Journal of Affective Disorders 384 (2025) 60–68

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research paper

The relationship between alexithymia, non-suicidal self-injury, and emotion regulation

Nadine Baumann [a,1], Angelika Ecker [a], Daniel Schleicher [a], Stephanie Kandsperger [a], David A. Preece [b,c,d], Romuald Brunner [a], Irina Jarvers [a,*]

[a] Department of Child and Adolescent Psychiatry and Psychotherapy, University of Regensburg, Germany
[b] Curtin University, Curtin enAble Institute & School of Population Health, Australia
[c] Stanford University, Department of Psychology, USA
[d] The University of Western Australia, School of Psychological Science, Australia

ARTICLE INFO

Keywords:
Non-suicidal self-injury
Emotion regulation
Alexithymia
Cognitive reappraisal
Expressive suppression

ABSTRACT

Background: Previous studies link non-suicidal self-injury (NSSI) to alexithymia and emotion dysregulation. However, the role of specific NSSI functions and the role of emotional valence in alexithymia, remain unclear. Thus, the present study investigated associations between lifetime-NSSI, alexithymia, and emotion regulation strategies (expressive suppression, cognitive reappraisal), focusing on NSSI functions and emotional valence in alexithymia.

Methods: A total of 328 participants ($M = 29.18$ years, $SD = 12.73$) with and without lifetime-NSSI participated in the study. They completed online questionnaires regarding alexithymia, NSSI, and preferred emotion regulation strategies. A binominal logistic regression was computed to predict NSSI group assignment.

Results: Participants with lifetime-NSSI reported significantly higher levels of alexithymia, more frequent use of expressive suppression, and less frequent use of cognitive reappraisal than those without NSSI. Alexithymia correlated with a higher tendency for expressive suppression and reduced cognitive reappraisal. Both positive and negative emotional alexithymia were linked to NSSI, with alexithymia significantly associated with stronger endorsement of intrapersonal-positive NSSI functions. Key predictors of NSSI group membership included younger age, lower use of cognitive reappraisal, and greater difficulty in appraising feelings.

Limitations: The cross-sectional design precluded causal inferences.

Conclusions: Findings reveal that individuals with lifetime-NSSI exhibit higher levels of alexithymia, favor expressive suppression as maladaptive emotion regulation strategy, and exhibit greater difficulty in adaptive cognitive reappraisal compared to those without NSSI. These findings underscore the importance to address emotion regulation and alexithymia in NSSI interventions. This is the first study to report a link between alexithymia and the endorsement of specific (intrapersonal-positive) NSSI functions.

1. Introduction

Non-suicidal self-injury (NSSI) refers to the intentional, repeated, direct injury to one's own body surface without suicidal intent (American Psychiatric Association, 2018). NSSI is especially prevalent in adolescents, with 8–47 % reporting NSSI (Brunner et al., 2014; Cipriano et al., 2017; Zetterqvist et al., 2021). In adults, between 4 and 39 % of the general population report NSSI (Cipriano et al., 2017), making it a highly relevant health issue.

Much research to date has focused on *why* people intentionally hurt themselves. The Four-Function Model (Nock, 2009; Nock et al., 2010) differentiates four NSSI functions: Interpersonal-negative functions, where NSSI is used to avoid unpleasant social situations or conflicts; interpersonal-positive functions, where NSSI is used to attain attention or pity; intrapersonal-positive functions, where NSSI is used for self-punishment, to elicit euphoria, or to end dissociative states; and intrapersonal-negative functions, where NSSI is used to reduce and regulate aversive states such as sadness, tension or anxiety.

* Corresponding author.
E-mail address: irina.jarvers@ukr.de (I. Jarvers).
[1] Present address: Department of Medical Psychology and Sociology, Medical Faculty, University of Augsburg, Stenglinstrasse 2, 86,156 Augsburg.

https://doi.org/10.1016/j.jad.2025.05.009
Received 4 November 2024; Received in revised form 8 April 2025; Accepted 4 May 2025
Available online 5 May 2025

Intrapersonal-negative functions are the most common, with up to 70 % reporting NSSI use for emotion regulation (Cipriano et al., 2017; Taylor et al., 2018).

This pattern has led to conceptualizing NSSI as a maladaptive emotion regulation strategy (Brausch et al., 2016; Wolff et al., 2019), an idea supported by numerous studies that have found impaired emotion regulation in people with NSSI (Chen and Chun, 2019; You et al., 2018). For instance, people who report NSSI are more likely to use maladaptive emotion regulation strategies, such as expressive suppression, and less likely to use adaptive strategies, such as cognitive reappraisal, compared to people without NSSI (Wolff et al., 2019; Angelakis and Gooding, 2021; Robinson et al., 2019).

Research also shows that individuals with NSSI have more difficulties identifying and differentiating their own emotions (Greene et al., 2020; Iskric et al., 2020; Norman et al., 2020), a concept coined alexithymia (Sifneos, 1973). As defined in the *attention-appraisal model of alexithymia (*Preece et al., *2017;* Preece and Gross, 2023*)*, alexithymia is a trait characterized by difficulties in identifying one's own feelings (DIF), difficulties in describing one's own feelings (DDF), and an externally orientated thinking style (EOT) whereby one rarely focuses attention on their emotions. That is, individuals with high alexithymia tend to avoid attending to their emotions (EOT), and when they do, they struggle to accurately appraise them (DIF, DDF).

The model, which situates the alexithymia construct within the broader process model of emotion regulation (Gross, 2015), highlights that these *attentional* on and *appraisal* difficulties impair emotion regulation because individuals lack the emotional insight needed to select effective strategies (see (Preece et al., 2023)). Consequently, adaptive strategies like cognitive reappraisal may be underused, while maladaptive strategies like NSSI or expressive suppression, become more likely (Laloyaux et al., 2015; Schiewer et al., 2022).

1.1. The present study

The present study investigated the relationship between NSSI, alexithymia, and the use of two emotion regulation strategies: expressive suppression and cognitive reappraisal. The main goal was to investigate whether NSSI is associated with higher alexithymia and more frequent use of expressive suppression.

Two additional concepts were explored. First, it remains unclear whether specific NSSI functions are differentially associated with emotion regulation strategies or alexithymia. Turner et al (Turner et al., 2012). found that more expressive suppression was associated with greater endorsement of intrapersonal NSSI functions and weaker endorsement of interpersonal NSSI functions, while no significant associations were found for cognitive reappraisal. As these findings have not been replicated, and no prior studies have investigated whether alexithymia is associated with specific NSSI functions, the present study explored these relationships using the Four-Function Model.

Second, while past research has examined links between NSSI and alexithymia, much of it has relied on the 20-item Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994) to operationalize alexithymia. However, the TAS-20 is an older tool which has recently been criticised for significant psychometric issues. Most notably, it demonstrates poor discriminant validity with measures of psychological distress (e.g (Leising et al., 2009; Marchesi et al., 2014; Preece et al., 2020; Preece et al., 2024),.). Additionally, the TAS-20 EOT subscale has low reliability (Kooiman et al., 2002), and the TAS-20 only assesses alexithymia for negative emotions (Chan and Becerra, 2023). To address these limitations, the present study employed a more recent and comprehensive measure, the Perth Alexithymia Questionnaire (PAQ (Preece et al., 2018);). The PAQ robustly assesses all facets of alexithymia, and includes items for the processing of both negative and positive emotions. This allows for a more detailed analysis regarding any differential associations of NSSI and the use of emotion regulation strategies with alexithymia concerning positive or negative emotions.

1.2. Hypotheses

1.2.1. NSSI and emotion regulation strategies

We hypothesized participants with lifetime NSSI to report more frequent use of expressive suppression and less frequent use of cognitive reappraisal than those without NSSI. Based on Turner et al (Turner et al., 2012),. we hypothesized that expressive suppression would be positively associated with intrapersonal NSSI functions and negatively with interpersonal ones.

