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Trajectory of Non-suicidal Self-Injury among adolescents with borderline personality disorder over a 5-year period

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Abstract

Background Engagement in Non-Suicidal Self-Injury (NSSI) is high among adolescents with borderline personality disorder (BPD), but the trajectory of NSSI in the transition period from adolescence to adulthood is unclear, and studies that look at predictors of persistence are highly needed.

Methods This study followed 111 adolescents aged 14–17 with BPD over a five-year period to observe the prevalence and predictors of NSSI. Information on NSSI was based on both self-report and clinician-administered interviews.

Results At the outset, 92.8% reported a history of NSSI, with an average of nearly five different types of NSSI. Despite this high initial prevalence, the rates of NSSI within the past two weeks decreased over time from 48% at baseline to 26% after one year, and further to 10% after two years. After five years, 37% reported engaging in NSSI within the past six months. Notably, all but one participant who reported NSSI after five years had engaged in NSSI already at baseline. The study identified that higher adolescent-rated but lower parent-rated BPD severity was associated with engagement in NSSI at baseline. Furthermore, ongoing NSSI after five years was predicted by lower parent-rated BPD severity and externalizing behaviors.

Conclusions NSSI is frequent in the early course of BPD, and persists in more than one-third after five years. Our findings highlight that baseline engagement in NSSI is a risk factor for persistence of NSSI in the transition period into early adulthood. Furthermore, the findings underscore the significance of integrating both adolescent and parent perspectives on BPD pathology in the assessment and management of NSSI.

Keywords Non-suicidal Self-Injury, Self-harm, Adolescents, Borderline personality disorder, Follow-up, Longitudinal

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Background

Non-Suicidal Self-Injury (NSSI) is defined by the International Society for the Study of Self-Injury as deliberate, self-inflicted damage of body tissue without suicidal intent and for non-socially or culturally sanctioned purposes [48]. This includes acts of cutting, bruising, biting, scratching, hitting oneself or hard objects, and leaving marks on the skin. NSSI can be differentiated from indirect acts of self-injury, where an individual engages in behavior that can have long-term negative consequences, such as eating disorders, promiscuity, reckless driving, or substance use [20, 76]. NSSI is the strongest predictor of later suicide attempts and death by suicide across multiple diagnoses [25, 62, 93]. NSSI is also associated with increased feelings of distress and burden among significant others [91] as well as high healthcare costs [31].

NSSI is considered a transdiagnostic marker of psychopathology [55] but is also recognized as a nosological entity in the Diagnostic and Statistical Manual of Mental Disorders, fifth Edition (DSM-5) Sect. 3 [4]. NSSI co-occurs in many mental disorders, such as personality disorders, depression, anxiety disorders, posttraumatic stress disorder, attention deficit hyperactivity disorder, eating disorders, autism spectrum disorders, and alcohol or substance use disorders [3, 10, 23, 59, 66, 73]. Yet, NSSI can also be considered a non-specific sign of distress occurring in many young people without a mental health disorder [71].

Taylor et al. [89] found that NSSI serves many purposes for the individual, which could be broadly divided into *intrapersonal* reasons (e.g., emotion regulation, punishing oneself, avoiding negative emotions, and inducing positive emotions), and *interpersonal reasons* (e.g., communicating distress, influencing others, and punishing others). Several risk factors for NSSI have been documented, including individual characteristics, such as negative affect (e.g., [63]), and predictors related to an invalidating environment, including childhood maltreatment, neglect, sexual abuse, bullying, and attachment problems [21, 34, 92, 97].

Non-suicidal Self-Injury in young people

NSSI is highly prevalent in adolescents with an estimated worldwide community prevalence of 16–18%, and displaying an increasing trend during the past decades [37, 49, 55, 75, 87]. A recent review of a sample of non-clinical adolescents found a global aggregate lifetime prevalence of NSSI of 22%, and 23.2% 12-month prevalence [96]. The prevalence of NSSI is even higher in clinical samples of adolescents with rates up to 50–60% [9, 56], and appears to have increased even further during the COVID pandemic [104]. NSSI usually peaks around the age of 15 years followed by a decline into young adulthood [78].

Adolescents appear to be particularly vulnerable to NSSI due to heightened emotional reactivity and impulsivity owing to ongoing brain maturation [24], and pubertal changes [30]. Early onset of NSSI has been associated with poorer prognosis with regards to severe NSSI, suicidality, and risk of developing borderline personality disorder [5, 11, 35, 72, 78].

