSSI-AT behavior and frequency module interpretations in a university population. The NSSI-AT is a web-based measure of NSSI, designed for use in community populations of young adults and adults for research purposes. The NSSI-AT was developed in 2005 to assess primary (such as form, frequency, and function) and secondary (including but not limited to NSSI habituation, contexts in which NSSI is practiced, and NSSI perceived life interference, treatment, and impacts) NSSI characteristics, as well as the complex relationship between NSSI and STB. For those who screen positive to the initial NSSI assessment, the NSSI-AT generally requires from 5-20 minutes depending on modules used and the degree of detail respondents provide in qualitative fields. The NSSI-AT was developed in stages, first by reviewing existing literature, then closely examining existing assessment tools, and finally through interviews with individuals who self-injure and service

professionals who directly work with individuals who self-injure as a means of assuring that the language and constructs used by individuals with direct NSSI experience were represented. To date, the NSSI-AT has been used in several large-scale surveys (Baetens, Claes, Hasking, Grietens, Onghena, & Martin, 2012; Cheng, Mallinckrodt, Soet, & Sevig, 2010; Whitlock, Eckenrode, & Silverman, 2006; Whitlock et al., 2011), including a longitudinal study collecting data over a three-year period (Whitlock et al., 2012). An initial examination of test-retest reliability evidence, as well as content, concurrent, convergent and discriminant validity evidence, for the NSSI-AT in a university population is presented here.

Method

Participants

Data for these analyses were drawn from three samples, all of which were originally part of a 2007 study of randomly selected students from 8 Northeast and Midwest public and private universities that participated in a web-based study entitled the *Survey of Student Wellbeing* (SSWB; see Whitlock et al., 2011 for more detail on the sample selection procedures). Five of the eight schools were private, one was a mix of public and private, and two were public. School size and population varied considerably, ranging from fewer than 2000 undergraduates to over 11,000 undergraduates. The analyses in this paper draw primarily on data from the main cross-sectional sample (Sample One), as well as two sub-samples of Sample One, a test-retest sub-sample (Sample Two), and a longitudinal sub-sample (Sample Three; Table 1).

Sample One. The original, cross-sectional sample of 14,385 students from the 8 original universities. In order to assess reliability of NSSI-AT scores and validity of NSSI-AT score interpretations in a young adult population, the sample used for this paper was restricted to participants under the age of 26, yielding a final sample size of 11,529. This sample was

representative of the overall student population across all 8 universities in terms of ethnicity, age, and socioeconomic status, although more females than males participated (57.6% vs. 41.7%; $Z = 14.96, p < .001$). Of the total Sample One population ($N=11,529$), 15.4% ($n=1773$) reported any NSSI behavior: only individuals reporting any NSSI behavior on module A were shown the remainder of the NSSI-AT modules (i.e., modules B through I; Table 2). Unless otherwise specified, data in this paper come from Sample One.

Sample Two. The test-retest sub-sample, used to assess reliability of NSSI-AT scores in this population. A random sub-group of 300 students in one of the universities was invited to participate in a 4-week follow-up administration of the SSWB, which included the complete NSSI-AT. Of the 300 invited participants, 196 participants completed the re-test administration. Of these, 12.8% ($n=25$) reported any NSSI at time 1 and/or 2 (compared to a 15.4% NSSI prevalence in the entire study population at baseline; Table 1). Due to the small size of the NSSI sub-population in Sample Two ($n=25$), test-retest analyses were not restricted by age. Test-retest analyses are reported in Table 3 for NSSI-AT scores we expected to be stable over the 4 week re-test period.

Sample Three. The longitudinal sub-sample was used to supplement assessments of the validity of NSSI-AT score interpretations for the behavior and frequency modules. This sample was collected in 5 of the original 8 schools in three waves (2007, 2008, and 2009). Of the 2,320 participants who were invited to participate in the longitudinal study, 1,466 provided data (63.2% response rate). For the present analyses, only those who participated in both Waves 1 and 2 and who were under the age of 26 at Wave 1 were included ($n=815$). Of these, 15.5% ($n=126$) reported NSSI at Wave 1. Data from Sample Three are reported in Table 4.

Study Design and Questionnaire

The SSWB was administered on a secure Internet server and required 15-30 minutes to complete. The study was approved by all participating universities' Committees for Human Subjects. All participants provided on-line consent before taking the survey and were free to discontinue at any time. Multiple response enhancement strategies (e.g., incentives, follow-up reminders, personalized invitations) were employed. Links to local mental health resources were provided throughout the survey.

Measures

NSSI-AT. The NSSI-AT was developed via a thorough review of existing academic literature, exploratory interviews with 27 young adults with NSSI experience, and 9 interviews with mental health practitioners (e.g., pediatrician, secondary school counselor, psychiatrist, psychologist, etc.) who had extensive experience working with self-injurious adolescents and young adults. These interviews assessed a broad array of epidemiological and contextual characteristics associated with NSSI, and, in combination with a review of extant tools and the literature, were the basis for the original NSSI-AT, which was piloted in a two-college study (Whitlock et al., 2006; Whitlock & Knox, 2007; Whitlock, Muehlenkamp, & Eckenrode, 2008) and refined for use in an eight-college sample (Kress, Newgent, Whitlock, & Mease, in press; Muehlenkamp, Brausch, Quigley, & Whitlock, 2013; Whitlock et al., 2011) and related longitudinal study (Whitlock et al., 2012). The NSSI-AT is comprised of 12 modules: a) behavior-based screening questions (self-injury forms); b) functions; c) recency and frequency (and age of cessation); d) age of onset; e) wound locations; f) initial motivations; g) severity; h) practice patterns; i) habituation and perceived life interference; j) NSSI disclosure; k) NSSI treatment experiences; and l) personal reflections and advice (Table 2; see Appendix for full

instrument). When administered, the entire sample is given the first module (behavior-based screening questions), but remaining modules are visible only to those who screen positive for NSSI.¹ Although it can be administered as a paper and pencil assessment, the NSSI-AT was designed as a web-based data collection tool to accommodate skip patterns that permit deeper-level questioning when indicated.

