



# Identifying High-Risk Subgroups of College Students with Non-Suicidal Self-Injury: A Latent Profile Analysis and Two-Years Follow-up Study

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## Abstract

Non-Suicidal Self-Injury (NSSI) is associated with a heightened overall risk of future psychopathological problems. However, elucidating specific characteristics that determine an increased risk for certain individuals remains an area requiring further exploration. This study aimed to identify latent subgroups in a sample of college students with NSSI. Additionally, it sought to explore the differential associations of these subgroups with their psychopathological status (e.g., borderline symptoms and suicidal tendencies) both at baseline and after two years. The sample comprised 259 participants (89% females,  $M_{age} = 20.39$ ,  $SD = 1.90$ ) who reported engaging in NSSI in the last year. Three latent groups were found. The group exhibiting severe NSSI-features, high emotion dysregulation, and low perceived social support was the profile with high-risk of psychopathology both at baseline and follow-up. The findings enhance our understanding of the complex association between NSSI and future mental health issues, aiding in the early identification of at-risk individuals.

**Keywords** Non-suicidal self-injury · Perceived social support · Emotion dysregulation · College Students · Latent profile analysis · Longitudinal study

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## Introduction

Non-suicidal self-injury (NSSI) is a serious public health concern. NSSI refers to the deliberate, self-inflicted destruction of body tissue without suicidal intent and for purposes not socially sanctioned, and includes behaviors such as cutting or burning oneself (Nock, 2010). NSSI tends to first emerge during early adolescence (Plener et al., 2015) or early adulthood (Gandhi et al., 2018) and is prevalent among adolescents (17.2%) and young adults (13.4%) in the community (Swannell et al., 2014). Previous studies have shown that young adults with NSSI has remarkable increased risk of future suicide attempts and poor mental health, suggesting that this behavior may serve as an early indicator of psychological vulnerability (Ghinea et al., 2020; Nakar et al., 2016). However, there is still limited research on the existence of possible higher-risk profiles. This study addresses this research gap using a person-centered approach (i.e., Latent Profile Analysis), with the aim of identifying latent subgroups that are differentially related to later psychological issues.

Prior cross-sectional studies have shown that individuals engaging in NSSI exhibited elevated levels of emotion dysregulation and a diminished perception of social support (Mendez et al., 2022; Muehlenkamp et al., 2013). Briefly, perceived social support alludes to the perception that one would be loved, valued, and supported in times of need by their social network (Barrera, 1986). Congruently, NSSI is associated with impaired psychological and social functioning both in the short and long-term (Skegg, 2005). Remarkably, despite limited in number, longitudinal studies indicate that this impairment could be sustained over time, irrespective of whether NSSI persists (Daukantaitė et al., 2021; Wångby-Lundh et al., 2023). This relationship is stronger between NSSI and later development of borderline personality disorder (BPD; Stead et al., 2019).

Given that NSSI is a heterogeneous phenomenon, several previous studies have examined how individuals who engage in NSSI are grouped together according to a particular set of symptoms, behaviors, or traits. This relatively novel approach is substantially different from the usual methodologies that compare a group of individuals with NSSI versus a healthy control group. In this regard, the existence of different subgroups of individuals engaging in NSSI has been confirmed in two seminal works with young adults (Klonsky & Olino, 2008; Whitlock et al., 2008). For instance, one of these studies identified four subgroups that differed on NSSI features. When compared to measures of depression, anxiety, BPD, and suicidality, the subgroup with the highest risk of psychopathology (i.e., the highest scores on these clinical measures) was the group with higher number of episodes, functions, and methods of NSSI (Klonsky & Olino, 2008).

Subsequently, only a few studies have replicated and extended these earlier findings, identifying subgroups of

individuals that differ not only on NSSI characteristics but also on emotion dysregulation. For example, a previous study found four subgroups in which emotion dysregulation and number of NSSI methods appeared to describe a continuum of risk in a sample of undergraduate students (Peterson et al., 2019). Here, the subgroup exhibiting high emotional difficulties along with elevated frequency of severe NSSI had a more severe risk (i.e., higher rates of suicide attempt, disordered eating, and impulsivity) than the other three subgroups. Similarly, a recent study identified three different profiles of undergraduate students with NSSI, where the subgroup exhibiting emotion regulation difficulties was the one that presented psychopathological symptoms (i.e., risky drinking, symptoms of BPD, eating disorders, depression, anxiety and stress) (Christoforou et al., 2021). On the other hand, previous studies have also shown that interpersonal difficulties can constitute a variable that helps establish more homogeneous groups. For instance, among different profiles, the subgroup with higher emotion regulation difficulties reported parent–child relational problems (Guérin-Marion et al., 2021) and, in another similar study, the subgroup characterized by frequent and multiple methods of NSSI reported problematic parental relationships and poor quality of friendships (Hamza & Willoughby, 2013). Lastly, it is worth noting that all this previous research conclude that less severe profiles were associated with a lower frequency of NSSI, lower difficulties in emotion regulation and fewer problems in the parental relationship.

