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SUBTYPING NONSUICIDAL SELF-INJURERS: AN APPLICATION OF LATENT
VARIABLE MIXTURE MODELING

by

Katherine L. Bracken

A Thesis

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

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Abstract

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Subtyping Nonsuicidal Self-Injurers: An Application of Latent Variable Mixture Modeling. Major Professor: Meghan McDevitt-Murphy, Ph.D.

Using latent variable mixture modeling (LVMM), we sought to identify subtypes of individuals who engage in nonsuicidal self-injury (NSSI). Specifically, this study replicated Klonsky and Olino's (2008) investigation of undergraduate self-injurers in which they found four clinically distinct subtypes: "Experimental NSSI," "Mild NSSI," "Multiple Functions/Anxious," and "Automatic Functions/Suicidal" groups. The current study was also an extension of Klonsky and Olino in two ways. First, analyses were conducted on a combined sample of undergraduates and internet users who endorsed NSSI. Also, differences in exposure to trauma, post-traumatic stress disorder, and alcohol use were investigated. Results revealed a similar four-class structure of NSSI, with an additional fifth "Multi-method" group.

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Subtyping Nonsuicidal Self-Injurers: An Application of Latent Variable Mixture Modeling

Many researchers and clinicians in the area of nonsuicidal self-injury (NSSI) have speculated that self-injurers form a heterogeneous population, and that treatment needs may vary based on the type of self-injurer presenting for treatment (Evans, 2000; Hawton & Sinclair, 2003; Klonsky & Olino, 2008; Slee, Arensman, Garnefski, & Spinhoven, 2007). The majority of researchers and clinicians, however, approach NSSI as a homogeneous syndrome. A better understanding of this variability within this population could lead to more focused research efforts and potentially more effective treatment. Klonsky and Olino (2008) recently conducted a study to identify smaller, more homogenous groups within a population of 205 college students who reported having engaged in NSSI. To do so, they assessed endorsement of specific methods of NSSI, including cutting, biting, burning, carving, pinching, hair pulling, scratching, banging/hitting, wound picking, rubbing skin, needle sticking, and swallowing dangerous substances. They also examined several other characteristics of NSSI, including whether or not pain is felt at the time of NSSI, whether NSSI occurs in the presence of others, latency between the urge to self-injure and the actual act of NSSI, and self-reported social (external) and automatic (internal) reinforcement of NSSI as assessed by the *Inventory of Statements about Self-Injury* (ISAS; Klonsky & Olino, 2008; Klonsky & Glenn, 2009). These aforementioned variables were then entered into a latent variable mixture model (LVMM), which is a person-centered approach to classifying groups based on similar response patterns. Their findings suggested that a four-class model was the best fit for the data, resulting in four subgroups of self-injurers, labeled as follows: Experimental NSSI,

Mild NSSI, Multiple Functions/Anxious (MF/Anxious), and Automatic Functions/Suicidal (AF/Suicidal). A characterization of each class is given in Table 1.

Thus far in the literature there is consensus on the definition of NSSI, and much research has been conducted on specific behaviors or methods that constitute NSSI, theories of the functions of NSSI, and what precedes or tends to co-occur with NSSI. Klonsky and Olino's (2008) study was the first of its kind in the field of NSSI research, and their findings indicate a need for further investigation into differing types of self-injurers. For instance, there is a need to reproduce these analyses with another college sample in order to determine if Klonsky and Olino's findings are replicable. Klonsky and Olino also discussed the importance of replicating these analyses in a sample of treatment-seeking self-injurers and hypothesized such a population of self-injurers may be more represented in the MF/Anxious and AF/Suicidal groups. Finally, other measures of pathology and variables of interest should be added to investigations of differing types of self-injurers, such as trauma exposure and alcohol use. These are the goals of the current investigation.

Definition and Functional Models of NSSI

The term "self-harm" (or "deliberate self-harm") has been used to describe a range of behaviors that can be distinguished topographically and functionally, but which are similar in as much as they involve self-inflicted physical harm. Specifically, the term has been used to describe suicide attempts (Patton et al., 2007; Rossow et al., 2007; Syed & Khan, 2008), parasuicide (Haw, Houston, Townsend, & Hawton, 2001; O'Connor, Armitage, & Gray, 2006), general self-destructive behavior (Turp, 2002), overdosing or swallowing dangerous substances regardless of suicidal intent (Haw & Hawton, 2008),

Table 1
Description of Four-Class Model Solution Found by Klonsky and Olino (2008)

Class	Percentage of Sample	Description
Experimental NSSI	61%	Fewest clinical symptoms of depression, anxiety, suicidality, and BPD, and reported the fewest NSSI behaviors.
Mild NSSI	17%	Endorsed an earlier age of onset for NSSI and a wider variety of NSSI methods compared to the Experimental NSSI Group (mainly biting, pinching, and banging/hitting), and had a higher level of BPD symptoms than the Experimental and Multiple Functions/Anxious groups.
Multiple Functions/Anxious	11%	Mainly endorsed banging/hitting, hair pulling, pinching, cutting, biting, and scratching, indicated that NSSI served both a social and automatic reinforcing function, and had a higher level of anxiety than any of the other 3 classes.
Automatic Functions/Suicidal	10%	High rate of cutting (90.9%) for automatic reinforcement. Elevated levels on all 3 psychopathology measures (depression, anxiety, and BPD). Most members of this class indicated they self-injured when alone, and this class had higher rates of suicidal ideation, attempts, and instances of seeking medical attention as a result of a suicide attempt.

nonsuicidal self-injury (Croyle, 2007; Fox, Murray, & Warm, 2003; Gratz, Conrad, & Roemer, 2002), or any combination of these behaviors (Clarke et al., 2001; Sinclair, Gray, & Hawton, 2006; Slee, Garnefski, Spinhoven, & Arensman, 2008). It is the latter construct, nonsuicidal self-injury (NSSI), which was the focus of the current investigation.

NSSI is defined as deliberate harm to oneself without suicidal intent, and does not include self-injurious behaviors exhibited by individuals with developmental disorders such as autism, nor does it include culturally acceptable behaviors such as tattooing or piercing. In addition, NSSI is no longer viewed strictly as a symptom of the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition-Text Revision* (DSM-IV-TR; American Psychiatric Association, 2000) diagnosis of Borderline Personality Disorder (BPD), and research on NSSI is no longer restricted to using BPD samples. NSSI has now been studied in college students (e.g., Gratz et al., 2002; Klonsky & Olino, 2008; Whitlock, Eckenrode, & Silverman, 2006), the military (Klonsky, Oltmanns, & Turkheimer, 2003), “privileged youth” (Yates, Tracy, & Luthar, 2008), and community samples of adolescents (Ross & Heath, 2002; Ross & Heath, 2003; Weierich & Nock, 2008).

Several functional models of NSSI have been proposed. In the emotion regulation conceptualization of NSSI, NSSI is used as a strategy to attempt to diminish or control extreme negative affect. Indeed, many self-injurers state that prior to NSSI, they have feelings of anger, guilt, helplessness (Briere & Gil, 1998; Favazza & Rosenthal, 1993), anxiety, terror, “bad feelings” (Brown, Comtois, & Linehan, 2002), and tension (Briere & Gil, 1998) that are at least temporarily alleviated following the act of NSSI. One literature

review concluded that the emotion regulation model has the most empirical support when compared to other models such as self-punishment (using NSSI as a means of directing anger, hate, or disappointment towards oneself), anti-dissociation (bringing oneself out of a state of depersonalization or numbness by self-injuring), interpersonal-influence (knowingly or unknowingly using NSSI to manipulate others), sensation-seeking (the goal of NSSI is simply to produce feelings of excitement or a “rush”), anti-suicide (self-injuring as a means of preventing suicidal ideation), and interpersonal boundaries (establishing one’s identity and separating oneself from others through NSSI). This finding was significant even when controlling for the fact that more studies have been published on the emotional regulation model than any other model (Klonsky, 2007).

The Experiential Avoidance Model (EAM) is a more recently developed model of NSSI, and proposes that NSSI is a negatively reinforced strategy for reducing or eliminating unwanted thoughts, emotional arousal, bodily sensations, or other distressing internal experiences (Chapman, Gratz, & Brown, 2006). This model subsumes previous models focusing solely on emotion regulation, dissociation, and issues with interpersonal boundaries, and suggests that consistent avoidance of undesirable experiences negatively reinforces NSSI. There have only been a handful of empirical studies that have examined experiential avoidance and NSSI (Armey & Crowther, 2008; Chapman, Specht, & Cellucci, 2005). Gratz found that female college students endorsing NSSI had significantly higher levels of experiential avoidance compared to their matched counterparts (as cited in Chapman et al., 2006). Chapman and colleagues (2005) found that female inmates with higher diagnostic scores for BPD were more likely to endorse NSSI as well as have higher scores on measures of experiential avoidance, and increased

thought suppression was associated with number of NSSI incidents. Using structural equation modeling and a non-linear analysis referred to as a cusp catastrophe model, Arney and Crowther (2008) found that, in a sample of undergraduates, “individuals experiencing aversive self-awareness are more susceptible to NSSI” (p. 13). More research is needed to determine the validity of an experiential avoidance model of NSSI. For a review of other models of NSSI that have been examined, see Klonsky (2007) and Suyemoto (1998).

Precipitants and Correlates of NSSI

Depression and anxiety. Multiple studies have attempted to determine whether people who self-injure report higher symptoms of depression and anxiety. For instance, Ross and Heath (2002) examined a community sample of 440 adolescent girls and boys and found that those who reported engaging in NSSI also reported significantly higher levels of depression and anxiety than those who did not have a history of NSSI. Lambert and de Man (2007) investigated alexithymia, depression, and NSSI in a sample of adolescent girls. Although a sequential logistic regression revealed alexithymia and depression together distinguished between adolescent girls who self-injured and those girls who did not have a history of NSSI, depression was the more powerful predictor. Ross and Heath (2003) investigated differences in levels of anxiety in a community sample of adolescents and found that those who engaged in NSSI had significantly higher levels of trait anxiety (i.e., a general feeling of anxiety) and state anxiety (i.e., brief periods of anxiety usually experienced as a result of some triggering situation) than those without a history of NSSI. Other studies have also found that individuals who engage in NSSI have higher levels of anxiety and depression (Briere & Gil, 1998; Glenn &

Klonsky, 2009; Klonsky et al., 2003; Polk & Liss, 2007; Ross & Heath, 2002) and elevated levels of physiological arousal, tension-reduction, or decreased negative affect as a result of an NSSI episode (Bennun, 1984; Brain, Haines, & Williams, 1998; Briere & Gil, 1998; Haines, Williams, Brain, & Wilson, 1995; Murray, Warm, & Fox, 2005; Nock & Mendes, 2008; Ross & Heath, 2003).