Non-suicidal Self-Injury and borderline personality disorder in adolescence

BPD is characterized by instability in affect, behaviors, and relationships [65]. NSSI and self-harming behaviors are diagnostic criteria of BPD and frequently co-occur with BPD [7, 61]. Compared to a community prevalence of NSSI of around 17%, prevalence rates of 75–95% have been reported for adolescents and adults with BPD [8, 39, 102, 103]. Moreover, around half of those who have engaged in NSSI have been found to meet criteria for BPD [42, 77]. A review of studies of the longitudinal associations between NSSI and BPD in adolescents concluded that at this point there is insufficient knowledge to reliably determine how NSSI and BPD are related over time [86]. However, a more recent follow-up study of NSSI among adolescents in a community sample comparing those who reported NSSI in adolescence with those who did not found that persistence of NSSI over time was associated with higher ratings of BPD symptomatology and greater impairment in psychosocial functioning mediated by deficits in emotion regulation [16]. Similarly, another study found that engagement in NSSI in adolescence was associated with a higher risk of later development of BPD [36].

Even though rates of NSSI are high among individuals with BPD, studies suggest that rates of self-harming behaviors decline over time. For instance, Zanarini et al. [100, 101] found that among their sample of adult participants with BPD, the past two-week occurrence of self-harming behaviors decreased from 81% at study intake to only 26% six years later. However, we lack prospective data that have examined whether occurrence of NSSI in adolescents with BPD similarly declines over time.

Prospective data on the predictors of NSSI in adolescents with BPD are equally rare. Retrospective studies have, for instance, identified child abuse [58] and early onset of NSSI [102, 103] as potential predictors of NSSI in adolescents with BPD. A couple of short-term prospective studies utilizing ecological momentary assessment have identified affective dysregulation and interpersonal instability as short-term antecedents of NSSI in adolescents with BPD [63, 80, 81]. However, whether the presence of NSSI in adolescents with BPD can be predicted over a longer period of time remains unknown. Prior research highlights several factors as important correlates

or predictors of NSSI, including severity of borderline pathology [16, 36, 38], depression [60], internalizing and externalizing pathology [22, 70], attachment security [88], exposure to childhood trauma [82], and mentalizing capacity [64]. These findings provide a foundation for evaluating potential predictors of long-term NSSI outcomes in BPD. The current study aimed to evaluate the persistence of NSSI among adolescents with a BPD diagnosis over a five-year period. To this end, we used data from a randomized clinical trial to establish baseline prevalence of NSSI. We then followed up on the adolescents at one, two, and five-year time-points to establish long-term rates of NSSI. Our second aim was to identify potential baseline variables that were associated with lifetime NSSI at baseline, as well as variables that predicted the presence of NSSI at the 5-year follow-up timepoint.

Methods
Sample and procedures
The sample consisted of 110 female adolescents and one male adolescent ($N=111$; $M_{age}=15.8$ years, $SD=1.1$). Participants were recruited from four child and adolescent mental health outpatient clinics in Region Zealand, Denmark as part of a randomized clinical trial (the M-GAB trial; [13] ClinicalTrials.gov identifier: NCT02068326). The trial aimed to assess the effectiveness of mentalization-based group therapy (MBT-G) compared to treatment as usual (TAU) for adolescents with BPD. Participants were included if they were between 14 to 17 years old and met at least four DSM-5 criteria for BPD. Additionally, all participants were required to score above the clinical threshold for BPD on the Borderline Personality Features Scale for Children (BPFS-C; [29]). Exclusion criteria included having a pervasive developmental disorder, an IQ below 75, anorexia nervosa, a current psychotic disorder or schizotypal personality disorder, antisocial personality disorder, current substance dependence, or if any other mental disorder was considered the primary diagnosis. Lastly, participants were excluded if they were currently in inpatient treatment. The participants received one year of treatment and were followed up over five years [51, 53]. Informed consent was obtained from the adolescents and their caregivers. Inclusion criteria were: 1) ages 14 to 17 years, and 2) meeting a minimum of four DSM-5 BPD criteria.

