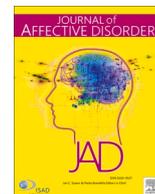


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Research paper

## Borderline personality traits mediate the relationship between low perceived social support and non-suicidal self-injury in a clinical sample of adolescents

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## ABSTRACT

**Background:** Non-suicidal self-injury (NSSI) is a serious public health concern among adolescents, especially in clinical settings. Social support plays a critical role in the onset and maintenance of NSSI in adolescence. NSSI is closely associated with borderline personality disorder (BPD), yet no previous work has analyzed the mediating role of borderline traits in the relationship between perceived social support (PSS) and NSSI. This study aimed to address this gap.

**Methods:** Participants were 228 adolescent patients (12 to 18 years old), who completed a clinical interview and self-report measures of BPD-traits, current psychological distress, emotion dysregulation and PSS. They were grouped based on the presence (vs. absence) of NSSI. Univariate and multivariate logistic regression analyses were used to identify risk factors of NSSI, and a mediation analysis was conducted to examine the intermediary role of borderline traits in the relationship between PSS and NSSI.

**Results:** NSSI was highly prevalent in our sample (58%) and was associated with higher clinical severity. Low PSS predicted NSSI in univariate, but not multivariate regression. Mediation analyses showed that borderline traits fully accounted for the relationship between low PSS and NSSI, even when controlling for current psychological distress and gender.

**Limitations:** Cross-sectional design through self-report assessment.

**Conclusions:** Findings suggest that adolescents with low PSS are especially vulnerable for developing NSSI due to elevated BPD traits. In clinical settings, interventions aimed to reduce borderline symptoms may be a promising treatment option for adolescents with NSSI and low PSS.

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## 1. Introduction

Non-suicidal self-injury (NSSI) refers to the deliberate destruction of one's own body tissue in the absence of conscious suicidal intent (Nock, 2010; Plener et al., 2015; Vega et al., 2018). NSSI is associated with potentially detrimental consequences, ranging from low interpersonal, academic, and daily functioning to high risk of suicide (Claes et al. 2003; Daukantaitė et al. 2020). Adolescence constitutes a critical and vulnerable phase for developing NSSI, as indicated by higher prevalence rates in both community (17–38%; Brunner et al., 2014) and clinical samples (50–60%; Kaess et al., 2013). Recent research suggests a crucial role of social factors in the onset and maintenance of NSSI during this important developmental period (Brown and Witt, 2019). Therefore, it is not surprising that in the context of the social distancing measures imposed during the COVID-19 pandemic, NSSI rates have increased even more, especially in those adolescents suffering from mental disorders (Plener, 2021; Wester et al. 2018). In this regard, a deeper understanding of how social factors contribute to the prevalence and severity of NSSI in adolescent psychiatric samples, as well as how they interplay with other risk factors, is necessary to maximize prevention and treatment programs.

In adolescents, NSSI is present in broader internalizing and externalizing problems (Meszaros et al., 2017; Zetterqvist, 2015), and is highly associated with borderline personality disorder (BPD) (Nock et al., 2006; Sadeh et al., 2014). Around 61% of adolescents with BPD pathology have engaged in NSSI at least once, making the criterion “recurrent NSSI and suicidal behavior” the most frequently met in adolescents with BPD (Chanen et al., 2008; Kaess et al., 2014). The occurrence of NSSI often precedes a BPD diagnosis and is therefore considered to be a precursor for BPD (Ghinea et al., 2019; Groschwitz et al., 2015; Homan et al., 2017). On the other hand, the presence of BPD symptoms (such as emotion dysregulation or identity disturbances) increases the risk of engaging in some form of NSSI in adolescents (Stead et al., 2019), and the presence of a BPD diagnosis involves greater severity of NSSI (Jacobson et al., 2008; Stead et al., 2019). Therefore, it has been suggested that BPD features precede and interact with NSSI (Reichl and Kaess, 2021). Notwithstanding the above, additional research is needed to clarify this relationship, as approximately 50% of adolescents with NSSI do not meet diagnostic criteria for BPD (Ayodeji et al., 2015).

Prior research indicates that emotion dysregulation, a core feature of BPD, is a specific risk factor for NSSI (Wolff et al., 2019). For example, emotion regulation difficulties predict the presence of NSSI in psychiatric inpatients, regardless of sex and psychopathology (Perez et al., 2012). In addition, adolescents commonly report engaging in self-harm as a strategy to cope with emotional pain (Laye-Gindhu and Schonert-Reichl, 2005). In this regard, NSSI could be considered as a maladaptive response to strong negative affect because of poor emotion regulation skills (Chapman et al., 2006).

In addition to individual risk factors (e.g., emotion dysregulation), social factors also play a prominent role in NSSI engagement (Cipriano et al., 2017; Taylor et al., 2018). Most people engaging in NSSI usually endorse social motives (e.g., to cope with social conflicts) (Hankin and Abela, 2011; Klonsky, 2007). For instance, interpersonal conflicts or feelings of rejection by peers are frequent triggers for NSSI (Briónes-Buixassa et al., 2021; Klomek et al., 2016). Importantly, adolescents who engage in NSSI often report feelings of loneliness, low social competence, poorer relationships with parents, and invalidating life environments (Musser et al., 2018; Wang et al. 2020).

