Risk for Suicidal Ideation and Attempt among a Primary Care Sample of Adolescents Engaging in Nonsuicidal Self-Injury

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One in five adolescents in the United States has engaged in nonsuicidal self-injury (NSSI), one in eight have had serious thoughts of suicide, and one in 25 have attempted suicide. Research suggests that NSSI may increase risk for suicide attempt, yet little is known about the relationship between NSSI and suicidal ideation or attempts. In a primary care setting, 1,561 youth aged 14–24 years completed a brief, comprehensive, mental health screen as part of a routine well visit to determine which factors were most likely to predict suicidal ideation and attempt among youth engaging in NSSI. Results of recursive partitioning revealed that current depression and history of alcohol use best differentiated youth engaging in NSSI with low versus high risk for suicidal ideation and attempts. This simple algorithm is presented as a clinical screening tool that might aid medical providers in determining which youth would benefit from more intensive assessment and intervention.

Self-harm behaviors, including suicidal thoughts and behaviors (STB) and nonsuicidal self-injury (NSSI), increase dramatically during adolescence and occur at particularly high rates during young adulthood. Suicide is the second leading cause of death for 15- to 24-year-olds and the fourth leading cause of death for 5- to 14-year-olds in the United States (Hoyert & Xu, 2012). In their lifetime, an estimated 12.1% of adolescents in the United States consider suicide, 4.0% make a plan, and 4.1% make an attempt (Hoyert & Xu, 2012; Nock et al., 2013). Given the costs of suicide to both society and individuals, a better understanding of the risk factors associated with suicide is critical (Centers for Disease Control and Prevention [CDC], 2011).

One poorly understood risk factor for suicide is NSSI. Rates of NSSI are markedly high, with prevalence rates reaching as high as 38% among college samples (Nock, Teper, & Hollander, 2007; Whitlock, Eckenrode, & Silverman, 2006) and 61% in clinical samples (Darche, 1990). Furthermore, researchers have found NSSI to be significantly associated with STB. For example, Andover and Gibb (2010) found that frequency of NSSI was positively correlated with number of suicide attempts in an inpatient sample, even after controlling for depressive symptoms, suicidal
ideation, and symptoms of borderline personality disorder. Klonsky, May, and Glenn (2013) found similar results across four studies and revealed that, second only to suicidal ideation, NSSI had the strongest relationship to attempted suicide. Recent research has also revealed that not only is NSSI strongly associated with STB, it is a predictor of future suicide attempts. A study by Guan, Fox, and Prinstein (2012) revealed that NSSI prospectively predicted suicidal ideation and attempts among a sample of community adolescents. These studies not only reveal strong associations between NSSI and STB, they also highlight the importance of assessing the risk for suicide among youth who engage in NSSI.

Given the life-threatening nature of STB, many institutions including hospitals, clinics, and research laboratories have specific protocols in place to help provide appropriate care for youth who express suicidal intent. However, there is less guidance on how to proceed when a young patient presents with self-injurious behavior with no suicidal intent. In particular, providers struggle with whether self-injurious behavior falls on the spectrum of suicidal behavior. Thus, NSSI is quite concerning for mental health providers, school personnel, and staff in primary care and emergency departments. Across these settings, professionals have little information regarding how to assess NSSI, how to know when it is associated with suicide, and how to provide the correct level of care for these youth (Walsh, 2007).

This clinical dilemma has been exacerbated by the lack of empirical research regarding the relationship between these phenomena, as well as our limited ability to successfully predict when self-injurious behavior may be a precursor to suicidal behavior (Nock, 2012). To date, research has suggested that youth who engage in NSSI or who report STB share several common risk factors. These include demographic characteristics such as gender, age, race, and sexual orientation (Anestis & Joiner, 2011; Gratz & Chapman, 2007; Muehlenkamp & Gutierrez, 2004; Whitlock et al., 2006); environmental characteristics such as childhood abuse/maltreatment and trauma (Glassman, Weierich, Hooley, Deliberto, & Nock, 2007); personality characteristics such as emotion dysregulation and impulsivity (Gratz & Roemer, 2004; Nock, Wedig, Holmberg, & Hooley, 2008); and psychopathology, including depression and borderline personality disorder in particular (Andover, Pepper, Ryabchenko, Orrico, & Gibb, 2005; Zanarini et al., 2006).