Borderline personality disorder. NSSI is included in the DSM-IV-TR diagnostic criteria for BPD (APA, 2000), and therefore it is not surprising that some studies have reported prevalence rates of NSSI between 63 and 80% in samples of individuals meeting criteria for BPD (Gunderson, 2001; Linehan, 1993; Shearer, 1994; Shearer, Peters, Quaytman, & Ogden, 1990). One study, however, found that slightly more than half of an inpatient sample endorsing NSSI did not meet criteria for BPD, and when NSSI was excluded as a criterion, only 28% met BPD diagnosis (Herpertz, Sass, & Favazza, 1997). It is important, nonetheless, to take into account BPD symptoms when determining the relationship between depression, anxiety, and NSSI, as BPD is commonly comorbid with mood and anxiety disorders (APA, 2000; Gunderson et al., 2008; Zanarini, Frankenburg, Hennen, Reich, & Silk, 2004). Indeed, effects of depression and anxiety on NSSI may become inconsequential when symptoms of BPD are accounted for, as some research has suggested (Andover, Pepper, Ryabchenko, Orrico, & Gibb, 2005). Deficits in emotion regulation strategies common in individuals with BPD could account for depression and anxiety falling short of predicting NSSI beyond BPD, which would lend support to emotion regulation as a functional model of NSSI.

Trauma and post-traumatic stress disorder. Several studies have investigated the possibility that trauma may play a causal role in NSSI. Some researchers have

posited that childhood trauma, particularly childhood sexual abuse, increases the risk for the development of NSSI (Gratz & Chapman, 2007; Gratz et al., 2002; Roe-Sepowitz, 2007). In a sample of 256 female prisoners, Roe-Sepowitz (2007) found that those reporting NSSI (42.3% of the sample) also reported higher rates of childhood emotional and sexual abuse. Gratz et al. (2002) found different patterns of predictors of NSSI among male and female college students. Among women, dissociation, insecure paternal attachment, childhood sexual abuse, and maternal and paternal emotional neglect all predicted NSSI. For men, childhood separation and dissociation predicted NSSI, but childhood sexual abuse did not. In a sample of 198 female inpatients at a psychiatric facility, those with a history of NSSI (77% of the sample) reported significantly higher levels of childhood sexual abuse than those not endorsing NSSI (79% to 49%, respectively). Multiple theories have been proposed to explain this relationship. For instance, some researchers suggest that people who have experienced childhood abuse engage in NSSI as a means of reliving their traumatic events (Connors, 2000; Noll, Horowitz, Bonanno, Trickett, & Putnam, 2003). Briere and Gil (1998), on the other hand, suggest that those who have experienced sexual abuse may use NSSI in order to cope with symptoms of post-traumatic stress disorder (PTSD); for example, a person may cut him/herself to reduce distress associated with being reminded of the abuse, or to alleviate feelings of dissociation or numbing that have occurred as a result of the abuse.

A recent meta-analysis examined 43 studies (45 samples) of childhood sexual abuse and NSSI (Klonsky & Moyer, 2008). The meta-analysis only included studies that differentiated between NSSI and suicide attempts, and between childhood sexual abuse and other types of abuse (e.g., physical abuse). They found a relatively weak relationship

between childhood sexual abuse and endorsement of NSSI, with an aggregate phi coefficient of .23, and suggested that a publication bias may explain the abundance of studies with positive findings compared to the number of studies with nonsignificant results. Furthermore, many studies have found that when other environmental and psychological risk factors are controlled for, the relationship between childhood sexual abuse and NSSI becomes nonsignificant (Evren & Evren, 2005; Gladstone et al., 2004; Weierich & Nock, 2008; Zlotnick, Shea, Pearlstein, et al., 1996; Zweig-Frank, Paris, & Guzder, 1994).

In a study of 94 adolescents, Weierich and Nock (2008) found that childhood sexual abuse was significantly related to NSSI after controlling for Major Depressive Disorder and BPD symptoms. With the addition of PTSD symptoms, however, they found the relation between childhood sexual abuse and NSSI was fully mediated by reexperiencing and avoidance/numbing. This study suggests that PTSD may be critical to linking the experience of trauma to NSSI behavior.

Only a few studies have examined the relationships among adult-experienced trauma, PTSD, and NSSI. In a study of over 500 veterans diagnosed with PTSD, over half of the veterans indicated that they had engaged in NSSI in the two weeks prior to the assessment (Sacks, Flood, Dennis, Hertzberg, & Beckham, 2008). Compared to those without a history of NSSI, veterans who endorsed NSSI had higher levels of PTSD, impulsivity, hostility, and depression. The authors' assessment of self-reported emotional and physical sensations occurring prior to and following NSSI give support to an "automatic-positive reinforcement function" (Sacks et al., 2008, p. 492) of NSSI. In other words, NSSI in their sample served to increase positive feelings, as opposed to lessening

negative affect. Sansone, Chu, and Wiederman (2007) examined NSSI in 113 psychiatric inpatients and found that women who had experienced domestic violence were more likely to report engaging in NSSI than those who had not. Similarly, Murray, Wester, and Paladino (2008) examined dating violence and NSSI in a sample of 1,777 undergraduates and found that dating violence explained 6% of the variance in NSSI. Based on the findings from this limited number of studies conducted on the relationship between adult-experienced trauma, PTSD, and NSSI, there is a need for more research in this area to determine the extent of the impact.

Alcohol use. NSSI has been characterized as a coping strategy for dealing with intense emotion, similar to some conceptualizations of substance abuse as a form of “self-medication” (Briere & Gil, 1998; Farber, 1997; Nixon, Cloutier, & Aggarwai, 2002; Turner, 2002; Van der Kolk, Perry, & Herman, 1991). Given that both have been associated with the personality traits of impulsivity and neuroticism in past research (Claes, Vandereycken, & Vertommen, 2005; Sacks et al., 2008; von Diemen, Bassani, Fuchs, Szobot, & Pechansky, 2008; Zlotnick, Shea, Recupero, et al., 1997), the question of overlap between NSSI and substance abuse has been approached in a small number of studies. Hasking, Momeni, Swannell, and Chia (2008) found that individuals engaging in NSSI were more likely to report alcohol use than those who did not engage in NSSI. In the previously mentioned study of NSSI in a veteran population, however, this relationship was not found (Sacks et al., 2008). The most extensive study of NSSI and alcohol use examined these constructs in a sample of 500 female college students (Ogle & Clements, 2008) and found that participants who reported NSSI also reported riskier

patterns of alcohol use than those who denied NSSI, despite the fact that there were no differences in overall alcohol consumption between the groups.

One explanation for the inconsistent findings across studies examining the relationship between NSSI and various areas of psychopathology, including depression, anxiety, BPD, trauma, PTSD, and alcohol use is that NSSI was treated as a monolithic construct. This ambiguity provides a rationale for replicating Klonsky and Olinos work to determine whether their heterogeneous structure is indeed reproducible and applicable to explicating these relationships.

The Present Study

The current investigation replicated Klonsky and Olinos (2008) work by conducting an LVMM in a sample of nonsuicidal self-injurers. We also extended this line of inquiry in two ways: a) by conducting the LVMM with a combined sample of undergraduate students attending a public university and internet users who reported a history of NSSI and were recruited from NSSI discussion boards or websites, thus likely reflecting a more severe sample than students alone, and b) by examining differences between the different groups of self-injurers on measures of trauma, PTSD symptoms, and alcohol use in addition to the measures included in the original study to determine differences between the subtypes derived from the LVMM.

The internet has become an efficient means of collecting data from individuals who engage in NSSI, and some researchers have already used their experiences to inform others as to how to conduct methodologically sound internet research on NSSI in an ethical manner (Fox et al., 2003). The rationale for recruiting people who engage in NSSI from the internet was to obtain a more representative sample of self-injurers: almost 80%

of Klonsky and Olino's undergraduate population belonged in the first 2 classes of self-injurers, which were described as having "fewer or less NSSI behaviors and fewer clinical symptoms" (2008, p. 22). By including users of NSSI-related websites (hereafter referred to as "internet self-injurers"), we hoped to increase the range of severity in the sample, and thus explore the reliability of the classification structure in this diverse sample. Furthermore, we anticipated that by adding measures of trauma, PTSD, and substance use, we would further clarify how these constructs are related to NSSI.

Our hypotheses were as follows:

1.) Using LVMM, we expected to replicate the results found in Klonsky and Olino (2008). Specifically, we expected to find Klonsky and Olino's aforementioned four-class structure within the combined college and internet NSSI sample.

2.) Using ANCOVAs with time since last episode of NSSI as a covariate, we expected the more "severe" classes (i.e., the MF/Anxious Group and the AF/Suicidal Group) to have more traumatic experiences, PTSD symptoms, and more hazardous drinking. Specifically:

2a.) Individuals in the MF/Anxious Group and the AF/Suicidal groups would have significantly higher number of traumatic experiences than the Experimental and Mild NSSI groups.

2b.) Individuals in the MF/Anxious Group and the AF/Suicidal groups would have significantly higher PTSD symptom severity than the Experimental and Mild NSSI groups.

2c.) Individuals in the MF/Anxious Group and the AF/Suicidal groups would have significantly higher levels of hazardous drinking than the Experimental and Mild NSSI groups.

3.) We also examined motives for drinking alcohol across the groups. Considering the findings of Klonsky and Olino (2008), we expect:

3a.) Individuals in the MF/Anxious group who endorsed drinking alcohol would be more likely to endorse drinking motives related to coping with symptoms of anxiety on the DMQ-R than any other class because this group had higher levels of general anxiety than any other group.

3b.) Individuals in the AF/Suicidal group who endorsed drinking alcohol would be more likely to endorse drinking motives related to coping with symptoms of depression on the DMQ-R than any other class because of their predicted levels of depression and suicidality.