1.2.2. Alexithymia and emotion regulation strategies

We hypothesized that higher alexithymia scores would be associated with more frequent use of expressive suppression. Additionally, we expected that greater use of cognitive reappraisal would be associated with lower alexithymia total scores and lower scores on all alexithymia subscales (i.e., DIF, DDF, and EOT for both positive and negative emotions), reflecting more adaptive emotion regulation.

1.2.3. Alexithymia and NSSI

We expected participants with lifetime NSSI to score higher in total alexithymia, DIF, and DDF. While a recent meta-analysis suggests EOT may not relate to NSSI (Norman et al., 2020), those findings were based on the low-reliability TAS-20 EOT subscale. Stronger associations may be observed with the PAQ EOT scale. We therefore expected to observe differences in EOT scores using the PAQ. Finally, based on the theorized role of alexithymia in emotion regulation (Laloyaux et al., 2015; Schiewer et al., 2022), we hypothesized associations between alexithymia and intrapersonal NSSI functions, and explored whether NSSI relates differently to difficulties with positive versus negative emotion processing.

2. Methods

2.1. Recruitment

Participants enrolled in the study both from the general population as well as from the Clinic and Polyclinic for Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy of the University of Regensburg at the medbo District Hospital Regensburg between January 2023 and April 2024. Participants had to be at least 14 years old (minors required the consent of a legal guardian for participation). After completing the study, participants could enter a raffle to win 50 vouchers for 25€. The study was approved by the Ethics Committee of the University of Regensburg (22–2985-104) and is preregistered in the German Clinical Trials Register (DRKS00029332).

2.2. Procedure

The study was conducted online using PsyToolkit (Stoet, 2010; Stoet, 2017) and was part of a more comprehensive questionnaire-based investigation validating the German version of the PAQ and the German version of the Cognitive, Affective and Somatic Empathy Scales (Raine et al., 2022). Participants were explicitly informed that questions on depressive, anxiety-related, and stressful topics would be asked during the survey. Additionally, contact information for emergency consultation hours of the local psychiatric clinic or the telephone counselling service were displayed. After consenting to participate, participants answered standard demographic questions. Next, they were asked about current or past psychological treatment as well as any current distress, they might be experiencing. If participants were currently seeking treatment or indicated current distress, they were asked to select area(s) of distress from a list of categories. Afterwards, participants completed several psychometric questionnaires, as described below. The study also included several attentiveness checks (based on which $n = 48$ participants were excluded from analysis) and took $M = 80.68$ min ($SD = 317.36$) to complete.

2.2.1. Perth alexithymia questionnaire (PAQ)

To assess alexithymia, the German version of the PAQ (Preece et al., 2018; Kaemmerer et al., 2021) or, in the case of minors, the *Perth Alexithymia Questionnaire Adapted for Children* (Preece et al., *2018;* Jarvers et al., *2022)* was used. The PAQ consists of 24 items on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with higher scores indicating higher alexithymia. Five subscales can be derived from the PAQ, corresponding to different facets of alexithymia across negative and positive emotions: *Negative-Difficulty Identifying Feelings* (N-DIF), *Positive-Difficulty Identifying Feelings* (P-DIF), *Negative-Difficulty Describing Feelings* (N-DDF) and *Positive-Difficulty Describing Feelings* (P-DDF), and *General-Externally Orientated Thinking* (EOT). These subscales can also be combined into various theoretically meaningful composite scores. Valence-specific DIF and DDF subscales can be combined into general DIF and general DDF composites, respectively. All DIF and DDF subscales can also be combined into a General-Difficulty Appraising Feelings composite (DAF, also with valence-specific N-DAF and P-DAF versions), reflecting these facets common alignment with the appraisal stage of emotion processing in the attention-appraisal model (as differentiated from EOT, which aligns with the earlier attention stage (Preece et al., 2024);). All items can be summed into a total score as an overall marker of alexithymia. In the present sample, very good internal consistencies were found for the subscales of German version of the PAQ (McDonald's $\omega = 0.88$ to 0.95).

2.2.2. Emotion regulation questionnaire (ERQ)

The German version of the ERQ ((Abler and Kessler, 2011), original (Gross and John, 2003)) was used to measure individual preferences in the use of expressive suppression (as a maladaptive emotion regulation strategy) and cognitive reappraisal (as an adaptive emotion regulation strategy). The ERQ comprises 10 items rated on a 7-point Likert scale from 1 (*not at all true*) to 7 (*completely true*), with higher values indicating more frequent use of the respective strategy. In previous studies, the ERQ has shown good reliability and validity (Abler and Kessler, 2011; Sala et al., 2012). In the present sample, the questionnaire showed good internal consistency (McDonald's $\omega = 0.84$ for cognitive reappraisal, 0.80 for suppression).

2.2.3. Self-injurious thoughts and behaviors interview (SITBI-G)

NSSI was assessed using an adapted version of the NSSI module of the SITBI-G ((Fischer et al., 2014), original (Nock et al., 2007)). Participants were asked whether they had ever intentionally harmed themselves without wanting to die (item 143 of the SITBI-G). For participants who reported lifetime NSSI, the age of the first and last NSSI episode (items 144 and 145), as well as lifetime frequency (item 146), frequency in the last year (item 147.2), and in the last month (item 148) were recorded. The SITBI-G also assesses functions of NSSI based on the Four-Function Model (items 153, 154, 155, 156), with higher scores on a scale from 0 (*not at all*) to 4 (*very much*) indicating higher endorsement of the respective function. Since primary functions of NSSI may change over time, current functions (most important for the *last* episode) and general functions (most important for the *majority* of all episodes) were assessed separately.

2.3. Analysis

The sample was divided into an NSSI group (who reported at least one lifetime incident of NSSI) and a no-NSSI group (who reported no lifetime incident of NSSI). Statistical analyses were performed using SPSS (version 29.0). The significance level was set to $\alpha = 0.05$ and was adjusted for multiple tests using the false discovery rate (Benjamini and Hochberg, 1995).

Since the ERQ and the PAQ (excluding DAF) were not normally distributed (Kolmogorov-Smirnov $p > .05$) non-parametric tests were used for analysis. For descriptive analyses, Pearson Chi-squared tests with effect size Cramer's *V* (0.10, 0.30, 0.50 for small, medium and large effect sizes, respectively), Friedmann-test with Kendall-*W* (0.10, 0.30, 0.50 for small, medium and large effect sizes, respectively), Kruskal-Wallis-test and Mann-Whitney-*U* tests with η^2 (0.01, 0.06, 0.14 for small, medium and large effect sizes, respectively), as well as ANOVAs, *t*-test with Cohens *d* (0.20, 0.50 and 0.80 for small, medium and large effect sizes, respectively) and Kendall correlations (Kendall-Tau-b) were used as appropriate. All effect sizes were interpreted according to Cohen (Cohen, 1988).

To examine the relationship of NSSI with the ERQ, Mann-Whitney-*U* Tests were calculated. Kendall correlations were used for the association of the ERQ with NSSI functions and with the PAQ. Finally, associations of the PAQ with NSSI were examined using a single-factor ANOVA for DAF and Mann-Whitney-*U* Tests for all other scales. In addition, Kendall correlations (Kendall-Tau-b) were used to explore possible associations between the PAQ and NSSI functions. As a final step, a binominal logistic regression was computed with group assignment (NSSI, no-NSSI) as the dependent variable and emotion regulation strategies and alexithymia as independent variables. Gender and age were added as control variables.

3. Results

3.1. Descriptive results

Overall, $n = 328$ complete datasets were included in the analysis (72.9 % female, 3.3 % diverse, $M = 29.18$ years, $SD = 12.73$ range 14–67 years). Detailed demographics and descriptive data can be found in Table 1. See Fig. 1 for a percentual depiction of areas of distress. Overall, 34.0 % reported one area of distress, 22.7 % reported two, 17.5 % reported three and 15.4 % reported >3 areas of distress. The most

Table 1
Descriptive statistics.

