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Predicting Persistence of Non-suicidal Self-Injury in Suicidal Adolescents

Shirley Yen, Ph.D.^{1,4}, Kevin Kuehn, B.S.¹, Caitlin Melvin, B.A.¹, Lauren M. Weinstock, Ph.D.^{1,4}, Margaret S. Andover, Ph.D.², Edward A. Selby, Ph.D.³, Joel B. Solomon, M.D.^{1,4}, and Anthony Spirito, Ph.D.¹

¹Department of Psychiatry and Human Behavior - Warren Alpert Medical School of Brown University, Providence, RI

²Department of Psychology, Fordham University, Providence, RI

³Department of Psychology, Rutgers University, Providence, RI

⁴Butler Hospital, Providence, RI

Abstract

This study examined prospective predictors of persistent non-suicidal self-injury (NSSI) in adolescents admitted to an inpatient psychiatric unit for suicidal behaviors and followed naturalistically for six months. Seventy-one (77%) participants reported NSSI at baseline and 40 (56%) persisted at the six month follow-up. Those who endorsed automatic positive reinforcement (APR) as the predominant reason for NSSI, were more likely to persist in NSSI. Depression over follow-up, but not at baseline, also predicted persistence. These results suggest that helping high risk adolescents to identify alternative ways of generating emotion(s) to counter the effects of APR that may accompany NSSI, should be a high priority treatment target.

Introduction

Non-suicidal self-injurious behavior (NSSI) is an increasing phenomenon in high risk youth, and engagement in NSSI is associated with increased risk for suicidal behaviors. It is common in adolescents, with approximately 13–45% of adolescents (Lloyd-Richardson et al., 2007; Plener et al., 2009; Ross, & Heath, 2002) reporting NSSI during their lifetime. NSSI is the intentional destruction of body tissue without suicidal intent and for purposes not socially sanctioned (Nock, 2010). Common forms of NSSI include cutting, pinching, severe scratching, burning, banging or hitting. In a study of adolescents who engaged in NSSI, 87.6% met criteria for a DSM-IV disorder, 70% of adolescents reported a lifetime suicide attempt, and 55% reported multiple attempts (Nock et al., 2006). Therefore, those who engage in NSSI have significant psychiatric morbidity and are also at significant risk for suicidal behaviors (Hamza, & Willoughby, 2014; Whitlock et al., 2013).

Address correspondence to: Shirley Yen, PhD.

¹Results remained insignificant when BPD was analyzed with all 9 (including self-injurious behavior) criteria ($\chi^2 = 1.44$; NS).

One theoretical framework for understanding the motivations behind NSSI proposes four distinct functions: automatic-negative reinforcement, automatic-positive reinforcement, social-negative reinforcement, and social-positive reinforcement (Nock, & Prinstein, 2004). Automatic contingencies concern reasons within oneself (e.g., to stop feeling anxious), while social contingencies refer to interactions with others (e.g., to get attention). Automatic positive reinforcement (APR) involves the presentation of a favorable stimulus as a result of the behavior (e.g., to feel something, even if it is pain), perhaps during times of “psychological numbness” (Nock, & Prinstein, 2005). Automatic negative reinforcement (ANR) involves the removal of an aversive stimulus as a result of the behavior, such as reduction of negative affective states or aversive tension (e.g., to stop psychological pain). Most adolescents engage in NSSI for automatic reinforcement, whether positive or negative (Nock, & Prinstein, 2004; Selby et al., 2014). Social-negative reinforcement (SNR) refers to the use of NSSI behaviors for interpersonal avoidance (e.g., to avoid reproach). Social-positive reinforcement (SPR) refers to behaviors to gain attention from others (e.g., to get a reaction or response).

The most commonly reported reasons for NSSI behaviors generally fall in the category of ANR; for example, self-injury to distract from negative emotional states (Klonsky, 2007; Nock, & Prinstein, 2004). In a sample of adolescent inpatients, recent suicide attempt and hopelessness were only associated with the ANR function of NSSI (Nock, & Prinstein, 2004; Nock, & Prinstein, 2005). This has also been referred to as an affect regulation strategy (Klonsky, 2007) with stated reasons such as “to stop bad feelings,” “to decrease feelings of rage,” and “tension release.” Hence, it is akin to other maladaptive behaviors (e.g. substance use, binge eating) that presume to alter one’s immediate affect, followed by potentially adverse consequences.