Together, these previous findings provide support for the different vulnerability profiles that may co-exist within populations of students with a history of NSSI. NSSI features as well as emotion dysregulation can be variables that identify different levels of psychopathological risk and social difficulties. However, this field of study is at an early stage and all these studies are cross-sectional. The few longitudinal studies with latent profiles of young people with NSSI have focused on identifying latent trajectories of NSSI over time (Barrocas et al., 2015; Tilton-Weaver et al., 2023). However, a previous study longitudinally analyzed the psychopathological status of different subgroups of late adolescents practicing NSSI (Burke et al., 2018). In this study, it was identified that the subgroup with greater affective dysregulation showed more depressive symptoms and worse well-being, as well as higher risk of engaging in NSSI, at 1-year follow-up. These results suggest that the identification of subgroups of young people engaging in NSSI could have value not only at baseline, but also in detecting future mental health problems.

## Current Study

While the association between NSSI and an elevated risk of future psychological problems is acknowledged, the

specific characteristics of individuals at greater risk for such outcomes remain unknown. The present longitudinal study aimed to bridge this research gap, specifically examining the interaction between NSSI features, emotion dysregulation, and perceived social support in the formation of latent groups. Based on previous research, there is hypothesized to find different subgroups (Hypothesis 1), among which the group exhibiting the most psychopathological symptoms is expected to be characterized by the most severe NSSI, heightened emotion dysregulation, and low perceived social support (Hypothesis 2). Moreover, it is anticipated that this high-risk subgroup at baseline (Time 1) will exhibit a sustained elevated level of psychopathology at the two-year follow-up (Time 2) compared to the other subgroups, irrespective of the continued presence of NSSI (Hypothesis 3).

## Methods

### Participants

A total of 854 college students ( $M_{age} = 20.50$ ,  $SD = 2.01$ ; 79.4% females) took part in the study. Participants were recruited from two Universities in Catalonia (Autonomous University of Barcelona and University of Vic- Central University of Catalonia). Participants who reported having engaged in NSSI five or more times in the last year formed the final sample of study. This sample consisted of 259 participants (30% of the original sample;  $M_{age} = 20.39$ ,  $SD = 1.90$ ; 89% females). The average age of onset of NSSI was 14.57 years old ( $SD = 2.68$ ), and participants reported using an average of 4.46 different NSSI-methods ( $SD = 2.24$ , range 1–11).

After two years (i.e., follow-up), a total of 113 participants completed the survey again (44% of the final sample;  $M_{age} = 21.48$ ,  $SD = 2.01$ ; 81% females).

### Procedure

First, cross-sectional data collected by an online survey was analyzed. Prospective participants were invited to participate by e-mail between January and February 2020 (Time 1), where they were informed that participation was voluntary and were given information regarding the purpose of the study. Furthermore, they were informed of the possibility to receive a monetary compensation (30 euros) as an acknowledgement of their time, effort, and contribution. After reading the instructions, participants interested in participating provided informed consent electronically. Then, they were redirected to the online survey which consisted of three different sections (see below): (i) socio-demographic information; (ii) perceived social support; (iii)

emotion dysregulation; (iv) clinical information; and (v) NSSI features. The last section about NSSI features was only completed if participants reported having engaged in NSSI (i.e., frequency, methods, age of onset and functions). Time to complete the survey ranged between 30 and 40 min approximately.

Second, the same methodology in a follow-up evaluation two years later was used (i.e., between January and February 2022; Time 2), which allowed us to collect longitudinal data. At Time 2, the criterion for being included in the NSSI group was  $\geq 1$  episodes in the last year. All procedures were approved by the Clinical Research Ethics Committee of Bellvitge University Hospital (protocol number: PR330/17).

## Measures

### Self-reported measures for the latent profile analysis

**NSSI characteristics** NSSI frequency, methods and age of onset were assessed by means of the Section I of the Inventory of Statements about Self-Injury (ISAS; Klonsky & Glenn, 2009; Vega et al., 2017). This section assesses the frequency of 12 NSSI behaviors: hitting self, biting, burning, carving, cutting, wound picking, needle-sticking, pinching, hair pulling, rubbing skin against rough surfaces, severe scratching, and swallowing chemicals. For the current study the cumulative frequency of moderate/severe and minor methods of NSSI was computed by summing the frequency of occurrence of each NSSI method (ranging from 0 to 4: 0 = null; 1 = 1–4 times; 2 = 5–10 times; 3 = 11–15 times; 4 = more than 15 times) in accordance with Lloyd-richardson et al. (2007) (see Supplementary Table S1 in the Supporting information). The NSSI behaviors of the original ISAS show good internal reliability ( $\alpha = 0.84$ ) and in the present study showed an acceptable internal reliability at Time 1 ( $\alpha = 0.72$ ) and Time 2 ( $\alpha = 0.72$ ).

