Research paper

Non-suicidal self-injury and suicide attempts in a New Zealand birth cohort

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ABSTRACT

Background: Non-suicidal self-injury (NSSI) and suicide attempts are related, but distinct behaviors. The primary aim of the current study was to identify factors that distinguish those with different lifetime histories of self-injury. A secondary aim was to test whether lifetime history of self-injury at age 26 predicted current suicide ideation at age 32.
Methods: Participants were 26 year olds from a large birth cohort with a lifetime history of no self-injury (n = 466), a lifetime history of NSSI (n = 191), or a lifetime history of NSSI and a suicide attempt (NSSI + SA; n = 52). They were compared on a history of psychiatric disorders, 12-month suicide ideation, lifetime history of childhood sexual abuse, and lifetime exposure to suicide.
Results: An anxiety disorder, a substance dependence disorder, suicide ideation, and a history of childhood sexual abuse distinguished the NSSI + SA and NSSI only groups. Longitudinal results demonstrated that a history of NSSI predicted future suicide ideation after adjusting for other selected risk factors.
Limitations: The majority of analyses are cross-sectional which limits inferences about causality. The retrospective self-report for lifetime behavior could be subject to reporting biases.
Conclusions: Adults with a history of NSSI and adults with a history of NSSI and a suicide attempt are clinically distinct groups that are both at risk of future suicide ideation. Identifying and treating NSSI could be a key preventive factor in reducing subsequent suicide risk.

1. Introduction

Non-suicidal self-injury (NSSI) and suicide attempts are both significant public health issues. NSSI has been defined as the direct and deliberate destruction of body tissue in the absence of any observable intent to die (Nock, 2010). A suicide attempt refers to engagement in potentially self-injurious behavior in which there is some intent to die from the behavior (Nock, 2010). The lifetime prevalence of NSSI among adults and adolescents is approximately 5.5% and 17.2% respectively (Swannell et al., 2014). The lifetime prevalence of suicide attempts among adults and adolescents is approximately 1.9 to 8.7% and 3.1–8.8% respectively (Nock et al., 2008a, 2008b). Both NSSI and suicide attempts are associated with numerous negative life outcomes and have significant economic and social consequences (Goldman-Mellor et al., 2014; Plener et al., 2015; Shepard et al., 2016).

NSSI and suicide attempts are related, but distinct behaviors (Grandclerc et al., 2016). NSSI and suicidal behaviors appear to co-occur at high rates and NSSI is a strong predictor of suicide attempts (Klonsky et al., 2014). Estimates of the co-occurrence of a lifetime

history of NSSI and a lifetime history of suicide attempt range from 17% to 70% (Andover and Gibb, 2010; Cheung et al., 2013; Cloutier et al., 2010; Nock et al., 2006). A large study with four samples varying in age and clinical severity found a robust relationship between NSSI and attempted suicide (Klonsky et al., 2013). A comprehensive review found that regardless of participant age, sex and socioeconomic status, engaging in NSSI increases risk of attempting suicide (Hamza et al., 2012).

Every person who engages in NSSI, however, does not go on to attempt suicide. Understanding, among those with a history of self-injury, what specific factors are associated with risk of attempting suicide would have significant clinical utility. A growing number of studies have investigated this research question, but the evidence base is still limited (Nock, 2014). These studies have attempted to identify unique risk factors for NSSI and suicide attempts through comparing self-injury groups (e.g. a history of NSSI alone versus a history of NSSI and a suicide attempt) on various clinical, cognitive, and psychosocial factors (Asarnow et al., 2011; Brausch and Gutierrez, 2010; Jacobson et al., 2008; Muehlenkamp and Gutierrez, 2007, 2004; Stewart et al., 2017; Wong et al., 2007). Individuals with a history of NSSI and a suicide

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attempt have been found to have higher rates of psychiatric diagnoses, especially depression and PTSD, more severe psychiatric symptoms, and higher rates of suicide ideation than individuals with a history of NSSI alone (Brausch and Gutierrez, 2010; Claes et al., 2010; Jacobson et al., 2008; Muehlenkamp et al., 2011; Muehlenkamp and Gutierrez, 2004; Taliaferro et al., 2012; Wong et al., 2007). Additionally individuals with a history of NSSI and a suicide attempt report more adverse childhood experiences (e.g. physical abuse) and stressful life events (e.g. exposure to suicide) than individuals with a history of NSSI alone (Baetens et al., 2011). Several reviews have summarized all potential differences between self-injury groups (Andover et al., 2012; Grandclerc et al., 2016; Hamza et al., 2012) and concluded that individuals with a history of NSSI and a suicide attempt could be considered a more clinically severe population than individuals with a history of a suicide attempt alone.