Recent research has also identified factors that distinguish youth who engage in NSSI from youth who report STB. The majority of youth who engage in NSSI do so only once or twice and the severity of these acts is typically mild (Whitlock et al., 2006). Also, unlike suicidal youth who often believe that they have no control over their lives, that their psychological pain is endless, and that there is nothing they can do to improve their lives, youth who self-injure often have contrary beliefs (Walsh, 2007). Those who self-injure tend to view NSSI as a method of control over their pain, knowing that it will provide feelings of relief and reduce tension (Klonsky, 2007; Linehan, 1993). Furthermore, research suggests that geographic characteristics, particularly living in rural areas compared with urban areas, are associated with increased risk for suicide, but not NSSI (Nance, Carr, Kallan, Branas, & Wiebe, 2010; Plener, Libal, Keller, Fegert, & Muehlenkamp, 2009). Thus, professionals working with youth who self-injure should not presume that these youth are necessarily suicidal. Additional information is needed prior to making such a determination.

Although only a minority of individuals who engage in NSSI go on to attempt suicide, recent research has found NSSI to be a strong predictor of suicide attempts, possibly because NSSI might desensitize an individual to the pain and fear associated with suicide (Klonsky, 2011; Selby, Bender, Gordon, Nock, & Joiner, 2011). Along these lines, researchers have begun to examine factors that may place some self-injuring individuals at increased risk for suicide attempts. These studies, conducted primarily in inpatient psychiatric settings, have sug-
gested that, compared with self-injuring people with no history of suicidal behavior, those who have attempted suicide have significantly higher levels of depressive symptoms, borderline personality disorder symptoms, and suicidal ideation (Jacobson, Muehlenkamp, Miller, & Turner, 2008; Muehlenkamp, Ertelt, Miller, & Claes, 2011). The role of other variables, such as demographic characteristics or childhood trauma, in increasing risk of suicide remains unclear (e.g., Csorba, Dinya, Plener, Nagy, & Páli, 2009; Muehlenkamp, Kerr, Bradley, & Adams Larsen, 2010; Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). In sum, although research has revealed that NSSI is not only correlated with but may also predict suicide attempts, little is known about what specific factors lead some individuals who engage in NSSI to attempt suicide.

Research on the relationship between NSSI and suicide is limited in several ways. First, the vast majority of these studies have been conducted with psychiatric inpatient samples. Although NSSI and STB, particularly suicide attempts, are more prevalent among these samples, these studies are limited in their generalizability to community samples, where NSSI and STB are also major concerns. Relatedly, only one of the studies has considered risk factors for suicidal ideation, as opposed to attempts (Klonsky & Olino, 2008). Additional research examining suicidal ideation is needed for several reasons. First, suicidal ideation is far more prevalent than suicide attempts among community and clinical samples and is one of the strongest predictors of attempts. Therefore, taking into consideration the whole range of suicidal behavior in relation to NSSI will allow researchers to more comprehensively identify self-injurers who may be at greatest risk for eventual completed suicide. Finally, although research has begun to provide insight into what may place some self-injuring youth at risk for suicide, no research has attempted to integrate these factors into a useful algorithm that could be used to help predict outcomes such as suicidal ideation or attempts (Nock, 2012). Such research could enable clinicians to more accurately screen clients for NSSI and suicide risk to identify those who would benefit from more time- and resource-intensive suicide assessments, as well as to tailor interventions that may best serve the unique needs of specific subsets of the heterogeneous group of youth who engage in NSSI.

The goal of the current study was to examine variables that place self-injuring adolescents and young adults at increased risk for suicide. By determining which variables best differentiate between self-injuring youth (1) with no history of suicidal ideation or attempts, (2) with a history of ideation but no attempts, and (3) with a history of suicide attempts, the aim of the current study was to develop an algorithm that may be easily used by clinicians to help assess the severity of suicide risk among youth engaging in NSSI.

METHODS

Participants

Participants in the study were 1,561 youth aged 14 to 24 years who completed a computer-based survey in their primary care physician’s (PCPs) office. Of the total sample, 203 (13.0%) endorsed a lifetime history of engagement in NSSI. This final sample was used for all analyses and had a mean age of 17.68 \( (SD = 2.94, \text{range 14–24}) \) years; were 75.4% female; identified their race as 78.3% White, 2.0% Black/African American, 1.5% Asian, 2.0% Other, 10.3% More than One Race, and 5.9% Not Sure; and identified their ethnicity as 14.3% Hispanic.