Measures
Clinical assessments
At baseline, BPD criteria were assessed using the Childhood Interview for DSM-IV Borderline Personality Disorder (CI-BPD; [98]). Comorbid personality disorders were assessed using the Structured Clinical Interview for DSM-IV Axis II (SCID-II; [32]). Lastly, other comorbid mental disorders were assessed through the Mini-International Neuropsychiatric Interview for Children and Adolescents (MINI-KID 6.0; [84]). At the five-year follow-up, prevalence of personality disorders was assessed with the Structured Clinical Interview for DSM-5 Personality Disorders (SCID-5-PD; [33]), and mental disorders were assessed using the World Health Organization's Schedules for Clinical Assessment in Neuropsychiatry (SCAN; [95]).

Non-suicidal Self-Injury
Lifetime NSSI at baseline: Lifetime presence of NSSI was measured with the self-harm scale of the Risk-Taking and Self-Harm Inventory for adolescents (RTSHIA; [94]). Items are rated on a 4-point Likert scale with higher scores indicating higher frequency of engagement in risk-taking or self-harming behaviors. Internal consistency for this measure was found to be good to excellent in the M-GAB trial (Cronbach's alpha: 0.87) [13]. The RTSHIA measures whether adolescents have ever engaged in NSSI and self-harming behaviors, but only the nine items pertaining to NSSI were used for this study.

NSSI at baseline, one and two year follow-up: Past two-week presence of NSSI was assessed at study intake, at end of treatment after one year, and two years after inclusion into the study by use of the semi-structured clinical interview the Zanarini Rating Scale for Borderline Personality Disorder (ZAN-BPD; [99]). For the current study, we used the following question from the self-harm module of the ZAN-BPD: "*Within the past two weeks have you deliberately hurt yourself physically (e.g., cut yourself, burned yourself, punched yourself, punched your hand through windows, punched the wall, banged your head into something)?*", and dichotomized answers into engagers (one or more acts of NSSI in the past two weeks) versus non-engagers (no past two-week prevalence of NSSI).

NSSI at five-year follow-up: Past six-month presence of NSSI was assessed with the Deliberate Self-Harm Inventory: Nine-Item Version (DSHI-9), which is a shortened and modified version of the original DSHI [17, 41]. Respondents rate the number of times they have deliberately engaged in any of nine different types of self-harming behaviors in the past six months from 0 (never) to 6 (more than five times). If they have engaged in NSSI, they are asked to elaborate whether the NSSI had occurred within the past week, past month, or past six months. A continuous variable was constructed by summarizing the scores on all DSHI-9 items, resulting in a total value ranging from 0 to 54 [17] with higher scores indicating higher frequency.

Baseline predictors

Sexual and physical abuse: At baseline, the participants were interviewed using a self-devised interview designed to gather background information. Information on exposure to lifetime sexual or physical abuse were recorded as present or absent.

Adolescent borderline personality features were measured using the 24-item BPFS-C [29], and the corresponding parent version BPFS-Parent (BPFS-P; [83]. The BPFS is used to assess BPD features in children and adolescents from ages 9 years and older. It consists of four subscales with six items per subscale: affective instability, identity problems, negative relationships, and self-harm. Items are rated on a 5-point Likert scale ranging from 1 (not at all true) to 5 (always true). Higher scores indicate increased levels of BPD features. Internal consistency for the BPFS-C was found to be good to excellent in the M-GAB trial (Cronbach's alpha: 0.85), and excellent for the BPFS-P (Cronbach's alpha: 0.90; [13]).

Depression was measured with the 20-item Beck's Depression Inventory for Youth (BDI-Y; [12]). The BDI-Y measures children's negative thoughts about themselves, their lives, and their future, and feelings of sadness and physiological indicators of depression. Items are rated on a 4-point Likert scale from 0 (never) to 3 (always), and higher scores indicate higher severity of depressive symptoms. Internal consistency for this measure was found to be good to excellent in the M-GAB trial (Cronbach's alpha: 0.91; [13]).

Internalizing and externalizing symptoms were measured with the 112-item Youth Self Report (YSR; [1]) and the corresponding parent version the Child Behavior Checklist (CBCL; [2]). The YSR and the CBCL assess emotional and behavioral problems among children and adolescents aged 11–17 grouped into *externalizing* and *internalizing* symptoms. Items are rated on a 3-point Likert scale ranging from 0 (not true) to 2 (very true or often true), and higher scores indicate higher severity of internalizing and externalizing pathology. Internal consistency for these measures was found to be excellent in the M-GAB trial (Cronbach's alpha for YSR internalizing and externalizing: 0.86 and 0.85, respectively; and 0.90 and 0.85 for CBCL internalizing and externalizing, respectively; [13].