While previous studies have elucidated valuable potential differences between those with a history of NSSI and those with a history of suicide attempts, there are several limitations and gaps in the literature. The vast majority of these studies have been conducted with adolescents and in clinical settings (Jacobson and Gould, 2007). While clinical adolescents are the population with the highest rates of NSSI (Andover et al., 2012; Jacobson and Gould, 2007; Klonsky et al., 2014), NSSI and suicide attempts are still prevalent among adults in the general population (Nock et al., 2008a, 2008b; Swannell et al., 2014). The lack of large scale studies with representative samples of adults has been highlighted as an area of concern in NSSI research (Nock, 2012). Developmental and clinical factors might restrict the generalizability of previous findings. From a methodological perspective, the studies are largely cross-sectional and often lack a self-injury control group, which limits the conclusions that can be drawn about causality. Additionally, numerous studies rely on self-report measures of psychopathology (Brausch and Gutierrez, 2010; Muehlenkamp and Gutierrez, 2007). Semi-structured and structured interviews, however, are considered the gold-standard for ascertaining psychiatric diagnoses (Beck and Perry, 2008). Therefore, there would be significant value in comparing self-injury groups for psychiatric diagnoses determined by use of a structured clinical interview. Finally, as Stewart et al. (2017) noted, previous studies have often tested risk factors in isolation, which might hinder the identification of unique risk factors for suicide attempts. Comparing those with a history of NSSI and a history of NSSI and suicide attempts on numerous risk factors in the same study could advance our understanding of risk factors for suicide attempts among those with a history of self-injury.

The aim of the current study is to identify factors that distinguish those with different lifetime histories of self-injury. We compared individuals with a lifetime history of no self-injury, a lifetime history of NSSI, or a lifetime history of NSSI and a suicide attempt (NSSI + SA) in a large birth cohort of 26 year olds on current psychiatric disorders, 12 month suicide ideation, lifetime history of childhood sexual abuse, lifetime exposure to suicide of a family member, and lifetime exposure to suicide of a friend. First, we hypothesized that both the NSSI alone group and NSSI + SA group would have higher rates on all variables than the no self-injury group. Additionally, we expected that the NSSI + SA group would have the highest rates on all variables. Second, we hypothesized that a current diagnosis of a depressive disorder, a substance dependence disorder, suicide ideation, lifetime history of childhood sexual abuse, and exposure to suicide of a family member would distinguish those with a history of NSSI + SA from those with a history of NSSI alone. Our prediction of these specific factors is based on prior research (Andover et al., 2012; Fox et al., 2015; Nock et al., 2008a, 2008b; Ribeiro et al., 2016). Finally, we sought to test if lifetime history of self-injury at age 26 predicted current suicide ideation at age 32. Based on prior research (Ribeiro et al., 2016), we hypothesized that there would be a dose-response relationship between self-injury history and later suicide ideation and that those who also had a history of SA would be at the greatest risk for future suicide ideation.

2. Method

2.1. Participants

The participants are part of a birth cohort (n = 1037) born in Dunedin, New Zealand between 1 April 1972 and 31 March 1973 and enrolled in the Dunedin Multidisciplinary Health and Development Study. They were assessed at age 3, and thereafter biennially until 15, and at ages 18, 21, 26, 32, and 38 years (Poulton et al., 2015). At age 26 (1998–1999), 472 women and 494 men, consented to an interview on self-harm behaviors (Nada-Raja et al., 2004). The sample represents all socioeconomic levels (Poulton et al., 2015). Of the 966 participants who consented to the self-harm interview, 257 were excluded from the current study for the following reasons. 229 participants were excluded as they reported no NSSI or SA, but reported another form of self-harm behavior as a way of dealing with emotional pain or stress. The other forms of self-harm were intoxication with alcohol/other substances, self-denial, and exercising with the purpose of hurting oneself. These participants were excluded to ensure the control group was a pure control group that had no history of self-injury or self-harm. Another 12 participants were excluded because the intent of their self-injury could not be ascertained from their self-harm interview and 16 participants were excluded from the NSSI alone group because they reported both traditional NSSI methods (e.g. cutting) and suicide attempt methods (e.g. drowning), but did not report a suicide attempt. The incongruence between type of self-injury method and suicide attempt history could be due to the limits of retrospective self-report. To ensure that participants in the NSSI group had only engaged in NSSI, these participants were excluded from analyses. The final sample for this study is 709 participants.