A) Behavior-based screening questions (Self-injury forms). To screen for NSSI, all participants were asked, “Have you ever done any of the following *with the purpose of intentionally hurting yourself?*” followed by a list of 16 NSSI behaviors, plus an “other” option (Table 2; behaviors listed in Table 2 were endorsed by $\geq 5\%$ of the sample). Behaviors that were endorsed by less than 5% of the NSSI sample include: engaged in fighting or other aggressive activities with the intention of getting hurt (4.1%); tried to break your own bone(s) (2.1%); ingested a caustic substance(s) or sharp object(s) (Drano, other cleaning substances, pins, etc.) (1.0%); dripped acid onto skin (0.6%); and broke your own bone(s) (0.4%). Participants could also respond that they had never intentionally hurt themselves in any of these ways. A positive endorsement of any NSSI behavior moved the participant into the remaining modules of the NSSI-AT, while those participants indicating that they had never engaged in any NSSI behavior, or who did not complete this question, were skipped out of the remainder of the NSSI-AT. Suicidal intent was not screened out in the preliminary NSSI assessment stage; rather, this was accomplished through assessment of function.

B) Functions. The 18 function questions were developed through iterative analyses of qualitative interviews with individuals with self-injury history and treatment specialists, as well

¹The subsequent paragraphs (from “Behavior-based screening questions” to “Personal reflections and advice”) report on different modules within the NSSI-AT. However, this is not a complete list, and only pertains to those modules highlighted in Table 2. For a complete list of all modules and items, please see the Appendix.

as through review of extant function literature. In these items, participants were asked to select the statements that best described why they intentionally hurt themselves. Using exploratory factor analysis (EFA) under oblique rotation, five latent factors emerged from these questions: Affective Imbalance - Low Pressure (4 items; management of depressive or dissociated emotion states), Social Communication and Expression (3 items; social communication), Self-Retribution and Deterrence (4 items; self-punishment or as an alternative to other, more severe behaviors), Sensation Seeking (4 items; use as a stimulant), and Affective Imbalance - High Pressure (3 items; management of agitating or high energy affective states). Scale items are listed in Table 2. Also included in the list of function items were questions that assessed suicidal intent. Individuals who indicated that they used the behaviors assessed in the NSSI screening question *only* as a means of practicing or attempting suicide ($n=61$) were skipped out of the remainder of the NSSI-AT. Individuals who endorsed suicide functions as well as other functions were asked a follow-up clarification question, “In the above question, you indicated that you intentionally hurt yourself with the intention of practicing or committing suicide. Was practicing or attempting suicide the primary reason you intentionally hurt yourself?” A “yes” response to this question skipped participants out of the remainder of the NSSI-AT items.

C) Recency and frequency (and age of cessation). Recency was assessed by asking participants to report on the last time they intentionally hurt themselves (7-point interval scale, *less than 1 week ago to more than 2 years ago*). Because NSSI can be cyclical, cessation was also assessed using this item: if it had been at least one year since their last NSSI incident, the participant was then asked how likely he or she was to self-injure again (5-point interval scale, *very unlikely to very likely*). Individuals indicating that their last self-injury was a year ago or more and that they were *very unlikely* or *somewhat unlikely* to self-injure again were assumed to

have ceased self-injury, and were asked how old they were when they last self-injured (Table 2). To assess frequency, participants reported the approximate number of total occasions on which they had hurt themselves (7-point interval scale, *only once to more than 50 times*). Participants in this module were also asked to estimate the raw total number of occasions on which they had hurt themselves, in order to provide greater flexibility in analyses. However, responses to this question were widely variable and, when on the higher end of the range, were often reported as “a lot” or “over 100” or “1000.” Thus, the responses to the forced-choice response option question were deemed more reliable and used in the present analyses.

D) Age of onset. Participants were asked to supply the age at which they first intentionally hurt themselves (Table 2).

E) Wound locations. Using a list of 17 locations (including an “other” category), participants were asked to specify on what area(s) of their body they had intentionally hurt themselves (Table 2; locations listed in Table 2 were endorsed by $\geq 5\%$ of the sample). Wound locations that were endorsed by less than 5% of the NSSI sample include: other (4.3%; locations not specified), shoulders or neck (3.9%), feet (3.7%), breasts (3.0%), lips or tongue (2.9%), back (2.4%), genitals or rectum (1.1%), and buttocks (0.9%).

G) Severity. Severity of NSSI was assessed using eight items, including items that assessed a) whether participants had ever hurt themselves more severely than expected (dichotomous), b) if they had ever hurt themselves so badly they should have been seen by a medical professional, even if they were not (dichotomous), and c) if they had ever sought medical treatment for any injuries they had caused (dichotomous; Table 2).