Social interactions and social support are vital for healthy personality development in young people (Blakemore and Mills, 2014; Orben et al., 2020). Perceived social support (PSS) refers to an individual's perceptions of the general availability and quality of the social support available to them (Haber et al., 2007). Adolescents with high PSS exhibit better mental health and less high-risk behaviors (Lai and Ma, 2016; Reiningger et al., 2012). Previous evidence suggests that high PSS is a

protective factor for suicide and self-harm (Kleiman and Liu 2013; Muehlenkamp et al., 2013; Nemati et al., 2020; Tham et al., 2020). More specifically, different previous studies show that high PSS decreases the odds of engaging in NSSI in adolescents from nonclinical (Wan et al., 2018) and clinical samples (Baiden et al., 2017; Miller et al., 2015). A recent longitudinal study with a 5-year follow-up also suggests that high PSS from friends may be particularly critical in preventing the onset of self-cutting in adolescents (Rissanen et al., 2021).

It should also be noted that young people with low PSS are prone to use the social media as an alternative source to feel connected with others (Zhang et al., 2018). However, the reality is that overuse of the internet and the social media has been associated with psychological distress in adolescents (Marino et al., 2018). More specifically, internet addiction might be a risk factor for engaging in NSSI in the presence of a comorbid psychiatric disorder (Karaer and Akdemir, 2019; Mészáros et al., 2020), suggesting that virtual interaction does not improve perceptions of social support in these adolescents.

It is worth noting that PSS may interact with other risk factors to augment or reduce the odds of engaging in NSSI in adolescents. For example, a large-scale study involving ten European countries showed that adolescents with parental and peer support were at significantly lower risk of engaging in direct self-injurious behaviors after being victimized by bullying, compared to students without social support (Klomek et al., 2016). Similarly, high parental support appears as a protective factor against NSSI in adolescents who are bullied (Claes et al., 2015). Lastly, Crowell et al. (2009) also suggested that the association between NSSI and emotion dysregulation becomes stronger in non-supportive social contexts, further emphasizing the protective role of social support.

While a significant body of research has demonstrated the protective effects of social support on NSSI in adolescents, only a few studies have explored the mediating mechanisms that may underlie this association in adolescents. Rissanen et al. (2021) reported that depression symptoms mediated the effect of subjective loneliness on the initiation of self-cutting in a non-clinical sample of adolescents. Similarly, Madjar et al. (2021) found that depression symptoms fully mediated the association between perceptions of school-related social support (e.g., from teachers and peers) and NSSI in a non-clinical adolescent sample. Lastly, a different study in young adults revealed that deficits in emotion regulation mediated the relationship between feelings of alienation in parent and peer relationships (i.e., low PSS) and NSSI (Yurkowski et al., 2015).

These studies only focused on the mediating role of emotion dysregulation and depressive symptoms in the relationship between PSS and NSSI. However, despite a strong association between NSSI and BPD (e.g., Stead et al., 2019), no previous study has analyzed the potential mediating role of borderline features. In this regard, it is important to note that unsupportive and invalidating environments during infancy and childhood (e.g., disturbed relationships, bullying) have been suggested as a prominent risk factor for the development of BPD (Crowell et al., 2009; Fruzzetti et al., 2005). However, longitudinal studies do not provide consistent evidence to support this causal relationship. For instance, while a study of Wolke et al. (2012) suggests that victimisation by peers in childhood increases the risk of developing BPD symptoms in early adolescence, another study indicates reciprocal associations between invalidating parenting behaviors (e.g., low caregiver warmth) and BPD symptoms in adolescence (Stepp et al., 2014). Importantly, these studies assessed constructs (e.g., low caregiver warmth) related to social support, but they have not directly assessed PSS. Taken together, prior evidence does not allow us to establish temporal precedence in the relationship between PSS and borderline features in adolescence.

To address these gaps, the current study aimed to examine whether low PSS predicts NSSI in a Spanish clinical sample of adolescents. For the first time to our knowledge, we also explored whether borderline personality traits mediate this relationship in such a clinical sample. Based on previous research, we hypothesized that adolescents who engage in

NSSI would report lower PSS than adolescents without NSSI. Additionally, we hypothesized that psychological distress (i.e., depression and anxiety) and emotion dysregulation would mediate the association between PSS and NSSI. Lastly, given the well-established relationship between BPD and NSSI, as well as the negative bias in the processing of social information previously found in BPD patients (Kleindienst et al., 2019; Reichenberg et al., 2017), we also hypothesized that borderline personality traits would appear as an important mediator in the association between PSS and NSSI. However, given that the present study is cross-sectional and there is no prior evidence that firmly supports the specific ordering of the variables in this mediation model, we also explored a competing hypothesis (i.e., a plausible alternative model where PSS mediates the association between BPD features and NSSI)."

## 2. Methods

### 2.1. Participants

The present study was conducted between April 2019 and February 2020 in partial and complete hospitalization programs from six hospitals in the county of Barcelona (Spain): Consorci Sanitari de l’Anoia, Hospital Clínic de Barcelona, Hospital de la Santa Creu i Sant Pau, Hospital Sant Joan de Déu de Barcelona, Althaia Manresa, and Consorci Corporació Sanitària Parc Taulí. By means of a recruiting sampling method, 382 consecutive patients were invited to participate. Inclusion criteria comprised ages between 12 and 18 years old, and a written informed consent form signed by both patients and their parents or legally authorized representatives. Exclusion criteria included clinically significant behavior problems that impede the assessment, failure to complete all phases of the evaluation, and IQ below 70. For the NSSI group, participants reporting NSSI on less than five days in the past year were also excluded from the study.