Another common NSSI function that has garnered more recent attention is APR. This model posits that in the presence of detachment and emotional numbing, individuals may be triggered to engage in NSSI as they find it positively reinforcing at the intrapersonal level. Consistent with this model, (Nock, & Prinstein, 2005) found that in a sample of 89 hospitalized adolescent inpatients, those with symptoms of major depressive disorder and post-traumatic stress disorder were significantly associated with APR reasons for NSSI, possibly to compensate for feelings of emptiness, detachment, anhedonia, and restricted range of affect. A recent study using an experience sampling design, (Selby et al., 2014) reported that over 50% of self-injurious adolescents reported at least one instance of NSSI for APR over a two week period. Those who reported APR also had elevated and longer duration of NSSI thoughts, and more NSSI behaviors, suggesting that APR motivations may be more pernicious than NSSI due to other reasons. Furthermore, the pain analgesia/opiate hypothesis (Stanley et al, 2010) which suggests that those who engage in NSSI have a lower sensitivity to pain, can tolerate pain for a longer duration and have elevated levels of endogenous opiates (endorphins) in the body, is consistent with the APR model in that it suggests that pain generation may result in a positive physiologic state for some.

While a number of prospective studies have focused on predicting the onset of NSSI fewer have focused on predicting its recurrence. The majority of such studies suggest that recurrence is best predicted by prior NSSI behaviors (Tuisku et al., 2014; Wilkinson et al.,

2011) and associated characteristics such as frequency, method, and recency (Glenn, & Klonsky, 2011), severity of behavior (Andrews et al., 2013), and participants' behavioral forecast of future NSSI behaviors (Glenn, & Klonsky, 2011). Other modifiable characteristics that have been shown to predict persistent NSSI include psychiatric morbidity, particularly alcohol use, anxiety (Olfson et al., 2013; Wilkinson et al., 2011) and personality disorders (Glenn, & Klonsky, 2011; Olfson et al., 2013), low emotional support from family (Muehlenkamp et al., 2013; Tatnell et al., 2014) or peers (Andrews et al., 2013; Hamza, & Willoughby, 2014), and cognitive appraisal and vulnerability factors (Andrews et al., 2013; Franklin et al., 2014; Guerry, & Prinstein, 2010). However, no study to our knowledge has prospectively examined NSSI functions, or reasons for self-injury, as predictors of persistent NSSI.

The present study sought to examine prospective predictors of persistent NSSI over six months of naturalistic follow-up in a high-risk sample of adolescents who were hospitalized on the basis of suicide risk. Specifically, we examined whether baseline function of NSSI predicted persistence of NSSI during six months of prospective follow-up. Based on extant literature, we hypothesized that among those who engage in NSSI, high endorsement of automatic functions, particularly APR, would predict continued NSSI over six months of follow-up.

Method

Participants

Participants were adolescents recruited from an inpatient psychiatric unit due to elevated suicide risk (e.g., recent suicide attempt, suicidal ideation, or self-injury with suicidal ideation). Other reports based on this sample have been published elsewhere (Selby, & Yen, 2014; Yen, Fuller, Solomon, & Spirito, 2014; Yen, Gagnon, & Spirito, 2013; Yen, Kuehn, et al., in press; Yen et al., 2012). The present study differs from those studies in that here we examine predictors of NSSI using the Functional Assessment of Self-Mutilation (FASM). Parental/legal guardian consent and adolescent assent were obtained prior to the assessment. Parent(s) provided collateral information. Adolescents and parents were each compensated for their participation with a payment of \$50 (US) for their baseline assessment and for their 6-month follow-up assessment. This study protocol was approved by the institutional review boards of the hospital recruitment site as well as the affiliated university. Of study participants who provided follow-up data ($N = 104$), analyses were limited to the 92 participants who also completed baseline self-report measures.

Assessment

Baseline interviews and self-report measures were administered to both adolescent and parent during the adolescent's hospitalization or shortly after discharge. Baseline assessments were used to assess demographic characteristics, psychiatric diagnoses, and history of suicide events and self-harm behaviors. Phone calls were made to adolescent and parent at 2- and 4-months to assess for key outcomes of suicidal and self-harm behaviors. At the 6-month follow-up assessment, interviews and self-reports were administered to both adolescent and parent to assess a number of outcomes. Discrepant ratings between

adolescent and parent on data obtained from clinical interviews were discussed in team meetings and all available data were used to reach consensus agreement for a summary rating.