Method

Participants

Data were collected in an online format from two separate samples: a college sample ($n = 174$) and an internet sample ($n = 266$) for a total sample size of 440 self-injurers. College students were recruited through The University of Memphis Sona Systems (<http://memphis.sona-systems.com>), which is an online recruitment tool that allows university students to volunteer for participation in advertised research studies conducted within The University of Memphis Psychology Department. The internet sample was recruited through posted advertisements on several online discussion boards

pertaining to NSSI (see Appendix). This study received full approval from The University of Memphis Institutional Review Board.

Sample characteristics by recruitment method are displayed in Table 2, along with results of t-tests and chi-square tests conducted to examine differences between undergraduate self-injurers and internet self-injurers. There were significant differences between the samples on many demographic and clinical measures, which were expected considering our goal of incorporating more clinically severe self-injurers in our study. Age of the total sample of participants ranged from 18 to 56 years, with a mean age of 22.85 ($SD = 6.17$). The majority of the sample was Caucasian (81.1%; $n = 357$) and female (82.3%; $n = 362$). Cutting was the most highly endorsed method of NSSI ($n = 346$; 78.6%), followed by banging or hitting oneself ($n = 300$; 68.2%), wound picking ($n = 269$; 61.1%), severe scratching ($n = 252$; 57.3%), and burning ($n = 223$; 50.7%). Table 3 illustrates the lifetime frequencies of each NSSI behavior for the entire sample.

Procedure

All participants received informed consent and then completed a set of online questionnaires through the online survey software SurveyMonkey (www.surveymonkey.com). Internet self-injurers were recruited from several online discussion boards that described themselves as having the topics of “self-harm,” “self-injury,” “self-mutilation,” etc. Permission to post advertisements for the project was requested from the webmasters of each discussion board prior to posting any advertisements for the project.

Table 2

Summary of Sample Demographics and Percentages, Means, and Standard Deviations of Outcome Measures

	Undergraduates (<i>n</i> = 174)	Internet Users (<i>n</i> = 266)	Total Sample (<i>n</i> = 440)	<i>df</i>	<i>t</i>	χ^2
Age, <i>M</i> (<i>SD</i>)	21.21 (4.82)	23.94 (6.72)	22.85 (6.17)	416.46	-4.84***	
Gender, <i>n</i> (%)						
Male	43 (24.9)	33 (12.5)	76 (17.3)	1		11.23**
Female	130 (75.1)	232 (87.5)	362 (82.3)	-		-
Race/Ethnicity, <i>n</i> (%)						
White/Caucasian	104 (59.8)	231 (86.8)	335 (76.1)	1		42.43***
Black/African American	47 (27.0)	4 (1.5)	51 (11.6)	1		66.80***
Hispanic	9 (5.2)	17 (6.4)	26 (5.9)	1		0.28
Asian	2 (1.1)	5 (1.9)	7 (1.6)	1		0.36
American Indian/Alaska Native	1 (0.6)	0 (0)	1 (0.2)	1		1.53
Other	3 (1.7)	5 (1.9)	8 (1.8)	1		0.01
Multi-racial	8 (4.6)	4 (1.5)	12 (2.7)	1		3.80 [†]
Relationship Status, <i>n</i> (%)						
Single	76 (43.7)	164 (61.7)	240 (54.5)	1		13.71***
With member of opposite sex	69 (39.7)	52 (19.5)	121 (27.5)	1		21.33***
With member of same sex	8 (4.6)	9 (3.4)	17 (3.9)	1		0.42
Married	19 (10.9)	29 (10.9)	48 (10.9)	1		0.00
Separated	0 (0)	3 (1.1)	3 (0.7)	1		1.98
Divorced	3 (1.7)	8 (3.0)	11 (2.5)	1		0.71
Widowed	0 (0)	1 (0.4)	1 (0.2)	1		0.66
Age of Onset, <i>M</i> (<i>SD</i>)	12.02 (4.44)	13.83 (5.72)	13.12 (5.32)	436	-3.52***	

(continued)

Table 2 (continued)

Summary of Sample Demographics and Percentages, Means, and Standard Deviations of Outcome Measures

	Undergraduates (<i>n</i> = 174)	Internet Users (<i>n</i> = 266)	Total Sample (<i>n</i> = 440)	<i>df</i>	<i>t</i>	χ^2
Depression, <i>M</i> (<i>SD</i>)	12.98 (11.86)	25.03 (12.11)	20.02 (13.38)	409	-10.03***	
Anxiety, <i>M</i> (<i>SD</i>)	10.47 (9.88)	17.32 (11.21)	14.53 (11.19)	390.56	-6.58***	
BPD, <i>M</i> (<i>SD</i>)	5.61 (2.74)	7.08 (2.18)	6.48 (2.52)	314.98	-5.85***	
Suicidality, <i>n</i> (%)						
Thoughts	96 (55.5)	222 (88.8)	318 (72.3)	1		60.79***
Attempt	39 (22.5)	134 (53.6)	173 (39.3)	1		40.80***
Need for medical attention	14 (8.1)	76 (30.4)	90 (20.5)	1		30.38***
Trauma, <i>n</i> (%)						
Child sexual abuse	32 (18.6)	59 (23.9)	91 (20.7)	1		1.66
Child physical abuse	25 (14.5)	57 (23.1)	82 (18.6)	1		4.70**
Adult sexual assault	35 (20.3)	61 (24.7)	96 (21.8)	1		1.09
Adult abusive relationship	43 (24.9)	60 (24.4)	103 (23.4)	1		0.01
Multiple abuse types	20 (11.6)	46 (18.6)	66 (15.0)	1		3.83 [†]
PTSD Symptom Severity	42.93 (15.90)	55.30 (15.60)	50.35 (16.82)	218	-5.72***	
Hazardous Drinking, <i>M</i> (<i>SD</i>)	5.49 (6.76)	6.16 (7.52)	5.88 (7.21)	414	-0.94	
Drinking Motives, <i>M</i> (<i>SD</i>)						
Depression	1.84 (1.08)	2.15 (1.23)	2.01 (1.18)	292.88	-2.37*	
Anxiety	2.14 (1.10)	2.30 (1.07)	2.23 (1.08)	300	-1.31	

Note: Sample size varied due to missing data.

* $p < .05$. ** $p < .01$. *** $p < .001$. [†] $p < .06$

Table 3
Lifetime Frequencies of 12 NSSI Behaviors in Full Sample of Self-Injurers (n = 440)

Type of behavior	0 times (%)	1 or 2 times (%)	3-10 times (%)	11-50 times (%)	More than 50 times (%)
Banging or hitting	31.8	3.6	22.2	22.0	20.4
Hair pulling	52.7	4.3	18.6	13.7	10.7
Pinching	51.8	3.2	14.6	16.2	14.2
Cutting	21.4	5.0	9.2	10.4	54.0
Biting	50.9	5.9	20.4	13.3	9.5
Wound picking	38.9	2.2	11.6	13.5	33.8
Severe scratching	42.7	5.0	16.8	17.2	18.3
Rubbing skin	71.4	4.6	12.6	5.0	6.4
Burning	49.3	10.7	20.1	10.3	9.6
Needle sticking	70.7	3.4	10.2	10.5	5.2
Carving	69.1	5.0	16.4	5.9	3.6
Swallowing ^a	79.5	7.7	7.7	1.8	3.3

^aIndicates swallowing chemicals.

The following message was posted on the discussion boards:

We are looking for people who are interested in completing a brief (about 15-20 minutes) set of online questionnaires about deliberate self-harm and other feelings and behaviors, like depression, anxiety, suicidality, and potentially traumatic experiences, including sexual assault and sexual abuse. Please note that you will be asked specifically about self-injury, so if you are currently struggling with self-injury and are concerned that you may be triggered, we do not recommend that you complete this survey. Our only requirement is that you must be at least 18 years old. The purpose of our project is to learn more about the feelings and behaviors that may be related to deliberate self-harm. Participation for this project is completely voluntary, and there is no compensation offered for completing this survey. This project is being conducted by a clinical psychology graduate student from The University of Memphis, and has been approved by The University's Institutional Review Board. Follow this link to the consent form and survey questions: <survey link> Some questions may be difficult to answer, but we ask that you simply answer to the best of your ability (e.g., estimate if you are unsure of the exact answer). If you have any questions prior to or after completing this study, please contact us at uofm.project@gmail.com, an email account set aside for this project, or post your comments or questions below. Thank you!

Undergraduates were recruited from the Sona Systems website using a similar posting that stated they would receive a research credit that could apply to a psychology course in exchange for their participation in the project. Also, undergraduates were

informed in the advertisement that it was not required to have a history of NSSI to participate, although those who denied a history of NSSI were not included in this study.

Participants were told within the consent form that they could withdraw from the study at any time with no penalty. Within the consent form, at the top of every page in the survey, and at the completion of the survey, a list of resources was provided that participants could use if they became emotionally upset to the point of having suicidal thoughts or other thoughts of harming themselves. These and other ethical considerations and precautions were taken based on research previously conducted on NSSI that utilized the internet (Fox et al., 2002).

Measures

The following instruments were used in Klonsky and Olino's (2008) study, and were therefore used in the current investigation:

Inventory of Statements About Self-Injury (ISAS; Klonsky & Olino, 2008; Klonsky & Glenn, 2009). The ISAS was used as a measure of NSSI and its functions. It is composed of several items that assess methods and frequency of self-harming behavior, age of onset, whether or not physical pain is experienced during self-harm, whether the act occurs when the person is alone or with others, time between the urge to self-harm and the act, whether or not there is a desire to stop self-harming, and 41 items that assess the self-reported functions or reinforcements of NSSI. In the current study, the social reinforcement scale showed excellent internal consistency with a Cronbach's alpha of .90, and the automatic reinforcement scale showed adequate internal consistency ($\alpha = .78$).