Measures

The Behavioral Health Screen. The Behavioral Health Screen (BHS) was developed by Diamond et al. (2010) to address the need for comprehensive behavioral health screening in primary care (Bevans, Diamond, & Levy, 2012). The BHS is designed for an adolescent and young adult
patient population and consists of psychiatric symptom scales and risk behaviors that cover all the psychosocial areas suggested by best practice guidelines. The BHS contains 55 core items with an additional 38 embedded items that are presented when certain items are positively endorsed. It is composed of 13 modules: demographics, medical, school, family, safety, substance use, sexuality, nutrition and eating, anxiety, depression, suicide, psychosis, and trauma and abuse (for a summary of the BHS variables, see Table 1). Depending on the number of problems endorsed, it takes about 7 to 10 minutes to complete. The program scores and generates a report, and the provider reviews the report before the meeting with the patient. The report is then integrated into the medical record, but data can be aggregated for quality assurance or research reports. The BHS can be administered in Spanish or Mandarin Chinese and is listed on the Substance Abuse and Mental Health Services Administration’s (SAMHSA) best practice registry.

Several studies have explored different aspects of the BHS. First, focus groups found PCPs and patients receptive to computerized screening. In a feasibility study, adolescents reported that they (1) liked the computer program, (2) completed the tool in around 10 minutes, (3) understood the questions, (4) said they reported honestly, and most importantly, (5) found it helpful during the appointment (Diamond et al., 2010). Fein et al. (2010) used the BHS in an emergency department (ED). Their study began with qualitative interviews with 60 adolescents, their parents, and 45 medical providers. All three groups supported the idea of comput-

TABLE 1
Summary of BHS Variables Included in Recursive Partitioning Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of items</th>
<th>Range</th>
<th>Period assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic</td>
<td>4</td>
<td>Variable</td>
<td>Current</td>
</tr>
<tr>
<td>Diagnostic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three depression subscales</td>
<td>3 each</td>
<td>0–4</td>
<td>Past 2 weeks</td>
</tr>
<tr>
<td>Depression symptoms</td>
<td>10</td>
<td>0–4</td>
<td>Current and lifetime</td>
</tr>
<tr>
<td>Three anxiety subscales</td>
<td>3 each</td>
<td>0–4</td>
<td>Past 2 weeks</td>
</tr>
<tr>
<td>Anxiety symptoms</td>
<td>7</td>
<td>0–4</td>
<td>Current and lifetime</td>
</tr>
<tr>
<td>Three PTSD subscales</td>
<td>3 each</td>
<td>0–4</td>
<td>Lifetime</td>
</tr>
<tr>
<td>PTSD/trauma symptoms</td>
<td>9</td>
<td>0–4</td>
<td>Current and lifetime</td>
</tr>
<tr>
<td>Three substance abuse subscales</td>
<td>3 each</td>
<td>0–4</td>
<td>Past year</td>
</tr>
<tr>
<td>Substance abuse symptoms</td>
<td>17</td>
<td>Variable</td>
<td>Current and lifetime</td>
</tr>
<tr>
<td>Three eating disorder subscales</td>
<td>3 each</td>
<td>0–4</td>
<td>Current</td>
</tr>
<tr>
<td>Eating disorder symptoms</td>
<td>7</td>
<td>0–4</td>
<td>Current</td>
</tr>
<tr>
<td>Psychosis symptoms</td>
<td>2</td>
<td>0, 1, 2</td>
<td>Lifetime</td>
</tr>
<tr>
<td>Behavioral</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexual behavior</td>
<td>10</td>
<td>Variable</td>
<td>Current and lifetime</td>
</tr>
<tr>
<td>Safety problems</td>
<td>7</td>
<td>0, 1, 2</td>
<td>Current</td>
</tr>
<tr>
<td>School problems</td>
<td>8</td>
<td>Variable</td>
<td>Current</td>
</tr>
<tr>
<td>Social</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family problems</td>
<td>6</td>
<td>0, 1, 2</td>
<td>Current and lifetime</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical problems</td>
<td>2</td>
<td>0, 1, 2</td>
<td>Past year</td>
</tr>
<tr>
<td>Satisfaction with survey</td>
<td>5</td>
<td>0, 1, 2</td>
<td>Current</td>
</tr>
<tr>
<td><strong>Total = 109</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Depression, anxiety, PTSD/trauma, substance abuse, and eating disorder subscales consisted of (1) mean of items, (2) sum of items, and (3) clinical significance of items (coded as yes or no). PTSD, posttraumatic stress disorder.
eralized screening in the ED, with some concerns about privacy, health care provider sensitivity, time constraints, and lack of referral options. Over a 1-year period, 857/3,979 (21.5%) of eligible subjects completed the BHS-ED. There was a significant increase in the identification of mental illness or behavioral problems after initiation of the BHS-ED (10.5% vs. 2.5%, OR = 4.58, 95% CI 3.53, 5.94) and more frequent ED-based behavioral health assessments by social workers or psychiatrists (8.3% vs. 1.7%, OR 5.12, 95% CI 3.80, 6.88).