Measures

Schedule for Affective Disorders and Schizophrenia for School-Age Children

– **Present and Lifetime Version (K-SADS-PL)**—The K-SADS-PL (Kaufman et al., 1997) was used to obtain demographic information, family psychiatric history, history of childhood sexual abuse, psychiatric diagnoses, and history of suicidal behavior from adolescents and their parents. This semi-structured diagnostic interview provides a reliable and valid assessment of DSM-IV psychopathology in children and adolescents. Inter-rater agreement has been found to be high by the developers (range 93–100%), and in this current sample (k range 0.61–1.00 for disorders endorsed by at least 15% of the sample).

Functional Assessment of Self-Mutilation (FASM)

—The FASM (Lloyd-Richardson et al., 2007) is a widely utilized self-report measure that is used to assess the methods, frequency of occurrence, and current use of NSSI in the past year. Our follow-up version was adapted to capture the six months of the follow-up interval. Additionally, the behavioral functions of NSSI were assessed with a 22-item set of questions, which was divided into four subscales: automatic positive reinforcement, automatic negative reinforcement, social positive reinforcement, and social negative reinforcement. These items measure participants' perceived reasons for engaging in NSSI. Responses were rated on a 4-point Likert scale ranging from (1) never to (4) often, using the average score for each subscale in analyses. Cronbach's alpha for the four subscales on the FASM was 0.92.

Childhood Interview for Borderline Personality Disorder (CI-BPD)

—The CI-BPD is the adolescent adaptation of the Diagnostic Interview for DSM-IV Personality Disorders (DIPD-IV; (Zanarini et al., 1996), and was administered to both adolescents and parents separately. Discrepant ratings were discussed in team meetings and consensus summary scores were used for analyses. The DIPD-IV compares favorably to other structured interviews for personality disorders, with excellent inter-rater reliability ($k = \text{BPD} = 0.94$) and test-retest reliability ($r = 0.85$; (Zanarini et al., 1987). The CI-PBD was administered at baseline and at the 6-month follow-up. In the present sample, the k coefficient based on 20 randomly selected interviews was 0.82.

Adolescent - Longitudinal Interval Follow-Up Evaluation (A-LIFE)

—The A-LIFE (Keller et al., 1987) is a semi-structured interview that is used to assess psychopathology, functioning, and treatment utilization over longitudinal follow-up. The A-LIFE was administered to adolescents and parents separately. Any discrepancies between the responses of informants were discussed in research team meetings, and a summary score based on all available information was determined by team consensus. The A-LIFE (Keller et al., 1987) evaluates the course of symptoms by identifying change points, frequently anchored by memorable dates (e.g., holidays, school start and end dates). Three clinical characteristics of interest to the present set of analyses were captured by the A-LIFE: major depressive disorder (MDD), substance use disorder (SUD), and suicide ideation. Weekly

psychiatric status ratings (PSR) are assigned to each clinical variable on either a 3 or 6-point scale. A 6-point scale (1 for no symptoms, 2 to 4 for varying levels of subthreshold symptoms and impairment, to 5 or 6 for full criteria with different degrees of severity or impairment) was used to track MDD. A 3-point scale (ranging from 1=not present to 3 = full threshold) was used to track substance use disorders (SUD).

Data Analyses

Baseline NSSI status (present/not present in past 6 months) and functions of NSSI were determined by responses to the FASM. Persistent NSSI was defined as endorsement of NSSI at both the baseline and the 6 month follow-up, determined using all available data (i.e., the self-report FASM, information provided over phone check-ins, interview administered CIBPD, and clinical reports). This comprehensive approach was necessary to mitigate against incomplete self-report participation at follow-up. Logistic regression analyses were conducted with NSSI status at follow-up (persistent versus not persistent) regressed onto baseline NSSI function scores derived from the FASM (APR, ANR, SPR, SNR). A number of covariates, including MDD and SUD at both baseline and follow-up, were also examined.

Results

Sample Characteristics

The mean age of our sample was 15.31 years ($SD = 1.38$) and 64.4% of the sample were females. Our sample was mostly *White* (83.7%) and non-minority status (88.9%). One-third of the sample (33.7%) had past lifetime history of any (physical or sexual) abuse and about one-third (35.6%) of the sample had a past suicide event or attempt history. Of those who report NSSI 91.1% reported cutting behaviors at baseline (94.3% at follow-up) and 34.2% reported burning skin at baseline (42.9% at follow-up).