Finally, 83 participants (or parents) rejected to participate, and 71 participants were excluded (74.65% were incomplete assessments). The final sample of study comprised 228 adolescents. Participants were divided in two groups as a function of a history of NSSI (N= 132: NSSI group; N= 96: Non-NSSI group). Demographic characteristics are provided in Table 1. Ethics approval was issued by the Bellvitge’s Hospital Ethics Committee (PR330/17).

### 2.2. Procedure

First, a trained senior member of the study staff gathered clinical information (see Table 1). All participants were assessed with the Spanish version of the Mini International Neuropsychiatric Interview Kid (M.I.N.I. Kid) (Colón-Soto et al., 2005) (see Table S1). After that, participants answered both demographic questions and self-reported questionnaires through an online platform under the supervision of a researcher. This platform also included questions about: (i) healthy habits, (ii) usage of internet and social media, and (iii) lifetime NSSI (yes or not).

### 2.3. Measures

#### 2.3.1. Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet et al., 1990)

We used the Spanish version of the MSPSS ([www.heardalliance.org](http://www.heardalliance.org)), which is one of the most broadly used scales to rate social support. It consists of 12 items, which assess three sources of personal support: (i) family (e.g., “my family really tries to help me”), friends (“my friends really try to help me”), and significant others (e.g., “there is a special person who is around when I am in need”). A higher score in this scale indicates higher PSS. Both scores from the original and Spanish version of the MSPSS show good internal reliability ( $\alpha = .88$  and  $\alpha = .90$

**Table 1**  
Sociodemographic characteristics of the sample.

	NSSI (N = 132)		Non-NSSI (N = 96)		Analysis	
	Mean	SD	Mean	SD	Z / t	p
<b>Age</b>	15.46	1.30	15.17	1.62	-1.10	.270
<b>Lifetime Suicide Attempts</b>	.73	1.76	.20	.72	-4.40	<.001
<b>Social media use</b>						
Item 1	2.46	1.07	1.85	.86	-4.75	<.001
Item 2	1.86	.91	1.69	.86	-1.48	.141
Item 3	1.88	.99	1.60	.84	-2.19	.029
Item 4	1.59	.89	1.44	.75	-1.41	.161
Item 5	2.05	1.04	1.78	.82	-2.13	.034
<b>Sex (female)</b>	n	%	n	%	$\chi^2$	p
	104	68	49	32	19.32	<.001
<b>Academic Performance</b>						
Bad	48	36.36	18	18.75	9.97	.007
Regular	36	27.27	26	27.08		
Good	48	36.36	52	54.17		
<b>Internet use</b>						
> 20 hours per week	47	35.61	25	26.04	2.35	.125
<10% of time for study	57	43.51	27	29.03	5.41	.020
<b>Daily hours of Sleep</b>						
< 6 hours	38	28.79	8	8.33	14.43	<.001
<b>Meals per day</b>						
< 4 food intakes	63	47.7	27	28.1	8.94	.003
<b>Alcohol abuse</b>						
Never	66	50	72	75	14.74	.001
1-3 days	45	34.1	15	15.6		
≥ 4 days	21	15.9	9	9.4		
<b>Lifetime Suicide Attempts</b>						
≥ 1 attempts	52	39.50	11	11.50	21.69	<.001

*Note.* Problematic social media use was captured by the following items: Item 1 = ‘do you prefer to connect with people over the Internet than in person?’; Item 2 = ‘has your academic performance been adversely affected by social network usage?’; Item 3 = ‘do you suffer from sleep disorders due to aspects related to mobile phones?’; Item 4 = ‘do you feel restless when you don’t receive messages or calls?’; Item 5 = ‘how often do you say things on your cell phone that you wouldn’t say in person?’. Participants self-reported their academic performance (bad, regular, and good). Internet use refers to the total number of hours per week spent surfing on the Internet, and the % of that time which was dedicated to study tasks. Alcohol abuse episodes in the last year (never, 1 to 3 days, more than 4 days).

respectively) (Calderón et al., 2021; Zimet et al., 1990). Suitable psychometric properties have been shown in different populations, including adolescents (Canty-Mitchell and Zimet, 2000).

### 2.3.2. The borderline personality questionnaire (BPQ) (Fonseca-Pedrero et al., 2011)

This questionnaire assesses BPD traits or symptoms, based on the DSM-IV criteria. It consists of nine subscales: Impulsiveness, Affective Instability, Abandonment, Relationship, Self-Image, Suicide/Self-Mutilation, Emptiness, Intense Anger, and Quasi-Psychotic States. BPQ is a good screening tool to detect BPD in outpatient youth (Chanen et al., 2008). In the current study, we used the total BPD-score as a measure of general BPD features, but we excluded the Suicide/Self-Mutilation subscale to avoid a potential confounding effect in the analysis.