	Sample (n = 328)		NSSI (n = 121)		No-NSSI (n = 207)	
	n	%	*n*	%	*n*	%
Gender						
Female	239	72.9	89	73.6	150	72.5
Male	78	23.8	22	18.2	56	27.1
Diverse	11	3.3	9*	8.3	1*	0.5
Age	$M = 29.18$ $SD = 12.73$		$M = 24.72$* $SD = 10.03$		$M = 31.78$* $SD = 13.42$	
<18 years	45	13.7	97	80.2	186	89.9
≥18 years	283	86.3	24	19.8	21	10.1
Family status						
Single	139	42.4	64	52.9	75	36.2
In relationship	106	32.3	36	29.8	70	33.8
Married	74	22.6	20	16.5	54	26.1
Other	9	2.7	1	0.8	8	3.9
Self-assignment						
Pupil	56	17.1	30	24.8	26	12.6
University student	86	26.2	37	30.6	49	23.7
Trainee	21	6.4	10	8.3	11	5.3
(Self)Employed	147	44.8	34	28.1	113	54.6
Retired	2	0.6	1	0.8	1	0.5
Unemployed	2	0.6	1	0.8	1	0.5
Currently unable to work	8	2.4	6	5.0	2	1.0
Housewife/homemaker	4	1.2	2	1.7	2	1.0
Other	2	0.6	0	0.0	2	1.0
Psychiatric, psychological treatment						
Currently	69	21.0	39*	32.2	30*	14.5
In the past	71	21.6	38*	31.4	33*	15.9
Never	188	57.3	44*	36.4	144*	69.6
Current distress [a]						
Yes	171	52.1	83*	68.6	174*	84.1
No	157	47.9	38*	31.4	33*	15.9

Note. Significant differences between the NSSI group and the no-NSSI group are marked with * $p < .05$.

[a] Dichotomous item "Do you currently feel distressed?"

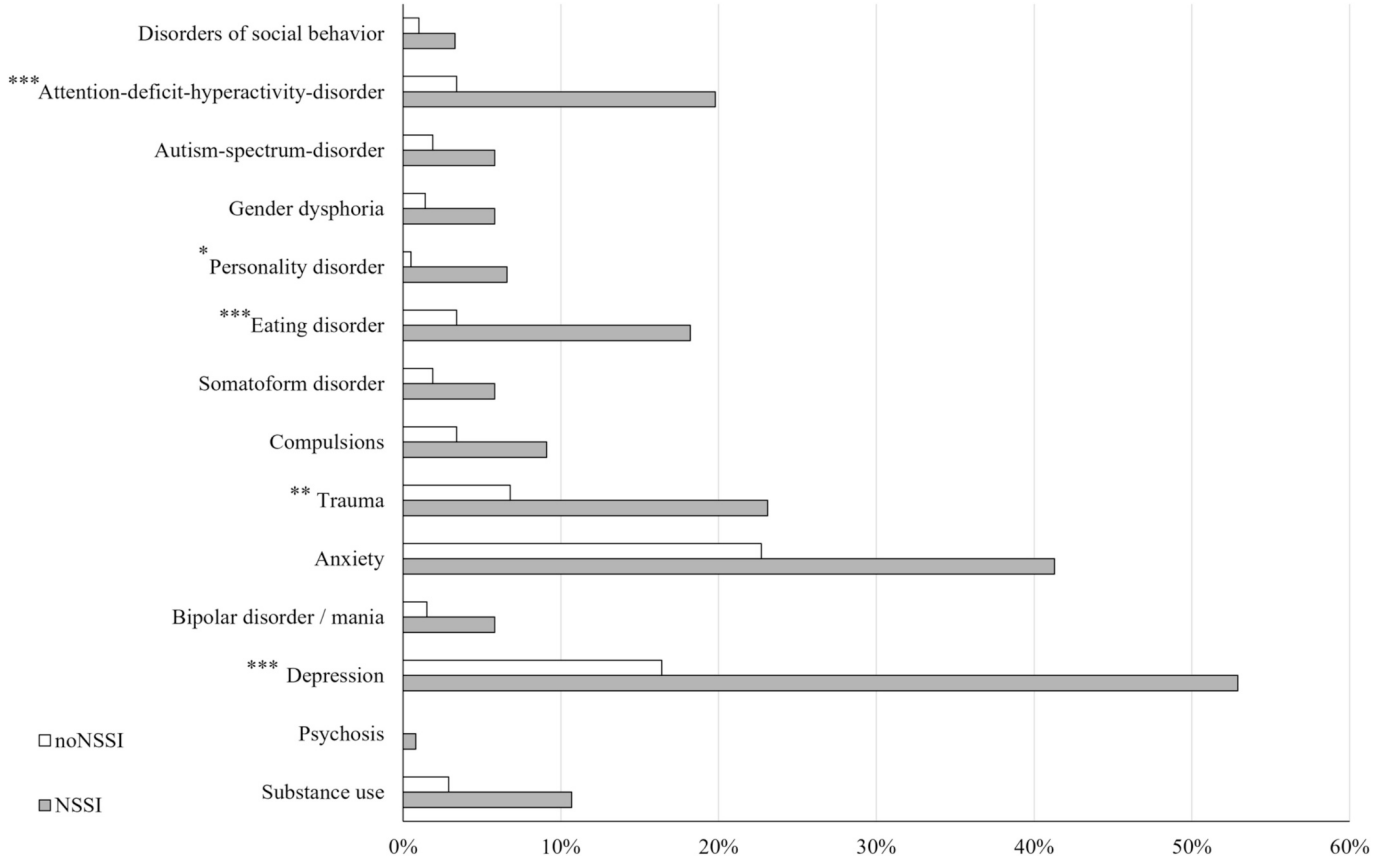

Fig. 1. Areas of distress.
Note. Multilple answers were possible. Significant differences between the NSSI group and the no-NSSI group are marked with * $p < .05$, ** $p < .01$, *** $p < .001$.

common combination was depression and anxiety (reported by $n = 11$), followed by depression and eating disorder, as well as depression, anxiety and compulsions (reported by $n = 5$ each).

3.1.1. NSSI

Of the total sample, 36.9 % ($n = 121$) stated that they had injured themselves at least once in their lives, of which 54.5 % had done so in the last year ($n = 66$, 20.1 % of the total sample) and 30.6 % in the last month ($n = 37$, 11.3 % of the total sample). On average, the participants reported $M = 174.93$ NSSI incidents in their life ($SD = 608.05$), $M = 25.55$ in the last year ($SD = 114.96$), and $M = 1.24$ in the last month ($SD = 3.52$). The average age at the first NSSI episode was $M = 14.71$ years ($SD = 5.82$) and an age of $M = 19.95$ years ($SD = 8.29$) was reported for the last episode. Participants with NSSI were significantly more likely to report current or past psychological treatment ($\chi^2(2) = 34.54$, $p < .001$, Cramer's $V = 0.33$) and current distress ($\chi^2(1) = 13.30$, $p < .001$, Cramer's $V = 0.20$). The reported NSSI functions differed between intra- and interpersonal functions, as well as between intrapersonal-positive and intrapersonal-negative functions. See Fig. 2A for a graphical depiction of NSSI functions across the whole sample.