**NSSI functions** The motivations (or functions) of NSSI were assessed by means of the Spanish translation of the Non-Suicidal Self-Injury Disorder Scale (NSSIDS; Victor et al., 2017). NSSIDS is a self-report measure designed to assess proposed criteria for Non-Suicidal Self-Injury Disorder (DSM-5: American Psychiatric Association, 2013). In this scale, the items 3 (“to obtain relief from negative feelings or thoughts”) and 4 (“to cope with problems with other people”) were used to assess intrapersonal and interpersonal motivations, respectively. The Spanish version of the NSSIDS shows good internal reliability ( $\alpha = 0.88$ ) (Victor et al., 2017). In the present study, the internal reliability was acceptable at Time 1 ( $\alpha = 0.79$ ) and Time 2 ( $\alpha = 0.78$ ).

**Perceived social support** Perceived social support was assessed by using the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al., 1990). The Spanish version of the MSPSS was used ([www.heardalliance.org](http://www.heardalliance.org)), which is one of the most broadly used scales to rate perceptions of social support. It consists of a 12-item scale, which assesses three sources of perceived social support: (i) family, (ii) friends, and (iii) significant others. The Spanish version of the MSPSS shows good internal reliability ( $\alpha = 0.88$ ) (Calderón et al., 2021). In the present study, the internal reliability was good at Time 1 ( $\alpha = 0.90$ ) and Time 2 ( $\alpha = 0.89$ ).

**Emotion dysregulation** Emotion dysregulation was assessed by means of the Brief Version of the Difficulties in Emotion Regulation Scale (DERS-18; Victor & Klonsky, 2016). The Spanish translation of this scale was used. This is an 18-item self-report measure that assesses 6 subscales: (i) lack of emotional awareness, (ii) lack of emotional clarity, (iii) inability to engage in goal-directed behavior when feeling emotional, (iv) engagement in impulsive behavior when feeling emotional, (v) nonacceptance of emotions, and (iv) inability to access emotion regulation strategies. This scale presents high internal reliability (Cronbach's  $\alpha = 0.91$ ) (Victor & Klonsky, 2016). In the present study, results show good internal reliability at Time 1 ( $\alpha = 0.85$ ) and Time 2 ( $\alpha = 0.85$ ).

### Clinical and sociodemographic self-reported measures

**Borderline symptoms** The Borderline Personality Questionnaire (BPQ; Fonseca-Pedrero et al., 2011). It assesses BPD traits or symptoms. It consists of 80 statements that assess nine subscales based on the DSM-IV criteria: Impulsiveness, Affective Instability, Abandonment, Relationship, Self-Image, Suicide/Self-Mutilation, Emptiness, Intense Anger, and Quasi-Psychotic States. The total BPQ-score was used as a measure of general BPD traits. The Spanish version of the BPQ presents moderate to high internal reliability (Cronbach's  $\alpha = 0.78$  to  $0.93$ ) through the nine scales (Fonseca-Pedrero et al., 2011). Interestingly, the total score of this questionnaire has been used as a screening instrument for Borderline Personality Disorder (cut-off score  $>56$ ) (Chanen et al., 2008). In the current study, the BPQ total score showed good internal reliability at Time 1 ( $\alpha = 0.84$ ) and Time 2 ( $\alpha = 0.86$ ).

**Psychological distress** Depression Anxiety Stress Scales (DASS-21; Bados et al., 2005). It assesses psychological distress through the frequency of 21 negative emotional symptoms during the week prior to the evaluation. DASS-21 consists of 3 subscales: Depression, Anxiety, and Stress. The Spanish version presents moderate to good internal

reliability (Cronbach's  $\alpha = 0.84$ ,  $0.70$  and  $0.82$ ) for each of the subscales, respectively (Bados et al., 2005). In the present study, the depression subscale showed an excellent internal reliability at Time 1 ( $\alpha = 0.92$ ) and Time 2 ( $\alpha = 0.92$ ). On the other hand, anxiety and stress subscales showed good internal reliability at Time 1 ( $\alpha = 0.86$  and  $\alpha = 0.81$ ) and Time 2 ( $\alpha = 0.80$  and  $\alpha = 0.82$ ), respectively.

**Suicidal tendencies** Suicidal tendencies. One item of dichotomous response (true or false) was used from the Suicide/Self-Mutilation BPQ-subscale (BPQ; Fonseca-Pedrero et al., 2011) to assess potential suicidal tendencies in the sample of study ('I have made a suicide attempt in the past').

### Statistical Analyses

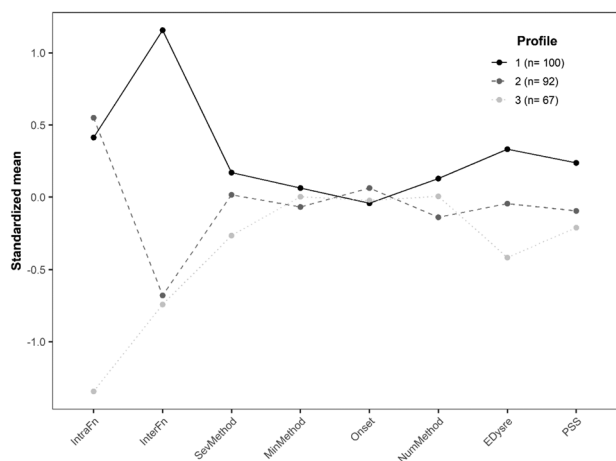
The statistical analysis comprised three steps. Firstly, a latent profile analysis was conducted to identify subgroups of college students engaging in NSSI. This type of analysis allows to explore latent heterogeneity within a group of individuals with a common observable characteristic (i.e., NSSI). In other words, latent profile analysis allows to establish a classification of individuals based on unobserved (i.e., latent) characteristics within an observed data rather than the typical classification based on a diagnostic cutoff (e.g., clinical group vs. control group) (Oberski, 2016).