H) Practice patterns. Using dichotomous response options, participants responded to seven items about the nature of their NSSI (note: in subsequent administrations, response options

were changed to a 5-point interval scale, and so this is presented in the Appendix). When the dichotomous items were analyzed using EFA under varimax rotation, two latent factors emerged: Social Dimensions of NSSI Practice (4 items) and Routines (3 items; Table 2).

I) *Habituation and perceived life interference.* To assess NSSI habituation, participants responded to four items on a 5-point interval scale (*strongly disagree* to *strongly agree*) intended to assess characteristics common in habituation patterns, including tolerance, intensity, and lack of control over behavior (Shadel, Shiffman, Niaura, Nichter, & Abrams, 2000). Items included in the scale were, 1) I have had to intentionally hurt myself more deeply and/or in more places on my body over time to get the same effect; 2) I want to stop intentionally hurting myself altogether, but have trouble stopping; 3) I will not need help from someone to stop intentionally hurting myself altogether - I can do it on my own; and 4) When I have the urge to intentionally hurt myself it is easy to control it. Using EFA under varimax rotation, one latent factor emerged from the four included questions (Table 2). To assess perceived life interference, participants were asked if the fact that they hurt themselves was a problem in their life (5-point interval scale, *strongly disagree* to *strongly agree*).

K) *NSSI treatment experiences.* The five treatment questions focused on therapy, including if the participant had ever gone to therapy, and if they had gone to therapy because of their NSSI (Table 2). Participants who had ever seen a therapist were also asked if they had hurt themselves again after therapy stopped, and of these, 41.1% reported that they no longer self-injured after treatment. Response options for the treatment questions were a mix of nominal, ordinal, and open-ended (see Appendix).

L) *Personal reflections and advice.* The final two items on the NSSI-AT asked participants to reflect on their NSSI experience, including asking the participant to select all the

ways that intentionally hurting themselves has impacted their life, both positively and negatively, from a list of 7 response options (Table 2). Using EFA under oblique rotation, two latent factors emerged from these seven impact items (Table 2).

Evidence of validity. To support validity arguments, several analyses were performed to provide validity evidence based on the relationship of NSSI-AT scores with other variables. First, data were collected on the behavior module from the FASM (Lloyd-Richardson et al., 2007) from a random subset of Sample Three participants ($n=122$). The FASM was designed to assess NSSI behaviors and functions in adolescent samples, and has evidence of reliability and validity in high-school aged adolescents (Lloyd-Richardson et al., 2007). The 11 FASM behavioral items include both minor NSSI (e.g., hitting self, biting self) and moderate/severe NSSI (e.g., cutting/carving, burning). Following Lloyd-Richardson et al. (2007), for these analyses we excluded participants who reported that their only NSSI behavior was “picked at wound” (p. 1186). Participants who endorsed any of the remaining 10 items were considered to possess self-injury history on the FASM screen (1=Yes, 0=No). We hypothesized that NSSI behaviors reported on the NSSI-AT would be positively and significantly associated with NSSI behaviors reported on the FASM.

Second, existing literature suggests that NSSI should be more strongly correlated with mental health variables than with other risk-taking behavior variables (Hasking, Momeni, Swannell, & Chia, 2008; Williams & Hasking, 2010); thus, to provide convergent evidence, we included STB, disordered eating, general psychological distress, and lifetime trauma, and hypothesized that each of these would be positively and significantly associated with any NSSI and lifetime NSSI frequency. To provide discriminant evidence, we included binge-drinking, number of sexual partners, and lifetime prescription drug use, and hypothesized that these would

not be significantly associated with any NSSI or lifetime NSSI frequency. These data were all from Sample One, except for data on sexual partners and prescription drug use, which were collected from Sample Three. Descriptives for these variables are listed in Table 4.

To measure STB, a scale developed by Kessler and colleagues (2005) was used. Participants were asked if they had ever seriously considered or attempted suicide. Participants who reported any STB were then asked a series of questions to assess thoughts (i.e., seriously thought about suicide, made a general plan but did not carry it out) and behaviors (e.g., left a note, had a method, made a serious attempt). Participants endorsing either of the thought questions, but none of the behavior questions, were coded as experiencing suicidal thoughts only; the comparison group was participants reporting no suicidal thoughts or attempts (1=Yes, 0=No). Participants endorsing any of the five behavior items were coded as experiencing suicidal behaviors; the comparison group was participants reporting no suicidal thoughts or attempts (1=Yes, 0=No). To assess disordered eating, items from the American College Health Association National College Health Assessment (2003) were used. Participants were asked if they had ever repeatedly severely restricted their eating, binged and purged, over-exercised to lose or manage their weight, and/or used laxatives or diet pills. A dichotomous variable reflects endorsement of any of these disordered eating behaviors (1=Yes, 0=No). General psychological distress was assessed using the K6 (Kessler et al., 2002), a 6-item questionnaire. Participants were asked, in the past 30 days, how often they had experienced certain feelings (e.g., hopelessness), and answers were provided using a 4-point interval scale (1=*none of the time* to 4=*most of the time*). Responses across the 6 items were summed to create the psychological distress score ($\alpha=0.81$). Lifetime trauma was assessed using items from the Trauma History Questionnaire (Green, 1996) by asking participants if they had experienced any of six traumatic

events (e.g., death of a parent). Responses across the six items were summed to index the number of traumas the participant had experienced in his/her lifetime.