Depression Anxiety Stress Scales (DASS-21; Lovibond & Lovibond, 1995). The short form of the DASS-21 is a self-report instrument that consists of three 7-item subscales: stress, anxiety, and depression. Participants indicated on a 4-point scale how much each item had applied to them over the past week. Sample items include, “I found it hard to wind down,” “I was aware of dryness in my mouth,” and “I couldn’t seem to experience any positive feeling at all.” In one study using a mixed clinical and community sample, the depression, anxiety, and stress scales were shown to have Cronbach’s alphas of .94, .87, and .91, respectively (Antony, Bieling, Cox, Enns, & Swinson, 1998). For this study the depression and anxiety scales were used, and both had excellent reliability, with Cronbach’s alphas of .93 and .85.

Youth Risk Behaviors Survey (YRBS). Suicidal thoughts and behaviors were assessed by items taken from the YRBS, which is a larger questionnaire developed by the National Centers for Disease Control and Prevention. Participants answered “yes” or “no” to the following questions: “Have you ever seriously thought about killing yourself?” “Have you ever tried to kill yourself?” and “If you have tried to kill yourself, did any attempt result in an injury, poisoning, or overdose that had to be treated by a doctor or nurse?” All items on the YRBS have shown moderate to substantial reliability (Brenner et al., 2002), and the suicide items have been used independent of, or in relation to, other items contained in the YRBS (Felts, Chenier, & Barnes, 1992; Perez, 2005; Swahn & Bossarte, 2007; Witte et al., 2008).

McLean Screening Instrument for Borderline Personality Disorder (MSI-BPD; Zanarini et al., 2003). BPD symptoms were assessed using the MSI-BPD. The MSI-BPD is a 10-item, self-report questionnaire in which the participants answered “yes”

or “no” to questions like “Have any of your closest relationships been troubled by a lot of arguments or repeated breakups?” “Have you often been distrustful of other people?” “Have you frequently felt unreal or as if things around you were unreal?” The MSI-BP has shown good test-retest reliability (Spearman’s $\rho = .72$) and internal consistency ($\alpha = .74$). A score of 7 or more “yes” responses indicates a positive screen that has shown good levels of sensitivity (.81) and specificity (.85) for the diagnosis of DSM-IV-TR BPD (Zanarini et al., 2003). Internal consistency for this measure in our sample was the same as in previous studies ($\alpha = .74$).

The following instruments were also administered to all participants:

Traumatic Events Questionnaire (TEQ; Vrana & Lauterbach, 1994). The TEQ is a self-report measure that assesses multiple traumatic experiences (e.g., combat, large fires/explosions, serious industrial/farm accidents, sexual assault/rape) and characteristics of each event (e.g., number of experiences, their age at the time(s), whether or not the event included physical injury or life threat). The TEQ has been used in a variety of populations including college students (Vrana & Lauterbach, 1994), pregnant survivors of childhood sexual abuse (Lev-Wiesel & Daphna-Tekoa, 2007), and primary care patients (Crawford, Lang, & Laffaye, 2008), and has a test-retest reliability of .91 in a sample of 51 students over a 2-week interval (Lauterbach & Vrana, 1994). Items used in this study included the experience of childhood sexual abuse, childhood physical abuse, adult sexual assault, and involvement in an abusive relationship as an adult, physical or otherwise.

PTSD Checklist for Civilians (PCL-C; Weathers, Litz, Huska, & Keane, 1994). Symptoms of PTSD were assessed using the PCL-C. This instrument is a 17-item, self-

report questionnaire in which participants indicated how much they have been bothered by specific PTSD symptoms over the past month on a 5-point scale ranging from “not at all” to “extremely.” The PCL has exhibited excellent psychometric properties among differing populations, and has been suggested to be a good measure of PTSD symptoms in college students (Adkins, Weathers, McDevitt-Murphy, & Daniels, 2008; Weathers et al., 1993; Yeager, Magruder, Knapp, Nicholas, & Frueh, 2007). The PCL showed excellent internal consistency in our sample ($\alpha = .94$).

Alcohol Use Disorder Identification Test (AUDIT; Saunders, Aasland, Babor, De La Fuente, & Grant, 1993). Hazardous drinking was assessed using the AUDIT. The AUDIT is a 10-item, self-report instrument that assesses amount and frequency of alcohol consumption, alcohol dependence, and problems resulting from heavy drinking. Scoring for each item ranges from 0 to 4. Studies that report psychometric properties of the AUDIT generally show good test-retest reliability and internal consistency, with Cronbach’s α ’s generally in the .80 range (Allen, Litten, Fertig, & Babor, 1997; Reinert & Allen, 2007). Internal consistency of the AUDIT in our sample was excellent ($\alpha = .89$).

Modified Drinking Motives Questionnaire-Revised (Modified DMQ-R; Grant, Stewart, O’Connor, Blackwell, & Conrod, 2007). Motives for alcohol use were assessed using the Modified DMQ-R, which is a list of 28 self-reported reasons for drinking alcohol that fall into 5 different domains: social, coping-anxiety, coping-depression, enhancement, and conformity. Participants indicated how much their drinking is related to each item on a 5-point scale ranging from “almost never/never” to “almost always/always.” For this study, only the coping-anxiety and coping-depression scales were examined. In a large sample of undergraduates, the DMQ-R scales showed internal

consistencies ranging from a Cronbach's α of .66 (social reinforcement scale) to .91 (coping-depression scale), and good to excellent test-retest reliability (Grant et al., 2007). In our sample, the coping-depression and coping-anxiety scales showed excellent internal consistency (α 's = .96 and .97, respectively).

Analytic Approach

Latent variable mixture modeling. LVMM is a statistical method for dividing a population into mutually exclusive classes using discrete and continuous data (Muthén & Muthén, 1998-2004). The LVMM was conducted using the statistical package Mplus Version 3.14 (Muthén & Muthén, 1998-2004). The primary aim of the LVMM was to determine the most parsimonious solution that best represented the varying constellations of endorsement of characteristics of NSSI with our sample of self-injurers. A total of 15 dichotomous items were included in the LVMM: the 12 NSSI behaviors, endorsement of the absence of pain at the time of a self-injurious act, whether the individual is typically alone at the time of the act of NSSI, and whether or not the individual waited at least an hour between the urge to self-injure and the act. Two continuous variables were also included in the analysis: the automatic and social reinforcement scales of the ISAS that ranged from 0 (no endorsement of items on the scale) to 8 (maximum endorsement of the items on the scale). The LVMM was conducted by examining how well several models fit the data, by first examining the data as a whole (one class), and then examining each model thereafter by increasing the number of classes by one. This process continued until the number of individuals with each class was too small to conduct subsequent analyses on differences among the groups, or until the analyses did not converge on a solution.

To determine the fewest number of classes that best characterized the sample, several fit statistics were considered, including the Akaike information criteria (AIC), Bayesian information criteria (BIC), sample-size adjusted BIC (SABIC), and the Lo-Mendell-Rubin likelihood ratio test (LMR LRT; Lo, Mendell, & Rubin, 2001). It is also considered a necessity to examine the interpretability and theoretical implications of solutions with different numbers of classes in conjunction with the aforementioned fit statistics (Muthén, 2003).

ANCOVAs, pairwise comparisons, and chi-square tests. After the latent classes were extracted, participants were assigned to their most likely class and were compared on several demographic and clinical measures. ANCOVAs and subsequent pairwise comparisons (Least Significance Difference tests) were conducted with time since last episode of NSSI in months used as a covariate to determine whether the classes differed on the following variables: age of onset of NSSI, symptoms of depression, anxiety, BPD, PTSD, hazardous drinking, as well as drinking motives related to depression and anxiety. Chi-square tests were used to determine differences in suicidality and the experience of specific types of trauma (i.e., childhood sexual abuse, childhood physical abuse, adult sexual assault, involvement in an abusive relationship as an adult, and whether or not multiple abuse types were endorsed).

Results

Latent Variable Mixture Modeling

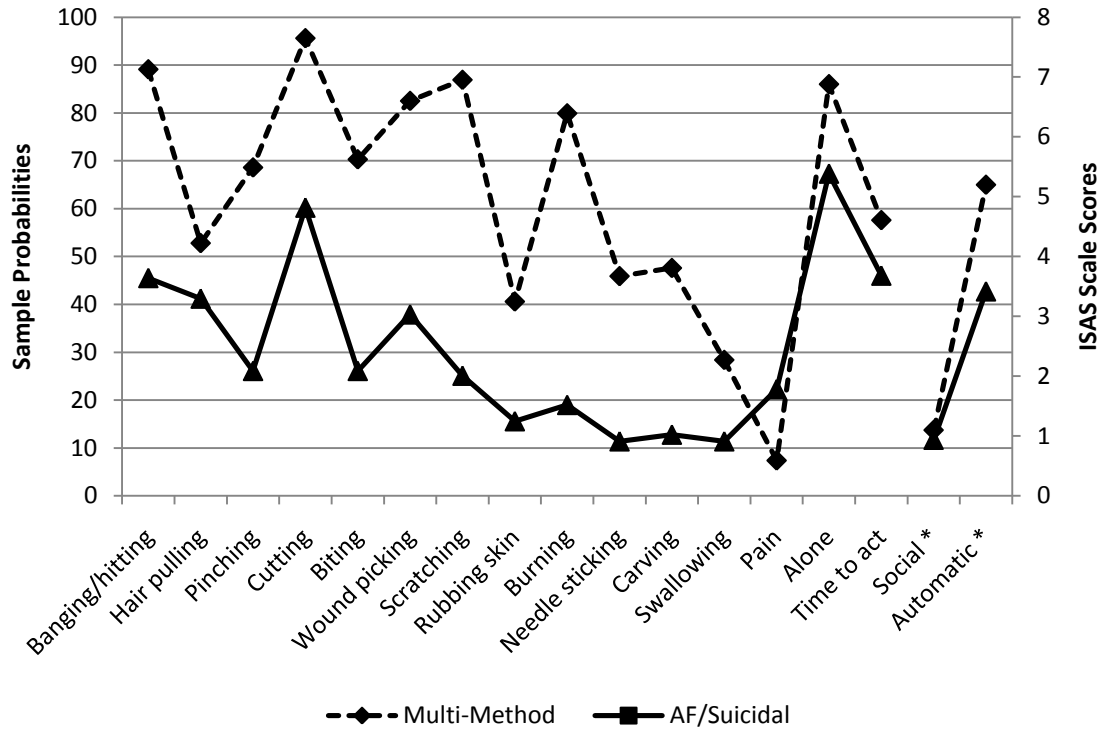
Latent models with 1-6 classes were conducted. Analyses were discontinued once the number of participants within a class was considered too small to conduct subsequent analyses comparing the latent classes (i.e., class $n < 10$). Figure 1 illustrates two- through

six-class model solutions. The primary vertical axis is indicative of the percentage of endorsement for each of the dichotomous measures of NSSI. Because two continuous scale scores from the ISAS that measure the amount of social (i.e., external) and automatic (i.e., internal) reinforcement received from engaging in NSSI were used in the LVMM, the sample means of these scales are reported on the secondary vertical axis.