Secondly, the subgroups were compared on clinical and sociodemographic measures to identify those with higher risk for psychopathology. The presence of two or more subgroups that exhibit significant differences in the clinical and sociodemographic measures would support the hypothesis of the study.

Finally, a follow-up assessment was conducted two years later to identify any potential changes in the psychopathological status of the subgroups over time and explore whether they continued to engage in NSSI.

#### Step 1. Latent profile analysis

Three different types of information were included in the latent profile analysis. First, information about NSSI features: (i) functions of NSSI (intrapersonal and interpersonal), (ii) severity of methods used for engaging in NSSI (number of moderate/severe versus minor methods), (iii) age of onset of NSSI, (iv) total number of different methods used to engage in NSSI. Second, information relating to emotion dysregulation (i.e., the total score of the DERS-18 scale) and perceived social support was included (i.e., the total score of the MPSS) (see Fig. 1). The total scores rather than the subscales of the DERS-18 and MSPSS was included to obtain a more parsimonious model.



**Fig. 1** Three-profile solution. IntraFn Intrapersonal NSSI-function, InterFn Interpersonal NSSI-function, SevMethod cumulative frequency of moderate/severe NSSI-methods, MinMethod cumulative frequency of minor NSSI-methods, Onset age of NSSI onset, NumMethod number of NSSI-methods (range 1–11), EDysre Emotion Dysregulation, PSS Perceived Social Support. \* PSS scores were inverted to facilitate interpretation, therefore, a higher score indicates less perceived social support

The “mclust” package (Scrucca et al., 2016) was used to estimate the latent profile analysis models with 1–9 profiles and with four different model configurations (Wardenaar, 2021). Model configuration refers to whether the variances and covariances of the variables included in the latent profile analysis are fixed, constrained and/or freely estimated between profiles. In the first model, the variances of the variables are allowed to vary within profiles but are constrained to be equal between (EEI model; equal volume, equal shape [and undefined orientation]). In the second model, like EEI model, the complete (co)variance matrix is estimated and constrained to be equal across profiles (EEE; equal volume, equal shape, and equal orientation). In the third model, the covariance of the variables within- and between profiles is set to zero, but variances are now allowed to vary within and between profiles (VVI; varying volume, varying shape [and undefined orientation]). The fourth model allows the most variation in (co)variances across profiles; both the variances and covariances are allowed to vary within and between profiles (VVV; varying volume, varying shape, varying orientation) (see Wardenaar, 2021). Finally, the models were fitted using expectation maximization (EM) clustering. The best fitting model was selected based on the Bayesian Information Criterion (BIC) and classification accuracy. Lower BIC values indicate better model fit and a classification accuracy value greater than 0.90 was considered adequate (Muthén & Muthén, 2000). Once the optimal number of profiles was obtained, each participant was allocated to a profile based on their highest-profile probability.

## Step 2. Comparison of subgroups on clinical and sociodemographic measures

A subgroup comparison analysis was conducted using RStudio (R Core Team, 2017) and IBM SPSS Statistics (Version 27). For continuous variables, a one-way ANOVA was performed with the Clinical and Sociodemographic measures as within-subject factors and Profile (1, 2, 3) as between-subject factor. In the presence of violations of normality and homogeneity of variance, a non-parametric Kruskal-Wallis test was performed. For multiple comparisons, the Bonferroni post-hoc test was utilized. For unequal variances, the Games-Howell test was used. Lastly, when the subgroups were compared on categorical variables, Pearson’s Chi-square test ( $\chi^2$ ) was used. The post-hoc test was calculated using the corrected standardized residuals. This method indicates which cells of the contingency table contribute significantly to the overall chi-square statistic (see Beasley & Schumacher, 1995).

## Step 3. Comparison of subgroups in the follow-up

Linear mixed models (LMM) were performed (Pineiro & Bates, 2000) with a restricted maximum likelihood (REML) estimation method to evaluate whether the three subgroups (i.e., Profiles) obtained in the latent profile analysis showed changes in clinical measures and NSSI behavior at two-years follow-up (Time 2). For these analyses, Subgroups (i.e., Profile 1 vs Profile 2 vs Profile 3), Time of clinical measures (i.e., Time 1 vs Time 2), and their interaction (i.e., Profiles  $\times$  Time), were modeled as fixed effects. The participants’ intercept was modeled as a random effect. LMM allows modeling both variation in clinical measures from Time 1 to Time 2 (i.e., within-person effects) and the effect of Subgroups (i.e., between-person effects) on these clinical measures. LMM is advantageous because it allows modeling observations, that are assumed to be correlated with each other, by including fixed and random effects simultaneously in the same model and fitting subjects as a random term (West et al., 2014). These analyses were performed with the lme4 package (Bates et al., 2015) in Rstudio (R Core Team, 2017).