### 2.3.3. Brief Version of the Difficulties in Emotion Regulation Scale (DERS-18) (Victor and Klonsky, 2016)

We used the Spanish translation of this scale (Briones-Buixassa et al., 2021). This 18-item self-report measure assesses 6 subscales of emotion regulation difficulties: (i) lack of emotional awareness, (ii) lack of emotional clarity, (iii) nonacceptance of emotions, (iv) inability to engage in goal-directed behavior when feeling emotional, (v) engagement in impulsive behavior when feeling emotional, and (vi) inability to access emotion regulation strategies. The total DERS-score presents a high internal reliability, and the six scales show moderate to high internal reliability (Victor and Klonsky, 2016).

### 2.3.4. Depression anxiety stress scales (DASS-21) (Arturo et al., 2005)

The DASS-21 is a self-report instrument that assesses current psychological distress. It measures the frequency of 21 negative emotional symptoms related to Depression, Anxiety, and Stress during the previous week. The Spanish version presents moderate to good internal reliability for each of the three subscales, respectively (Arturo et al., 2005). *Ad hoc questionnaire assessing internet addiction and mobile* (Beranuy et al., 2009). Participants were asked to indicate their Internet and mobile usage. They responded to the following 5 items by choosing one of four answers: ('almost never', 'sometimes', 'most times', 'almost always'): (1) 'do you prefer to connect with people over the Internet than in person?', (2) 'has your academic performance been adversely affected by social network usage?', (3) 'do you suffer from sleep disorders due to aspects related to mobile phones?', (4) 'do you feel restless when you don't receive messages or calls?', (5) 'how often do you say things on your cell phone that you wouldn't say in person?'. These questions were obtained from two previous questionnaires in the Spanish language (Beranuy et al., 2009).

Only participants with NSSI (NSSI group) completed the following scales:

### 2.3.5. Non-suicidal self-injury disorder scale (NSSIDS) (Victor et al., 2017)

The NSSIDS is a self-report measure that assesses whether participants meet criteria for the DSM-5 NSSI disorder. We used a Spanish translation to test whether the 'criterion A' was met (i.e., five or more days in the past year in which participants engaged in NSSI).

### 2.3.6. Inventory of statements about self-injury (ISAS) (Klonsky and Glenn, 2009)

This inventory assesses lifetime frequency of 12 NSSI behaviors (e.g., cutting) and 13 NSSI functions. These functions are grouped into two separate factors that index interpersonal (e.g., interpersonal influence) and intrapersonal NSSI functions (e.g., affect-regulation). We administered the Spanish version of the ISAS (Vega et al., 2017).

## 2.4. Statistical analyses

All analyses were conducted in RStudio (R Core Team, 2021). To

investigate between-group differences (NSSI vs. Non-NSSI), we conducted Pearson's chi-squared tests for categorical variables, independent-samples t-tests for dimensional variables that met the assumption of normality, and Mann-Whitney U tests for dimensional variables that violated the assumption of normality.

### 2.4.1. Logistic regression analysis

The outcome was a dichotomized variable indicating the presence ( $\geq 5$  days) or absence of NSSI in the past year, and the explanatory variables were age, gender, perceived social support (MSPSS-Family, MSPSS-Friends, MSPSS-Significant Others, MSPSS-Total), borderline traits (BPQ), current psychological distress (DASS-21), and difficulties in emotion regulation (DERS-subcales). We first ran univariate logistic regression on all predictors, producing odds ratios (OR) presented with 95 % confidence intervals. Predictors that showed a statistically significant effect in the univariate analyses were entered in a multivariate logistic regression analysis, using a backward stepwise selection to obtain the final model. Before running the multiple regression analysis, we checked for multicollinearity by calculating the variation inflation factor (VIF) for all predictors entered in the model. All VIF values were below 3, indicating that there are no multicollinearity problems (Hair et al., 2010). Receiver operating characteristic (ROC) curve analysis was also conducted to determine the capacity of the final model to discriminate between patients with and without a history of NSSI.

### 2.4.2. Mediation analysis

We finally conducted a mediation analysis to assess whether borderline traits (BPQ) account for the relationship between perceived social support and NSSI and, alternatively, whether perceived social support may account for the relationship between borderline traits and NSSI. The "Mediation" package in R (Tingley et al., 2014) was used to test the theorized mediation relationship with 10000 bootstrapped samples. Unstandardized indirect effects were computed for each of 10000 bootstrapped samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. Unstandardized indirect effects were computed using the difference between coefficients approach ( $c - c'$ ), that is, the difference between the total and direct effect. To ensure that the indirect effects estimated with this approach are not affected by a change of scale in the logistic regression models (i.e., our mediation is based on logistic regression), we repeated all mediation analyses by standardizing the coefficients before estimating the indirect effect (Rijnhart et al., 2019).

## 3. Results

### 3.1. Sample characteristics

Participants were between 12 and 18 years old at the time of consent ( $M_{\text{age}} = 15.34$ ,  $SD = 1.45$ ), and were mostly females (67.1%) (Table 1).

As shown in Table 1, the presence (vs. absence) of NSSI was associated with a worse academic performance, less hours of sleep, more alcohol abuse, lower food intake, and more problematic use of the internet and the social media. Specifically, participants in the NSSI group showed a significantly stronger preference to connect with others via the internet and online social networks rather than in person, and they recognized sleep disturbances due to social media use more frequently (Table 1). In addition, only 62.1% ( $n=82$ ) of participants in the NSSI group met the full criteria for the NSSI disorder (based on the NSSIDS). This result is similar to previous findings in clinical samples of adolescents (e.g., Washburn et al., 2015).