In another study, 415 adolescents in primary care completed the BHS and a validation battery (Diamond et al., 2010). Analyses demonstrated that the BHS-PC scales were unidimensional, internally consistent (Cronbach’s α = .75–.87), and capable of accurately and efficiently discriminating among adolescents with a range of diagnostic symptoms (e.g., depression, anxiety, suicide, and trauma). Sensitivity and specificity were strong with an overall accuracy ranging between 78% and 85%. Patients above scale cutoffs on depression, suicide, anxiety, and posttraumatic stress disorder (PTSD) symptoms were at least four times more likely to endorse other risk behaviors or stressors. The scales, although brief, are psychometrically comparable to longer validated scales. The BHS has been successfully used in Pennsylvania in over 25 sites including primary care, emergency rooms, psychiatric crisis centers, college health centers, and schools.

**Procedure**

Data for this study were collected as part of a SAMHSA-funded suicide prevention project in primary care. Ten northern Pennsylvania primary care sites participated. Half of the sites were in rural areas and the other half were in semi-urban areas with small- (~10,000 people) or medium-sized (~100,000 people) populations. The BHS was set up on personal computers in the waiting or exam rooms of the PCP office. Patients were instructed to complete the tool before the medical interview. The questionnaire was automatically scored and a report was generated in the nursing station for the PCP to review before the medical appointment.

The second page of the screening tool presented the patients with an IRB-approved consent form which asked whether their deidentified data could be used for research purposes. Ninety percent of patients consented, and only these participants were included in the current study. Parental consent was not deemed necessary as Pennsylvania law stipulates that adolescents aged 14 and above can consent to mental health services without parental consent. This right has been extended to low-risk research that provides access to care (Diamond, Wintersteen, Fein, Tien, & Briner, 2014). All procedures were approved by the Children’s Hospital of Philadelphia institutional review board.

**Analytic Plan**

First, standard descriptive statistics were examined for all study variables to identify missingness and possible problems with distributions. Next, a classification tree approach called recursive partitioning (Friedman, 1977) was used to explore which, of all variables assessed by the BHS, best differentiated between three groups of youth engaging in NSSI: (1) youth who have engaged in NSSI but endorse no lifetime suicidal ideation or behavior (NSSI Only); (2) youth who have engaged in NSSI and endorse lifetime suicidal ideation, but not attempts (NSSI + Ideation); and (3) youth who have engaged in NSSI and also endorse at least one lifetime suicide attempt (NSSI + Attempt).

Recursive partitioning is an exploratory, non/semiparametric statistical method used to examine many variables simultaneously. This method has advantages of logistic or linear regression, because it allows for nonnormally distributed data and is not affected by colinearity, thus permitting several similar constructs to be analyzed simultaneously. Unlike
linear regression, which cannot accommodate nonlinear data, different classes of responses, or data that involve many predictors and few observations, recursive methods consider only one predictor variable at a time and sequentially test for all possible interactions of variables that best split the sample into more homogeneous subgroups at each decision point (Zhang & Singer, 1999). This method has been used increasingly to develop risk models for an array of medical and psychological issues, including suicide risk (e.g., Asarnow, McArthur, Hughes, Barbery, & Berk, 2012). This analytic method is particularly well suited to answer the current empirical question because the data are nonnormally distributed, the ratio of participants to response items is small (approximately 2:1), and it provides an empirically derived model for understanding suicide risk among youth who engage in NSSI (Zhang & Singer, 1999).