## Results

### Latent Profile Analysis

The best fitting model was a three-profile solution with an EEE configuration (equal volume, equal shape, and equal orientation), based on the BIC values (see Supplementary Table S2). In this EEE configuration model, mean scores varied across latent profiles, but the covariance matrix of the



**Table 1** Comparison of the three profiles on NSSI-features, emotion dysregulation and social support

	Profile 1 (N = 100)	Profile 2 (N = 92)	Profile 3 (N = 67)	F test/ H test	post-hoc comparison
Variables included in LPA					
NSSI-function					
Intrapersonal	5.76 (1.51)	6.05 (1.02)	2.00 (1.14)	140.49***	1, 2 > 3
Interpersonal	5.64 (1.04)	1.61 (0.73)	1.55 (1.87)	192.43***	1 > 2, 3
NSSI-methods					
Moderate/severe	3.20 (2.77)	2.69 (2.71)	2.11 (2.81)	9.57**	1 > 3, 1 = 2
Minor	4.47 (3.73)	3.93 (4.04)	4.32 (4.24)	1.94	1 = 2 = 3
Total	4.85 (2.06)	4.25 (2.13)	4.70 (2.19)	5.17	1 = 2 = 3
NSSI-age of onset	14.49 (2.80)	14.75 (2.87)	14.49 (2.88)	0.71	1 = 2 = 3
Emotion Dysregulation	58.41 (14.19)	52.85 (13.39)	47.22 (14.28)	22.78***	1 > 2 > 3
Perceived social Support	40.98 (15.07)	35.69 (16.13)	33.92 (13.62)	9.32**	1 > 2, 3

H Kruskal-Wallis test, LPA Latent Profile Analysis, *Intrapersonal* to obtain relief from negative feelings or thoughts, *Interpersonal* to cope with problems with other people, *Moderate/severe* cumulative frequency of moderate/severe NSSI-methods, *Minor* cumulative frequency of minor NSSI-methods, *Total number* number of NSSI-methods (1–11)

\*\* $p < 0.01$ ; \*\*\* $p < 0.001$

variables was equal across profiles (Wardenaar, 2021). The mean profiles probabilities (i.e., participants' probability of belonging to each profile) were 0.97, 0.95, and 0.94, for profile 1, 2, and 3, respectively, while the mean classification uncertainty (i.e., uncertainty of assigning participants to the correct profile) was 0.04, indicating high certainty that participants were assigned to the correct profile (see Supplementary Table S3). Figure 1 shows the standardized means of the resulting three-profile solution (i.e., subgroups).

Scores of NSSI features, emotion dysregulation and perceived social support included in the latent profile analysis are depicted in Table 1 for each profile. The majority of participants were grouped in Profile 1 ( $n = 100$ ; 38.5%), followed by Profile 2 ( $n = 92$ ; 35.5%) and Profile 3 ( $n = 76$ ; 25.8%). Regarding NSSI features, participants in Profiles 1 and 2 (vs Profile 3) showed more severe methods and reported more intrapersonal NSSI functions. In contrast to Profiles 2 and 3, participants in Profile 1 showed higher scores in interpersonal NSSI functions. All profiles were different in emotion dysregulation and perceived social support, with Profile 1 participants showing the higher (i.e., more severe) scores (i.e.,  $1 > 2 > 3$ ).

### Comparison of the Three Subgroups on Sociodemographic and Clinical Variables

Table 2 shows the between-groups comparison of clinical and sociodemographic variables. Profile 1 (high risk group) showed the highest scores on all psychopathological variables. Profile 3 (low risk group) showed the lowest scores across all psychopathological measures. Finally,

participants in Profile 2 (medium risk group) did not differ from participants in Profile 3 on any psychopathological measures, but they did score higher on emotion dysregulation and intrapersonal functions of NSSI (i.e., affect regulation function), suggesting that profile 2 is mainly characterized by emotion regulation difficulties without psychopathological comorbidity.

Moreover, an additional analysis including the subscales of the DERS-18 and the MSPSS was conducted (see Supplementary Table S4). This sub-analysis revealed that Profile 1 and Profile 2 were similar in the 'non-acceptance of emotions' DERS-18 subscale. Moreover, Profile 1 exhibited lower perceived social support from friends (versus family or other significant members), compared to the other profiles.

Finally, each Profile has been labeled according to this 'continuum of risk' (Profile  $1 > 2 > 3$ ). Thus, the Profile 1 was named the 'emotional dysregulation without social support' subgroup, the Profile 2 was named the 'emotional dysregulation with social support' subgroup, and lastly, the Profile 3 was named the 'emotional stability and social support' subgroup.