Binge drinking was also assessed using standard items from the American College Health Association National College Health Assessment (2003), by asking participants to recall the occasion on which they drank the most in the past two weeks, and then to record how many drinks they had on that occasion; binge drinking was defined as ≥ 4 drinks for women, and ≥ 5 drinks for men (NIAAA, 2012). To assess number of sexual partners (Hansen, Paskett, & Carter, 1999), participants were asked how many different partners they had sexual intercourse with in the past year, on a scale ranging from none to 10 or more. To assess prescription drug use (McCabe, West, & Wechsler, 2007), participants were asked on how many occasions they had used sleeping medication, sedative/anxiety medication, stimulant medicine for ADHD and/or pain medication that *had not* been prescribed to them. A dichotomous variables reflects any use of these non-prescribed drugs (1=Yes, 0=No).

Socio-demographics. Included were age, sex, and race/ethnicity (White, African-American, Hispanic, Asian, Other). Socio-demographic information for all three samples is presented in Table 1.

Analysis

The NSSI-AT is intended to present a broad, holistic picture of NSSI practice. However, since this survey is also intended to be administered to large, community samples, the number of items exploring each area is limited. Similar to arguments presented when validating the SITBI (Nock et al., 2007), factor analyses and internal reliability coefficients are generally not theoretically or empirically meaningful in this context, and therefore are not presented for the measure as a whole. However, there are modules of the NSSI-AT for which we did conduct

EFA, to aid in final variable selection (specifically, NSSI habituation, NSSI functions, NSSI practice patterns and NSSI personal reflections and advice; Table 2). While we found that the scales derived from EFA factored cleanly and explained a reasonable percentage of cumulative variance (34%-53%), in general, the alphas for these scales were low (range, 0.38-0.66), presumably because of the small number of items per scale (range, 3-4 items), because these items were not designed as scales, and possibly because of the dichotomous nature of the scoring for most items. Internal consistency reliability coefficients for all factored scales are presented in Table 2. In future administrations, we recommend Likert-type scales if the survey time permits, as opposed to dichotomous scoring.

To analyze the data from this survey, we calculated descriptive statistics for socio-demographics and the NSSI-AT questions. Reliability of NSSI-AT scores on individual questions and scales was assessed using test-retest analyses. Test-retest analyses were performed by using kappa statistics for dichotomous variables (Landis & Koch, 1977), and by using one-way random intraclass correlation coefficients (ICC) [1,1] for ordinal and continuous variables (Shrout & Fleiss, 1979). ICC[1,1] tests were performed using a test value of 0.70, with the hypothesis that coefficients should not significantly differ from 0.70, as this is a recommended minimum acceptable correlation for test-retest reliability (Kline, 2000, p. 26). Concurrent, convergent and discriminant evidence of validity, as demonstrated by associations between NSSI-AT scores and other variables, was assessed using kappa statistics (concurrent) and correlations (convergent, discriminant).

Results

Descriptive Statistics

Descriptive statistics for the three samples are presented in Table 1. For our primary analysis sample (Sample One, $N=11,529$), the mean age (SD) was 20.31 (1.80), and 64.3% reported their race/ethnicity as White.

Insert Table 1 about here

Descriptives for the majority of NSSI-AT variables and scales are presented in Table 2, including information on habituation, functions, practice patterns, and personal reflections and advice (see also Whitlock et al., 2011). In the cross-sectional sample of college students (Sample One), 15.4% reported any NSSI behavior. The majority of the NSSI sub-sample had hurt themselves 2 to 10 times in their lifetime (55.8%), and had initiated NSSI behaviors at age 15.27 (SD=3.16) (Table 2). The mean (SD) number of wound locations was 2.21 (1.63). Among those who self-injured, 19.5% had hurt themselves more severely than expected, and 20.6% reported that NSSI was a problem in their life (Table 2). The majority of this sample (54.4%) had not gone to therapy because of their NSSI behavior (Table 2).

Insert Table 2 about here

Reliability of NSSI-AT Test Scores

Test-retest reliability data from Sample Two for NSSI-AT scores expected to be stable over a 4-week period are presented in Table 3. The test-retest coefficient for any NSSI, obtained

by looking at agreement in the whole retest sample ($N=196$), was in the substantial agreement range, as described by Landis and Koch (1977). Scores for all other variables, assessed in the NSSI sub-sample only ($n=25$), showed a good degree of agreement between test occasions, with no test-retest coefficients significantly differing from the test value of 0.70, except the value for age at first self-injury, which was significantly higher ($ICC[1,1]=.91, p=.01$). The degree of test-retest association was lowest for number of wound locations ($ICC[1,1]=.63$), which may be because wound locations changed over the period between the initial test and the re-test four weeks later, though may also be due to recall bias coupled with small sample size. Overall, the test-retest coefficients obtained by looking at agreement on a number of NSSI-AT variables and scales over a 4-week period indicated that NSSI-AT scores exhibited preliminary reliability in our university population.

Insert Table 3 about here

Validity of NSSI-AT Test Score Interpretations

Evidence based on test content. As described above, several steps were taken to rigorously develop NSSI-AT test content at the outset, including tool construction grounded in a) a thorough review of extant theory, b) existing measures, and c) in-depth interviews with individuals with varied backgrounds and experience. The tool was also piloted with representatives of the target population and reviewed by clinicians willing to provide detailed feedback on content wording, representativeness, and ordering. All information yielded from this pilot was consistent with extant clinical and research portraits of NSSI in adolescent and young

adult populations (Conterio & Lader, 1998; Nock & Prinstein, 2005; Ross & Heath, 2002; Selekman, 2009; Walsh, 2012).

