



## Identifying Predictors of Non-Suicidal Self-Injuries in Individuals with Eating Disorders

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**Purpose:** Nearly one third of all patients with an eating disorder (ED) present with non-suicidal self-injury (NSSI). Although it is necessary to pay attention clinically to NSSI in ED patients due to an increased suicidal risk, there are limited data on potential predictors of NSSI in ED. We conducted this study to uncover predictors of NSSI in ED.

**Materials and Methods:** A total of 1355 ED patients who visited an ED clinic was evaluated through structured interviews by psychiatrists. The demographic and clinical characteristics of ED patients with NSSI (NSSI group) and ED patients without NSSI (non-NSSI group) were analyzed to identify potential predictors of NSSI in ED.

**Results:** Among all ED individuals, 242 (17.9%) reported a history of NSSI. Compared to the non-NSSI group, the NSSI group reported more severe eating symptomatology, more comorbid psychiatric disease, and more suicidal risk. Comorbid alcohol use disorder, depressive disorder, purging behavior, history of suicide attempt, and rumination symptoms were uncovered as predictors of NSSI in ED.

**Conclusion:** The findings of the study are meaningful in that they highlight predictors of NSSI in ED in a large clinical sample. Understanding risk factors of NSSI and offering appropriate interventions are important to preventing suicidality in ED.

**Key Words:** Eating disorder, non-suicidal self-injury, risk factor, predictor

### INTRODUCTION

Non-suicidal self-injury (NSSI) is a socially unaccepted behavior defined as an act of deliberate, self-inflicted damage to one's own body surface without intent to die.<sup>1,2</sup> NSSI can be categorized into 'impulsive' acts, such as skin cutting or burning, and 'compulsive' acts, such as hair pulling or skin picking.<sup>3</sup> Compared to an average incidence rate of 4–18% in the general population, NSSI is known to occur at an unusually high comorbid-

ity rate in eating disorder (ED), with incidence rates of 14–68% in anorexia nervosa and 25–55% in bulimia nervosa.<sup>3–6</sup> Considering that both NSSI and ED are known to be independently associated with an increased risk of suicidality,<sup>7</sup> it is of tremendous clinical importance to identify and to continue to investigate risk factors of NSSI in ED.

Although NSSI behaviors and ED symptoms have different apparent symptoms, both share major phenomenological characteristics, as both are self-damaging behaviors.<sup>8</sup> Considering the high comorbidity rate for NSSI in ED and the possibility of synergistic morbidity, researchers have suggested that NSSI and ED may share similar pathogenesis.<sup>8–10</sup> Both ED and NSSI initially occur in adolescence or early adulthood and have higher prevalences in women than in men.<sup>11</sup> Moreover, both ED and NSSI share identical psychosocial risk factors, such as history of abuse,<sup>12,13</sup> impulsivity,<sup>14,15</sup> depressive symptoms,<sup>8,13</sup> emotion dysregulation,<sup>16,17</sup> etc. Furthermore, recent research has indicated that both diseases share underlying neurobiological and psychological mechanisms, such as noradrenergic dysfunction, impulsivity, obsessive-compulsive characteristics, affect dys-

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regulation, dissociation, self-criticizing cognitive style, and need for control,<sup>8,18,19</sup> and comorbidity of the same psychiatric disorders, such as depression, anxiety, suicidality, and substance abuse.<sup>8,20,21</sup>