3.1.2. ERQ

Details are depicted in Fig. 2B. The use of cognitive reappraisal ($M = 4.37$, $SD = 1.19$) was reported significantly more often than expressive suppression ($M = 3.69$, $SD = 1.39$; $t(327) = -6.51$, $p < .001$, $d = 1.91$, 95 % CI [−0.47, −0.25]). Further analyses showed that male participants ($M = 4.24$, $SD = 1.43$) used expressive suppression significantly more often than females ($M = 3.48$, $SD = 1.32$, $p < .001$; Kruskal-Wallis $H = 18.68$, $\eta^2 = 0.05$, other genders n.s.). Furthermore, participants who had never been in psychological treatment used cognitive reappraisal ($M = 4.65$, $SD = 1.09$) significantly more often than participants who reported current ($M = 3.78$, $SD = 1.21$, $p < .001$) or past treatment ($M = 4.21$, $SD = 1.21$, $p = .004$; Kruskal-Wallis $H = 29.06$, $p < .001$, $\eta^2 = 0.05$). Individuals who reported feeling currently distressed used cognitive reappraisal significantly less often ($M_{rank} = 149.02$) than those without current distress ($M_{rank} = 181.36$; $U = 10{,}776.50$, $z = -3.09$, $p = .002$, $\eta^2 = 0.03$). Lastly, the use of expressive suppression declined with age ($\tau = -0.21$, $p < .001$).

3.1.3. PAQ

Descriptive results of the PAQ are shown in Fig. 2C. Participants who were currently seeking psychological treatment scored significantly higher on the PAQ total score ($M = 88.86$, $SD = 35.70$) than participants who reported past ($M = 73.80$, $SD = 33.44$, $p = .006$) or no treatment ($M = 71.13$, $SD = 27.69$; $\chi^2(2) = 13.84$, $p < .001$, $\eta^2 = 0.04$). The same was true for all PAQ subscales (all $p < .05$), except EOT. Participants who reported current distress also had significantly higher PAQ total scores ($M_{rank} = 183.15$) than participants without current distress ($M_{rank} = 144.18$, $U = 10{,}234.00$, $Z = -3.72$, $p < .001$, $\eta^2 = 0.04$), as well as significantly higher scores on all PAQ subscales (all $p < .05$). Furthermore, significant gender differences on the PAQ were found ($\chi^2(2) = 15.46$, $p < .001$, $\eta^2 = 0.04$). Specifically, female participants achieved lower scores on the PAQ ($M = 72.27$, $SD = 30.78$) compared to both male ($M = 80.09$, $SD = 29.58$, $p = .028$) and diverse people ($M = 111.27$, $SD = 36.56$, $p < .001$). PAQ scores also declined with age (total score $\tau = -0.23$, $p < .001$) with stronger coefficients for participants that reported current treatment ($\tau = -0.41$, $p < .001$), compared to those who reported past ($\tau = -0.29$, $p = .014$) and no treatment ($\tau = -0.14$, $p = .052$).

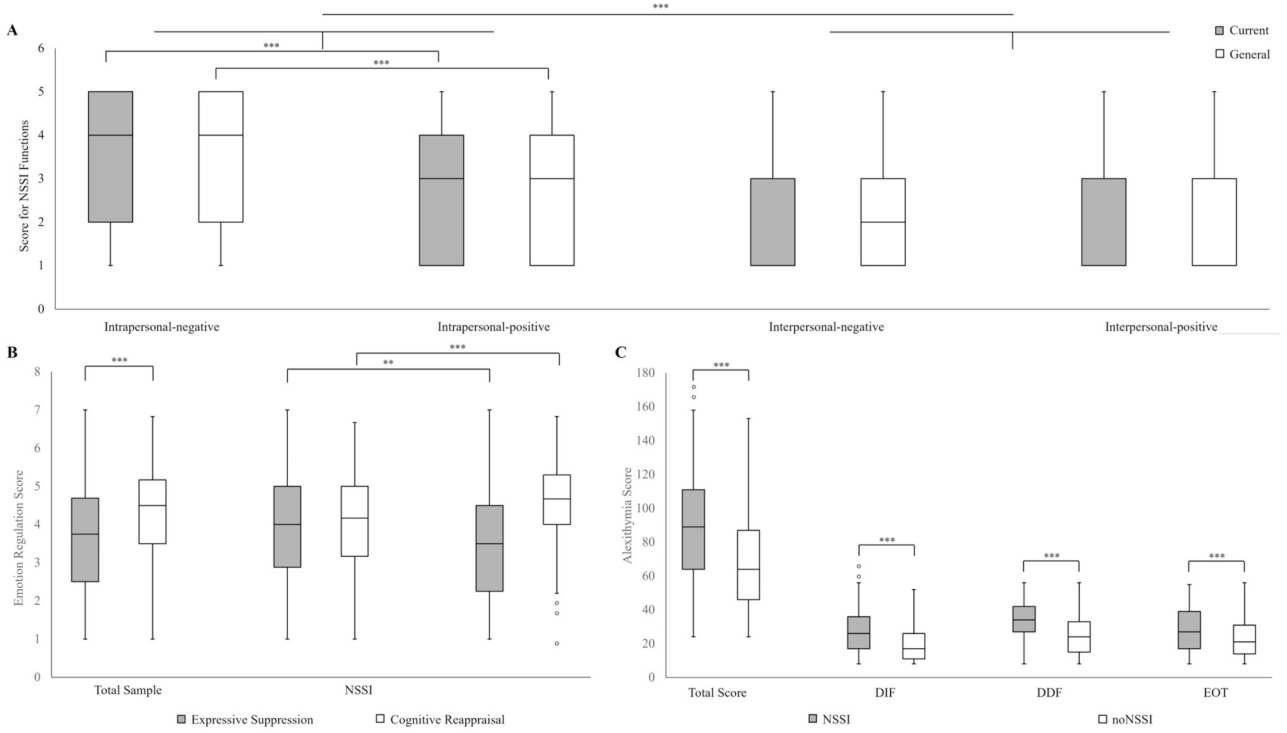

Fig. 2. Overview for A: NSSI functions, B: emotion regulation strategy, C: alexithymia.
Note. Significant group differences are marked with * $p < .05$, ** $p < .01$, *** $p < .001$. A: Intrapersonal NSSI functions were reported significantly more often than interpersonal functions, both for current and general NSSI. C: DIF = Difficulty Identifying Feelings; DDF = Difficulty Describing Feelings; EOT = Externally Orientated Thinking.

3.2. Hypotheses

3.2.1. NSSI and ERQ

The NSSI group used significantly more expressive suppression (*Mdn* = 4.00, U = 10,304.50, z = −2.68, p = .007, η^2 = 0.02) and less cognitive reappraisal (*Mdn* = 4.17, U = 8959.50, z = −4.31, $p < .001$, η^2 = 0.06) compared to the no-NSSI group (Mdn_{Sup} = 3.50, Mdn_{Reap} = 4.67). There was a significant positive correlation between the use of expressive suppression and intrapersonal-positive reinforcement (τ = 0.19, p = .039). Furthermore, the use of cognitive reappraisal correlated negatively with intrapersonal-negative reinforcement (τ = −0.26, p = .005). No significant correlations were found for other NSSI functions (all $p > .05$). The use of expressive suppression was significantly associated with engaging in NSSI during lifetime (τ = 0.25, p = .008) and the last year (τ = 0.21, p = .025), while no correlations could be identified for cognitive reappraisal.

3.2.2. ERQ and PAQ

More frequent use of expressive suppression was significantly associated with a higher PAQ total score (τ = 0.61, $p < .001$), as well as with higher scores on all other PAQ subscales ($p < .05$). In contrast, more frequent use of cognitive reappraisal was associated with a lower PAQ total score (τ = −0.25, $p < .001$), as well as with lower scores on all other subscales ($p < .05$).

3.2.3. PAQ and NSSI

The NSSI group (*Mdn* = 89.00) had significantly higher PAQ total scores than the no-NSSI group (*Mdn* = 64.00, U = 7663.50, z = − 5.87, $p < .001$, η^2 = 0.11). The NSSI group also scored significantly higher on all subscales ($p < .05$).