For the purposes of analyses, participants were categorized into the following groups on the basis of their history at age 26: no self-injury, NSSI only, and NSSI and suicide attempt (NSSI + SA). Inclusion criteria in the no self-injury group was no lifetime history of any self-injury or self-harm behavior. Inclusion criteria for the NSSI only group was a lifetime history of an NSSI behavior and no lifetime suicide attempt. Inclusion criteria for the NSSI + SA group was a lifetime history of an NSSI behavior and a reported lifetime suicide attempt. We did not include a suicide attempt only group because the sample size for this group was underpowered for analyses.

2.2. Measures at age 26

2.2.1. Self-harm interview

At age 26, participants completed a 20 min semi-structured in-person interview on self-harm thoughts and behaviors (Nada-Raja et al., 2004). Self-harm questions were asked about behaviors with the intent of hurting onself in the context of dealing with mental or psychological pain, emotions, or stress. Participants were presented with a set of specific behaviors identified in the International Classification of Diseases, 9th Revision Clinical Modification as intentional self-harm (e.g. cutting) as well as other self-harm behaviors (e.g. self-battery). Questions on suicide ideation and suicide attempts were included in the same interview. Lifetime history of suicide attempt was assessed with the question of, "Have you ever attempted suicide in your life?" 12-month history of suicide ideation was assessed with the question of, "In the past year have you thought about committing suicide?" This interview has been used in several previous studies on self-harm and suicidal behaviors in the Dunedin Study (Goldman-Mellor et al., 2014; Nada-Raja et al., 2004; Skegg et al., 2003). From the original list of self-harm behaviors the following methods were included as a form of NSSI: cutting self, burning self, stabbing self, banging own head/fist against something, hitting or bruising any part of self, picking own skin, piercing own skin, and biting self. All of these behaviors are included in the Deliberate Self-Harm Interview (Gratz, 2001), a measure with strong psychometric properties that has been used in several studies of NSSI

(Fliege et al., 2006; Turner et al., 2015). Of the original list of self-harm behaviors the following methods were included as a form of suicide attempt: cutting self, burning self, taking pills in excess, stabbing self, crashing car/motorbike, trying to poison self, trying to gas self, trying to hang self, trying to drown self, shooting self on purpose, and jumping from a high place. All of these behaviors are included in the Self-Injurious Thoughts and Behaviors Interview section on suicide attempts (Nock et al., 2007) which is a validated measure of suicidal behaviors and has been utilized in numerous studies (Bagge et al., 2013; Stanley et al., 2015).

2.2.2. Psychiatric disorders

At age 26, symptoms of psychiatric disorders during the past year were measured with a modified version of the Diagnostic Interview Schedule (DIS, Robins et al., 1995). (DIS-IV; Robins et al., 1995). The interview was administered by trained professionals with qualifications in medicine, psychology, and/or counselling. Diagnostic criteria were based on DSM-IV definitions and were determined with computer-run algorithms. The DIS in the Dunedin study has shown high reliability for diagnoses and functional impairment (Feehan et al., 1994; McGee et al., 1990; Newman et al., 1996). Based on responses to the DIS, the following disorders were diagnosed and used in analyses for the present study: depressive disorders (major depressive episode, dysthymia), anxiety disorders (panic disorder, generalized anxiety disorder, post-traumatic stress disorder, simple phobia, social phobia, and obsessive-compulsive disorder), and substance dependence (alcohol, marijuana, and other drug dependence). The diagnoses from the DIS at assessments at ages 18 and 21 were also used in the analyses for the present study and used to create a composite variable for each type of psychiatric disorder. These Axis I disorders were specifically chosen for the present analysis due to their linkage to both NSSI and suicide attempts (Andover et al., 2012; Nock et al., 2009). We collapsed disorders into broad diagnostic categories rather than testing individual disorders because of high rates of comorbidity and the low rates of certain disorders. This approach has been useful in previous studies on psychiatric disorders and self-injury (Beautrais et al., 1998; Skegg et al., 2004).