Attachment to parents and peers was measured with the 53-item Inventory of Parent and Peer Attachment-Revised (IPPA-R) [43]. The IPPA-R measures attachment to parents and peers in children between the ages 9 to 15 years according to the quality of communication, feelings of trust, and degree of alienation. The IPPA-R consists of two subscales: attachment to parents and attachment to peers, and higher scores indicate more attachment

problems. Internal consistency was found to be good to excellent (Cronbach's alphas of 0.94 for both subscales).

Mentalizing capacity was measured with the 46-item Reflective Function Questionnaire for Youth (RFQ-Y) [45]. The RFQ-Y measures adolescent reflective functioning (i.e., mentalizing capacity) on a 6-point Likert scale. The measure consists of two subscales A and B, but the total score was used in this study with higher scores indicating higher mentalizing capacity. Internal consistency was found to be moderate (Cronbach's alphas of 0.57).

All questionnaires were Danish-translated versions. We used published Danish versions of Beck's Depression Inventory for Youth, the Youth Self Report, and the Child Behavior Checklist [14, 47, 90]. The remaining measures were translated and back-translated following standard procedures.

Statistical analyses

Statistical analyses were conducted using SPSS 28, with significance set at $p < .05$. The study aimed to outline NSSI prevalence among adolescents with BPD over five years, and to examine associations between baseline variables and the presence and frequency of current acts of NSSI at inclusion as well as five years later. Descriptive statistics outlined NSSI frequencies on the RTSHI, the ZAN-BPD, and the DSHI-9. Independent two-tailed T-tests and chi-square tests of independence compared baseline variables between follow-up attendees ($n = 97$) and research dropouts ($n = 14$). Linear regression models, corrected for age and treatment (MBT-G or TAU) explored predictors of lifetime frequency of NSSI and five-year frequency of NSSI. Predictors showing significance were entered into combined models to assess independence. For the follow-up analysis, we initially tested whether current NSSI at baseline and baseline-reported lifetime frequency of NSSI were predictive of NSSI five years later. Since these variables were predictive, subsequent analyses were adjusted accordingly. Normality was assessed, and non-normal variables (BPFS-P, YSR externalizing, IPPA-R attachment to peers) were rank-transformed for analysis.

Results

Descriptive statistics

Of the 111 participants (M_{age} 15.8, $SD = 1.1$), who were included in the study, 106 (96%) met diagnostic criteria for BPD (≥ 5 BPD criteria) at study intake. Comorbid mental disorders were prevalent as the participants fulfilled a mean of more than four comorbid diagnoses, including major depressive disorder (55%), anxiety disorders (81%), and ADHD (26%). For extensive baseline sociodemographic and clinical information on the total sample, see Beck et al. [13]. Ninety-seven participants (96

females, one male) attended assessments for the five-year follow-up study (M_{age}: 21.5, $SD = 1.2$). Although BPD had remitted in 76% ($n = 74$) of the participants, 47% still met diagnostic criteria for any personality disorder, and only 15% had remitted from all mental disorders. At the time of the five-year follow-up, the most prevalent disorders were anxiety disorders (37%), depressive disorders (32%). Around half the participants were currently in psychotherapy (47%) and 44% were on psychotropic medication. For information on the full clinical presentation of the sample at five-year follow-up, see Jørgensen et al. [53]. There were no significant differences between the 97 participants who attended and the 14 participants lost to follow-up on any baseline variable or age. Please see Table 1 for bivariate associations.

The course of NSSI over a 5-year period

Regarding NSSI, 92.8% ($n = 103$) reported at baseline to have engaged in any type of NSSI throughout their lives

with a mean of 4.84 ($SD = 2.43$) different types of NSSI. For more information on lifetime presence of NSSI, see Table 2. At baseline, 48% ($n = 53$) reported past-two-weeks NSSI. After one year, the past-two-week frequency of NSSI decreased to 26% ($n = 21$), and only 10% ($n = 9$) reported past-two-week NSSI after two years. For more details on past-two-week NSSI, please see Table 3.

Of the 97 participants who attended five-year follow-up, 37% ($n = 36$) had engaged in any kind of NSSI within the past six months with a mean of 1 act of NSSI ($SD = 1.8$; cf. Table 4). Of those who had engaged in NSSI, 11% ($n = 4$) had done so within the past week, 28% ($n = 10$) within the past month, and 61% within the past six months. Out of the 36 participants who had engaged in NSSI within the past six months at five years follow-up, only one participant had started engaging in NSSI since baseline, meaning that 35 out of the 36 participants who engaged in NSSI reported to have done so already at baseline.