Interestingly, a higher PAQ total score was significantly associated with greater endorsement of intrapersonal functions for NSSI, specifically intrapersonal-positive functions (τ = 0.31, $p < .001$) currently and intrapersonal-negative (τ = 0.22, p = .016) and intrapersonal-positive (τ = 0.32, $p < .001$) functions in general. Similar correlations of intrapersonal(−positive) functions were found for most subscales of the PAQ.

There was a significant correlation between the PAQ and number of times individuals engaged in NSSI during their life (τ = 0.24, p = .011) and within the last year (τ = 0.24, p = .010). This correlation was stable for all subscales except for EOT ($p > .05$).

3.2.4. Predicting NSSI status

A binominal logistic regression was computed in order to identify variables that contribute unique variance to being in the NSSI group. Group assignment was added as dependent variable and emotion regulation strategies, and DAF and EOT were added as independent variables, thus examining the contributions of both the attention and appraisal stages of emotion processing. The decision to use the general scores, rather than the five specific subscales, was primarily to reduce the number of variables in the model and because earlier analyses showed that the negative and positive aspects of alexithymia functioned similarly, making it unnecessary to separate them in this context. Age and gender, coded as female(1)/male(0), were added as control variables. Participants reporting a diverse gender were excluded from the regression due to the small sample size. The model was significant ($\chi^2(6) = 73.19$, $p < .001$) and explained 27 % of the variance in group assignment (see Table 2).[2] Significant predictors were being younger, having difficulties appraising feelings, and reduced use of cognitive reappraisal as an emotion regulation strategy.

4. Discussion

The present study assessed NSSI, alexithymia, and the use of emotion

[2] The regression was repeated with diverse gender as a dummy coded variable and showed the same results (χ^2 (7) = 80.69, $p < .001$).

Table 2
Binary logistic regression predicting group assignment (NSSI, noNSSI).

Predictors	B	SE	Wald	CI 95 % OR	*p*	OR
Age	−0.05	0.01	15.95	0.93–0.98	< 0.001	0.95
Gender (female)	0.17	0.30	0.33	0.66–2.14	0.568	1.19
PAQ DAF	0.03	0.01	15.83	1.02–1.05	< 0.001	1.03
PAQ EOT	0.00	0.02	0.03	0.97–1.03	0.862	1.00
ERQ Suppression	−0.09	0.12	0.52	0.72–1.17	0.473	0.92
ERQ Reappraisal	−0.41	0.11	12.87	0.53–0.83	< 0.001	0.67

Note. PAQ = Perth Alexithymia Questionnaire; ERQ = Emotion Regulation Questionnaire; DAF = General Difficulty Appraising Feelings; EOT = Externally Orientated Thinking.

regulation strategies in a population-based sample in Germany. We found robust associations between NSSI, emotion regulation, and alexithymia, and were able to further investigate the role of emotional valence in alexithymia and associations with individual NSSI functions.

Over a third of the sample stated that they had self-injured nonsuicidal at least once in their lifetime. This lifetime prevalence is higher than previously reported (Cipriano et al., 2017; Klonsky, 2011; Liu, 2023; Plener et al., 2016), which may be due to also recruiting participants from a clinical setting. Nonetheless, these findings underscore the importance of NSSI as a widespread health problem. Concerning NSSI functions, intrapersonal functions (i.e. using NSSI for emotion regulation or self-punishment) were reported more frequently than interpersonal functions (i.e. using NSSI to attain attention or to avoid unpleasant social situations), with intrapersonal-negative functions (i.e. using NSSI to reduce negative emotions), being the most common. This finding corresponds to past studies investigating the four-function model of NSSI (Cipriano et al., 2017; Taylor et al., 2018; Bentley et al., 2014).

As expected, participants with NSSI used expressive suppression significantly more, and cognitive reappraisal significantly less, than participants without NSSI. While these results support the well-known relationship of NSSI with dysfunctional emotion regulation processes (Wolff et al., 2019; Chen and Chun, 2019; You et al., 2018; Robinson et al., 2019), the particular influence of both expressive suppression and cognitive reappraisal remains unclear. On the one hand, cognitive reappraisal (but not expressive suppression) was a significant predictor for NSSI in the regression analyses. On the other hand, correlational analyses showed that expressive suppression (but not cognitive reappraisal) was associated with lifetime and last-year NSSI. The present results thus underscore the importance of both cognitive reappraisal and expressive suppression, which are undoubtedly intertwined in their influence on NSSI.

Concerning NSSI functions, specific associations with emotion regulation strategies were found: First, the use of expressive suppression was associated with intrapersonal-positive functions, a result similar to Turner et al (Turner et al., 2012), who reported suppression to be associated with self-punishment functions. The present study also found a correlation of cognitive reappraisal with lower endorsement of intrapersonal negative functions, a result not found by Turner et al (Turner et al., 2012). In contrast, Turner et al (Turner et al., 2012). reported an association of suppression with intrapersonal-negative functions, as well as with social functions, while the present study found neither. Overall, both studies found stable relationships between emotion regulation strategies with NSSI functions, however specific associations differ. These differences might be due to different samples, different questionnaires, or definitions of NSSI. Since no other studies have investigated these associations, further research will be important in this area to determine the consistency of these specific links.

Concerning alexithymia, high alexithymia was associated with both more frequent use of maladaptive emotion regulation strategies, as well as with NSSI. This is in line with previous studies who have reported similar results (Preece et al., 2023; Schiewer et al., 2022). These findings align with the predictions of the attention-appraisal model of alexithymia (Preece and Gross, 2023), in terms of alexithymia impairing emotion regulation and being linked therefore with emotion-based pathologies like NSSI. With regard to the alexithymia subscales, results were less consistent for EOT as compared to both DIF and DDF. For instance, while EOT was higher in individuals engaging in NSSI, it was the only subscale not associated with NSSI incidents, and also did not predict NSSI group assignment in the regression analyses. This suggests, in accordance with a recent meta-analysis (Norman et al., 2020) that NSSI may be more strongly associated with difficulties at the appraisal stage of emotion processing, as compared with the attention stage.

Interestingly, while research thus far has primarily focused on the intrapersonal-negative functions of NSSI, intrapersonal-positive functions have often been neglected (Taylor et al., 2018; Edmondson et al., 2016). The present study identifies repeated associations between alexithymia with intrapersonal-positive NSSI functions. The more difficulties participants had in identifying and describing their emotions, the more often they used NSSI to punish themselves, to end dissociative states, or to achieve desired states such as euphoria. The association between alexithymia and specific NSSI functions has not previously been investigated, thus these findings are particularly novel. The present study suggests that it may be specifically these intrapersonal-positive functions, that are crucial to understanding the association of NSSI with alexithymia.

One possible explanation is, that participants who are prone to experience dissociation, also score higher on alexithymia measures (Reyno et al., 2020), as alexithymia is consistently linked with avoidant approaches to emotion and disconnection from emotions (e.g (Preece et al., 2023),.). Such individuals might be more likely to use NSSI to manage dissociation compared to those who do not experience it. Additionally, shared environmental factors may play a role; individuals who grew up in an emotionally invalidating environment are likely exhibit higher levels of alexithymia (Grove and Crowell, 2017) and an increased tendency towards self-punishment (Bracken-Minor and McDevitt-Murphy, 2014).

Interestingly enough, interpersonal-positive functions also emerged as significant in their association with expressive suppression, which in turn, was again associated with alexithymia. Altogether, the present results might also indicate a triangular relationship between alexithymia, expressive suppression, and endorsement of intrapersonal-positive functions of NSSI. A possible explanation is that individuals who struggle to identify and express their emotions may resort to suppressing them as a coping mechanism, leading to a buildup of unprocessed emotions that they manage through NSSI to achieve intrapersonal-positive outcomes.