Evidence based on relations to other variables. Substantial agreement existed between reports of any NSSI behaviors on the NSSI-AT and reports of any NSSI behaviors on the FASM (i.e., reports of any NSSI behavior as assessed by each measure, where 1=Yes and 0=No; $Kappa=0.77$, $p < .001$, 95% CI (0.61, 0.93)). Although this agreement is substantial, where there were differences in agreement, these likely occurred because items on the NSSI-AT assess behaviors that are generally more severe in nature than those assessed on the FASM. For example, the FASM asks participants if they have ever hit themselves on purpose, while the NSSI-AT asks participants if they have ever punched or banged themselves to the point of bruising or bleeding. In this sample, we found that 3.5% of participants were screened into the NSSI pool on the FASM but not on the NSSI-AT, while 2.6% were screened into the NSSI pool on the NSSI-AT but not on the FASM.

Results of analyses assessing convergent and discriminant evidence are shown in Table 4. As hypothesized, both the dichotomous (any NSSI) and continuous (lifetime NSSI occasions) NSSI variables were positively and significantly correlated with STB, disordered eating behaviors, general psychological distress and number of lifetime traumas (Table 4). Also as hypothesized, NSSI was not significantly correlated with binge drinking or number of sexual partners in the past year (Table 4). However, while number of lifetime NSSI occasions was not correlated with use of other people's prescription drugs ($r=-0.027$, $p=.801$), any NSSI was significantly correlated with this use ($r=0.089$, $p=.024$), though this correlation was small in magnitude. We also note that all associations used to assess convergent evidence were small to medium in size (r range, any NSSI, |0.17-0.38|; r range, lifetime NSSI occasions, |0.11-0.26|,

where a small effect size is $r=0.10$ and a medium effect size is $r=0.30$; Cohen, 1992), while those associations used to assess discriminant evidence were all less in value than $r=0.10$ (i.e., a small effect size; r range, any NSSI, $|0.010-0.089|$; r range, lifetime NSSI occasions, $|0.001-0.074|$).

Discussion

The development of the NSSI-AT extends previous surveillance capacity and psychometric work in this area. First, this tool not only has modules related to basic NSSI epidemiological information, such as form, function, and frequency (which can be assessed with other NSSI measures), but also contains modules that assess NSSI characteristics lacking on other measures of NSSI, including a) motivations for initiating NSSI, b) the contexts within which NSSI is practiced, c) variation in NSSI severity, d) disclosure, and e) help-seeking. Grounded in extant literature, as well as in research/exploratory interviews with individuals with NSSI use experience and clinicians with NSSI treatment experience, the NSSI-AT is designed to cover broad conceptual territory using language and concepts that accurately reflect the experience and behaviors of those who practice NSSI.

In this sample of college students, the test-retest reliability of NSSI-AT scores over a 4-week period did not significantly differ from Kline's (2000) recommended minimum cut-off of 0.70 (i.e., ~50% agreement), with the exception of age at first NSSI incident, which was higher (0.91). The coefficient for number of wound locations (0.63) was the lowest of all assessed scores; however, it is possible that real change occurred in this variable over the period between administrations (e.g., participants moved to a new wound location), and that this accounts for the lower reliability of scores on this module. Further, the number of participants in our test-retest sample was small ($n=25$), such that even if only a few participants changed over the test-retest period, this may have resulted in lower reliability of scores. Thus, additional testing in larger

samples is warranted, but this initial evidence suggests that NSSI-AT scores have promising reliability in a university population, as assessed by test-retest over a 4-week period.

Results for this sample also provide promising preliminary evidence for validity arguments related to the interpretation of behavior screen (module A) and frequency assessment (module C) scores, as demonstrated by the pattern of correlations in Table 4; except for the association between any prescription drug use and any NSSI behavior, these correlations all met our *a priori* hypotheses. The validity evidence provided in this paper met our initial aim of supporting validity arguments for the behavior module, and for introducing a tool capable of yielding a robust picture of NSSI in context. Future work with this measure will allow us to explore validity arguments for other modules of the NSSI-AT.

A strength of the NSSI-AT is that NSSI and behaviors with a suicidal intent are clearly delineated. The focus of the NSSI-AT on *non*-suicidal behaviors means this tool first and foremost assesses NSSI and not STB, while still allowing researchers to screen out false positives due to conflation with STB and thus explore the relationship between NSSI and suicide. Additionally, the breadth and depth of the NSSI-AT provide researchers with a unique opportunity to gather greatly detailed information (such as one might expect to obtain via a structured interview tool) from a large sample of individuals. This is because the web-based delivery of the NSSI-AT allows for some customization of questions and response options as a result of previous participant responses; the display and skip logic embedded in the NSSI-AT mean detailed, nuanced questions are asked of those with pertinent experiences and are not seen by others, which both reduces participant burden and increases the richness of information obtained.

The NSSI-AT expands on current assessments through the breadth of its modules. It is also unique in its origins since it was grounded in empirical interviews and reviews rather than shaped largely or solely through theory. For the functions module, in particular, the constructs derived through EFA overlap with extant NSSI function assessments, but also factored in ways not totally keeping with these existing measures (Klonsky & Glenn, 2009; Nock & Prinstein, 2004). Further testing will permit more rigorous assessment and comparison of NSSI-AT function constructs relative to other function assessments, but since the empirical derivation of the items that contributed to the functions construct is novel, we elected to include this as part of the presented NSSI-AT and as another functions framework for consideration. Other multi-factor modules such as “Practice Patterns” and “NSSI Personal Reflections and Advice” are completely novel in the NSSI literature, and offer ways to conceptualize and assess largely unmeasured domains of NSSI experience.