Table 1 Correlational table of the bivariate associations

Variable	BPFS-C	BPFS-P	YSR int[b]	YSR ext[b]	CBCL int[b]	CBCL ext[b]	BDI-Y	RFQ-Y	IPPA-R Parents	IPPA-R Peers	DSHI-9[c]
BPFS-C	-										
BPFS-P	.086	-									
YSR int[b]	.541[a]	-.156	-								
YSR ext[b]	.475[a]	.280[a]	.227[b]	-							
CBCL int[b]	.115	.350[a]	.298[a]	-.082	-						
CBCL ext[b]	.034	.752[a]	-.142	.382[a]	.302[a]	-					
BDI-Y	.617[a]	-.168	.711[a]	.136	.219[b]	-.173	-				
RFQ-Y	.102	.035	.116	.107	.011	-.012	.125	-			
IPPA-R Parents	.313[a]	-.024	.313[a]	.256[a]	.004	.159	.457[a]	.105	-		
IPPA-R Peers	.352[a]	-.160	.269[a]	.153	.139	-.121	.456[a]	-.058	.345[a]	-	
DSHI-9[c]	-.124	-.252[b]	.090	-.172	.201[b]	-.159	.046	-.114	.134	.003	-

[a] significant at the 0.01 level (two-tailed)

[b] significant at the 0.05 level (two-tailed)

[c] only participants from the five-year follow-up

Table 2 Lifetime presence of different types of NSSI at baseline (RTSHIA)

Type of NSSI (RTSHIA)	Never *n* (%)	One time *n* (%)	More than once *n* (%)	Many times *n* (%)
Cutting	12 (11)	5 (5)	24 (22)	70 (63)
Burned oneself	58 (52)	15 (14)	17 (15)	21 (19)
Bitten oneself until breaking of skin	63 (57)	19 (17)	20 (18)	9 (8)
Banged head or punched oneself until bruising	40 (36)	9 (8)	37 (33)	23 (21)
Prevented wounds from healing or picking oneself to the point of drawing blood	37 (33)	13 (12)	25 (23)	36 (32)
Intentionally scraped, scrubbed, or scratched skin to the point of breaking skin or drawing blood	25 (23)	25 (23)	29 (26)	32 (29)
Intentionally rubbed a sharp object or dripped anything toxic onto skin	78 (70)	12 (11)	12 (11)	9 (8)
Exercised an injured body part to hurt oneself	82 (74)	7 (6)	13 (12)	9 (8)
Intentionally pulled hair out	65 (59)	13 (12)	23 (21)	10 (9)

Table 3 Past two-week engagement in NSSI at baseline, 1-year- and at 2-year follow-up (ZAN-BPD)

Type of NSSI	Baseline ($n=111$) n (%)	1-year follow-up ($n=80$) n (%)	2-year follow-up ($n=91$) n (%)
Cutting	36 (32)	12 (15)	6 (7)
Burned oneself	8 (7)	2 (3)	1 (1)
Punched oneself/punched hand into something	35 (32)	12 (15)	2 (2)
Banged head against something	10 (9)	2 (3)	2 (2)
Past-two weeks any NSSI	53 (48)	21 (26)	9 (10)

Table 4 Past six months presence of different types of NSSI at 5-year follow-up (DSHI-9)

Type of NSSI (DSHI-9)	0 time n (%)	1–5 times n (%)	>5 times n (%)
Cutting	74 (76)	16 (16)	7 (7)
Rubbed skin	80 (83)	9 (9)	8 (8)
Burned oneself	89 (92)	5 (5)	3 (3)
Carved words, pictures, symbols, or other marks onto skin	93 (96)	1 (1)	3 (3)
Scratched or pulled skin	86 (89)	7 (7)	4 (4)
Bitten oneself	93 (96)	2 (2)	2 (2)
Stuck sharp objects into skin	93 (96)	3 (3)	1 (1)
Hit oneself/smashed hand into something	84 (87)	8 (8)	5 (5)
Prevented wounds from healing	83 (86)	5 (5)	9 (9)

Table 5 Associations between baseline variables and lifetime frequency of engagement in NSSI measured at baseline[a]