2.2.3. Negative life events

The following negative life events were included in analyses and ascertained at the age 26 assessments: childhood sexual abuse (CSA) ascertained via retrospective report, having a family member die by suicide, and having a friend die by suicide. CSA was assessed through a computer-administered interview on sexual behaviors and experiences of sexual abuse. CSA was defined as having one's genitals touched by another, being forced to touch another's genitals, or experiencing forced or attempted sexual intercourse before the age of 16. This measure of CSA has been used in other studies of mental health and self-harm (Nada-Raja and Skegg, 2011). Exposure to suicide deaths was assessed at age 26 as part of the self-harm interview. The suicide of a family member was measured with the question of "Has anyone in your family committed suicide?" The suicide of a friend was measured with the question of "Have any of your friends or someone important in your life committed suicide?" Follow up questions about that person's specific relationship to the participant and the year of the suicide were also asked.

2.2.4. Demographics

The following demographics at age 26 were included in analyses: education (i.e. secondary school certificate; no secondary school certificate), socioeconomic status (SES) according to the Elley and Irving Index (low SES levels 5–8; high SES levels 1–4), partnership status (married/co-habiting; single), caregiver status (caregiver to a child; not a caregiver to a child), and employment (i.e. employed/student; unemployed). Caregiver status was defined as having or expecting a dependent child. The Elley and Irving Index is a widely-used measure of SES in New Zealand that is based on income and education levels (Elley and Irving, 1985; McGee et al., 1990).

2.3. Measures at age 32

At age 32, a follow-up semi-structured interview on self-harm thoughts and behaviors was conducted and included a question on suicidal ideation: "In the past year have you thought about committing suicide?" While questions about NSSI and suicide attempts were asked at age 32, we did not include these outcomes in the present analysis due to their low prevalence. At age 32, the past 6-year prevalence (i.e. since the last assessment) was 1.7% for NSSI and 1.4% for suicide attempts.

2.4. Procedure

At age 26, participants came to the Dunedin Research Unit for a day of interviews and assessments, including self-harm, sexual abuse, and mental health interviews. On providing informed consent they were interviewed about their self-harm history by trained interviewers who were blind to the participant's responses to the mental health interview (Nada-Raja et al., 2004). At the end of the self-harm interview, all participants were provided with a list of services that support people who self-harm. All study members consenting to the self-harm interview were eligible for the interviews and represented 94% of the original birth cohort. The present study's participants are a sub-group of the Dunedin Study's birth cohort. At age 32, similar procedures to those at age 26 were followed. Of the 966 participants who consented to the self-harm interview at age 26, 961 participants consented to the self-harm interview at age 32 (99.5% retention).

2.5. Statistical analysis

Chi-Square tests were used to test for associations between self-injury group and all demographic factors. Logistic regression analyses were used to test cross-sectional associations between self-injury group, psychiatric diagnoses, and selected negative life events. For these analyses, we controlled for gender due to the significant sex differences observed in chi-square tests in the present study as well as those reported in previous studies of self-injury (Moscicki, 1994; Sornberger et al., 2012). Odds ratios (ORs) and 95% confidence intervals (CI) were calculated. Logistic regression analyses were run with all participants and the no self-injury group was set as the reference group. Logistic regression analyses were also run with participants with a history of NSSI alone, and the NSSI alone group was set as the reference group. To test if self-injury history at 26 predicted suicide ideation at age 32, logistic regression analysis was run with the no-self-injury group as the reference group. A separate logistic regression analysis was conducted to examine whether there were differences in risk for suicidal ideation between the two NSSI groups, with the NSSI alone group as the reference group. Initially bivariate analyses were run to identify significant predictors, then all significant predictors were included in a multivariate logistic regression. All analyses were run in SAS software 9.3 (SAS Institute, Cary NC).

3. Results

3.1. Self-injury prevalence and demographics at age 26

Within a sample of 709 adults meeting our study criteria, there was a 34% lifetime prevalence of NSSI and a 7% lifetime prevalence of suicide attempts. The past year prevalence at age 26 of NSSI was 14% and suicide attempts was 1.1%. Among the 243 participants with a lifetime history of NSSI, 21.4% reported having made a suicide attempt in their life by age 26. The demographics of the different self-injury groups at age 26 are presented in Table 1. There were significant differences in the self-injury groups for gender, socioeconomic status (SES), and family structure. Both self-injury groups had higher percentages of males and low SES. Regarding family structure, both self-injury groups had lower rates of marriage/cohabitation, but higher

Table 1
Demographic variables by lifetime self-injury history at age 26.