4.1. Implications

The results of this study once again emphasize the importance of alexithymia for NSSI. In particular, it was shown that people with lifetime NSSI have higher alexithymia, i.e. more difficulties in identifying, describing, and differentiating their own emotions. This corresponds to the assumptions of the Attention-Appraisal Model of alexithymia (Preece et al., 2017; Preece et al., 2018): Individuals with high alexithymia fail to focus their attention sufficiently on their own emotions and cannot identify, describe, and appraise them correctly. As a result, less information is available for the selection of suitable emotion regulation strategies, which makes the use of adaptive emotion regulation strategies, such as cognitive reappraisal, more difficult and increases the likelihood that inadequate, maladaptive strategies such as NSSI and expressive suppression are used (Wolff et al., 2019; Preece et al., 2023).

Furthermore, the presented findings underline the role of emotion regulation in NSSI and support the idea that NSSI may function as a maladaptive emotion regulation strategy for people who lack adaptive strategies such as cognitive reappraisal and/or who are prone to other maladaptive strategies such as expressive suppression as well. The concept of NSSI as a maladaptive strategy for intrapersonal emotion regulation also aligns with theories that conceptualize certain self-

injurious behaviors as forms of self-regulation, similar to repetitive and restrictive behaviors observed in OCD or autism spectrum conditions (e.g (Kinsbourne, 2011),.). Particularly in autistic individuals, some repetitive behaviors serve to regulate arousal and may include self-injurious elements. In line with this, our results suggest that individuals high in alexithymia or reliant on expressive suppression may engage in NSSI for similar self-regulatory purposes. From a clinical perspective, these findings highlight the potential benefits of targeting emotion identification and cognitive reappraisal skills in interventions for NSSI. Moreover, the observed decline in expressive suppression with age in our study may reflect a developmental shift, wherein individuals gradually adopt more adaptive emotion regulation strategies. Understanding and facilitating this transition could be a valuable focus for future preventive efforts.

Despite the widespread prevalence of NSSI, only few empirically validated treatments for NSSI are available (Brausch and Girresch, 2012; Garisch et al., 2017). However, a similar approach can be seen in other treatments, such as dialectical behavior therapy (DBT), which addresses emotion recognition and has been shown to successfully reduce NSSI (Cook and Gorraiz, 2016; Prada et al., 2018). Our results suggest that interventions specifically targeting alexithymia and the building of emotion regulation skills could have significant promise in respect to NSSI, and that routine assessment of alexithymia and emotion regulation patterns will likely be useful in cases where NSSI is present.

4.2. Limitations and future directions

Several limitations of the present study should be noted: First, all findings are purely cross-sectional, thus no causal inferences can be drawn. While the Attention-Appraisal Model suggests that alexithymia contributes to the development of NSSI, the reverse may also be true – engaging in NSSI could potentially influence or reinforce alexithymic traits. The current design does not allow us to determine the directionality of these relationships. Although we compared individuals with lifetime NSSI and those with NSSI in the past year to explore possible temporal patterns, we found no differential associations. Specifically, expressive suppression as well as alexithymia were significantly higher for participants with NSSI compared to those without, but no significant differences could be found for recent versus lifetime NSSI. This is at odds with the idea that recent NSSI is associated with, perhaps even predicted by, an increase in alexithymia or emotion dysregulation (Chen and Chun, 2019; Robinson et al., 2019; Bordalo and Carvalho, 2022). However, our cross-sectional design as well as the general lack of longitudinal studies impede any final conclusions regarding temporal sequencing of NSSI and alexithymia or emotion regulation strategies. Future longitudinal research is needed to clarify the causal pathways between these variables.

Second, the sample consisted mostly of young, educated women, which limits any generalization of the results, for instance with regard to the prevalence of NSSI in non-student populations (Hamza et al., 2021) or with regard to alexithymia in people with a lower level of education (Kokkonen et al., 2001). Furthermore, the sample explicitly included both people from the general population as well as from a clinical setting, which is a strength in terms of the diversity of the sample, but also means that conclusions cannot be made for one specific sample type. Although the online format can be seen as a limitation, it also entails several advantages for the current study including increased anonymity (which is particularly relevant for sensitive topics such as NSSI), and easier accessibility for a variety of populations. Additionally, the current study included several attentiveness checks to control participants' concentration, thus increasing the likely validity of the data. Regarding NSSI, it is noteworthy, that all participants with lifetime NSSI were treated as one homogenous group. In order to better depict reality, future studies could adopt continuous approaches to assess NSSI (Fox et al., 2015). Lastly, the present study assessed alexithymia using the German version of the PAQ. As this German language version has not been psychometrically validated yet in other samples (though the English form from which it was translated has been extensively validated), the results reported here should be viewed with appropriate caution. However, the internal consistencies found in the present study indicate good psychometric properties.

4.3. Conclusion

Our findings highlight the important roles that alexithymia and emotion regulation can play in NSSI. Both the negative and positive valence domains appear to be important with respect to alexithymia, with deficits in the appraisal stage of emotion processing exhibiting the strongest relationships with NSSI. Similarly, low usage of adaptive strategies and high usage of maladaptive strategies underpin NSSI. Our findings emphasize the importance of considering different types of functions of NSSI, as these can show differential relationships with alexithymia and emotion regulation. This is the first study to examine and report a link between alexithymia and the endorsement of specific (intrapersonal-positive) NSSI functions.

CRediT authorship contribution statement

Nadine Baumann: Writing – original draft, Investigation, Formal analysis, Conceptualization. **Angelika Ecker:** Writing – review & editing, Visualization, Supervision, Resources, Investigation, Conceptualization. **Daniel Schleicher:** Writing – review & editing, Resources, Investigation, Conceptualization. **Stephanie Kandsperger:** Writing – review & editing, Investigation, Conceptualization. **David A. Preece:** Writing – review & editing, Conceptualization. **Romuald Brunner:** Writing – review & editing, Supervision, Resources. **Irina Jarvers:** Writing – review & editing, Writing – original draft, Validation, Resources, Investigation, Formal analysis, Conceptualization.

Funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We would like to extend our heartfelt thanks to all participants of this study, whose time and commitment made this research possible. Special thanks go to Anna-Lena Eich for her invaluable support in recruitment, ensuring a smooth and successful process.

References

Abler, B., Kessler, H., 2011. ERQ - Emotion Regulation Questionnaire: Verfahrensdokumentation aus PSYNDEX Tests-Nr. 9006192 und Fragebogen. https://doi.org/10.23668/psycharchives.402.

American Psychiatric Association, 2018. Diagnostisches und Statistisches Manual Psychischer Störungen DSM-5: Deutsche Ausgabe herausgegeben von Peter Falkai und Hans-Ulrich Wittchen, mitherausgegeben von Manfred Döpfner, Wolfgang Gaebel, Wolfgang Maier, Winfried Rief. Hogrefe, Henning Saß und Michael Zaudig. https://doi.org/10.1026/02803-000 https://elibrary.hogrefe.com/book/10.1026/02803-000.

Angelakis, I., Gooding, P., 2021. Experiential avoidance in non-suicidal self-injury and suicide experiences: A systematic review and meta-analysis. Suicide Life Threat Behav 51 (5), 978–992. https://doi.org/10.1111/sltb.12784.

Bagby, R.M., Taylor, G.J., Parker, J.D.A., 1994. The twenty-item Toronto Alexithymia Scale: II. Convergent, discriminant, and concurrent validity. J Psychosom Res 38 (1), 33–40. https://doi.org/10.1016/0022-3999(94)90006-X.