Predictor	β	S.E.	T	*p*
Abuse				
Sexual abuse	3.791	1.618	-2.343	**.021**[*]
Physical abuse	− 0.840	1.452	.579	.564
Clinical measures				
BPFS-C total score	.248	.044	5.660	**<.001**[**]
BPFS-P total score[b]	− .115	.042	-2.733	**.007**[**]
YSR Internalizing	.254	.057	4.457	**<.001**[**]
YSR Externalizing[b]	.241	.067	3.599	**<.001**[**]
CBCL Internalizing	− .021	.066	− .322	.748
CBCL Externalizing	− .085	.054	-1.579	.117
BDI-Y	.223	.053	4.203	**<.001**[**]
Reflective functioning and attachment				
RFQ-Y	1.011	.962	1.051	.296
IPPA-R Parents	.179	.049	3.619	**<.001**[**]
IPPA-R Peers[b]	.165	.058	2.829	**.006**[**]

[a] All predictors were controlled for age

[b] Normalized score

[*] significant at *p* < .05

[**] significant at *p* < .01

Predictors of NSSI

Results of the linear regression between baseline variables and lifetime frequency of NSSI measured at baseline (cf. Table 5) show that higher lifetime frequency of NSSI was associated with the following variables: exposure to sexual abuse, higher adolescent-reported BPD but lower parent-reported BPD, increased adolescent-reported internalizing and externalizing symptoms, higher depression severity and more attachment problems with parents and peers. When all the significant findings were entered into the same statistical model, only higher adolescent-reported BPD (β: 0.174, $SE=.061$, t=2.873, *p*=.005) and lower parent-rated BPD (β: − .138, $SE=.039$, t = -3.532, *p*=.001) remained statistically significant and were therefore the dominant predictors of lifetime NSSI.

Frequency of NSSI at five-year follow-up was furthermore predicted by baseline past two-week engagement in NSSI (β: 4.041, $SE=1.738$, t: 2.325, *p*=.02), but not baseline-reported lifetime frequency of NSSI (β: .232, $SE=.143$, t: 1.630, *p*=.11; see Table 6 for results from the linear regression analysis for frequency of NSSI at 5-years follow-up). We again observed that lower parent-rated BPD severity at baseline predicted higher frequency of NSSI 5 years later. Additionally, we found that parent-rated lower externalizing on the CBCL significantly predicted higher frequency of NSSI five years later. When the BPFS-P and the CBCL externalizing subscale were entered into the same regression model both BPFS-P and CBCL externalizing turned insignificant (*p*=.06 and *p*=.96, respectively) indicating that the two variables shared variance, which is substantiated by the correlation analyses that show a strong correlation between the two variables in question ($r=.75$; cf. Table 1).

Discussion

Given the high rates of NSSI among adolescents, it is important to outline the developmental course of NSSI in BPD to evaluate the usefulness of BPD-specific interventions to prevent persistence of NSSI [79, 86]. Even so,

Table 6 Predictors of frequency of NSSI after five years[a]

Predictor	β	S.E.	T	p
Abuse				
Sexual abuse	-3.945	2.376	-1.660	.10
Physical abuse	3.075	2.083	1.476	.14
Clinical measures				
BPFS-C total score	− .127	.071	-1.788	.08
BPFS-P total score[b]	− .088	.030	-2.959	**.01**
YSR Internalizing	.029	.099	.297	.77
YSR Externalizing[b]	− .061	.030	-2.002	.05#
CBCL Internalizing	.134	.102	1.313	.19
CBCL Externalizing	− .176	.079	-2.241	**.03**
BDI-Y	− .019	.090	− .215	.83
Reflective functioning and attachment				
RFQ-Y	-1.135	1.407	− .807	.42
IPPA-R Parents	044	.079	.555	.58
IPPA-R Peers[b]	− .004	.033	− .113	.91

[a] All predictors were controlled for baseline NSSI, treatment, and age

[b] Normalized score

there is a paucity of available data examining the longitudinal course of NSSI among young people with BPD. The current study addressed this gap by following up a sample of young people with BPD at three time points over the course of five years. At intake, 96% of participants met the full diagnostic criteria for BPD. After five years, 76% were in remission; however, 70% still exhibited at least one BPD diagnostic criterion, and nearly half continued to meet criteria for another personality disorder [53]. These findings are consistent with previous research in both adolescent [18, 27, 67] and adult samples [44, 101, 103], which indicate high remission rates over time, yet also show that some BPD symptoms tend to persist even when full diagnostic criteria are no longer met [15]. Compared to adults, adolescents with BPD more frequently present with "acute" symptoms, such as NSSI [57], and the transition into adulthood is marked by a symptomatic shift toward more enduring social and functional impairment, identity disturbance, and affective instability [57]. Thus, it is highly relevant to study predictors of persistent NSSI in this specific age group.