	No Self-Injury (N = 466)	NSSI (N=191)	NSSI + SA (N=52)	X^2
	%	%	%	
Sex				
Male	45.71	71.73	59.62	37.67[***]
Socioeconomic Status				
Low SES	24.68	29.32	40.38	6.51[*]
Currently Unemployed	21.24	21.47	42.31	12.06[**]
Left with a New Zealand School Certificate or Less	31.33	38.74	55.77	13.77[**]
Family Structure				
Currently Married / Living with Partner	62.23	43.98	44.23	21.47[***]
Caregiver for Child	20.60	17.28	34.62	7.50[*]

[***] = p < 0.0001.
[**] = p < 0.01.
[*] = p < 0.05.

rates of child caregiver status.

3.2. Self-injury methods

Table 2 displays the different types of self-injury by the two self-injury groups (NSSI alone vs NSSI + SA). In both groups, banging one's head or fist was the most common method of self-injury. The most prevalent method of attempting suicide was taking pills in excess of a therapeutic dose. The different types of self-injury methods by gender are also presented in Table 2. More males than females reported banging one's head or fist, but this gender difference did not exist for other methods of self-injury including cutting and burning.

3.3. Cross-sectional results

3.3.1. Distinguishing between no self-injury and self-injury groups

We tested differences in psychiatric diagnoses, suicide ideation, and negative life events between those with no self-injury and those with a

Table 2
Methods of self-injury by non-suicidal and suicidal self-injury groups and sex at age 26.

Method of Self-Injury[a]	NSSI (N=191)	NSSI + SA (N=52)	Sex
	N (%) Lifetime	N (%) Lifetime	N (%) Male[b]
Banged head or fist	170 (89.01)	45 (86.54)	96 (53.06)
Bit self	1 (0.01)	1 (1.92)	0 (0)
Burned self	5 (2.62)	7 (13.46)	6 (50)
Crashed car or motorbike on purpose	0 (0)	2 (3.85)	2 (100)
Cut self	21 (10.99)	27 (51.92)	22 (50)
Hit or bruised self	15 (7.85)	10 (19.23)	7 (28.16)
Jumped from a high place on purpose	0 (0)	3 (5.77)	1 (33.33)
Picked Skin	0 (0)	1 (1.92)	0 (0)
Pierced Skin	1 (0.01)	0 (0)	1 (100)
Shot self on purpose	0 (0)	0 (0)	0 (0)
Stabbed self	0 (0)	1 (1.92)	1 (100)
Took pills in excess of theraputic dose	0 (0)	33 (63.46)	17 (51.15)
Tried to drown self	0 (0)	2 (3.85)	1 (50)
Tried to Electrocute self	0 (0)	0 (0)	0 (0)
Tried to Gas Self	0 (0)	2 (3.85)	2 (100)
Tried to hang self	0 (0)	2 (3.85)	2 (100)
Tried to Poision Self	0 (0)	1 (1.92)	0 (0)

[a] Participants could report more than one behavior.
[b] Percent among the number of participants that reported using that method of self-injury.

history of NSSI. The following variables were associated with increased odds of NSSI: history of anxiety disorder, history of depressive disorder, history of substance abuse disorder, 12-month suicide ideation, being a victim of sexual abuse before the age of 16, and exposure to friend's suicide (Table 3). Past 12-month suicide ideation at age 26 was associated with the greatest odds of NSSI. We also tested the differences between those with no self-injury and those with a history of NSSI and SA. The following variables were associated with increased odds of NSSI and SA: history of anxiety disorder, history of depressive disorder, history of substance abuse disorder, 12-month suicide ideation, being a victim of sexual abuse before the age of 16, and exposure to friend's suicide (Table 3) Overall, similar to the NSSI alone analyses, 12-month suicide ideation at age 26 was associated with the greatest odds of a history of NSSI and SA.