### Comparison of the Three Subgroups at Follow-up

A total of 113 students (44% of the original sample) completed the follow-up assessment and were included in the longitudinal analysis (retention rates: Profile 1, 42%; Profile 2, 45%; Profile 3, 45%). These participants were similar than the rest of the sample (non-responders at T2,  $n = 146$ ) on clinical measures scores (all  $p$ -values  $> 0.05$ ), NSSI characteristics (all  $p$ -values  $> 0.24$ ), gender ( $p = 0.75$ ), and age ( $p = 0.45$ ).

**Table 2** Comparison of the three profiles on demographic information and clinical measures

	Profile 1 (N = 100)	Profile 2 (N = 92)	Profile 3 (N = 67)	$\chi^2/F$ test/ test	Post-hoc comparison
Age M (SD)	20.15 (1.80)	20.30 (1.67)	20.88 (2.24)	4.91	1 = 2 = 3
Sex (female) N (%)	91 (91%)	82 (89.13%)	58 (86.57%)	0.81	1 = 2 = 3
Clinical variables					
BPQ total M (SD)	43.92 (12.63)	34.19 (10.47)	33.02 (14.81)	20.52***	1 > 2, 3
BPD screening positive N (%)	18 (18%)	2 (2.17%)	3 (4.48%)	16.99***	1 > 2, 3
DASS-21 M (SD)					
Depression	13.56 (6.06)	9.96 (6.14)	8.32 (5.66)	30.69***	1 > 2, 3
Anxiety	11.69 (5.95)	7.95 (5.71)	8.44 (5.33)	20.39***	1 > 2, 3
Stress	13.30 (4.51)	10.34 (4.74)	9.61 (4.64)	28.64***	1 > 2, 3
Suicidal tendencies N (%)	42 (42%)	20 (21.74%)	19 (28.36%)	9.50**	1 > 2, 3

$\chi^2$  Chi-square test, *H* Kruskal–Wallis test, *Attended Psy/Psych* ever attended a psychologist or psychiatrist, *BPQ Total* Borderline Personality Questionnaire, *BPD screening positive* Diagnosis for Borderline Personality Disorders based on cut-off < 56 (Chanen et al., 2008), *DASS-21* Depression, Anxiety and Stress Scales, *Suicidal tendencies* past suicide attempts

\*\* $p < 0.01$ ; \*\*\* $p < 0.001$

A significant reduction in NSSI frequency from Time 1 to Time 2 was found in all three subgroups. Specifically, only 16 of participants in Profile 1 (38.1%;  $\chi^2 = 37.65, p < 0.001$ ), 19 of participants in Profile 2 (46.3%;  $\chi^2 = 30.06, p < 0.001$ ) and 8 participants in Profile 3 (26.7%;  $\chi^2 = 34.73, p < 0.001$ ) reported engaging in NSSI at Time 2. No significant differences were found between subgroups in the frequency of NSSI at Time 2 ( $\chi^2 = 2.84, p = 0.24$ ).

Most importantly, the mixed model analysis revealed differences in the psychopathological status of the subgroups in a similar way that was found at baseline (i.e., a significant effect of subgroup). The participants in Profile 1 maintain, after two years, higher scores in the measures of psychopathology than the other two profiles (even though many of them have stopped engaging in NSSI), suggesting that the variables that define Profile 1 could be used to identify individuals at higher risk (see Tables 3 and 4).

### Discussion

Previous research has demonstrated that young adults who engage in NSSI exhibit a heightened risk of future suicide attempts and poor mental health. Nevertheless, there is still a lack of studies exploring latent subgroups that may exhibit different associations with subsequent psychopathological risk. The current longitudinal study intricately explores the interaction between NSSI features, emotion dysregulation, and perceived social support to uncover latent subgroups within individuals engaged in NSSI, identifying those at an increased risk for future psychopathological problems.

**Table 3** Multilevel analyses of clinical measures and profiles at two-year follow-up

Multilevel models	B	SE	<i>p</i> -value
BPQ total			
Borderline traits change			
BPQ (Time 1 – Time 2)	–1.57	2.38	0.51
Profile (1, 2, 3)	–6.44	1.56	<0.001
BPQ × Profile	0.46	1.15	0.69
DASS-21			
Depression change			
Depression (Time 1 – Time 2)	–2.56	1.41	0.07
Profile (1, 2, 3)	–2.84	0.71	<0.001
Depression × Profile	0.94	0.69	0.17
Anxiety change			
Anxiety (Time 1 – Time 2)	–3.12	1.34	<0.05
Profile (1, 2, 3)	–1.69	0.65	<0.05
Anxiety × Profile	1.11	0.65	0.09
Stress change			
Stress (Time 1 – Time 2)	–0.61	1.17	0.60
Profile (1, 2, 3)	–1.52	0.56	<0.01
Stress × Profile	0.36	0.57	0.52

There was a significant Time effect on anxiety levels, such that anxiety reduced from Time 1 to Time 2. Even so, Profile 1 continued to maintain significantly higher anxiety symptoms compared to the other profiles (i.e., Profiles 2 and 3)

*BPQ Total* Borderline Personality Questionnaire, *DASS-21* Depression, Anxiety and Stress Scales

Importantly, three profiles were observed, each maintaining a consistent level of psychopathology both at baseline and follow-up. Current results extend previous findings that