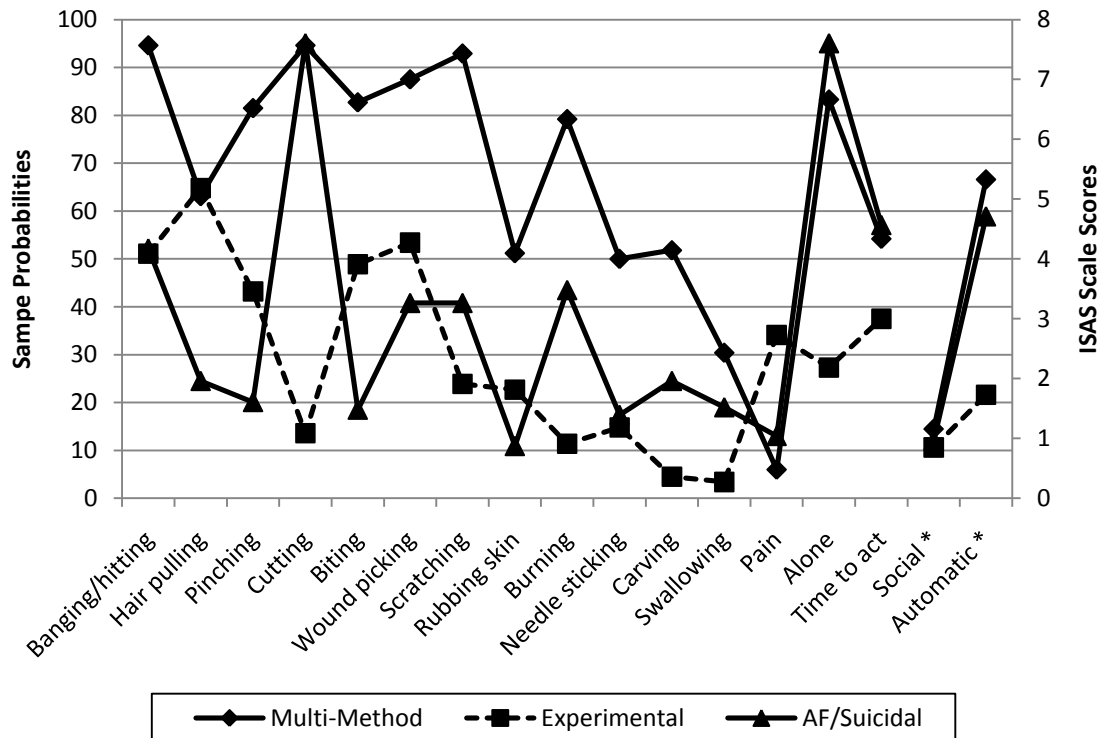
The two-class solution (see Figure 1) included a class (48.0%) of self-injurers with a high probability of cutting and moderate levels of banging or hitting oneself, with low levels of social reinforcement but high levels of automatic reinforcement who almost always self-injure when alone, similar to Klonsky and Olino's (2008) AF/Suicidal group. The second class (52.0%) had moderate-to-extremely-high levels of all NSSI behaviors with the exception of swallowing dangerous substances. This group mimicked the AF/Suicidal class in terms of low levels of social reinforcement but high levels of automatic reinforcement, high probabilities of feeling pain during NSSI, high probabilities of self-injuring in isolation, and high probabilities of at least an hour latency between the thought of NSSI and the actual act. Based on the characteristics of this group, it will be referred to as the "Multi-method" group. The three-class solution retained the two classes found in the previous solution (41.8% and 38.2% of the sample, respectively) and also included a class (20.0%) with overall low probabilities of NSSI methods, with the exception of moderate levels of banging or hitting oneself, hair pulling, biting, and wound picking, with low levels of social and automatic reinforcement. This class is similar in description to Klonsky and Olino's "Experimental NSSI" group.

The four-class solution consisted of all classes found in the three-class solution (41.6%, 37%, and 17% of the sample, respectively) and an additional class (4.3%) that