Despite the clinical importance of NSSI due to a high prevalence in ED and correlation with suicidal risk of ED, studies have only been conducted on potential risk factors for ED and NSSI individually, and studies on risk factors of NSSI in clinical ED samples are scarce. NSSI estimates in ED vary widely in each study, and related reviews on the topic remain at the narrative level.<sup>6,8</sup> Svirko and Hawton<sup>8</sup> suggested impulsivity, obsessive-compulsive characteristics, affect dysregulation, dissociation, self-criticizing cognitive style, and need for control as potential risk factors of ED and NSSI. Furthermore, they suggested that early trauma, such as childhood sexual abuse and possibly certain characteristics of the early family environment, may contribute to these factors. Also, in an earlier study conducted on 245 ED patients in order to reveal putative risk factors for NSSI in ED, negative self-evaluation, suicide attempts, lifetime substance use, peer aggression, low weight in parents, family tension at mealtime, parental alcohol problems, childhood abuse, and some negative antecedent life events were identified as risk factors of NSSI in ED.<sup>22</sup> In addition, a few studies have mentioned impulsivity, negative childhood experience (neglect, physical and sexual abuse, etc.), negative affectivity as related risk factors for NSSI in ED.

Therefore, we designed this study to investigate predictors NSSI in ED patients using a large clinical sample. As far as we know, this is the first study in Korea to investigate risk factors of NSSI in an ED clinical sample. Consistent with previous research and conceptual models,<sup>1,8,22</sup> we aimed to see how risk factors, such as impulsivity, obsessive-compulsive characteristics, etc., appear as predictors of NSSI in an actual clinical ED population.

## MATERIALS AND METHODS

### Participants

The participants consisted of 1355 women who visited an ED outpatient clinic for treatment. All participants were included after being diagnosed with ED according to the Diagnostic and Statistical Manual of Mental Disorders-fifth edition (DSM-5)<sup>2</sup> after interview and evaluation by a certified psychiatrist. This study was carried out under the guidelines for the use of human participants established by the Institutional Review Board at Severance Mental Health Hospital, Yonsei University (SMH-090703).

### Measures

To assess all participants, a semi-structured diagnostic interview by a psychiatrist was conducted. According to DSM-5, NSSI was defined as deliberate, self-inflicted destruction of body tissue without suicidal intent and for purposes not socially sanc-

tioned, including behaviors, such as cutting, burning, biting, and scratching skin.<sup>2</sup> History of NSSI (positive/negative) and its frequency were evaluated after interviews with the psychiatrist. In addition, in order to objectively evaluate eating psychopathology and other psychopathological features, such as depressing, anxiety, and obsessive-compulsive behavior, we asked all of the subjects to complete self-report questionnaires, such as Eating Disorders Inventory-2 (EDI-2),<sup>23</sup> Beck Depression Inventory (BDI),<sup>24</sup> Beck Anxiety Inventory (BAI),<sup>25</sup> Maudsley Obsessive Compulsive Inventory (MOCI).<sup>26</sup>

The EDI-2 is a self-report questionnaire consisting of 91 items scored on a 6-point scale, with 11 subscales that measure symptoms and psychological factors associated with ED symptoms: drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears, asceticism, impulse regulation, and social insecurity.<sup>23,27</sup> The Cronbach's alpha value for the EDI-2 is 0.77–0.93 for Koreans.<sup>23</sup> The MOCI is a 30-item self-report test that assesses four types of obsessive compulsive complaints: checking, washing, doubting, and slowness. The Cronbach's alpha value of MOCI is 0.80 for Koreans.<sup>26</sup> The BDI is a self-report questionnaire that evaluates the intensity of depression,<sup>24</sup> and the Cronbach's alpha value for the BDI is 0.85 for Koreans.<sup>28</sup> The BAI is a self-report questionnaire that measures anxiety symptom severity,<sup>25</sup> and the reliability and validity of the Korean version are well established.<sup>29</sup>

### Statistical analysis

To compare demographic and clinical characteristics of ED patients with and without NSSI, we used chi-square tests and independent t-tests for categorical and continuous variables, respectively. Results are presented as means and frequencies. The significance threshold for each test was  $p < 0.05$ . A binary logistic regression model was used to identify factors strongly associated with NSSI in ED patients. The effects of several factors on NSSI in ED were investigated, including onset age, current age, duration of illness, hospitalization history, suicide attempt history, comorbidity of alcohol use disorder, comorbidity of depressive disorder, comorbidity of anxiety disorder, binge and purging behavior (as defined in DSM-5 criteria<sup>2</sup>), EDI subscales, and MOCI subscales. The final model was selected by means of backward stepwise procedures. Results are presented as odd ratios (ORs) and 95% confidence intervals. The global predictive capacity of the final selected model was measured with Nagelkerke's  $R^2$  model. All statistical analyses were conducted using SPSS version 25.0 (IBM Corp., Armonk, NY, USA).