Self-harm at baseline

Seventy-one (77.2%) participants reported NSSI at baseline, with a mean of 60.33 episodes and a median of 8 episodes per participant for the preceding six months. Those who reported NSSI at baseline were compared to those who denied NSSI at baseline on demographic and clinical characteristics (Table 1). With the exception of age, there were no significant differences detected between the two groups. Age was entered as a covariate in all analyses, but was not significant in any model.

Persistent self-harm during follow-up

Of those reporting NSSI at baseline, 40 (56.3%) also reported NSSI behaviors during six months of follow-up, with a mean of 31.51 episodes and a median of seven episodes per participant. Only one study participant reported a new onset of NSSI during follow-up; this individual's data was not included in analyses.

Table 2 summarizes the demographic and clinical data for the sample dichotomized into those who persisted in NSSI throughout follow-up and those who reported NSSI at baseline but did not engage in NSSI during the follow-up interval. Participants who stopped NSSI during follow-up were significantly more likely to have major depressive disorder (MDD)

and substance use disorder (SUD) at baseline than those who persisted in NSSI. There were no other statistically significant differences between those who did and did not engage in NSSI during follow-up on demographic variables, past history of abuse, or psychiatric diagnoses.

Functions of Self-harm Predicting Persistent NSSI

Table 3 describes mean scores on each of the NSSI functions by those who did and did not engage in NSSI over follow-up. Logistic regression analyses were conducted to test the functions of NSSI reported at baseline as predictors of persistent NSSI during follow-up (Table 3). Among those who reported NSSI at baseline, higher scores on the APR subscale predicted continued engagement in NSSI six months later (OR = 1.90, $p = 0.03$, 95% CI = 1.07–3.37). This effect remained significant even after controlling for possible covariates of age, MDD, and SUD. The remaining functions of ANR, SPR, and SNR did not significantly predict persistence of NSSI during follow-up.

Follow-up MDD and SUD predicting Persistent NSSI

Given the unexpected baseline finding that those who persisted in NSSI were less likely to meet criteria for MDD at baseline, we analyzed MDD over follow-up to more closely examine the association between MDD and NSSI. Using the weekly psychiatric status ratings for each disorder respectively, we calculated the proportion of the 26-week follow-up interval in which the participant reported moderate to severe symptoms for each disorder respectively. The sample was then dichotomized into a “high” (more than 50% of follow-up with moderate to severe symptoms) symptomatology group vs a “low” (less than 50% of follow-up with moderate to severe symptoms) symptomatology group. Thus, the high depression group consisted of those who spent more than half of the follow-up period with moderate to severe depression. In the logistic regression analysis, high follow-up depression was associated with persistence in NSSI during follow-up (OR = 3.32, $p = 0.02$, 95% CI = 1.20–9.16). In a multivariate model containing follow-up depression and APR, both APR (OR = 2.57, $p = 0.01$, 95% CI = 1.27–5.21) and high follow-up depression (OR = 5.47, $p = 0.01$, 95% CI = 1.55–19.28) remained a significant predictor of persistent NSSI.

Discussion

Our results suggest that higher endorsement of automatic positive reinforcement reasons for their self-harm predicted persistent self-harm in the six months of follow-up. Other functions were not significant in predicting persistence. It is possible that NSSI is indeed effective in generating emotions, the goal of APR, which further reinforces this behavior, whereas NSSI may not be as effective in stopping bad feelings or in obtaining interpersonal gains, thereby decreasing the reinforcement potential of these other functions. Furthermore, recent data suggesting that APR is associated with elevated and longer duration of NSSI thoughts and more NSSI behaviors (Selby et al., 2014) augments our finding that APR reasons for NSSI are particularly deleterious. From a clinical perspective, those particularly vulnerable to engaging in NSSI for APR appear more likely to experience feelings of emptiness, numbness, detachment, anhedonia, and a restricted range of affect, evidenced by significant and unique associations between APR with MDD and PTSD (Nock, & Prinstein, 2005).