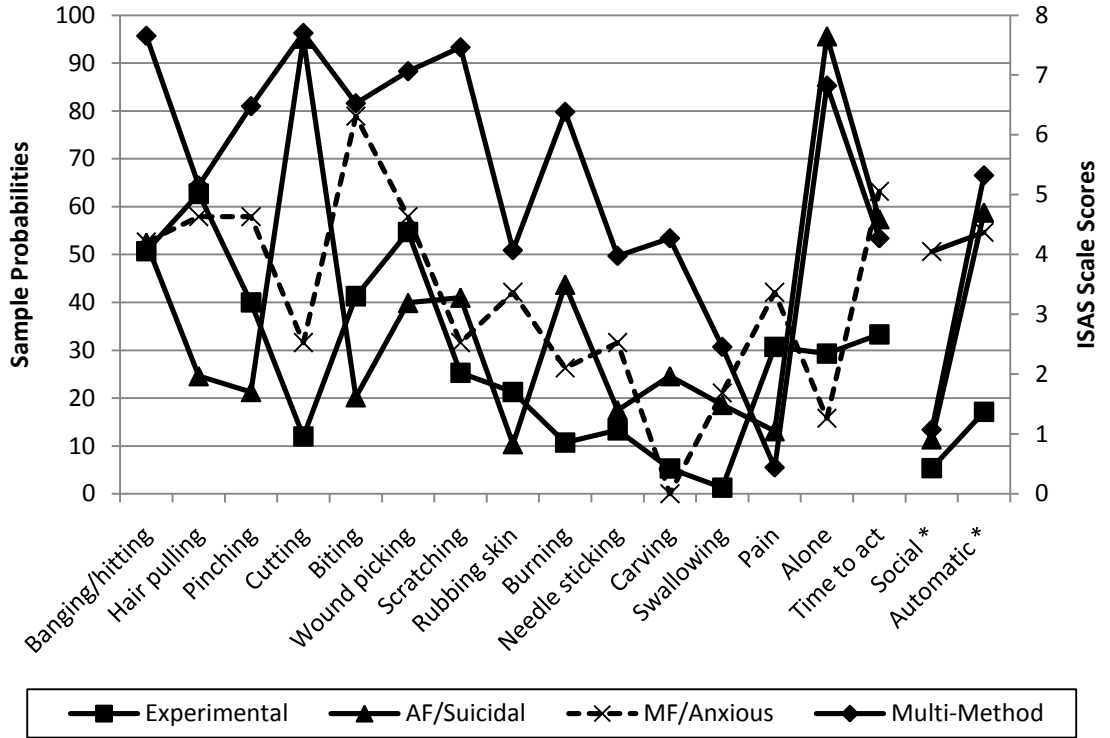
Two-Class Solution



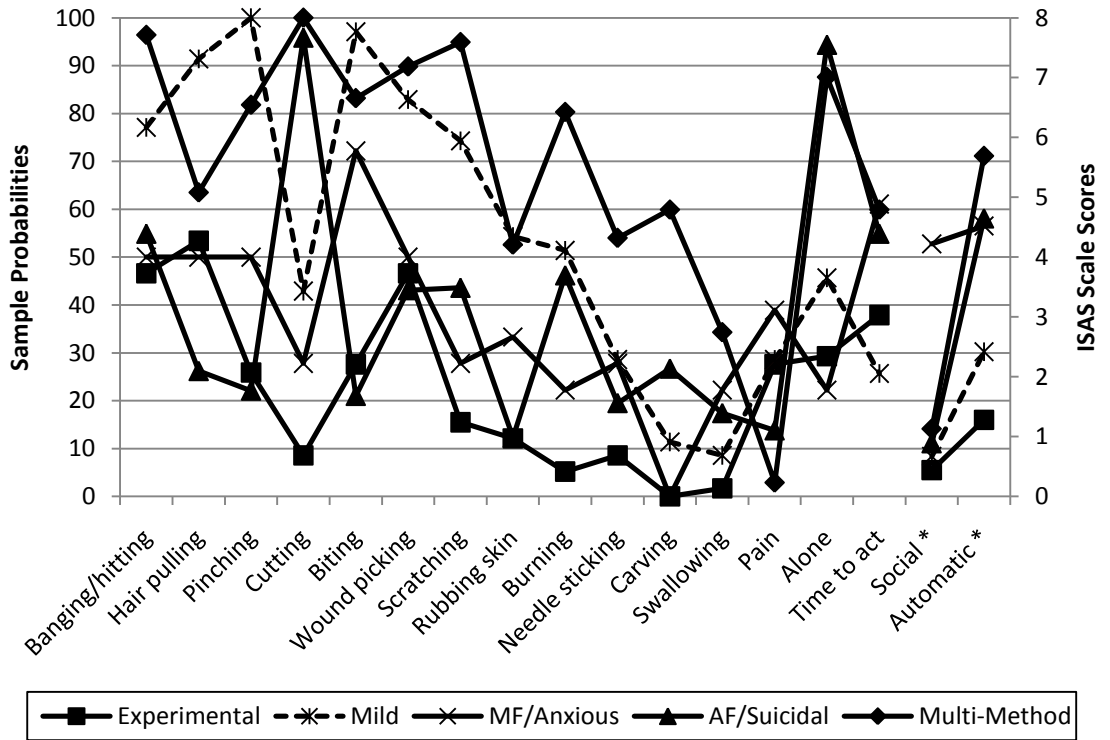
Three-Class Solution



Four-Class Solution



Five-Class Solution



Six-Class Solution

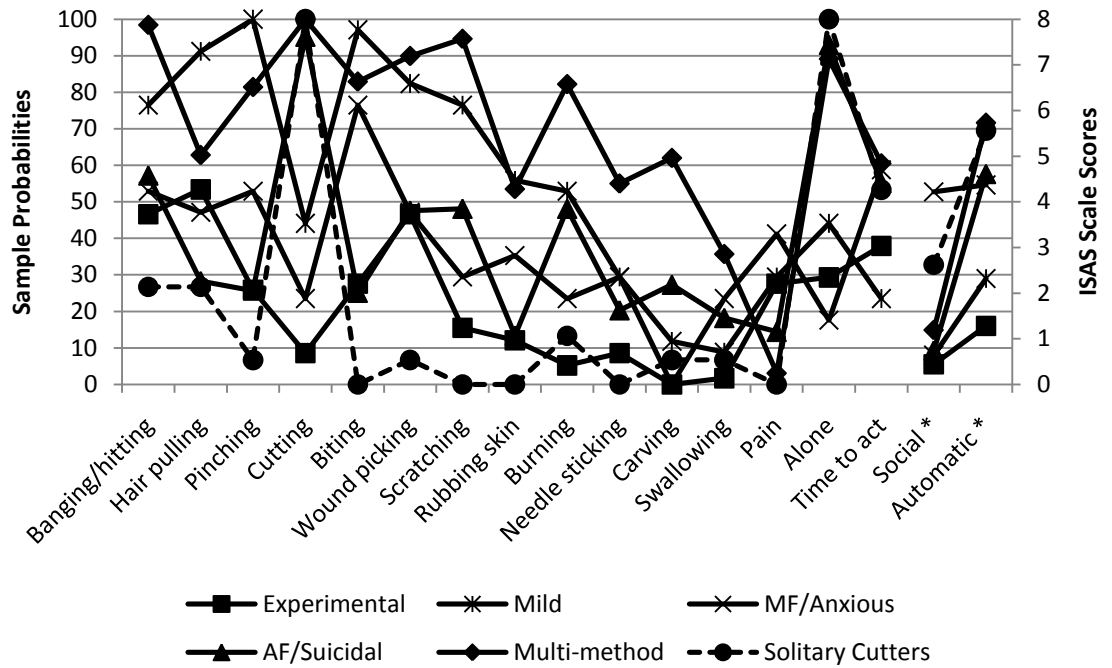


Figure 1. Two- through six-class solutions for LVMM conducted with nonsuicidal self-injurers. Dashed lines indicate a class that was not evident in the previous model solution.

*Refers to the social and automatic reinforcement subscales of the ISAS which are measured on a scale of 0 (no endorsement of items) to 8 (maximum endorsement of items).

had moderate-to-high probabilities of banging or hitting oneself, hair pulling, pinching, biting, and wound picking, and who had low probabilities of self-injuring only when alone and relatively high levels of social and automatic reinforcement, comparable to Klonsky and Olino's (2008) MF/Anxious group. The five-class solution retained the four classes found in the previous model solution (43.2%, 31.6%, 13.2%, and 4.1% of the sample, respectively) with an additional class (8.0%) that had moderate probabilities of burning and rubbing skin against rough surfaces, and high-to-extremely high probabilities of banging or hitting oneself, hair pulling, pinching, biting, wound picking, and severe scratching. However, this subgroup had relatively low levels of social and automatic reinforcement. This subgroup was comparable to Klonsky and Olino's "Mild NSSI" group. The six-class solution retained the five classes from the previous model (42.5%, 29.3%, 13.2%, 3.9%, and 7.7%, of the sample, respectively) and added a subgroup (3.4%) composed entirely of individuals who cut themselves only when alone, and who have extremely low endorsement rates of other methods of NSSI. This group will be referred to as the "Solitary Cutters" group.

The resulting fit indexes suggested several models provided a good fit for the data (see Table 4). The AIC, BIC, and sample-size adjusted BIC suggested different models ranging from four to six classes. The LMR LRT pointed to a three-class model, although this value was also marginally significant ($p = .08$) for the five-class solution. Considering these fit statistics, the substantive meaning of each model, and the previous findings of Klonsky and Olino (2008), the five-class model appeared to be the best fit. The four-class model lacked in terms of distinguishing between the two less severe NSSI groups (i.e., Experimental and Mild NSSI groups), a delineation which may prove

Table 4
Fit Indices and Entropies for Latent Variable Mixture Modeling Analyses

Number of Classes	AIC	BIC	SABIC	LMR LRT	Entropy
1 Class	11401.12	11478.77	11418.47	-	-
2 Classes	10821.54	10972.75	10855.33	583.62***	0.76
3 Classes	10537.12	10761.90	10587.35	303.78**	0.82
4 Classes	10431.78	<u>10730.11</u>	10498.44	134.01	0.86
5 Classes	10373.76	10745.65	<u>10456.86</u>	89.14 [†]	0.87
6 Classes	<u>10365.58</u>	10811.04	10465.13	41.40	0.87

Note. $N = 440$. AIC = Akaike information criterion; BIC = Bayesian information criterion; SABIC = sample-size adjusted Bayesian information criterion; LMR LRT = Lo-Mendell-Rubin likelihood ratio test. The null hypothesis for p values associated with the LMR LRT is that a solution with a given number of classes provides the same fit to the data as a solution with one less class. Underline indicates the smallest value for each information criteria based indices.

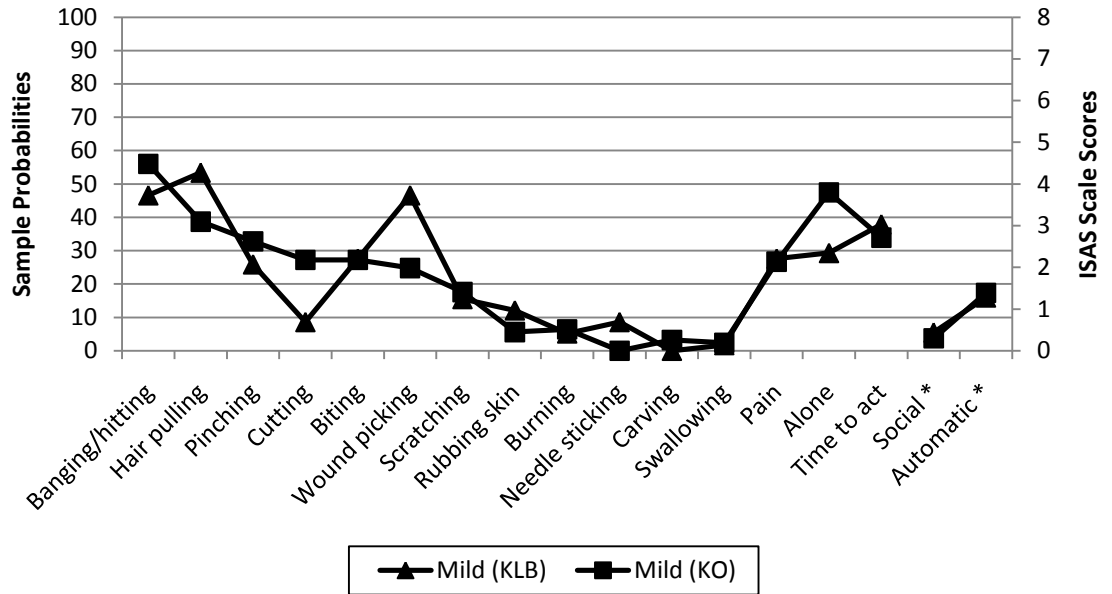
** $p < .01$. *** $p < .001$. [†] $p < .10$.

valuable in research and clinical settings. Conversely, from the perspective of parsimony, the six-class model solution was unnecessarily complicated. Therefore, the five-class solution was considered the most parsimonious, yet descriptive, solution and was used in all follow-up analyses. Entropy for this solution was excellent (.87), indicating that participants fit well into their respective subgroups. The distribution across the five classes differed across our two subsamples. Approximately one third of the undergraduates were classified into the Experimental NSSI group ($n = 57$; 32.8%), approximately a third in the AF/Suicidal ($n = 59$; 33.9%), and the remaining third was distributed across the three remaining classes: Mild NSSI ($n = 29$; 16.7%), MF/Anxious ($n = 15$; 8.6%), and Multi-method ($n = 14$; 8.0%). The internet self-injurers were mostly classified as AF/Suicidal ($n = 131$; 49.2%) and Multi-method ($n = 125$; 47.0%). To allow for further examination of whether four of the five classes found in the current study replicated the four classes found in the original authors' study, sample probabilities provided in Klonsky and Olino's article are reproduced and superimposed on the sample probabilities of the findings from the current study in Figure 2.

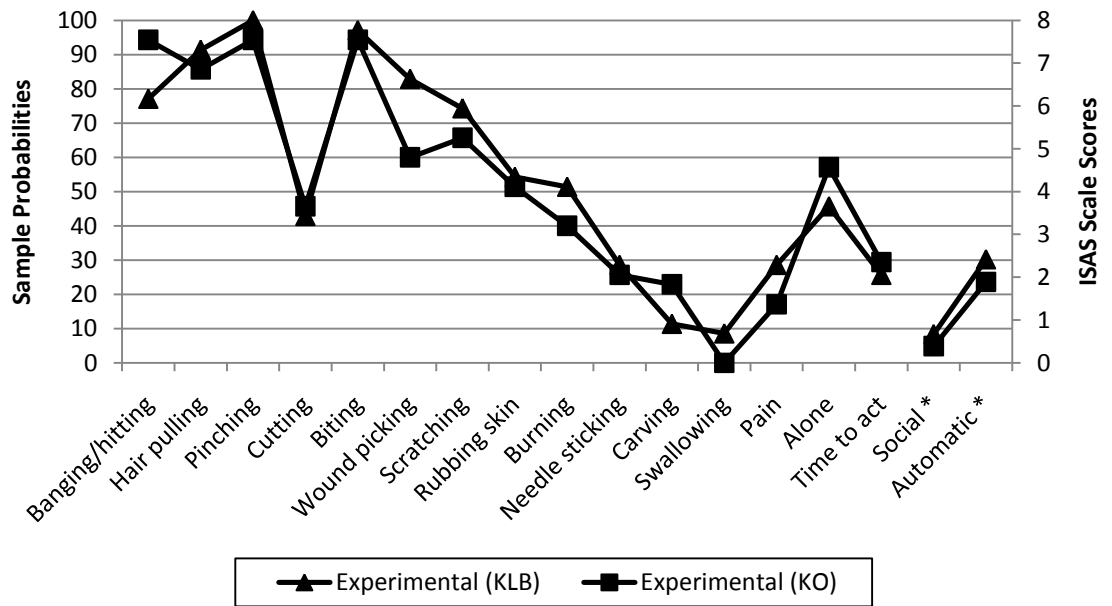
Class Comparisons

Some participants did not complete all clinical measures. However, individuals with missing data did not vary significantly across the five extracted classes, $\chi^2(4) = 9.32, p > .05$, nor did they differ in terms of scores on any other clinical measure (all p 's $> .05$). Group comparisons were examined through ANCOVAs and pairwise comparisons, as well as chi-square analyses. There was statistically significant variation across classes with respect to time since last episode of NSSI, $F(4, 435) = 7.65, p < .001$, and because this could potentially effect clinical symptom severity presentation, this