## RESULTS

### Demographic and clinical characteristics

The average age of the participating ED subjects was 23.12 (SD=6.09) years, and the average duration of disease was 3.78 (SD=

4.42) years (Table 1). In this study, among 1355 ED subjects, 242 (17.9%) showed NSSI symptoms.

**Differences between ED with NSSI and ED without NSSI**  
ED patients with NSSI showed younger onset age (18.5±4.3

**Table 1.** Demographic and Clinical Characteristics of the Non-NSSI and NSSI Groups

	NSSI group, n=242	Non-NSSI group, n=1113	p value
Current age (yr)	22.0±5.9	23.4±6.1	0.002*
Onset age (yr)	18.5±4.3	19.5±5.0	0.001*
Current BMI (kg/m <sup>2</sup> )	19.5±3.7	19.6±3.7	0.683*
Max and min weight range (kg)	17.7±9.3	17.7±8.5	0.999*
Duration of illness (yr)	3.7±4.0	3.8±4.5	0.655*
Amenorrhea history (%)	66.5	66.4	0.896 <sup>†</sup>
Duration of amenorrhea (months)	11.3±14.7	9.8±12.4	0.218*
Hospitalization history (%)	12.0	4.1	<0.001 <sup>†</sup>
Suicide attempt history (%)	55.20	11.20	<0.001 <sup>†</sup>
Suicide attempt frequency	3.4±8.9	1.2±1.5	0.005*
Alcohol use disorder (%)	10.7	5.2	0.003 <sup>†</sup>
Depressive disorder (%)	53.7	22.0	<0.001 <sup>†</sup>
Diagnosis (%)			0.055
Anorexia nervosa, restricting type	9.5	5.0	
Anorexia nervosa, binge-eating/purging type	12.9	19.4	
Bulimia nervosa	41.3	40.1	
Binge eating disorder	16.1	15.3	
Other specified feeding or eating disorder	19.7	19.8	
EDI, drive for thinness	15.5±4.9	14.0±5.6	<0.001*
EDI, bulimia	13.6±5.5	11.7±6.0	<0.001*
EDI, body dissatisfaction	17.5±7.9	15.1±7.6	<0.001*
EDI, ineffectiveness	18.0±7.8	12.5±7.8	<0.001*
EDI, perfectionism	8.4±4.6	7.2±4.2	<0.001*
EDI, interpersonal distrust	8.4±5.3	5.7±4.7	<0.001*
EDI, interoceptive awareness	16.5±7.0	13.0±7.3	<0.001*
EDI, maturity fears	11.4±7.0	9.0±5.5	<0.001*
EDI, asceticism	9.5±4.5	8.1±4.0	<0.001*
EDI, impulse regulation	13.4±7.2	7.8±6.0	<0.001*
EDI, social insecurity	12.3±0.8	8.8±5.3	<0.001*
MOCI total score	11.7±6.8	9.0±5.7	<0.001*
MOCI, checking	2.9±2.0	2.3±1.8	<0.001*
MOCI, tidiness	1.6±1.5	1.2±1.3	<0.001*
MOCI, doubting	3.2±2.0	2.6±1.9	<0.001*
MOCI, fear of contamination	1.1±1.2	0.8±1.1	0.003*
MOCI, rumination	1.0±0.9	0.6±0.8	<0.001*
Beck Depression Index	29.5±11.2	21.3±10.2	<0.001*
Beck Anxiety Index	27.3±13.8	17.9±12.2	<0.001*

BMI, body mass index; EDI, Eating Disorder Inventory; NSSI, non-suicidal self-injury; MOCI, Maudsley Obsessive-Compulsive Inventory.  
\*t-test, <sup>†</sup>chi-square test.

years old) (Table 1). In total, 12% of patients in the ED with NSSI group and 4.1% of patients in the ED without NSSI group reported a history of psychiatric hospitalization. In the ED with NSSI group, comorbid rates of alcohol use disorder and depressive disorder were significantly higher, as were a history and frequency of suicidal attempts.