Benjamini, Y., Hochberg, Y., 1995. Controlling the false discovery rate: A practical and powerful approach to multiple testing. J R Stat Soc Ser B Stat Methodol 57 (1), 289–300. https://doi.org/10.1111/j.2517-6161.1995.tb02031.x.
Bentley, K.H., Nock, M.K., Barlow, D.H., 2014. The four-function model of nonsuicidal self-injury. Clin Psychol Sci 2 (5), 638–656. https://doi.org/10.1177/2167702613514563.
Bordalo, F., Carvalho, I.P., 2022. The role of alexithymia as a risk factor for self-harm among adolescents in depression - A systematic review. J Affect Disord 297, 130–144. https://doi.org/10.1016/j.jad.2021.10.029.
Bracken-Minor, K.L., McDevitt-Murphy, M.E., 2014. Differences in features of non-suicidal self-injury according to borderline personality disorder screening status. Arch Suicide Res 18 (1), 88–103. https://doi.org/10.1080/13811118.2013.809040.
Brausch, A.M., Girresch, S.K., 2012. A review of empirical treatment studies for adolescent nonsuicidal self-injury. J Cogn Psychother 26 (1), 3–18. https://doi.org/10.1891/0889-8391.26.1.3.
Brausch, A.M., Muehlenkamp, J.J., Washburn, J.J., 2016. Nonsuicidal self-injury disorder: does criterion B add diagnostic utility? Psychiatry Res 244, 179–184. https://doi.org/10.1016/j.psychres.2016.07.025.
Brunner, R., Kaess, M., Parzer, P., Fischer, G., Carli, V., Hoven, C.W., Wasserman, C., Sarchiapone, M., Resch, F., Apter, A., Balazs, J., Barzilay, S., Bobes, J., Corcoran, P., Cosmanm, D., Haring, C., Iosuec, M., Kahn, J.-P., Keeley, H., Wasserman, D., 2014. Life-time prevalence and psychosocial correlates of adolescent direct self-injurious behavior: A comparative study of findings in 11 European countries. J Child Psychol Psychiatry 55 (4), 337–348. https://doi.org/10.1111/jcpp.12166.
Chan, J., Becerra, R., 2023. Assessing alexithymia across Asian and Western cultures: psychometric properties of the Perth alexithymia questionnaire and Toronto alexithymia Scale-20 in Singaporean and Australian samples. J Pers Assess 396–412. https://doi.org/10.1080/00223891.2022.2095641.
Chen, W.-L., Chun, C.-C., 2019. Association between emotion dysregulation and distinct groups of non-suicidal self-injury in Taiwanese female adolescents. Int J Environ Res Public Health 16(18), Artikel 3361. https://doi.org/10.3390/ijerph16183361.
Cipriano, A., Cella, S., Cotrufo, P., 2017. Nonsuicidal self-injury: A systematic review. Front Psychol 8, 1946. https://doi.org/10.3389/fpsyg.2017.01946.
Cohen, J., 1988. Statistical Power Analysis for the Behavioral Sciences, 2. ed. Erlbaum. https://doi.org/10.4324/9780203771587.
Cook, N.E., Gorraiz, M., 2016. Dialectical behavior therapy for nonsuicidal self-injury and depression among adolescents: preliminary meta-analytic evidence. Child Adolesc Mental Health 21 (2), 81–89. https://doi.org/10.1111/camh.12112.
Edmondson, A.J., Brennan, C.A., House, A.O., 2016. Non-suicidal reasons for self-harm: A systematic review of self-reported accounts. J Affect Disord 191, 109–117. https://doi.org/10.1016/j.jad.2015.11.043.
Fischer, G., Ameis, N., Parzer, P., Plener, P.L., Groschwitz, R., Vonderlin, E., Kölch, M., Brunner, R., Kaess, M., 2014. The German version of the self-injurious thoughts and behaviors interview (SITBI-G): A tool to assess non-suicidal self-injury and suicidal behavior disorder. BMC Psychiatry 14, 265. https://doi.org/10.1186/s12888-014-0265-0.
Fox, K.R., Franklin, J.C., Ribeiro, J.D., Kleiman, E.M., Bentley, K.H., Nock, M.K., 2015. Meta-analysis of risk factors for nonsuicidal self-injury. Clin Psychol Rev 42, 156–167. https://doi.org/10.1016/j.cpr.2015.09.002.
Garisch, J.A., Wilson, M.S., O'Connell, A., Robinson, K. [Kealagh], 2017. Overview of assessment and treatment of nonsuicidal self-injury among adolescents. N Z J Psychol 46 (3), 98–105.
Greene, D., Boyes, M.E., Hasking, P.A., 2020. The associations between alexithymia and both non-suicidal self-injury and risky drinking: A systematic review and meta-analysis. J Affect Disord 260, 140–166. https://doi.org/10.1016/j.jad.2019.08.088.
Gross, J.J., 2015. Emotion regulation: current status and future prospects. Psychol Inq 26 (1), 1–26. https://doi.org/10.1080/1047840X.2014.940781.
Gross, J.J., John, O.P., 2003. Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. J Pers Soc Psychol 85 (2), 348–362. https://doi.org/10.1037/0022-3514.85.2.348.
Grove, J.L., Crowell, S.E., 2017. Invalidating environments and the development of borderline personality disorder. In: Swales, M.A. (Ed.), The Oxford Handbook of Dialectical Behaviour Therapy. Oxford University Press, pp. 46–68. https://doi.org/10.1093/oxfordhb/9780198758723.013.47.
Hamza, C.A., Goldstein, A.L., Heath, N.L., Ewing, L., 2021. Stressful experiences in university predict non-suicidal self-injury through emotional reactivity. Front Psychol 12, 610670. https://doi.org/10.3389/fpsyg.2021.610670.
Iskric, A., Ceniti, A.K., Bergmans, Y., McInerney, S., Rizvi, S.J., 2020. Alexithymia and self-harm: A review of nonsuicidal self-injury, suicidal ideation, and suicide attempts. Psychiatry Res 288, 112920. https://doi.org/10.1016/j.psychres.2020.112920.
Jarvers, I., Ecker, A., Schleicher, D., Otto, A., Jarvers, C., 2022. The alexithymia questionnaire for children – German version (AQC-G). Center for Open Science. https://doi.org/10.31234/osf.io/ra65t.
Kaemmerer, M., Grüning, D.J., Luminet, O., Preece, D.A., 2021. German translation of the Perth Alexithymia Questionnaire. https://doi.org/10.31234/osf.io/gj5e3.
Kinsbourne, M., 2011. Repetitive movements and arousal. In: Fein, D. (Ed.), The Neuropsychology of Autism. Oxford Univ, Press.
Klonsky, E.D., 2011. Non-suicidal self-injury in United States adults: prevalence, sociodemographics, topography and functions. Psychol Med 41 (9), 1981–1986. https://doi.org/10.1017/S0033291710002497.
Kokkonen, P., Karvonen, J.T., Veijola, J., Läksy, K., Jokelainen, J., Järvelin, M.R., Joukamaa, M., 2001. Prevalence and sociodemographic correlates of alexithymia in a population sample of young adults. Compr Psychiatry 42 (6), 471–476. https://doi.org/10.1053/comp.2001.27892.
Kooiman, C.G., Spinhoven, P., Trijsburg, R.W., 2002. The assessment of alexithymia: a critical review of the literature and a psychometric study of the Toronto Alexithymia Scale-20. J Psychosom Res 53 (6), 1083–1090. https://doi.org/10.1016/s0022-3999(02)00348-3.
Laloyaux, J., Fantini, C., Lemaire, M., Luminet, O., Larøi, F., 2015. Evidence of contrasting patterns for suppression and reappraisal emotion regulation strategies in alexithymia. J Nerv Ment Dis 203 (9), 709–717. https://doi.org/10.1097/NMD.0000000000000353.
Leising, D., Grande, T., Faber, R., 2009. The Toronto alexithymia scale (TAS-20): A measure of general psychological distress. J Res Pers 43 (4), 707–710. https://doi.org/10.1016/j.jrp.2009.03.009.
Liu, R.T., 2023. The epidemiology of non-suicidal self-injury: lifetime prevalence, sociodemographic and clinical correlates, and treatment use in a nationally representative sample of adults in England. Psychol Med 53 (1), 274–282. https://doi.org/10.1017/S003329172100146X.
Marchesi, C., Ossola, P., Tonna, M., Panfilis, C. de, 2014. The TAS-20 more likely measures negative affects rather than alexithymia itself in patients with major depression, panic disorder, eating disorders and substance use disorders. Compr Psychiatry 55 (4), 972–978. https://doi.org/10.1016/j.comppsych.2013.12.008.
Nock, M.K., 2009. Why do people hurt themselves? New insights into the nature and functions of self-injury. Curr Dir Psychol Sci 18 (2), 78–83. https://doi.org/10.1111/j.1467-8721.2009.01613.x.
Nock, M.K., Holmberg, E.B., Photos, V.I., Michel, B.D., 2007. Self-injurious thoughts and behaviors interview: development, reliability, and validity in an adolescent sample. Psychol Assess 19 (3), 309–317. https://doi.org/10.1037/1040-3590.19.3.309.
Nock, M.K., Prinstein, M.J., Sterba, S.K., 2010. Revealing the form and function of self-injurious thoughts and behaviors: A real-time ecological assessment study among adolescents and young adults. Psychol Violence 1, 36–52. https://doi.org/10.1037/2152-0828.1.S.36.
Norman, H., Oskis, A., Marzano, L., Coulson, M., 2020. The relationship between self-harm and alexithymia: A systematic review and meta-analysis. Scand J Psychol 61 (6), 855–876. https://doi.org/10.1111/sjop.12668.
Plener, P.L., Allroggen, M., Kapusta, N.D., Braehler, E., Fegert, J.M., Groschwitz, R.C., 2016. The prevalence of nonsuicidal self-injury (NSSI) in a representative sample of the German population. BMC Psychiatry 16 (1), 353. https://doi.org/10.1186/s12888-016-1060-x.
Prada, P., Perroud, N., Rüfenacht, E., Nicastro, R., 2018. Strategies to Deal with suicide and non-suicidal self-injury in borderline personality disorder, the case of DBT. Front Psychol 9, 2595. https://doi.org/10.3389/fpsyg.2018.02595.
Preece, D.A., Gross, J.J., 2023. Conceptualizing alexithymia. Personal Individ Differ 215, 112375. https://doi.org/10.1016/j.paid.2023.112375.
Preece, D.A., Becerra, R., Allan, A., Robinson, K. [Ken], Dandy, J., 2017. Establishing the theoretical components of alexithymia via factor analysis: introduction and validation of the attention-appraisal model of alexithymia. Personal Individ Differ 119, 341–352. https://doi.org/10.1016/j.paid.2017.08.003.
Preece, D.A., Becerra, R., Robinson, K. [Ken], Dandy, J., Allan, A., 2018. The psychometric assessment of alexithymia: development and validation of the Perth alexithymia questionnaire. Personal Individ Differ 132, 32–44. https://doi.org/10.1016/j.paid.2018.05.011.
Preece, D.A., Becerra, R., Boyes, M.E., Northcott, C., McGillivray, L., Hasking, P.A., 2020. Do self-report measures of alexithymia measure alexithymia or general psychological distress? A factor analytic examination across five samples. Personal Individ Differ 155, 109721. https://doi.org/10.1016/j.paid.2019.109721.
Preece, D.A., Mehta, A., Petrova, K., Sikka, P., Bjureberg, J., Becerra, R., Gross, J.J., 2023. Alexithymia and emotion regulation. J Affect Disord 324, 232–238. https://doi.org/10.1016/j.jad.2022.12.065.
Preece, D.A., Petrova, K., Mehta, A., Sikka, P., Gross, J.J., 2024. Alexithymia or general psychological distress? Discriminant validity of the Toronto alexithymia scale and the Perth alexithymia questionnaire. J Affect Disord 352, 140–145. https://doi.org/10.1016/j.jad.2024.01.271.
Raine, A., Chen, F.R., Waller, R., 2022. The cognitive, affective and somatic empathy scales for adults. Personal Individ Differ 185. https://doi.org/10.1016/j.paid.2021.111238.
Reyno, S.M., Simmons, M., Kinley, J., 2020. A meta-analytic study examining the relationship between alexithymia and dissociation in psychiatric and nonclinical populations. Research in Psychotherapy 23 (1), 439. https://doi.org/10.4081/ripppo.2020.439.
Robinson, K. [Kealagh], Garisch, J.A., Kingi, T., Brocklesby, M., O'Connell, A., Langlands, R.L., Russell, L., Wilson, M.S., 2019. Reciprocal risk: the longitudinal relationship between emotion regulation and non-suicidal self-injury in adolescents. J Abnorm Child Psychol 47 (2), 325–332. https://doi.org/10.1007/s10802-018-0450-6.
Sala, M.N., Molina, P., Abler, B., Kessler, H., Vanbrabant, L., van de Schoot, R., 2012. Measurement invariance of the emotion regulation questionnaire (ERQ). A cross-national validity study. Eur J Dev Psychol 9 (6), 751–757. https://doi.org/10.1080/17405629.2012.690604.
Schiewer, V., Dietz, T., Tavenrath, S., Öztürk-Arenz, H., Jäger, R.S., Klein, A., Labouvie, H., Kusch, M., 2022. Gemeinsame Grundlage von Alexithymie und expressiver suppression: Ergebnisse einer empirischen Studie [common foundation of alexithymia and expressive suppression]. Psychotherapeut 67 (2), 166–175. https://doi.org/10.1007/s00278-021-00546-x.
Sifneos, P.E., 1973. The prevalence of 'alexithymic' characteristics in psychosomatic patients. Psychother Psychosom 22 (2), 255–262. https://doi.org/10.1159/000286529.