3.3.2. Distinguishing between self-injury groups

We tested the differences in psychiatric diagnoses, suicide ideation, and negative life events between those with a history of NSSI and those with a history of NSSI and SA. The following variables distinguished those with a history of NSSI and SA from those with a history of NSSI alone: history of anxiety disorder, history of substance use disorder, 12-month suicide ideation, and being a victim of sexual abuse before the age of 16 (Table 4). Being a victim of sexual abuse before the age of 16 was associated with the greatest odds for a suicide attempt among those with a history of NSSI.

3.4. Longitudinal results

3.4.1. Predicting suicide ideation at age 32

When no-self injury was set as the reference group, both NSSI alone (OR = 4.25, 95% CI = 2.13 – 8.51) and NSSI+SA by age 26 (OR = 10.85, 95% CI = 4.76 – 24.74) predicted 12-month suicide ideation at age 32 in an unadjusted model. After testing the significance of all mental health and negative life events, only significant predictors (suicide ideation and a history of any anxiety disorder at age 26) were added to the adjusted model with the history of self-injury variables. In this adjusted model, both NSSI alone (AOR = 2.95, 95% CI = 1.41 – 6.13) and NSSI+SA (AOR = 4.82, 95% CI = 1.93 – 12.03) predicted 12-month suicide ideation at age 32. Suicide ideation at age 26 (AOR = 4.40, 95% CI = 2.12–9.13) and a history of any anxiety disorder at age 26 (AOR = 2.34, 95% CI = 1.22 – 4.49) also predicted 12-month suicide ideation at age 32. This model explained approximately 8% (R^2 = 0.08) of the variation in 12-month suicide ideation reported at age 32.

When NSSI alone was set as the reference group, NSSI+SA (OR = 2.55, 95% CI = 1.18 – 5.51) predicted suicide ideation at age 32 in an unadjusted model. After testing the significance of all mental health and negative life events, only significant predictors (suicide ideation at 26 and a history of any anxiety disorder at age 26) were added to the adjusted model with the history of self-injury variables. In this adjusted model, NSSI+SA (AOR = 1.63, 95% CI = 0.71 – 3.75) did not significantly predict 12-month suicide ideation at age 32. Suicide ideation at age 26 (AOR = 4.01, 95% CI = 1.83 – 9.01) and a history of any anxiety disorder at age 26 (AOR = 2.51, 95% CI = 1.15 – 5.47) did predict 12-month suicide ideation at age 32. This model explained approximately 9% (R^2 = 0.09) of the variation in 12-month suicide ideation reported at age 32

4. Discussion

The present study sought to identify mental health factors and negative life events that distinguished between adults aged 26 with a history of NSSI versus a history of NSSI and a suicide attempt (NSSI + SA) in a large cohort study. We also sought to test if a history of self-injury at age 26 predicted future suicide ideation at age 32. Several of our initial hypotheses were supported. Self-injury groups shared

Table 3
Mental Health and Negative Life Events by Lifetime Self-Injury History at Age 26.

	No Self-Injury (N = 466)	NSSI (N = 191)		NSSI + SA (N = 52)	
	%	%	OR (95% CI)[a]	%	OR (95% CI)[a]
Mental Health[b]					
History of Anxiety Disorder	15.95	25.65	2.24 (1.45 – 3.45)	53.85	7.16 (3.86 – 13.28)
History of Depressive Disorder	8.19	21.47	3.85 (2.32 – 6.39)	28.85	5.22 (2.59 – 10.54)
History of Substance Use Disorder	27.80	48.17	1.83 (1.26 – 2.64)	65.38	4.76 (2.52 – 9.02)
12-Month Suicide Ideation	2.58	15.71	7.82 (3.83 – 15.99)	32.69	19.57 (8.58 – 44.65)
Negative Life Events					
Victim of Sexual Abuse Before Age 16	13.58	16.93	2.06 (1.24 – 3.41)	56.00	12.87 (6.43 – 25.76)
Lifetime Family Member Died by Suicide	9.66	8.90	0.88 (0.48 – 1.60)	9.62	0.97 (0.37 – 2.58)
Lifetime Friend Died by Suicide	23.82	41.88	2.30 (1.59 – 3.33)	53.85	3.73 (2.10 – 6.71)

[a] Controlling for sex.

Table 4
Mental health and negative life events among participants with a lifetime self-injury history at 26 (*N* = 243).