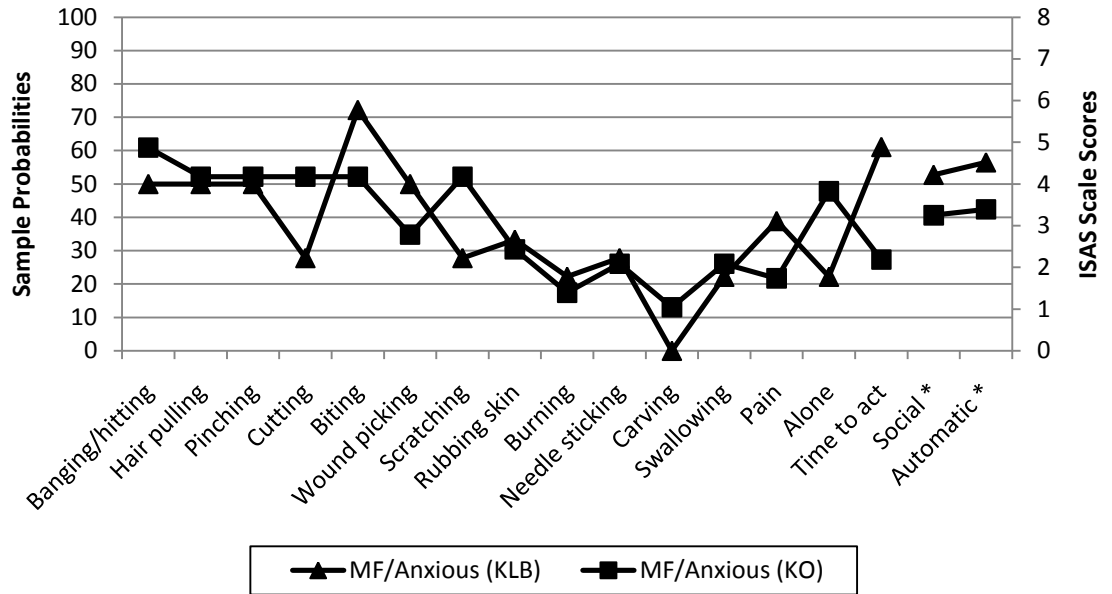
Experimental NSSI Group Comparisons



Mild NSSI Group Comparisons



Multiple Functions/Anxious Group Comparisons



Automatic Functions/Suicidal Group Comparisons

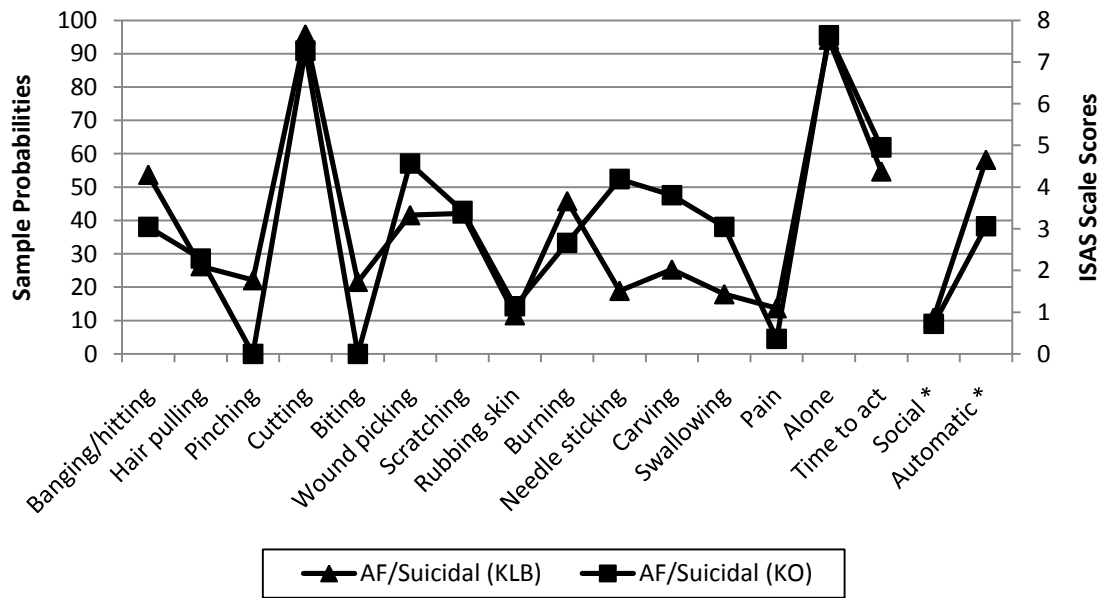


Figure 2. Comparisons of classes 1-4 found in the current study's five-class LVMM solution (KLB) with the four classes reported by Klonsky and Olino (KO).

*Refers to the social and automatic reinforcement subscales of the ISAS which are measured on a scale of 0 (no endorsement of items) to 8 (maximum endorsement of items).

variable was included as a co-variate in the subsequent ANCOVAs. Table 4 displays the results of these analyses in addition to adjusted means, standard errors, and percentages of endorsement for each measure within each latent class.

ANCOVAs revealed significant differences among the classes for age of onset of NSSI, severity of depressive and anxiety symptoms, as well as symptoms of BPD. Differences also emerged for PTSD symptoms in individuals who endorsed at least one of the traumatic experiences from the TEQ, hazardous drinking, and drinking motives related to coping with depression and anxiety for individuals who endorsed any alcohol use on the AUDIT. Results from pairwise comparisons indicated these overall trends: 1) the Experimental NSSI group had the lowest levels of symptoms on all clinical measures, though not significantly different from those of the Mild NSSI group; 2) the Multi-method group had the highest levels of symptoms of depression, anxiety, BPD, and PTSD, followed next in severity by the AF/Suicidal group, though many times neither of these groups was significantly different from the MF/Anxious group; and 3) the MF/Anxious group had significantly higher levels of hazardous drinking as well as higher levels of using alcohol to cope with depression and anxiety than any other group.

Chi-square analyses revealed group differences on lifetime occurrence of suicidal thoughts, suicide attempts, and the need for seeking medical attention as the result of a suicide attempt. The Multi-method group had significantly higher percentages of all three suicide items compared to all other classes. The AF/Suicidal group had higher endorsement rates of these variables than the Experimental NSSI, Mild NSSI, and MF/Anxious groups, but the Experimental NSSI, Mild NSSI, and MF/Anxious groups did not differ statistically from one another on any of the suicide items. There were

Table 4
Clinical Differences Among the Five Latent Classes of Self-Injurers

Variable	Experimental (<i>n</i> = 58)	Mild (<i>n</i> = 35)	MF/Anxious (<i>n</i> = 18)	AF/Suicidal (<i>n</i> = 190)	Multi-method (<i>n</i> = 139)	<i>F</i>	<i>df</i>	χ^2 (4)
Age of onset <i>M (SE)</i>	11.32 (0.69) _{a,c}	10.30 (0.88) _a	11.75 (1.25) _{a,c}	14.49 (0.37) _b	12.85 (0.44) _c	7.96***	4, 432	
Depression <i>M (SE)</i>	10.91 (1.62) _a	13.79 (2.08) _{a,b}	20.42 (3.12) _{b,c,d}	20.10 (0.91) _c	25.54 (1.08) _d	16.15***	4, 405	
Anxiety <i>M (SE)</i>	8.65 (1.40) _a	10.61 (1.77) _{a,d}	18.04 (2.50) _{c,e}	13.03 (0.77) _{c,d}	19.55 (0.91) _e	14.43***	4, 411	
BPD <i>M (SE)</i>	4.38 (0.30) _a	5.11 (0.39) _a	7.35 (0.57) _{b,c}	6.64 (0.17) _b	7.43 (0.20) _c	21.08***	4, 416	
Suicide, <i>n</i> (%)								
Ideation	21 (36.2) _a	19 (55.9) _a	9 (52.9) _a	148 (80.0) _b	124 (93.9) _c			86.10***
Attempt	8 (13.8) _a	3 (8.8) _a	2 (11.8) _a	78 (42.2) _b	82 (62.1) _c			62.91***
Medical	3 (6.4) _a	1 (4.0) _a	2 (11.8) _{a,b,c}	37 (24.5) _b	47 (39.8) _c			29.90***
Trauma exposure, <i>n</i> (%)								
Child sexual abuse	5 (8.8) _a	4 (11.8) _{a,b}	5 (31.3) _b	44 (24.7) _b	33 (24.6) _b			10.07*
Child physical abuse	4 (7.0) _a	4 (11.8) _{a,b}	2 (12.5) _{a,b}	37 (20.8) _b	35 (26.1) _b			11.35*

(continued)

Table 4 (continued)
Clinical Differences Among the Five Latent Classes of Self-Injurers

Variable	Experimental (<i>n</i> = 58)	Mild (<i>n</i> = 35)	MF/Anxious (<i>n</i> = 18)	AF/Suicidal (<i>n</i> = 190)	Multi-method (<i>n</i> = 139)	<i>F</i>	<i>df</i>	χ^2 (4)
Adult sexual assault	6 (10.5) _a	4 (11.8) _{a,b}	5 (31.3) _{b,c}	43 (24.2) _{b,c}	38 (28.4) _c			10.38*
Adult abusive relationship	12 (20.7)	3 (8.8)	5 (31.3)	45 (25.3)	38 (28.6)			6.60
Multiple abuse types	1 (1.7) _a	3 (8.8) _{a,b}	2 (12.5) _{a,b}	30 (16.9) _b	30 (22.4) _b			14.60**
PTSD <i>M (SE)</i>	43.93 (3.45) _a	50.88 (5.30) _{a,b}	51.85 (4.82) _{a,b}	48.45 (1.56) _a	54.56 (1.85) _b	2.52*	4, 214	
Hazardous drinking <i>M (SE)</i>	3.78 (0.95) _a	5.82 (1.22) _{a,c}	11.24 (1.78) _b	6.16 (0.53) _c	5.78 (0.63) _{a,c}	3.61**	4, 410	
Drinking motives <i>M (SE)</i>								
Depression	1.48 (0.17) _a	1.98 (0.22) _{a,c}	3.62 (0.29) _b	1.82 (0.09) _a	2.33 (0.12) _c	13.26***	4, 293	
Anxiety	1.91 (0.17) _a	2.33 (0.22) _{a,c}	3.12 (0.27) _b	2.06 (0.09) _a	2.47 (0.11) _c	5.85***	4, 296	

Note: Sample size varied due to missing data. Means presented are adjusted for length of time in months since previous NSSI episode.