**Table 4** Descriptive statistics of the multilevel analyses

	Profile 1 (N = 42) M (SD)	Profile 2 (N = 41) M (SD)	Profile 3 (N = 30) M (SD)
Clinical variables			
BPQ total			
Time 1	42.60 (13.00)	31.63 (11.53)	30.31 (12.60)
Time 2	40.49 (13.78)	32.37 (13.50)	29.04 (14.04)
DASS-21			
Depression			
Time 1	13.17 (5.86)	9.51 (6.52)	7.77 (5.94)
Time 2	11.34 (5.80)	9.17 (5.91)	7.80 (6.24)
Anxiety			
Time 1	11.20 (5.82)	7.51 (6.32)	8.13 (5.16)
Time 2	8.83 (5.51)	7.24 (4.54)	7.93 (5.39)
Stress			
Time 1	12.78 (4.86)	10.20 (4.78)	9.93 (4.66)
Time 2	12.44 (4.65)	10.49 (4.22)	10.30 (5.20)

*BPQ Total* Borderline Personality Questionnaire, *DASS-21* Depression, Anxiety and Stress Scales

support the utility of identifying subgroups of young people engaging in NSSI, and provide new insights into its prospective value in the early identification of individuals at risk of developing mental health problems.

The latent profile analysis revealed three profiles among young people engaging in NSSI (see Fig. 1). Two of these profiles appear to represent the upper and lower end of a continuum (i.e., Profiles 1 and 3, respectively). Specifically, Profile 1 (compared to Profile 3) exhibited high endorsement of severe NSSI-methods (e.g., self-cutting), high difficulties in emotion regulation, and low perceived social support. Further, Profile 2 (the ‘middle’ profile) showed high endorsement of severe NSSI-methods (similar to Profile 1), high levels of perceived social support (similar to Profile 3), and medium levels of difficulties in emotion regulation. Importantly, Profile 1 exhibited the highest scores across all clinical measures of psychopathology (e.g., DASS-21) both at baseline and follow-up, emerging as the ‘high risk’ profile.

The current finding of (three) different profiles of risk in young people engaging in NSSI is consistent with previous studies (e.g., Christoforou et al., 2021), and supports the hypothesis that NSSI in non-clinical settings is a heterogeneous phenomenon. The existence of two profiles (1 and 2) composed of students with emotion regulation difficulties (high and medium, respectively) is congruent with prior theoretical and empirical work that emphasizes the crucial role of emotion dysregulation in the engagement of NSSI (e.g., Tuna & Bozo, 2014; Wolff et al., 2019). Indeed, these two profiles represented a significant part of the sample (74% of participants) and, in line with their emotion regulation difficulties, both groups reported frequently using NSSI for self-regulation

motives (i.e., intrapersonal NSSI-functions). On the other hand, Profile 3 (26% of participants) showed the least difficulties in emotion regulation. In this regard, individuals in this profile may have different strategies to cope with difficult emotions and, therefore, NSSI may represent an isolated and less severe coping behavior, as has been previously proposed in prior research (Peterson et al., 2019; Whitlock et al., 2008).

Participants across profiles also differed in their perceived social support. In contrast with Profiles 2 and 3, participants in Profile 1 reported less social support. This finding is consistent with previous cross-sectional and longitudinal research indicating that perceived social support is inversely associated with risk of NSSI (Hankin & Abela, 2011; Wolff et al., 2014). For instance, it has been observed that high social support decreases the odds of engaging in NSSI in adolescents from both nonclinical (Wan et al., 2019) and clinical samples (Baiden et al., 2017). In this regard, previous studies have demonstrated the prominent role of social factors in NSSI (Cipriano et al., 2017; Taylor et al., 2018). For example, interpersonal conflicts or feelings of rejection by peers are frequent triggers for NSSI (Briones-Buixassa et al., 2021; Brunstein Klomek et al., 2016). At the same time, young people who engage in NSSI often report feelings of loneliness, poorer relationships with parents, and invalidating life environments, which are constructs closely related to perceived social support (Musser et al., 2018; Wang et al., 2020).

Interestingly, social support is theorized to indirectly protect against NSSI behaviors by improving emotion regulation (Rissanen et al., 2021). Indeed, recent studies have showed that the social context may impact emotion regulation (Marroquín & Nolen-hoeksema, 2015). Thus, people who report higher levels of perceived social support are able to more positively and more effectively regulate their emotions (Lakey, 2010). For instance, in a sample of college students, the habitual use of cognitive reappraisal is associated with fewer future experiences of depression and anxiety, primarily through higher perceived social support (d’Arbeloff et al., 2018). This finding suggests that social support may help improve emotion regulation and may help cope more effectively with interpersonal (among others) stressors (see also: Sachs-Ericsson et al., 2021). Current results are congruent with these previous findings. On the one hand, it is plausible that among students in Profile 2 (compared to Profile 1), high social support mitigated or buffered the effects of poor emotion regulation, reducing clinical symptoms and risk for psychopathology. On the other hand, among students in Profile 1, low perceived social support could be exacerbating emotion regulation difficulties, thus increasing psychological suffering.