Compared to participants without NSSI, those engaging in NSSI exhibited more depressive and anxiety disorders, and higher suicide risk according to the MINI-KID classification. Moreover, although most participants in the non-NSSI group had 1 or 2 diagnoses, most participants in the NSSI group exhibited three or more clinical diagnoses (Table S1). Importantly, the average number of lifetime suicide attempts

was higher in the NSSI group than in the non-NSSI group. Specifically, there were significantly more patients reporting one or more suicide attempts in the NSSI group vs the non-NSSI group (see Table 1). Collectively, these results indicate that the presence of NSSI entails greater clinical severity and higher suicide risk.

Adolescents who engage in NSSI reported that the mean age of onset was 12.76 years (*SD* = 2.11). The most frequent types of NSSI were self-cutting (79.4%), hitting (74.8%), and scratching (71%) oneself. Results from the ISAS revealed that adolescents from the NSSI group incurred in NSSI mainly with an intrapersonal motivation (intrapersonal vs. interpersonal NSSI-function;  $M_{intrapersonal} = 3.41, SD = 1.43; M_{interpersonal} = .88, SD = .85; Z = -8.30, P < .001$ ).

Table 2 depicts between-group differences (NSSI vs. Non-NSSI) in the self-report measures. Participants with NSSI showed lower scores in perceived social support and higher scores in borderline traits, emotion dysregulation, and psychological distress, which further suggests higher clinical severity in the presence of NSSI.

### 3.2. Logistic regression analysis

Univariate logistic regression analyses showed that participants' gender, perceived social support (except the "significant other" MSPSS subscale), borderline traits (BPQ), current psychological distress (DASS-21), and difficulties in emotion regulation (all DERS-subscales) significantly predicted the odds of engaging in NSSI (Table 3). However, when all predictors were tested simultaneously in a multivariate regression, the final model obtained via backward stepwise selection showed that only borderline traits and current psychological distress significantly predicted NSSI, while gender was maintained in the model with a marginal significance (see Table 3).

Receiver operating characteristic (ROC) analysis showed that the Area Under the Curve (AUC) of the final multivariate model was .84 (95% CI: .79-.89; Sensitivity = .92; Specificity = .62) and the OR was

**Table 3**

Univariate and multivariate logistic regression analyses examining predictors of NSSI.

	Univariate Analyses		Multivariate Analyses	
	OR (95% CI)	<i>P</i> -value	OR (95% CI)	<i>P</i>
Age	1.15 (.96-1.38)	.12		
Sex	3.56 (2.00-6.35)	< .001	1.96 (.97-3.93)	.05
<b>MSPSS</b>				
Family	.91 (.87-.95)	< .001		
Friends	.95 (.92-.99)	< .05		
Significant others	.99 (.95-1.03)	.54		
MSPSS Total	.98 (.96-.99)	< .01		
<b>BPQ</b>				
	1.11 (1.08-1.15)	< .001	1.07 (1.03-1.11)	< .001
<b>DASS-21</b>				
	1.09 (1.06-1.11)	< .001	1.05 (1.02-1.08)	< .01
<b>DERS-18</b>				
Awareness	1.14 (1.04-1.24)	< .01		
Clarity	1.22 (1.12-1.32)	< .001		
Goals	1.22 (1.12-1.33)	< .001		
Impulse	1.21 (1.13-1.31)	< .001		
Non-acceptance	1.24 (1.15-1.34)	< .001		
Strategies	1.31 (1.20-1.43)	< .001		
DERS total	1.08 (1.06-1.11)	< .001		
AIC = 226.08				

Note. OR = Odds Ratio. MSPSS = Multidimensional Scale of Perceived Social Support. BPQ = Borderline Personality Questionnaire. DASS-21 = Depression Anxiety and Stress Scales. DERS-18 = Brief version of the Difficulties in Emotion Regulation Scale.

**Table 2**

Between-group differences in borderline traits, perceived social support, current psychological distress and emotion dysregulation.

	NSSI (N=132)		Non-NSSI (N=96)		Analysis W / t	Effect Size r / d
	Mean	SD	Mean	SD		
<b>BPQ</b>						
Suicide	4.74	1.29	1.19	1.62	-11.40**	.78
Impulsivity	3.15	1.60	2.12	1.44	-5.00**	.33
Self-Image	5.80	2.49	3.22	2.75	-6.59**	.44
Emptiness	7.31	2.51	4.16	2.75	-7.80**	.52
Affective Instability	7.54	2.04	5.62	2.58	-5.64**	.37
Intense Anger	5.72	2.80	4.31	2.60	-3.75**	.25
Quasi-Psychotic States	2.49	1.88	1.05	1.22	-6.03**	.40
Abandonment	4.96	2.68	2.59	2.04	-6.52**	.43
Relationships	4.33	2.42	2.74	2.03	-4.86**	.32
BPQ Total	41.31	11.81	25.80	11.69	-9.83**	1.32
<b>MSPSS</b>						
Family	18.64	6.85	22.47	6.30	-4.56**	.30
Friends	18.92	7.47	21.30	6.68	-2.58*	.17
Significant Other	21.22	7.08	21.80	7.46	.89	
MSPSS Total	58.79	17.47	65.57	16.26	-3.08*	.20
<b>DASS-21</b>						
Depression	15.31	4.98	8.38	5.70	-8.10**	.54
Anxiety	13.29	5.64	7.24	5.18	-7.22**	.48
Stress	13.57	4.60	9.31	5.14	-5.98**	.40
DASS total	42.17	13.13	24.94	14.42	-7.84**	.52
<b>DERS-18</b>						
Awareness	9.73	2.86	8.57	3.22	-2.71*	.18
Clarity	10.14	3.26	7.76	3.59	-4.90**	.33
Goals	12.07	3.02	9.77	3.66	-4.74**	.32
Impulse	9.95	3.98	7.04	3.56	-5.29**	.35
Non-acceptance	9.40	4.00	6.29	3.34	-5.66**	.38
Strategies	10.17	3.54	6.71	3.35	-6.68**	.44
DERS total	61.45	12.80	46.15	13.94	-8.59**	1.15