Three findings from the current study are noteworthy. First, the rate of NSSI in adolescents with BPD was found to be as high as in other studies of young people with BPD [8, 39]. Already at baseline, 92.8% reported lifetime engagement in NSSI, and 48% had engaged in acts of NSSI within the past two weeks. Rates of NSSI declined over the years to 26% past two-week engagement after one year and 10% after two years. After five years, 37% reported past six months engagement in NSSI, of which 11% had done so within the past week and 28%

within the past month. Second, the frequency of NSSI after five years was predicted by engagement of NSSI already at baseline. Only one of the participants who engaged in NSSI at the five-year follow-up had initiated engagement in NSSI since inclusion into the study. The remaining participants were already engaging in NSSI at the time of inclusion into the study. This finding confirms the conclusion of other studies that NSSI constitutes an important risk marker for future NSSI in adolescents with BPD (e.g., [79, 86]). Importantly, our study shows that frequency of engagement in lifetime NSSI at baseline was not predictive of continuing NSSI, so in the long run it does not seem to matter how frequent the NSSI was in the past, only whether the young person engaged in NSSI or not.

Third, we observed a notable discrepancy between adolescent and parent ratings of BPD severity at baseline. While higher adolescent-rated BPD severity was associated with an increased frequency of lifetime NSSI, *lower* parent-rated BPD severity predicted a higher frequency of lifetime NSSI. This suggests that adolescents' own experience of BPD pathology is a critical factor driving their engagement in NSSI. Conversely, parents who fail to recognize their child's suffering may inadvertently contribute to an increase in NSSI behaviors. This pattern persisted at follow-up, as parental reports of lower BPD severity and lower externalizing behaviors at baseline were predictive of a higher frequency of NSSI five years later. The correlation between parent-rated BPD severity and externalizing behaviors indicates that parents may be more attuned to observable symptoms, potentially overlooking the more subtle internal distress their child experiences. Given that NSSI is closely linked to internal experiences, this might explain why adolescent self-reports are more predictive than parental ratings. Moreover, when parents fail to recognize or are unaware of the more externalizing expressions of BPD, it could lead to a poor prognosis regarding NSSI. Prior research in this sample has shown that adolescents who report more severe BPD pathology and internalizing symptoms relative to their parents tend to experience greater attachment problems with their parents, [54]. Together, these findings underscore the need for greater parental education and awareness about the complexities of BPD symptoms, as their understanding is essential for supporting their child's mental health and mitigating the risk of NSSI.

It is, however, important to consider that BPD is associated with significant caregiver burden, as we also observed in the current sample [52]. The psychological strain of caring for a child with BPD could affect parental perceptions and responses to their child's distress, potentially creating a cycle in which parents become

less attuned to their child's internal distress, leading to inadequate support during critical moments of distress, ultimately contributing to long-term negative outcomes. Adding to that, stigma surrounding the BPD diagnosis [26, 46] may further exacerbate this dynamic, as parents might downplay or misinterpret symptoms due to fear of judgment or societal misconceptions.

Our study suggests that the way parents view the severity of BPD pathology in their child is important for the long-term prognosis. Some authors have argued that the action of NSSI expresses a relational need for care [85], and studies have found associations between adolescent NSSI and lack of emotional support from parents and parental rejection [6, 28]. It could be argued that NSSI is associated with parents' failure to adequately recognize and respond to the BPD pathology that the young person has, and which has been assessed and diagnosed by clinicians. Prior to engaging in NSSI, the young person experiences a disorganized and painful mental state and mentalizing failures exacerbate the problem, leading to difficulties in regulating self-experience and understanding others' motives accurately [74]. In these disorganized mental states, individuals revert to primitive modes of non-mentalizing such as *psychic equivalence* or *teleological* mode. In the teleological mode, individuals interpret others' behavior as evidence of their mental state, thereby isolating themselves from reality. The resulting distress and emotional dysregulation may drive NSSI as a means to discharge unmentalized experiences through physical means such as NSSI [74]. Ultimately, NSSI serves as an attempt to alleviate intolerable feelings and to reinstate stability to a sense of self even if it is negative [74].