Perhaps both a strength and a limitation of the NSSI-AT is its mode of delivery (on-line administration). The skip patterns embedded in this survey, while allowing for detailed, nuanced questions and response options to be presented based on previous responses, also make it cumbersome to complete in a paper-and-pencil format. However, online surveys represent an increasingly utilized and effective mode of research data collection, one with which young people in particular are likely to be comfortable sharing honest, personal information (DiLillo, DeGue, Kras, Di Loreto-Colgan, & Nash, 2006; Vereckren & Maes, 2006). The NSSI-AT has not been used in clinical populations or with secondary school populations, though it may have use in these areas (note, however, that we discourage using behavior-based items with secondary school students and instead recommend a more generic item assessing whether the participant has ever hurt their body on purpose but without wanting to end their life; a pilot test of this type

of item with 300 college freshmen in 2007 yielded the same prevalence rate as was yielded with the behavior-based questions used in this study).

Several other limitations should be noted. While the findings presented here provide initial support for the reliability of scores on a number of NSSI-AT questions and modules and for the validity of NSSI-AT behavior and frequency score interpretations in a university population, this is preliminary evidence. Based on the psychometric work accomplished thus far, we have made several recommended changes to the tool that have yet to be formally tested (e.g., the addition of other function items, interval scoring for what are now all binary response items, and additional items for 3-item scales). It is worth noting that several of the constructs measured (specifically practice patterns and personal reflections and advice) were not designed as scales but as items intended to measure what may well be variable dimensions of the overarching construct. Refinement of these constructs and delineation of specific scales, if useful, would be a logical next step. Further, our study population consisted entirely of college students and so it would also be useful to test the NSSI-AT in diverse populations and settings (e.g., cross-culturally). We also note that the sample used to provide test-retest reliability evidence for the NSSI sub-population was small ($n=25$), which resulted in a lack of precision for certain estimates, as indicated by wide confidence intervals. Thus, more information on the test-retest reliability of NSSI-AT scores in larger samples is needed to corroborate this preliminary evidence. Finally, if administered in a paper-and-pencil format, the NSSI-AT may be a burdensome assessment tool due to the number of skip patterns, and so we encourage web-based administration where possible. However, the format of the NSSI-AT allows the survey to be administered as individual modules, if necessary, to reduce participant/administrative burden.

Application of the NSSI-AT to a wider variety of populations, as well as by demographic subgroups, will permit more rigorous testing of constructs and measurement modalities. We also anticipate that use of the more novel NSSI-AT modules related to practices and contexts, as well as to perceived impact and treatment, will generate useful discussion about how to best capture these largely unmeasured elements of the NSSI experience. In future work, we plan to continue investigating the functions module, including some newly added items, as well as to investigate the clinical utility of the full set of modules. We also plan to assess age and gender invariance of the tool, including differential item functioning by module. It is our hope that the NSSI-AT will be both a useful tool as well as a springboard for consideration of measurement domains beyond primary epidemiological NSSI characteristics such as prevalence, form, function, recency, and severity.

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Table 1. Demographics and Information on Samples

	Sample One	Sample Two	Sample Three
Sample description	Main, cross-sectional sample	Test-retest sample	Longitudinal sample
Total sample size	14,385	196	1466
Effective sample size	11,529	n/a	815
Location	8 Northeastern and Midwestern public and private American universities	1 U.S. university (from Sample 1)	5 U.S. universities (from Sample 1)
Wave 1 age, y, mean (SD); range	20.31 (1.80); range, 18-25	26.57 (3.76); range, 21-48	19.37 (1.75); range, 18-25
NSSI at Wave 1, % yes (n)	15.4 (1773)	12.8 (25)	15.5 (126)
Gender, % (n) ^a			
Male	41.7 (4809)	37.8 (74)	41.7 (340)
Female	57.6 (6639)	61.2 (120)	57.2 (466)
Race/ethnicity, % (n)			
White	64.3 (7418)	77.6 (152)	69.2 (564)
African-American	3.7 (427)	1.0 (2)	4.8 (39)
Hispanic	4.9 (561)	3.1 (6)	2.9 (24)
Asian	15.3 (1764)	10.2 (20)	10.9 (89)
Other	11.3 (1299)	7.1 (14)	11.9 (97)

Percentages may not equal 100% due to missing data.

^aThirty-six participants in Sample One, two participants in Sample Two, and five participants in Sample Three listed their gender as transgender/non-gendered.

Table 2. NSSI-AT Modules ($n=1773$)