In addition, participants in Profile 1 reported feeling less supported, especially by friends (see Supplementary Table S4). They also highly endorsed interpersonal motives for engaging in self-injury. It is important to note that college



represents a critical developmental period, due to the transition from adolescence to young adulthood. Therefore, the findings may suggest that the college environment may make social support from friends particularly important for the mental health of young people and, especially for those students with emotion regulation difficulties. Consistently, previous studies found that negative peer relationships may increase the occurrence of NSSI behavior in young people (Heath et al., 2009; Peng et al., 2019). From a longitudinal point of view, these findings are consistent with a recent longitudinal study with a 5-year follow-up that found that high perceived social support from friends may be particularly critical in preventing the onset of self-cutting in adolescents (Rissanen et al., 2021).

Prior research proposes that NSSI can be an early behavioral marker of psychopathological vulnerability (e.g., Ghinea et al., 2019). The present study goes one step further to better understand this important relationship, suggesting that this vulnerability is not implicit to the NSSI, but rather a combination of emotion regulation difficulties with low perceived social support. This result is supported by the high scores on all measures of psychopathology (including suicidal tendencies) among students in Profile 1, both at baseline and at follow-up. Additionally, Profiles 1 and 2 are very similar except for social variables, which may suggest that social support plays a critical role in the relationship between NSSI, psychopathology, and suicide. In this respect, the results are consistent with previous findings showing that perceived social support is associated with fewer depressive and anxiety symptoms, and fewer suicide-related outcomes at 1-year follow-up (Scardera et al., 2020). Interestingly, at follow-up, the scores in psychopathological measures were maintained similar to the baseline, although most participants stopped engaging in NSSI (i.e., Profile 1 showed an enhanced psychopathological risk compared to the other two profiles). This finding is partially consistent with previous longitudinal studies showing a greater risk of developing later psychopathology in young people engaging in NSSI, regardless of whether NSSI is maintained over time (e.g., Daukantaitė et al., 2021).

The results of this study may have some clinical implications. On the one hand, the findings could help optimize preventive interventions, paying special attention to those young people with NSSI who also have high emotional regulation problems and a low perceived social support. On the other hand, current findings support evidence-based interventions for addressing NSSI such as dialectical behavioral therapy (DBT; Linehan et al., 2015). Interestingly, this type of psychological intervention addresses both interpersonal and emotion regulation skills. Currently, DBT has already been adapted for college settings to improve emotion regulation and social adjustment (Chugani, 2017), and its implementation so far has shown feasibility and acceptability (Uliaszek et al., 2016). For example, DBT interventions have been shown to

decrease NSSI events and improve emotion regulation capacity, social adjustments and functioning (Pistorello et al., 2012; Rizvi and Steffel, 2014) through decreasing dysfunctional coping skills (e.g., avoiding people) in college students (Uliaszek et al., 2018). However, further research is needed to determine its efficacy.

The present study has several limitations. First, only self-report measures were used, so a recall bias could influence the information reported by the participants, especially when asked about NSSI events in the last 12 months. Second, in the latent profile analysis model two functions commonly reported by young people was included (Taylor et al., 2018). However, other types of functions that are less common were not included (i.e., self-punishment function: Klonsky, 2007), but also characterize severe profiles in college students (Christoforou et al., 2021). Third, an overall measure of emotion dysregulation was included in the latent profile analysis (DERS: Gratz & Roemer, 2004). However, other measures of emotion dysregulation were not considered, such as rumination, which also characterizes severe NSSI profiles in college students (Guérin-Marion et al., 2021). Fourth, the sample was largely skewed toward females. However, this gender difference has been consistently found in previous studies, suggesting that females were significantly more likely to report a history of NSSI than males (see: Bresin & Schoenleber, 2015). Finally, a low retention rate was obtained in the follow-up that can yield biased estimates of participant characteristics under study (i.e., Type II error) and, therefore, may limit the conclusions from the longitudinal results.

## Conclusion

Despite acknowledging the link between NSSI and an elevated risk of psychopathology, unraveling the specific profiles at increased risk for future psychological issues remains an ongoing scientific challenge. This study explored the presence of latent subgroups in a sample of young adults engaged in NSSI using a longitudinal approach, as well as the distinct association of each of these groups with psychopathological risk over both the short term (baseline) and long term (follow-up). The findings revealed a high-risk profile characterized by a heightened endorsement of severe NSSI methods (e.g., self-cutting), elevated emotion dysregulation, and low perceived social support. These results contribute to highlight the role of perceived social support in the complex relationship between NSSI and the risk of psychopathology in young adults with NSSI. Moreover, these findings unveil promising avenues for prevention and treatment strategies in the management of NSSI. In this regard, fostering social support may be fundamental among youth engaging in NSSI.

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**Data Sharing and Declaration** The data supporting this study are available from the corresponding author upon request.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare no competing interests.

**Ethical Approval** All procedures were approved by the Clinical Research Ethics Committee of Bellvitge University Hospital (protocol number: PR330/17).

**Informed Consent** All participants in this study provided informed consent electronically.

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