There are important clinical implications of the current study. Our study showed that adolescents with BPD who engage in NSSI are at risk for poor long-term outcomes, and targeted treatment should be initiated. A systematic review of psychological therapies for adolescents with BPD found that dialectical behavior therapy could be particularly effective in reducing self-harming behaviors and should therefore be offered to adolescents with BPD who engage in NSSI [50, 68, 69]. Additionally, when adolescents with BPD engage in NSSI, clinicians should pay notion to the parent-child relationship, because if the parents do not recognize or are ignorant about the severity of their child's BPD, there is a risk of continuing engagement in NSSI. Our study underscores the importance of a broader family involvement and support in the assessment and treatment of BPD in early prevention initiatives.

Limitations
The present study is subject to several limitations that should be acknowledged. First, the sample included only one male, which limits the generalizability of the results to male populations. In our study, we did not specify a preference for gender in our recruitment efforts; however, the sample ultimately consisted of 110 girls and one boy. This skewed gender distribution may be attributed to the higher rates of BPD diagnoses among girls, as boys may either be less likely to be offered psychiatric help or may be diagnosed with other conditions such as ADHD, behavioral disorders, or substance use disorders. While BPD is seemingly evenly distributed between men and women in the general population [40], it tends to be more prevalent among females in clinical settings [19], a trend that appears to be even more pronounced in younger age groups. Therefore, caution should be exercised when interpreting the findings in relation to male adolescents with BPD. Second, the study utilized different measures of NSSI over time (RTSHIA, ZAN-BPD, and DSHI-9), which may introduce inconsistencies or discrepancies in the data. Furthermore, the study did not explore the vast differences in how individuals engage in NSSI. As highlighted by Møhl [71], there are differences in method (e.g., cutting, burning, biting, hitting oneself), 2) location on the body (e.g., arms, legs, stomach, face or genitals), 3) frequency, and 4) level of physical damage (mild, moderate, severe). By not examining these differences, the study findings lack comprehensive insights into NSSI behavior over time. Third, one limitation of the study is the absence of assessments at three and four years follow-up. The follow-up points were selected to align with key study objectives: the first two years to capture treatment outcomes and early post-treatment changes, and five years to explore the long-term developmental trajectories into adulthood. While additional follow-up points could provide a more granular understanding of intermediate changes, the focus was kept on the primary research questions without adding additional complexity to the study design. Lastly, we acknowledge that the lack of information on treatment engagement during the follow-up period is a limitation of our study. The retrospective nature of self-reported treatment history introduces the potential for recall bias, which may impact the validity and reliability of the information provided by participants. Consequently, we were unable to accurately determine the type or amount of treatment participants received during the follow-up period.

Conclusions
This study highlights the significant role of NSSI as both a prevalent and persistent issue in the early course of BPD. Initial high rates of NSSI observed at baseline, with a gradual decline over five years, emphasize the need for early and sustained interventions. Notably, the frequency of NSSI after five years was predicted by baseline

engagement, underscoring the importance of early detection. Additionally, our study suggests that parental perception and recognition of BPD pathology play a crucial role in the long-term prognosis of NSSI, reinforcing the need for broader family involvement in the treatment of BPD in adolescence.

Abbreviations

BDI-Y	Beck's Depression Inventory for Youth
BPFS-C/P	Borderline Personality Features Scale for Children/Parents
BPD	Borderline Personality Disorder
CBCL	Child Behavior Checklist
DSHI-9	Deliberate Self-Harm Inventory: Nine-Item Version
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
IPPA-R	Inventory of Parent and Peer Attachment-Revised
NSSI	Non-Suicidal Self-Injury
RFQ-Y	Reflective Function Questionnaire for Youth
RTSHIA	Risk-Taking and Self-Harm Inventory for Adolescents
YSR	Youth Self Report
ZAN-BPD	Zanarini Rating Scale for Borderline Personality Disorder

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
All procedures were approved by the Regional Ethics Committee of Zealand (no: SJ-371), and the data is registered at the Danish Data Protection Agency (no: REG-55-2014). All participants provided written informed consent to participate.

Consent for publication
Parental consent for the use of participant data in scientific publications was obtained at the time of their initial involvement in the study. Five years later in the follow-up study, the participants themselves provided informed consent for the use of their data in scientific publications.

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