	NSSI + SA[b] (N = 52) AOR (95% CI)[a]
Mental Health[c]	
History of Anxiety Disorder	3.20 (1.68 – 6.08)
History of Depressive Disorder	1.42 (0.71 – 2.86)
History of Substance Use Disorder	2.26 (1.18 – 4.36)
12-Month Suicide Ideation	2.48 (1.23 – 5.02)
Negative Life Events	
Victim of Sexual Abuse Before Age 16	6.18 (3.01 – 12.70)
Lifetime Family Member Died by Suicide	1.15 (0.40 – 3.30)
Lifetime Friend Died by Suicide	1.60 (0.86 – 2.98)

[a] Controlling for sex.
[b] Eeference group is lifetime history of NSSI and no SA.
[c] Disorders were assessed with the Diagnostic Interview Schedule at ages 18, 21, and 26.

numerous risk factors, but specific factors, such as a history of childhood sexual abuse, distinguished between self-injury groups. Additionally, a history of self-injury predicted future suicide ideation between self-injurers and non self-injurers, but not between groups of self-injurers.

Many findings from the present study align with and complement previous research on NSSI and suicide attempts. Several other studies have also demonstrated that psychiatric disorders and childhood sexual abuse are associated with both NSSI and suicide attempts (Nock et al., 2009; O'Connor and Nock, 2014; Turecki and Brent, 2016). Our findings demonstrate that NSSI and suicide attempts share several risk factors, but show that those with a suicide attempt are a more severe clinical group. We found that the NSSI + SA group had the highest rates on measures of poor socioeconomic status (e.g. low income and unemployment), similar to findings reported in previous studies (Page et al., 2014). The strong association between suicide ideation and both NSSI and suicide attempts is consistent with findings from previous studies in adolescent populations (Guan et al., 2012). Furthermore, the ability of suicide ideation to distinguish between adults with a history of NSSI and adults with a history of NSSI + SA aligns with the findings of a meta-analysis on correlates of suicide attempts among self-injurers (Victor and Klonsky, 2014). Victor and Klonsky (2014) concluded that suicide ideation was the strongest correlate of suicide attempt history above several variables including frequency of NSSI and depression. Additionally, our finding that future suicide ideation is predicted by a history of self-injury is consistent with findings from a recent meta-analysis that showed that a history of self-injurious thoughts and behaviors confers risk for future self-injurious thoughts and behaviors (Ribeiro et al., 2016).

However, we also found results that run counter to previous research. The overall prevalence of both NSSI and suicide attempts in our

sample are higher than estimates reported in several community samples of adults (Kessler et al., 1999; Klonsky, 2011). However, this birth cohort has been found to have high rates of psychiatric disorders, violence, and abuse compared with other community samples (McGee et al., 1990; Nada-Raja and Skegg, 2011). A recent study of New Zealand adolescents suggested that rates of NSSI may be especially high in New Zealand (Garisch and Wilson, 2015).

With regards to gender, we found a higher prevalence of males in both self-injury groups than has been reported in previous studies, in which higher rates prevailed in females (Bresin and Schoenleber, 2015; Nock et al., 2008a, 2008b). The gender difference may relate to the self-injury methods in the present study. Banging one's head or body was the most prevalent method of self-injury and more common among males in the current study. Other studies have found cutting (more common in females) has often been the prevalent method of self-injury in other studies (Barrocas et al., 2012; Nock, 2010). For other methods of self-injury in our study, such as cutting and burning, we did not observe gender differences. The result suggest that the method of self-injury is a key factor regarding gender differences in the prevalence of self-injury (Bresin and Schoenleber, 2015).

Participants were clear about the self-injurious intent of banging their head/body, and self-battery is included in a multitude of self-injury measures. While head banging is a behavior often associated with developmental disorders (Symons, 2011), there are not high rates of developmental disorders in the current study's sample. We are unclear about possible reasons for this method of self-injury being more prevalent in the current study than in previous research.

While several reviews have suggested depression is a clinical factor which potentially distinguishes between those with NSSI and those with NSSI and a suicide attempt (Andover et al., 2012; Victor and Klonsky, 2014), we found that depression did not distinguish the two groups. Our finding may reflect differences in age (our sample was adults while most studies have focused on adolescents) and/or methodological differences (we used a structured interview while previous studies have used self-report measures of depressive symptoms). Our findings suggest that among adults, anxiety disorders and substance use disorders may be more relevant than depression in distinguishing between those with NSSI and those with NSSI and a suicide attempt. This finding contributes to a growing body of research which suggests that anxiety disorder and substance use disorders are closely related to suicide attempts. In the World Mental Health Survey, Nock et al. (2009), found that disorders characterized by anxiety and poor-impulse control (e.g. substance use) predicted the transition from suicidal thoughts to suicide attempts. This finding on the unique role of anxiety and impulse control disorders in the pathway to suicide attempts has been replicated in several studies (Nock et al., 2010, 2013). Without discounting the important role that depression plays in the development of self-injurious behaviors, our results highlight that depressive disorders in combination with suicide ideation, anxiety, and substance use disorder may contribute to the transition from non-suicidal to suicidal behaviors.