Stoet, G., 2010. PsyToolkit: A software package for programming psychological experiments using Linux. Behav Res Methods 42 (4), 1096–1104. https://doi.org/10.3758/BRM.42.4.1096.

Stoet, G., 2017. PsyToolkit. Teach Psychol 44 (1), 24–31. https://doi.org/10.1177/0098628316677643.

Taylor, P.J., Jomar, K., Dhingra, K., Forrester, R., Shahmalak, U., Dickson, J.M., 2018. A meta-analysis of the prevalence of different functions of non-suicidal self-injury. J Affect Disord 227, 759–769. https://doi.org/10.1016/j.jad.2017.11.073.

Turner, B.J., Chapman, A.L., Layden, B.K., 2012. Intrapersonal and interpersonal functions of non suicidal self-injury: associations with emotional and social functioning. Suicide Life Threat Behav 42 (1), 36–55. https://doi.org/10.1111/j.1943-278X.2011.00069.x.

Wolff, J.C., Thompson, E., Thomas, S.A., Nesi, J., Bettis, A.H., Ransford, B., Scopelliti, K., Frazier, E.A., Liu, R.T., 2019. Emotion dysregulation and non-suicidal self-injury: A systematic review and meta-analysis. Eur Psychiatry 59, 25–36. https://doi.org/10.1016/j.eurpsy.2019.03.004.

You, J., Ren, Y., Zhang, X., Wu, Z., Xu, S., Lin, M.P., 2018. Emotional dysregulation and nonsuicidal self-injury: A meta-analytic review. Neuropsychiatry 08 (02), 733–748. https://doi.org/10.4172/Neuropsychiatry.1000399.

Zetterqvist, M., Jonsson, L.S., Landberg, Å., Svedin, C.G., 2021. A potential increase in adolescent nonsuicidal self-injury during COVID-19: a comparison of data from three different time points during 2011–2021. Psychiatry Res 305, 114208. https://doi.org/10.1016/j.psychres.2021.114208.