Recursive partitioning analyses were conducted with the statistical software R (Venables, Smith, & R Development Core Team, 2014). Through the creation of decision trees, recursive partitioning classifies members of the population based on any combination of categorical or continuous criterion variables. In the first split, the “trunk,” the variable that best discriminates between high- and low-risk groups within the full sample (youth with a history of NSSI with and without suicidal ideation and attempts) is determined. With each subsequent split, the process is repeated to generate a series of “branches,” which identify the dichotomous split at each node that yields the greatest improvement in predictive accuracy. This process continues until additional splits are infeasible, based on a set of stopping rules. The final branches, or “terminal nodes,” are obtained when predictive accuracy cannot be improved with additional splits. For the current study, the terminal nodes consist of population members who have similar profiles of the risk factors (out of the original 109 variables) that best predict the likelihood that youth will be in one of three categories (NSSI Only, NSSI + Ideation, or NSSI + Attempt).

A common concern with recursive partitioning is that using all available information in the data set leads to overfitting of the decision tree to the sample under study (Hellemann, Conner, Anglin, & Longshore, 2009). To mitigate this issue, resampling of smaller subsets of the data is used to produce cross-validation samples. These cross-validation samples allow for an estimate of the average performance of the decision tree, as well as an estimate of the variability of the performance of the tree. These parameters are comparable to explained variance ($1 - R^2$).

To determine which features of the tree are most fundamental to the underlying population, the overfit tree is pruned, such that later splits are removed one by one and then the cross-validated error rate compared across trees. The tree with the fewest splits and the smallest cross-validated error rate is selected as the optimal or best-fitting tree (Hellemann et al., 2009). For the current study, the original decision tree was examined and terminal nodes (risk factors for NSSI group status) were pruned in a stepwise fashion until the tree with the fewest number of splits and highest predictive validity was reached.

**RESULTS**

Of the 203 youth who endorsed a history of NSSI, 70 (34.5%) reported NSSI with no suicidal ideation or attempt, 77 (37.9%) reported NSSI with suicidal ideation, and 56 (27.8%) reported NSSI and suicide attempt. As presented in Table 2, there were significant differences between the non-NSSI and NSSI groups, as well as between the three NSSI groups. Youth in the NSSI + Ideation group were more likely to be female. Compared with youth with no history of NSSI or suicidality, youth in the three NSSI groups scored significantly higher on all clinical subscales, with the exception of substance use, on which only those in the ideation and attempt groups scored significantly higher than those with no NSSI. Youth in the NSSI + Ideation group scored significantly
higher than those in the NSSI Only group on depression, anxiety, and PTSD subscales. Youth in the NSSI + Attempt group scored significantly higher than the NSSI Only group on all scales except for eating disorders. Youth in the NSSI + Attempt group did not significantly differ from youth in the NSSI + Ideation group on any subscale, with the exception of substance use, on which those with a history of attempt scored significantly higher than those with a history of ideation.

In the current study, 109 variables assessed by the BHS were used as potential predictors of suicide risk. These included demographic and diagnostic variables, as well as variables related to safety, school problems, and family problems. Variables entered into the model included both individual BHS items as well as BHS subscales. After pruning, the tree presented in Figure 1 represents the best possible model for the data. The prediction error for the tree is 0.71, and thus the variance explained by the model in this sample is 29%. The cross-classification error for the model is 0.78, and thus the model explains 22.0 ± 5.6% of the variability in the population.

The final model revealed that the BHS mean current depression subscale score (continuous) best differentiated between low and high suicide risk. The model split on this variable twice and on lifetime alcohol use (dichotomous) once. First, youth with a mean score below 1.25 on the depression subscale (scored on a 1–4 scale) had the lowest suicide risk. These youth were most likely to be in the NSSI Only group (56%). Youth who had a mean score at or above 1.25 but below 2.75 displayed greater suicide risk and were most likely to be in the NSSI + Ideation group (54%). Youth were at moderate risk for suicide and most likely to be in the NSSI + Ideation group if they had a mean score at or above 2.75 on the depression subscale but endorsed no lifetime history of alcohol use (60%). Finally, youth with the greatest suicide risk were those who had a mean score at or above 2.75 but below 2.75 displayed greater suicide risk and were most likely to be in the NSSI + Ideation group (54%). Youth were at moderate risk for suicide and most likely to be in the NSSI + Ideation group if they had a mean score at or above 2.75 on the depression subscale but endorsed a lifetime history of ever drinking alcohol (coded yes or no; 60%). These youth were most likely to be in the NSSI + Attempt group (60%).