Note. BPQ = Borderline Personality Questionnaire. MSPSS = Multidimensional Scale of Perceived Social Support. DASS-21 = Depression, Anxiety and Stress Scale. DERS-18 = Brief version of the Difficulties in Emotion Regulation Scale. W = Mann-Whitney test. t = Student's t-test. r = effect size measure for the Mann-Whitney test. d = Cohen's d effect size. \* p < .01, \*\*p < .001.

20.33 (95% CI: 9.45–43.73,  $p < .001$ ), indicating a high capacity to discriminate between patients with and without NSSI (see Fig. 1).

### 3.3. Mediation analysis

Given that the effect of PSS on NSSI disappeared when borderline traits was included in the regression, we conducted two mediation analyses to examine whether this variable could account for the relationship between: (i) MSPSS-Family and NSSI, and (ii) MSPSS-Friends and NSSI. That is, whether the relationship between low perceived social support and NSSI could be explained by a negative association of PSS with borderline traits. Given that gender and current psychological distress (DASS-Total) significantly (or marginally) predicted NSSI in the final multivariate model, they were included in the analysis as covariates.

The effect of perceived social support from family (MSPSS-Family) on NSSI was fully mediated via borderline traits (BPQ). The bootstrapped estimate for the average causal mediation effect (ACME) was  $-.004$  (95% CI:  $-.006$  to  $-.001$ ). Thus, the indirect effect of MSPSS-Family on NSSI via BPQ was statistically significant, even when controlling for current psychological distress (DASS-21) and gender. The total effect, that is, the effect of MSPSS-Family on NSSI without controlling for the effect of the mediator, was estimated to be  $-.008$  (95% CI:  $-.011$  to  $-.001$ ) and was also statistically significant. However, the average direct effect (ADE), that is, the effect of MSPSS-Family on NSSI after controlling for the effect of the mediator, was  $-.005$  (95% CI:  $-.008$  to  $0.00$ ) and did not remain significant, indicating a full mediation (Fig. 2A).

Similarly, the effect of perceived social support from friends (MSPSS-Friends) on NSSI was fully mediated via borderline traits (BPQ). The bootstrapped estimate for the average causal mediation effect (ACME) was  $-.006$  (95% CI:  $-.000$  to  $-.001$ ), indicating that the indirect effect was significant, even when controlling for current psychological distress (DASS-21) and gender. The total effect was not statistically significant,  $-.002$  (95% CI:  $-.008$  to  $.01$ ), and neither was the average direct effect (ADE),  $.004$  (95% CI:  $-.003$  to  $0.01$ ), indicating a full mediation (see Fig. 2B).

To evaluate the specificity of borderline traits as a mediator in the relationship between perceived social support and NSSI, we conducted two additional mediation analyses exploring current psychological distress (DASS-21) as a mediator (controlling for borderline traits and gender). The bootstrapped estimate for the average causal mediation effect was not significant either for the mediation analysis with MSPSS-Family as the independent variable (ACME =  $-.0005$  [95% CI:  $-.001$  to  $.00$ ]) or for the mediation analysis with MSPSS-Friends as the independent variable (ACME =  $.001$  [95% CI:  $-.0001$  to  $.00$ ]). Therefore, perceived social support from family and friends only exerts an indirect effect on NSSI through borderline traits, but not through current psychological distress. Since none of the emotion dysregulation dimensions remained significant in the multivariate model, they were not further

explored as potential mediators.

Finally, as depicted in Figure S1, the mediation results we obtained using the standardized regression coefficients are consistent with the results we obtained using the unstandardized coefficients. In addition, given the cross-sectional design of our data, we analyzed alternative models with BPD-traits as the predictor and PSS as the mediator, but the indirect effect was not statistically significant (see the Supplementary Material).

## 4. Discussion

In the current study, we evaluated the association between perceived social support (PSS) and NSSI in a psychiatric sample of adolescents, and we also explored potential mediators of this relationship. Specifically, and in a novel way, we analyzed the mediating role of borderline personality traits. The most relevant results of this study suggest that low PSS from family and peers was indirectly related to NSSI through borderline personality traits, even when controlling for gender and current psychological distress. This finding suggests that adolescents with low PSS may be especially vulnerable for developing NSSI due to elevated BPD traits.