Depression throughout the follow-up interval, operationalized as weeks at moderate to high (full threshold) depression, also significantly predicted NSSI persistence. While this in itself is not unexpected, what is surprising is that meeting criteria for MDD and SUD at baseline had a negative significant association with NSSI persistence; specifically, these disorders predicted cessation of NSSI during follow-up. With regard to SUD, it is possible that substance use may be an alternative emotion regulation strategy which mitigates the risk of also engaging in NSSI. Some studies however, report a modest association between substance use and the positive functions for NSSI (Nock, & Prinstein, 2005). Thus it may be that while SUD or substance use is associated with an overall higher risk for NSSI engagement, it may reduce the risk of NSSI persistence. Given the small proportion of our sample that met criteria for a substance use disorder, our finding should be interpreted with caution. MDD, on the other hand, was prevalent in our sample, as participants were all recently admitted to an inpatient psychiatric unit due to suicide risk. The differential effect of MDD observed at baseline vs. MDD observed throughout follow-up may reflect the difference between acute, episodic depression vs. more chronic depression. Our results suggest that it is those with ongoing chronic depression (over six months) who are at greater risk for NSSI persistence.

Surprisingly, BPD at baseline, operationalized with and without the self-injurious behaviors criterion, did not predict NSSI at follow-up. As BPD is a disorder with elevated rates of NSSI and suicidal behaviors, it seems paradoxical that BPD diagnostic status did not predict persistence in NSSI; however, this finding is consistent with some previous studies. For example, Glenn and Klonsky (2011) found that the overlap between BPD and NSSI appears to be no more significant than that observed in other major psychiatric disorder, thus concluding that NSSI occurs independently of BPD. Additionally, a recent pilot study on the clinical utility of a proposed addition of NSSI-disorder to DSM-5 found no differences in BPD status between NSSI and non-NSSI groups (Odelius and Ramklint, 2014).

The mean number of episodes of NSSI, the wide range in variability, and the median number of episodes within a 6-month period (eight at baseline, seven at follow-up) are all within the scope of what is commonly observed in prior studies of NSSI (Nock et al., 2009). Consistent with other studies, automatic functions, both positive and negative, were more likely to be endorsed than the social functions. However, it was surprising that ANR did not predict NSSI persistence, particularly as it is typically the most frequently endorsed function among adolescents (Nock, & Prinstein, 2004) and has been associated with hopelessness and suicidal behavior (Nock, & Prinstein, 2005). It is possible that ANR reasons for NSSI are more salient for the initiation of NSSI, but less so for the maintenance of NSSI. Our results suggest that NSSI for ANR reasons (e.g., to stop bad feelings) is either less effective (e.g., bad feelings quickly return) or less reinforcing (e.g., bad feelings replaced by other bad feelings such as guilt or shame about self-injury), compared to NSSI for APR reasons (e.g., to feel something).

That being said, the relationship between APR and ANR are highly correlated (Nock, & Prinstein, 2004) and likely to be complex. Moreover, as our responses are based on self-report perceptions of NSSI functions, it is possible that a decrease in negative affect is perceived as an increase in positive affect and vice versa. Recent laboratory based research

has found mixed results in the association between NSSI and pain. In one study, participants with a recent history of NSSI reported a significant decrease in negative affect after being exposed to laboratory induced painful stimuli vs non-painful stimuli (Bresin et al., 2013), suggesting that pain is effective in regulating emotions. However, this same study found that laboratory induced painful stimuli did not lead to a significantly larger reduction in negative affect for participants with a recent history of NSSI compared to healthy controls. Similarly, Franklin et al., 2010 found that both NSSI and matched control groups reported a decrease in negative affect following a laboratory induced painful stimuli. Additionally, Franklin et al. 2012 reported that emotion dysregulation was correlated with a diminished pain perception within both NSSI and non-NSSI groups.

The present study has several limitations. The study sample was recruited from an adolescent inpatient psychiatric unit in which participants were admitted due to suicide risk. Thus, they likely occupy the more clinically severe spectrum of NSSI. Reports of NSSI and corresponding functions were limited to self-report, although we based our NSSI ratings on all available evidence which includes parent and/or treatment provider report. In addition, some subsamples that were of interest (e.g., those with substance use disorders) were underpowered to find effects or were too small to reliably conduct statistical analyses.

These findings have a number of clinical implications. Consistent with other studies we found that ANR was most frequently cited perceived function of NSSI. This suggests that most who engage in NSSI are experiencing concurrent negative mood states which should be identified and targeted for treatment. In addition, awareness that avoidance of these negative mood states may be the reason for NSSI engagement is critical and perhaps indicates the use of acceptance based strategies to improve coping with negative mood states. We also found that perceived APR for NSSI at baseline prospectively predicted persistent NSSI at follow-up, highlighting the pernicious effect of this type of reinforcement. For these individuals, treatment approaches, such as mindfulness-based therapies, that target emptiness and dissociative-like states are warranted. With regard to both APR and ANR, it seems critical to focus on emotion monitoring and positive alternatives to self-injury. Finally, given the differential outcomes associated with the various NSSI functions, it is important to assess reasons for NSSI in clinical evaluations, for both treatment purposes and to more reliably ascertain risk of ongoing self-harm.