A) Behavior-based screening questions (self-injury forms)	% yes (n)
<i>Any NSSI behavior</i>	15.4 (1773)
Severely scratched or pinched with fingernails or other objects to the point that bleeding occurs or marks remain on the skin ($n=1727$)	51.7 (916)
Cut wrists, arms, legs, torso or other areas of the body ($n=1727$)	39.7 (703)
Banged or punched <i>objects</i> to the point of bruising or bleeding ($n=1726$)	26.8 (475)
Bitten yourself to the point that bleeding occurs or marks remain on the skin ($n=1726$)	17.5 (311)
Punched or banged <i>oneself</i> to the point of bruising or bleeding ($n=1725$)	16.7 (296)
Carved words or symbols into the skin ($n=1726$)	11.9 (211)
Intentionally prevented wounds from healing ($n=1725$)	11.0 (195)
Ripped or torn skin ($n=1725$)	10.7 (190)
Pulled out hair, eyelashes, or eyebrows (with the intention of hurting yourself) ($n=1725$)	10.5 (187)
Burned wrists, hands, arms, legs, torso or other areas of the body ($n=1727$)	9.5 (168)
Rubbed glass into skin or stuck sharp objects such as needles, pins, and staples into or underneath the skin (not including tattooing, body piercing, or needles used for medication use) ($n=1726$)	8.3 (148)
B) Functions (I hurt myself...)	Mean score (SD), range / % yes (n)
<i>Affective imbalance, low pressure</i> ($n=1770$), $\alpha=.64$	1.33 (1.26), 0-4
...to cope with uncomfortable feelings (e.g., depression or anxiety)	50.8 (901)
...to change my emotional pain into something physical	35.6 (631)
...to feel something	26.6 (472)
...to get control over myself or my life	20.0 (354)
<i>Social communication and expression</i> ($n=1770$), $\alpha=.38$	0.27 (0.56), 0-3

...in hopes that someone would notice that something is wrong or that so others will pay attention to me	18.3 (325)
...to shock or hurt someone	5.9 (105)
...because my friends hurt themselves	2.5 (44)
<i>Self-retribution and deterrence (n=1769), $\alpha=.47$</i>	<i>0.45 (0.77), 0-4</i>
...as a self-punishment or to atone for sins	18.4 (326)
...because of my self-hatred	14.7 (260)
...so I do not hurt myself in other ways	7.5 (133)
...to avoid committing suicide	4.5 (79)
<i>Sensation seeking (n=1769), $\alpha=.52$</i>	<i>0.50 (0.83), 0-4</i>
...because I get the urge and cannot stop it	17.0 (302)
...because it feels good	16.2 (287)
...to get a rush or surge of energy	11.5 (204)
...because I like the way it looks	5.0 (89)
<i>Affective imbalance, high pressure (n=1769), $\alpha=.60$</i>	<i>1.05 (1.05), 0-3</i>
...to relieve stress or pressure	43.2 (766)
...to deal with frustration	36.8 (653)
...to deal with anger	24.8 (439)
<i>C) Recency and frequency (and age of cessation)</i>	% yes (n)
<i>Recency (n=1732)</i>	
Less than 1 month ago	19.0 (336)
Between 1 and 3 months ago	7.8 (139)
Between 3 and 6 months ago	7.1 (126)

Between 6 months and 1 year ago	10.0 (178)
Between 1 and 2 years ago ^a	16.6 (294)
More than 2 years ago ^a	37.2 (659)
<i>Frequency (n=1730)</i>	
Only once	12.9 (229)
2-10 times	55.8 (989)
11-50 times	20.2 (358)
More than 50 times	8.7 (154)
<i>Age of cessation^b</i>	<i>Mean age (SD), range</i>
Age at NSSI cessation	16.92 (2.43), 6-24
<i>D) Age of onset</i>	<i>Mean age (SD), range</i>
Age at first NSSI incident (n=1567)	15.27 (3.16), 3-25
<i>E) Wound locations</i>	<i>% yes (n)</i>
Arms (n=1771)	49.7 (882)
Hands (n=1773)	33.4 (593)
Wrists (n=1773)	33.4 (592)
Thighs (n=1771)	22.6 (400)
Stomach or chest (n=1770)	15.0 (266)
Calves or ankles (n=1771)	13.9 (246)
Fingers (n=1771)	11.0 (195)
Head (n=1770)	10.9 (194)

Face ($n=1770$)	8.2 (146)
G) Severity	% yes (n)
Ever hurt self more severely than expected ^c ($n=1725$)	19.5 (345)
Ever hurt self so badly should have been seen by medical professional ^d	27.0 (93)
Ever sought medical treatment for any physical NSSI injuries ^d	11.6 (40)
H) Practice patterns	Mean score (SD), range / % yes (n)
<i>Social dimensions of NSSI practice</i> ($n=1513$), $\alpha=.41$	<i>0.56 (0.77), 0-4</i>
I always intentionally hurt myself in private	54.5 (967)
I sometimes intentionally hurt myself in the presence of others	9.1 (162)
I have intentionally physically hurt another person	4.1 (72)
I sometimes let other people intentionally hurt me physically	3.4 (60)
<i>Routines</i> ($n=1513$), $\alpha=.48$	<i>0.43 (0.72), 0-3</i>
I tend to go through periods in which I intentionally hurt myself, then periods in which I do not, and this pattern repeats	19.2 (340)
I have a particular place/room I prefer to be when I intentionally hurt myself	10.4 (185)
I have a regular routine I follow when I intentionally hurt myself	6.9 (122)
I) Habituation and perceived life interference	
<i>Habituation</i> ($n=949$), $\alpha=.66$	<i>Mean score (SD), range</i>
Four item habituation scale	9.08 (3.71), 4-20
<i>Perceived life interference</i> ($n=1276$)	<i>% yes (n)</i>