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

significant differences among groups for childhood sexual abuse, childhood physical abuse, and adult sexual assault, but not for involvement in an adult abusive relationship. There were also group differences in the rates of having experienced multiple abuse types (i.e., whether or not someone endorsed more than one abuse item). Group differences on these items were not entirely consistent across all items, but generally the trends were that the Experimental NSSI group had the lowest endorsement rates of the abuse items but were not significantly different from those of the Mild NSSI group, and the Mild NSSI, MF/Anxious, AF/Suicidal, and Multi-method groups did not differ from one another on the abuse items with the exception of the Multi-method group having a higher endorsement rate of adult sexual assault than the Mild NSSI group.

Discussion

In the current study, we replicated and extended analyses conducted by Klonsky and Olino (2008) by examining the structure of NSSI in a sample with a wide range of severity of NSSI behavior. We hypothesized that by using LVMM we would find a four-class model solution that included classes resembling those found by the original authors, and this hypothesis was largely supported. The best-fitting solution for the current dataset had five classes, with four subgroups that appeared similar in structure and in clinical profile to Klonsky and Olino's with the addition of a fifth, "Multi-method" group. Although one cannot expect to replicate the exact values reported in a previous study, by and large, the classification structure found in the current study closely resembles that found by the original authors but suggests that, in more severe samples, a fifth class emerges, characterized by a more severe profile. Results from the measures included in the original study (i.e., age of onset of NSSI, depression, anxiety, BPD, and suicidality)

showed that, in general, the Experimental and Mild NSSI groups had the lowest levels of psychopathology and age of onset of NSSI. Also consistent with Klonsky and Olino, the AF/Suicidal group had higher levels of psychopathology than the first three groups except for anxiety, which was highest for the MF/Anxious group. The only notable difference in findings between studies was the fact that the MF/Anxious group had higher scores on the measure of BPD symptoms than the Mild NSSI group in the current study, which was not found in the original investigation. The additional Multi-method group was found to have significantly higher levels of psychopathology than the Experimental, Mild, and AF/Suicidal groups across all of these measures, but not significantly different from the MF/Anxious group.

In this study, we also investigated the pattern of trauma exposure and symptoms of PTSD symptoms across the groups, hypothesizing that individuals in the more severe groups would be more likely to endorse a variety of traumatic experiences and higher levels of PTSD symptoms. This hypothesis was partially supported. Differences among groups were not consistent across all trauma items, but there was a pattern for the more severe groups to have higher levels of these traumatic experiences relative to the Experimental and Mild NSSI groups. The Multi-method group had the highest level of PTSD symptom severity, but it was not significantly different from the Mild NSSI and MF/Anxious groups.

Given the parallels between NSSI and hazardous drinking as maladaptive coping strategies and the fact that both seem most common among adolescents and young adults, we sought to examine patterns of alcohol use and misuse across the groups. We found that the MF/Anxious group had significantly higher levels of hazardous drinking than any

other group, but the other more severe groups (i.e., AF/Suicidal and Multi-method groups) did not differ significantly from the Experimental and Mild NSSI groups. We had also hypothesized that the MF/Anxious group would endorse higher levels of drinking motives related to coping with anxiety, whereas the AF/Suicidal group would have higher levels of drinking motives related to coping with depression. Surprisingly, the MF/Anxious group not only reported significantly higher levels of hazardous drinking than any other class, but also scored higher on both anxiety and depression drinking motives compared to all other groups, and the AF/Suicidal and Multi-method groups did not differ from the Experimental or Mild NSSI groups in terms of drinking motives. These findings may help address some of the discrepancies in the literature. There appears to be a subset of self-injurers who do engage in risky alcohol use in order to cope with negative affect, whereas a majority of self-injurers seem to rely more heavily on NSSI to regulate emotions. We did not, however, measure drug use or other risky behaviors that may be used in tandem with NSSI to cope with negative emotions, and therefore true differences among the groups in the use of other coping mechanisms cannot be detected based on the results of our study.

The current findings shed light on some of the assumptions about self-harm behavior. The stereotypical self-injurer is often assumed to be someone who engages in cutting as opposed to other forms of self-injury, and does so solitarily. It is important to point out that only 3.4% of our sample fell into the “Solitary Cutters” group, which was the only group that unanimously endorsed cutting while alone. Furthermore, only 42.9% of the Mild NSSI group and 27.8% of the MF/Anxious group endorsed a history of cutting as a method of NSSI. These percentages are noteworthy considering many

researchers only recruit individuals who endorse cutting (e.g., Brown, Houck, Hadley, & Lescano, 2005; Suyemoto & MacDonald, 1995), and suggest that many individuals who self-injure do so by means other than cutting (i.e., hitting oneself, skin picking, severe scratching, burning). Similarly, in clinical settings it may be beneficial to conduct thorough topographical and functional assessments of NSSI. That is, a clinician should not assume that someone who denies cutting does not engage in any form of NSSI, and if a client presents with cutting it would be beneficial to inquire about other potential forms of NSSI to ensure the client does not simply increase other forms of NSSI once their cutting behaviors have been targeted through treatment. Also, a functional analysis that identifies reinforcing consequences of NSSI, such as internal (emotional) or external (environmental/social) cues, could lead to more targeted intervention.

Historically, another assumption about NSSI has been that it is indicative or an equivalent of BPD. This misperception is illustrated in the fact that much of the beginnings of research on NSSI were conducted on limited samples of mainly female BPD patients (e.g., Shearer, 1994; Zweig-Frank et al., 1994). Although self-harm is one of the BPD symptoms (APA, 2000), the present data suggest that not all self-injurers meet criteria for BPD, as supported by previous research (Herpertz et al., 1997). The groups differed significantly in terms of BPD, with only two of the five groups having group means above the cut-off used for screening BPD ($MSI-BPD \geq 7$). Therefore it is necessary for clinicians not to equate NSSI with BPD, but to remain open to the possibility of such a diagnosis. Doing so could reduce the number of individuals who may become stigmatized by an unfitting diagnosis of BPD.

There were several limitations to this study. All instruments used in this study were self-report and were administered online, therefore we had no ability to control the conditions under which participants completed the questionnaires. The use of the internet also limited our sample to those who have access to and are capable of using the internet. It is also impossible to determine differences between those self-injurers who self-selected to participate in the study versus those who declined. The possibility of individuals submitting multiple responses to the survey was less of a concern, however, due to SurveyMonkey's available settings to limit one response per computer.

We only examined a small number of specific traumatic experiences and did so in a dichotomous manner. Future studies should assess a broader range of traumatic experiences and measure them in a more detailed way, such as whether or not abuse is ongoing or an isolated incident and whether or not the self-injurer sees their NSSI as being directly related to the trauma. Traumatic experiences and depression, anxiety, BPD, PTSD, and other diagnoses may be better assessed through structured interviews and corroboration from loved ones. Furthermore, with the development of technology aiding in real-time assessment and treatment of psychological phenomena (Ebner-Priemer & Trull, 2009; Simons, Gaher, Oliver, Bush, & Palmer, 2005), it may be helpful to collect this type of data with self-injurers to determine whether classes vary on longitudinal, real-time clinical distress, cognitions, or other important areas. Although the present study supports the validity of the classification structure described by Klonsky and Olino, and extended that work in a more severe sample, there are still many remaining questions about how these findings might apply to other clinical samples of self-injurers, such as those in an inpatient or outpatient treatment setting. We assume that individuals in

clinical settings would fall into the MF/Anxious, AF/Suicidal, and Multi-method groups, but it is possible that clinical samples of self-injurers could comprise a class that differs either qualitatively or in terms of severity from the classes found thus far. It is also possible that “solitary cutters” might comprise a larger subgroup of that population. Another area for future research is to examine this typology in younger samples. Because NSSI often begins in adolescence (Jacobson & Gould, 2007), it may be fruitful to examine groups in this age range recruited through their schools or the community. NSSI is also seen frequently in male and female prison inmates (Chapman et al., 2005; Lohner & Konrad, 2006), and it would be interesting if a similar structure was supported in a forensic setting, especially because NSSI is typically viewed as a means of manipulating staff in such an environment (Franklin, 1988; DeHart, Smith, & Kaminski, 2009).

In sum, through identifying and examining multiple subgroups of individuals who endorsed a history of NSSI, we provided further support for Klonsky and Olino’s (2008) LVMM and addressed some existing gaps in the NSSI literature. Self-injurers do not present as one homogenous group of “solitary cutters” as is commonly portrayed in the media and perceived by some researchers and clinicians alike. They present with a myriad of characteristics of NSSI as well as varying types and levels of clinical distress. Perhaps more importantly, the next natural step will be for researchers to begin investigating whether or not there are varying treatment outcomes based on the “type” of self-injurer and to disseminate this information so that clinicians can be better informed and prepared for treating individuals who engage in NSSI.

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Appendix

Online NSSI Discussion Boards

“Bodies Under Siege” discussion board - <http://buslist.org/phpBB/>

“Safe Haven” discussion board - <http://gabrielle.self-injury.net/index.php>

“Self-Injury Awareness” group on Facebook – www.facebook.com

“Self-Injury Forum” on eHealth – www.ehealthforum.com