Previous studies of the relationship between childhood sexual abuse (CSA), NSSI, and suicide attempts report mixed findings with some reviews reporting significant associations (Maniglio, 2011) and some failing to find this association (Victor and Klonsky, 2014). Our findings suggest that CSA may distinguish adults with a history of NSSI and those with a history of NSSI and a suicide attempt. A meta-analysis on CSA abuse and self-injurious behaviors concluded that CSA is a statistically significant, but modest risk factor (Maniglio, 2011). The etiology of the relationship, however, between CSA and self-injury remains unclear. Some theories propose that self-injury is a method for coping with the intense emotional distress caused by CSA (Yates, 2004). In line with this theory, suicide attempts may serve as a means to escape from the distress caused by CSA. Others have proposed that CSA is an early life stressor, which disrupts the development of neurobiological systems and in turns increases suicide risk (van Heeringen and Mann, 2014). The current study is unable to advance our understanding of the etiology of the relationship, but it does reinforce the need to address CSA in treatment given it's pervasive and enduring impact on NSSI and suicidal behavior.

There are several potential implications regarding the prediction of suicide ideation. In the current study, a substantial percentage of the sample reported a lifetime history of NSSI by age 26, but a small percentage reported past year NSSI at age 26 or age 32. The results suggest that engaging in NSSI is relatively rare in early adulthood, but a history of NSSI confers continued risk for suicide ideation well into adulthood. This finding is a noticeable contribution considering that a recent meta-analysis reported that there was only one previous longitudinal study which tested if a history of NSSI predicted suicide ideation (Ribeiro et al., 2016). The finding that those with a history of NSSI and a suicide attempt were not at greater risk for future suicide ideation than those with a history of NSSI only highlights the importance of NSSI in suicide risk prediction.

4.1. Limitations

The present study is one of the largest community studies to compare adults with different histories of self-injury. While the findings add to understanding NSSI and suicide attempts, there are several limitations. First, the majority of the analyses are cross-sectional and therefore no inferences about causality can be drawn. Second, our use of retrospective self-report for lifetime behavior could be subject to reporting biases. Finally, all variables in the analyses were dichotomous clinical variables as opposed to continuous scales (e.g. symptom severity). While clinically useful, this approach may have limited our ability to detect between-group differences. The wide confidence intervals suggest poor specificity in the analyses. Due to low prevalences at age 32, we were able to predict only ideation, whereas, self-injurious behaviors (i.e. suicide attempts) may be of greater concern. Finally, the age 26 self-harm data were collected 18 years ago, which could potentially limit the implications for the modern context.

4.2. Future directions and implications

Building from the present study, future studies could examine the interactions of different psychiatric factors and negative life events to aid in better predicting suicide attempt behavior amongst people with a history of NSSI. Additionally, comparing these self-injury groups on more specific constructs from the Research Domain Criteria (Glenn et al., 2017) may elucidate risks of suicidal behavior that could be ameliorated through treatment. Examining more specific details of childhood sexual abuse (e.g. age at first episode of abuse, duration of abuse, severity of abuse) and their relation to NSSI and suicide attempts may provide better specificity of risk. Additionally, using self-injury history to predict suicide attempts in adulthood would be useful to understand if the trends we observed for ideation were true for behaviors.

In conclusion, adults with a history of NSSI and adults with a history of NSSI plus a suicide attempt are clinically distinct groups that are both at increased risk of suicide ideation. Suicide ideation is one of the strongest risk factors for future suicide attempts. Therefore, identifying and treating NSSI could be a first step in arresting the development of suicide ideation and subsequent suicide attempts during the life course.

Author disclosure

Contributors

SN designed the original study and collected the data. DC and SN conceptualized the analytic approach, ran the analyses, and drafted the manuscript. AB provided critical revisions.

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