The prevalence of NSSI in our sample (58%) was similar to previous studies with clinical samples (Kaess et al., 2013). Importantly, our findings suggest that the presence of NSSI is associated with high clinical severity and suicide risk, as well as with low interpersonal, academic, and daily functioning, regardless of the diagnosis. This finding is in line with previous research suggesting that NSSI may be an unspecific precursor of psychopathology and suicide (Groschwitz et al., 2015; Meszaros et al., 2017). Furthermore, adolescents engaging in NSSI reported lower PSS from family and friends and exhibited a stronger preference to interact virtually (e.g., connect with peers over the internet than in person), compared to adolescents without NSSI. These results are congruent with recent work indicating a relationship between PSS and risk of engaging in NSSI in clinical samples (Baiden et al., 2017; Miller et al., 2015). Moreover, consistent with our findings, previous studies have suggested that individuals with low PSS tend to use online social networks to compensate for the lack of social support experienced in the ‘real world’ (Tang et al., 2021).

Previous research shows that lower social support from family and peers plays a crucial role in the onset and maintenance of NSSI (Brown and Witt, 2019; Rissanen et al., 2021; Victor et al., 2019). The present study extends this evidence, providing data in a well-characterized clinical sample of adolescents. Specifically, in our sample, adolescents with NSSI perceived less support from family and friends than their counterparts without NSSI did, suggesting that PSS from very close relationships (i.e., family and friends but not from significant others) is a factor involved in NSSI. On the one hand, this finding may suggest an important role of interpersonal stress in triggering NSSI. In the context of low PSS, there may be a higher frequency of interpersonal stressors, which may enhance negative affect and promote NSSI as an emotion regulation strategy (Nock, 2010). On the other hand, the relationship between low PSS and NSSI may also indicate that adolescents who engage in NSSI may feel rejected or stigmatized by family and friends due to their self-harm behavior (Piccirillo et al., 2020), and may therefore feel less supported by their central social network.

We conducted a multivariate analysis to better understand the relationship between PSS and NSSI, which revealed that borderline traits and psychological distress significantly predicted NSSI, while PSS did not. This finding suggests that when tested simultaneously, clinical status is a better predictor of NSSI than PSS. Importantly, the NSSI predictor with the highest odds ratio in the multivariate model was borderline traits. This is consistent with a longitudinal study reporting that BPD features (along with NSSI severity) was the best predictor of continued engagement in NSSI one year later (Glenn and Klonsky, 2011), as well as with prior research showing that BPD-symptoms are associated with an increased risk of engaging in NSSI (Reichl and Kaess,

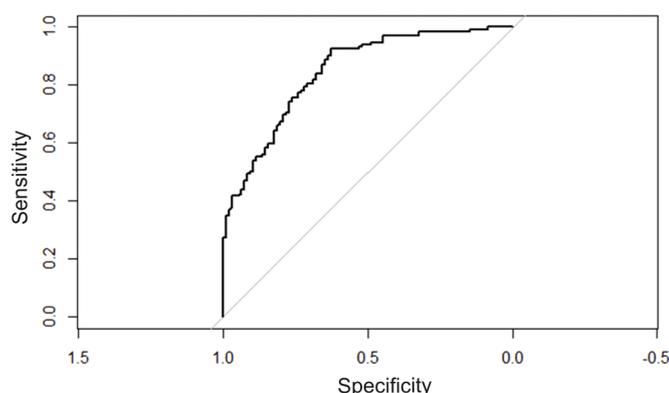
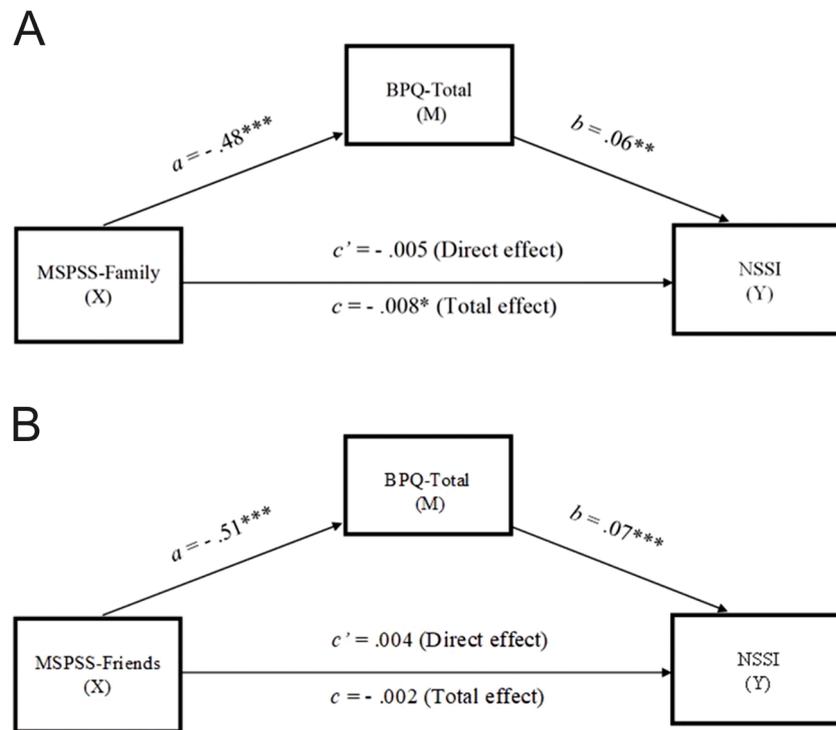


Fig. 1. ROC curve of the final logistic regression model, AUC.