DISCUSSION

In the current study we sought to answer the question, "Among youth who engage in NSSI, how can we begin to distinguish those

<table>
<thead>
<tr>
<th>TABLE 2</th>
<th>Demographic and Diagnostic Characteristics of the Three Study Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>No NSSI</td>
<td>NSSI Only</td>
</tr>
<tr>
<td>(n = 1,358)</td>
<td>(n = 70)</td>
</tr>
<tr>
<td>Age</td>
<td>17.64 (2.94)</td>
</tr>
<tr>
<td>% Female</td>
<td>60.65</td>
</tr>
<tr>
<td>% White</td>
<td>82.20</td>
</tr>
<tr>
<td>Depression</td>
<td>0.67 (0.96)</td>
</tr>
<tr>
<td>Anxiety</td>
<td>1.03 (1.04)</td>
</tr>
<tr>
<td>PTSD</td>
<td>0.40 (0.92)</td>
</tr>
<tr>
<td>Substance abuse</td>
<td>0.11 (0.47)</td>
</tr>
<tr>
<td>Eating disorder</td>
<td>0.52 (0.68)</td>
</tr>
</tbody>
</table>

<sup>a</sup>significantly different from No NSSI group.
<sup>b</sup>significantly different from NSSI Only group at p < .05 based on Tukey HSD contrasts.

Note. Means and standard deviations (or percentages) are presented; NSSI, nonsuicidal self-injury; PTSD, posttraumatic stress disorder; diagnostic subscale scores are means and range from 0 to 4.
who are at increased risk for suicidal behavior?" To our knowledge, the current study is the first to simultaneously examine a wide range of variables (demographic, diagnostic, and environmental) to determine which might best predict suicide risk among youth engaging in NSSI and to develop an algorithm to best classify who is at greatest risk for STB. This study adds to a small body of literature that has examined self-injury and comorbid suicidal behavior among a sample of adolescents and young adults presenting to primary care (as opposed to emergency rooms, inpatient units, or college samples; Druss & Mauer, 2010). Primary care has been identified by both the Affordable Care Act and the National Strategy for Suicide Prevention as one of the most important sites for the screening and identification of mental health problems (Wintersteen &
Diamond, 2013; U.S. Department of Health and Human Services, 2012). Similarly, this is one of the few studies to examine NSSI and STBs among youth in rural areas.

In our sample of youth in primary care clinics, of 109 variables, only two (current depressive symptoms and lifetime history of alcohol use) were necessary to distinguish three groups of self-harming youth: NSSI with no suicidal ideation or attempts (NSSI Only); NSSI with history of suicidal ideation (NSSI + Ideation); and NSSI with history of suicide attempt (NSSI + Attempt). Consistent with existing research, suicide risk among the youth in our sample increased with the severity of depressive symptoms and among youth who reported both moderate to high levels of depression and alcohol use (McManama O’Brien, Becker, Spirito, Simon, & Prinstein, 2014). In this study, we found that current depressive symptoms are perhaps the best predictor of suicidal ideation and that the combination of current depressive symptoms and a history of ever drinking alcohol is the best predictor of attempts among youth engaging in NSSI. On the one hand, these results are not surprising given the previously established robust relationships between depression, substance use, and self-harm behaviors. For example, research examining differences between groups of self-injurers with and without histories of suicide attempt suggests that, compared with self-injurers with no history of suicide attempt, self-injurers who have attempted suicide endorse significantly higher levels of depressive symptoms (e.g., Brausch & Gutierrez, 2010) and are more likely to meet full criteria for major depressive disorder according to diagnostic interview (Muehlenkamp et al., 2011). On the other hand, it is surprising that of the 109 variables included in the original model (including history of abuse/assault, family conflict, traumatic stress, etc.), current depressive symptoms and alcohol use were the only variables necessary to best distinguish between the three study groups. Given the prevalence of alcohol consumption in adolescence and young adulthood, it is also surprising that of the several alcohol-related variables assessed (including frequency in the last 30 days and presence of alcohol-related problems), the dichotomous variable of “have you ever in your whole life even once used alcohol” best differentiated those with suicide attempt from those without. It is important to note, however, that this variable was only associated with suicide attempt risk in conjunction with high levels of depression. Thus, alcohol use, in the absence of depression, may not be a significant predictor of suicidal ideation or attempts among youth engaging in self-injury.