The fact that I intentionally hurt myself is a problem in my life	20.6 (366)	
<i>K) NSSI treatment experiences</i>	% (n)	
Ever gone to a therapist ^e	Total sample	NSSI sub-sample
Yes	31.6 (3641)	53.6 (950)
No	67.6 (7797)	43.4 (770)
Ever gone to therapy because of NSSI ^f		
Yes	9.3 (88)	
No	54.4 (517)	
NSSI only part of reason for therapy	25.2 (239)	
<i>L) Personal reflections and advice^g</i>	Mean score (SD), range / % yes (n)	
<i>Ambivalence, $\alpha=.57$</i>	<i>0.54 (0.89), 0-4</i>	
The lasting marks/scars are constant reminders of a bad/rough time in my life	20.0 (141)	
My scars are my battle wounds – I made it through	12.1 (85)	
I still cannot talk about it and sometimes even thinking about it is difficult	11.1 (78)	
The remaining marks/scars are a source of embarrassment for me	10.7 (75)	
<i>Growth, $\alpha=.64$</i>	<i>0.54 (0.86), 0-3</i>	
In thinking/discussing my experience around intentionally hurting myself, I	29.7 (209)	

have learned a lot about myself and because of it have mentally/emotionally grown	
I am now able to help others who intentionally hurt themselves	15.5 (109)
Discussion of my experience around intentionally hurting myself has helped me grow closer to the people I care about	8.8 (62)

^aParticipants who reported that their last NSSI occurrence was between 1 and 2 years ago or more than 2 years ago were then asked how likely they were to hurt themselves again, on a five-point interval scale. See Appendix for more detail.

^bAsked only of people who no longer reported self-injury behavior ($n=670$).

^cParticipants endorsing this question were then asked to list how many times this had happened. See Appendix for more detail.

^dOf those who said they had ever hurt themselves more severely than expected ($n=345$).

^eResults are split into two columns. The first column lists the percentages for the entire sample ($n=11,438$) and the second column lists the percentages for the NSSI sub-sample ($n=1720$).

^fOf those in the NSSI sub-sample who had said they ever went to therapy ($n=950$). Participants who responded yes or that NSSI was only part of the reason they went to therapy were then asked if someone else insisted they go to therapy or if they decided to go on their own. See Appendix for more detail.

^gAsked only of people who no longer reported self-injury behavior ($n=704$).

Table 3. Test-Retest Reliability for Select NSSI-AT Scores in a University Population

Measure	Mean (SD), range	Test-retest reliability
Any NSSI behavior ^a	-	.74 [.58, .90]
Frequency of NSSI behavior	-	.85 [.62, .95]
Age at first NSSI incident	15.27 (3.16), 3-25	.91 [.75, .97]
Number of wound locations	2.21 (1.63), 0-16	.63 [.20, .86]
NSSI habituation	9.08 (3.71), 4-20	.73 [.23, .93]
NSSI functions	3.60 (3.06), 0-17	.79 [.50, .92]

All reported test-retest reliabilities are one-way random intraclass correlation coefficients [1,1], except the test-retest reliability for Any NSSI behavior, which is a kappa value.

^aTest-retest data for “any NSSI behavior” were provided by the entire sample ($N=196$). Test-retest data for all other table entries were provided by the NSSI sub-sample only ($n=25$).

Table 4. Convergent and Discriminant Evidence for Interpretation of NSSI-AT Behavior and Frequency Module Scores in a University Population^a

	Descriptives (n=11,529) Mean score (SD), range / % yes (n)	Any NSSI (n=11,529)	Lifetime NSSI Frequency (n=1503)^b
<i>Convergent Evidence</i>			
Any suicidal thoughts and/or behaviors	7.9 (909)	$r=.38, p<.001,$ $n=10,789$	$r=.24, p<.001,$ $n=1250$
Suicidal thoughts only	3.8 (435)	$r=.27, p<.001,$ $n=10,333$	$r=.15, p<.001,$ $n=990$
Suicidal behaviors	4.1 (474)	$r=.32, p<.001,$ $n=10,359$	$r=.26, p<.001,$ $n=1043$
Any eating disorder	19.5 (2245)	$r=.24, p<.001,$ $n=11,481$	$r=.15, p<.001,$ $n=1503$
General psychological distress (K6)	12.29 (3.65), 6-24	$r=.25, p<.001,$ $n=11,312$	$r=.11, p<.001,$ $n=1485$
Number of lifetime traumas	0.76 (0.93), 0-6	$r=.17, p<.001,$ $n=10,438$	$r=.13, p<.001,$ $n=1332$
<i>Discriminant Evidence</i>			
Binge drinking (past 2 weeks)	32.5 (3745)	$r=-.010, p=.373,$ $n=8673$	$r=-.001, p=.977,$ $n=1161$

Number of sexual partners (past year) ^c	17.78 (36.87), 0-99	$r=-.018, p=.604,$ $n=813$	$r=.074, p=.436,$ $n=113$
Any prescription drug use (lifetime) ^c	13.4 (109)	$r=.089, p=.024,$ $n=641$	$r=-.027, p=.801,$ $n=87$

^aIn addition to correlations, we also ran χ^2 tests to assess associations between any NSSI and any suicidal thoughts and behaviors, suicidal thoughts only, suicidal behaviors, any eating disorder, binge drinking and any prescription drug use; t-tests to assess associations between any NSSI and general psychological distress, number of lifetime traumas, and number of sexual partners; and t-tests to assess associations between lifetime NSSI frequency and any suicidal thoughts and behaviors, suicidal thoughts only, suicidal behaviors, any eating disorder, binge drinking and any prescription drug use. The pattern of results did not change for any of these associations, and thus correlations are reported for all variables, in order to reflect how validity evidence is typically presented in the literature.

^bDoes not include individuals who reported only a single lifetime NSSI occasion. Lifetime NSSI data were provided by the NSSI sub-sample only.

^cCollected from Sample Three ($n=815$). All other variables in this table are from Sample One.