**Fig. 2.** Borderline traits fully mediate the relationship between perceived social support from: (A) family (MSPSS-Family) and (B) Friends (MPSS-Friends), and the probability of engaging in non-suicidal self-injury (controlling for gender and current psychological distress). BPQ = Borderline Personality Questionnaire. MPSS = Multidimensional Scale of Perceived Social Support. DASS-21 = Depression, Anxiety and Stress Scale. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ .

2021; Stead et al., 2019). In addition to borderline traits, current psychological distress also appeared as a significant predictor of NSSI in our sample. Given that this predictor includes symptoms of anxiety and depression in the last two weeks, our results are consistent with prior findings in both adolescents (Giletta et al., 2012) and young adults (Kiekens et al., 2020) suggesting that higher levels of depressive symptoms in the past weeks predict NSSI (Fox et al., 2015). In contrast with our hypothesis, emotion dysregulation did not remain as a significant predictor of NSSI in the multivariate model.

Finally, we conducted a mediation analysis to explore if clinical status (i.e., BPD traits and current psychological distress) intermediates between PSS and the odds of engaging in NSSI. This analysis revealed that borderline traits fully explained the relationship between PSS (from family and friends) and NSSI, even when controlling for current psychological distress (i.e., symptoms of depression, anxiety, and stress). This would mean that, low PSS is associated with NSSI through higher levels of BPD traits. This finding is consistent with a recent study suggesting that high-perceived support from parents predicted fewer BPD symptoms in a psychiatric sample of adolescents, while invalidating behaviors from parents were associated with greater BPD symptoms in daily life (Vanwoerden et al., 2021). Congruently, recent research shows that adolescents with BPD perceive their caregivers to be less supportive and more invalidating than did controls without BPD, suggesting that their perceptions of caregiving behaviors are vital in the context of enduring borderline psychopathology (Bennett et al., 2019). Research in non-clinical adult samples also indicates that BPD features are associated with fewer supportive relationships and less satisfaction with social support (Beeney et al., 2018; Lazarus et al., 2016; Zielinski and Veilleux, 2014). Importantly, while BPD features are associated with low PSS, they are also closely associated with NSSI. For example, the number of BPD criteria met significantly predicted repeated (vs. single) NSSI history in an outpatient clinical sample of adolescents (Muehlenkamp et al., 2011).

While borderline traits mediated the relationship between PSS and NSSI when controlling for current psychological distress (e.g.,

depressive symptoms), current psychological distress did not significantly mediate this relationship when controlling for borderline traits. This result shows the relevance of long-lasting traits versus state symptoms in the relationship between PSS and NSSI. This finding may be inconsistent with prior studies in non-clinical samples that highlight the mediating role of depressive symptoms (Madjar et al., 2021; Rissanen et al., 2021). However, those studies did not control for borderline symptomatology, possibly because the latter tends to be more common in clinical rather than non-clinical adolescent samples (Hutsebaut and Aleva, 2021; Reichl and Kaess, 2021).

The current study highlights the role of interpersonal factors in adolescent NSSI, adding to existing research in clinical samples that has thus far focused on comorbid psychopathology, stressful life events and neglected social factors (Greenfield et al., 2015; Skabeikyte and Barauskiene, 2021; Strandholm et al., 2017). Despite promising findings, the present study is not without limitations. First, due to our cross-sectional design, we cannot establish temporal precedence in the relationships proposed in the mediation analyses (e.g., whether PSS predicts BPD traits or vice versa). Even though we tested a plausible, alternative model with BPD traits as the predictor and PSS as the mediator and found that the hypothesized indirect effect there did not materialize, our cross-sectional design does not allow us to discard this alternative model, and the matter will ultimately have to be investigated in longitudinal studies. Second, our data were collected through self-report questionnaires, which may entail retrospective memory biases. Third, our measure of PSS is quite general and fails to capture whether low PSS refers to childhood adversity or a difficult childhood temperament. Fourth, although participants were thoroughly assessed, no specific interview was used to diagnose BPD. Finally, although it was not the aim of the present study, future research needs to address potential differences between patients with NSSI who meet the full criteria for NSSI disorder and patients with NSSI who do not meet the full criteria. Findings from these studies may help determine the clinical utility of NSSI as an independent diagnostic category (Hooley et al., 2020).

Current findings highlight the mediating role of borderline traits in the relationship between PSS and NSSI. Results suggest that adolescents with NSSI constitute a more severe clinical group due to more pronounced BPD-traits and less PSS. Importantly, current results are consistent with previous evidence suggesting a role of perceived invalidation in borderline pathology (Zanarini et al., 1997). Findings could have several implications for prevention and treatment of NSSI in adolescents. On the one hand, our results emphasize the importance of evaluating BPD-traits in clinical settings, especially in those adolescents reporting low PSS. On the other hand, findings support the use of specific interventions aimed at improving BPD symptoms and social support in adolescent patients with NSSI and their caregivers (e.g., the Dialectical Behavioral Therapy; Boritz et al., 2021; McCauley et al., 2018). Indirectly, our findings could also be useful in the context of the current pandemic, where compliance with social distancing measures may lead to lower PSS and increased risk of NSSI, especially among adolescents with elevated BPD traits. Future research should also consider replicating our findings in non-clinical samples of adolescents with sub-clinical BPD.

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### Declaration of Competing Interest

All authors declare that they have no conflicts of interest.

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### Supplementary materials

Supplementary material associated with this article can be found, in

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