The current study’s findings regarding the relation between alcohol use and suicide are somewhat consistent with previous research. For example, extant research suggests that early alcohol use among youth is significantly associated with suicidal ideation and attempts (King et al., 2001; Swahn & Bossarte, 2007). However, in a study of STB among adolescents, Wong, Zhou, Goebert, and Hishinuma (2013) found that, after controlling for depressive symptoms, alcohol was the least likely of 10 substances to be associated with suicide attempt risk. In terms of NSSI, previous research has found substance use (including alcohol) to be significantly correlated with self-injury, but the extent to which alcohol use increases the risk for suicidal ideation or attempt among youth engaging in NSSI is unknown (Nock et al., 2006). Additional research is needed to clarify the potential roles of various substances in increasing risk for STB.

In addition to providing a simple algorithm that may be used to classify self-injuring youth at increased risk for suicidal behaviors, the current study supports the notion that NSSI is phenomenologically distinct from suicide (Selby et al., 2011). Results of this study suggest that a large proportion of youth (approximately 35%) engaging in NSSI had never considered suicide and the majority (72%) had never attempted suicide. This is not to say, however, that youth who engage in NSSI without suicidal ideation or attempt are free from psychiatric disorder. Youth with any history of NSSI were at
greater risk for psychopathology, overall, than their noninjuring peers. Among those who engaged in NSSI, the youth in the NSSI Only group had significantly lower scores than the other two groups on many diagnostic variables, including depression, anxiety, traumatic stress, and substance abuse. Taken together, these findings suggest that not all youth engaging in NSSI are at imminent risk for suicide. This is not to say that youth who engage in NSSI and have not thought about or attempted suicide will not do so in the future, but professionals should keep in mind that a high level of emergent care may not always be appropriate when an individual reports engaging in self-injurious behaviors.

Although the current study has many strengths, several limitations are worthy of note. First, the current study included only youth presenting to primary care, thus limiting generalizability of the findings to other settings, particularly inpatient settings where NSSI and STB are highly prevalent. Second, the BHS (Diamond et al., 2010) was designed to enable medical personnel to quickly assess a wide variety of psychological, social, and environmental domains. Therefore, the data used here was not from a planned research battery of measures to arrive at specific diagnoses or thoroughly assess NSSI or STB. Rather, the BHS is designed to provide useful screening information for the PCP to use during a clinical interview.

A final limitation of the current study is that although we were able to identify two factors that distinguished youth who engaged in NSSI from youth who engaged in NSSI and reported STB, we were nevertheless unable to establish an algorithm that correctly classified 100% of the youth who reported NSSI, or NSSI and STB. The model depicted in Figure 1 explains, on average, 29% of the variance in responses and correctly classifies between 54% and 60% of youth, which is in the average range when compared with typical psychology studies (e.g., Ferguson, 2009). As a diagnostic tool, this would be considered low. The authors do not suggest that results of assessment with this algorithm be used to make diagnostic decisions such as whether to refer a patient to the emergency room or inpatient psychiatric facility. Rather, it is designed to help clinicians quickly identify and assess key variables that may contribute to suicidal ideation and behavior among youth who self-injure. Based on the current study, providers in primary care clinics whose patients report NSSI should assess for severity of depressive symptoms and substance use. Assessing these key variables will allow clinical personnel to easily identify children who are at particular risk for suicidality and to follow-up appropriately (i.e., for further, more comprehensive assessment). Given the current data, the final algorithm represents the optimal combination of correct classification and parsimony. Additional research among diverse populations, and with a wide array of demographic and diagnostic variables, is needed to improve our ability to accurately classify those at greatest risk.

In sum, results of the current study suggest that a relatively simple algorithm may help to evaluate which youth engaged in NSSI may be at risk for suicidal ideation and attempts. The benefit of such a model is that it might be quickly and easily applied by a wide array of professionals to classify which youth might be at greatest suicide risk in situations where more in-depth information gathering may not be indicated or feasible. Based on the information provided by the model, at-risk youth may be identified and referred for appropriate treatments. For example, youth in the NSSI + Ideation group may best benefit from a treatment targeted at depressive symptoms, whereas those in the NSSI + Attempt group may benefit most from a treatment that focuses on both depression and substance use. Even in the absence of specific approaches, the model provides a hierarchy for determining when an individual engaging in NSSI might benefit from a greater level of service. Therefore, in addition to providing information about level of individual risk, the current model may be used to guide referrals for more specialized levels of care.
REFERENCES


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