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Table 1

Baseline demographics and clinical characteristics by NSSI at baseline

	NSSI at Baseline N=71 (77.2%)	No NSSI at Baseline N = 21(22.8%)	<i>t/χ²</i>
Sex			
-- Girls	49 (69.0%)	11 (52.4%)	1.98
-- Boys	22 (31.0%)	10 (47.6%)	
Mean Age (SD)	15.17 (1.33)	15.86 (1.46)	2.04*
Hispanic/Latino	10 (14.1%)	6 (28.6%)	2.63
Any Minority	13 (18.3%)	7 (33.3%)	2.05
Black Race	5 (7.0%)	4 (19%)	2.57
White Race	61 (85.9%)	16 (76.2%)	1.49
Any Abuse History	27 (38.0%)	5 (23.8%)	0.80
MDE	61 (85.9%)	18 (85.7%)	0.01
Any Bipolar d/o	7 (9.9%)	0 (0%)	2.24
Any Anxiety d/o	34 (47.9%)	8 (38.1%)	0.63
Any Substance d/o	15 (21.1%)	1 (4.8%)	3.02
Any Eating d/o	10 (14.1%)	0 (0%)	3.32
PTSD	22 (31.0%)	4 (19.0%)	1.14
Any DBD	26 (36.6%)	10 (47.6%)	0.82
BPD ^I	19 (26.8%)	7 (33.3%)	0.95

Notes. Any DBD = any disruptive behaviors disorder; BPD = borderline personality disorder (calculated without SIB criterion)¹*
p<0.05

Table 2

Baseline demographics and clinical characteristics by Persistence of NSSI over follow-up

	Persisted in NSSI over f/u N=40 (51.3%)	Did not persist in NSSI over f/u N=38 (48.7%)	<i>t/χ²</i>
Sex			
-- Girls	26 (65.0%)	27 (71.0%)	0.32
-- Boys	14 (35.0%)	11 (28.9%)	
Age	15.08 (1.35)	15.21 (1.26)	0.46
Hispanic/Latino	6 (15.0%)	4 (10.5%)	0.30
Any Minority	8 (20.0%)	6 (15.8%)	0.18
Black Race	3 (7.5%)	2 (5.3%)	0.14
White Race	34 (85.0%)	33 (86.8%)	0.30
Any Abuse History	17 (42.5%)	12 (31.5%)	1.88
MDE	31 (77.5%)	36 (94.7%)	4.78*
Any Bipolar d/o	5 (12.5%)	3 (7.9%)	0.45
Any Anxiety d/o	20 (50.0%)	17 (44.7%)	0.22
Any Substance d/o	5 (12.5%)	12 (31.6%)	4.16*
Any Eating d/o	5 (12.5%)	5 (13.16%)	0.01
PTSD	11 (27.5%)	11 (28.9%)	0.02
Any DBD	15 (37.5%)	14 (36.8%)	0.00
BPD ^I	12 (30.0%)	10 (26.32%)	0.19

Notes: Any DBD = any disruptive behaviors disorder; BPD = borderline personality disorder (calculated without SIB criterion¹).*
p<0.05

Table 3

Univariate models of NSSI function at baseline predicting Persistence of NSSI over f/u.

	NSSI over f/u	No NSSI over f/u		
	Mean (SD)	Mean (SD)	B (SE)	OR (95% CI)
APR	2.98 (0.76)	2.51 (0.95)	0.64 (0.29)	1.90* (1.07–3.37)
ANR	2.97 (0.93)	2.82 (0.96)	0.17 (0.26)	1.19 (0.72–1.97)
SPR	1.41 (0.57)	1.68 (0.81)	–0.50 (0.39)	0.61 (0.28–1.30)
SNR	1.48 (0.44)	1.53 (0.77)	–0.27 (0.36)	0.77 (0.38–1.56)

Notes. APR=automatic positive reinforcement; ANR=automatic negative reinforcement; SPR=social positive reinforcement; SNR=social negative reinforcement.

*
p<0.05