EDI-2 was conducted to evaluate ED symptoms, and the results for all 11 subscales were significantly higher in the ED with NSSI group than in the ED without NSSI group, including drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears, asceticism, impulse regulation, and social insecurity. In addition, compared to the ED without NSSI group, the ED with NSSI group reported significantly higher numbers in all categories of the MOCI scale. BDI and BAI also revealed significantly higher numbers in the ED with NSSI group than the ED without NSSI group.

**Factors associated with NSSI in ED**

Binary logistic regression was performed to identify the most significant variables associated with NSSI in ED. The most significant risk factor was a history of suicide attempt (OR=6.998). The model also identified comorbid alcohol use disorder (OR=2.590), comorbid depressive disorder (OR=1.864), comorbid purging behavior (OR=1.618), rumination symptom (as reflected by MOCI rumination score, OR=1.288), current age (OR=0.951) as important factors associated with NSSI in ED (Table 2).

**DISCUSSION**

The findings in this study highlight predictors of NSSI in ED and indicate that ED patients with and without NSSI differ significantly. In the current study, we found that 242 ED patients reported NSSI out of a total of 1355 ED subjects, which confirms a high prevalence of NSSI in ED patients. The most significant determinant of NSSI in ED patients was a history of suicide attempt, and comorbid alcohol use, depressive disorder, and purging behavior, along with rumination symptoms,

**Table 2.** Factors Associated with a History of Non-Suicidal Self-Injury in Eating Disorder

	B	SE	Wald	OR (95%CI)	p value
Current age	-0.050	0.016	9.604	0.951	0.002
Purging behavior	0.481	0.187	6.591	1.618	0.010
MOCI, rumination	0.253	0.107	5.578	1.288	0.018
Alcohol use disorder	0.952	0.441	4.666	2.590	0.031
Depressive disorder	0.623	0.210	8.816	1.864	0.003
Suicide attempt history	1.946	0.506	9.932	6.998	0.002

MOCI, Maudsley Obsessive-Compulsive Inventory; SE, standardized estimate; OR, odds ratio; CI, confidence interval.  
R<sup>2</sup>=0.301.

were also found to be significant risk factors.

Our findings confirmed that ED accompanied by NSSI occurs at a young age. In addition, ED individuals with NSSI appeared to have more severe eating symptomatology. Also, we found that ED patients with NSSI had more comorbid psychiatric disorders, such as alcohol use and depressive disorders. ED with NSSI also had a higher probability of suicide attempt history, with a higher number of suicide attempts. The ED patients with NSSI also more commonly reported discomfort from obsessive characteristics, such as checking, tidiness, doubting, fear of contamination, and rumination. Showing higher severity, comorbidity, and suicidal risk of symptoms, these results emphasize the importance of careful evaluation and clinical intervention in ED patients with NSSI.

In addition, we confirmed that not only do alcohol use disorder and depressive disorder have high comorbidity with NSSI in ED, but they are also important risk factors of NSSI in ED. As suggested in the model of Claes and Muehlenkamp,<sup>1</sup> psychiatric disorders, such as depressive disorder and alcohol use disorder, are common risk factors for the development of both ED and NSSI. In addition, both ED and NSSI are known to frequently co-occur with other health-risk behaviors,<sup>30</sup> and our findings highlight a high comorbidity rate for alcohol use disorder in ED patients with NSSI.

Interestingly, our finding also confirmed that rumination symptom is an important risk factor for NSSI in ED. In NSSI, the existence of functions used to escape or relieve negative affective states is known. Rumination is one maladaptive cognitive coping strategy that plays a role in exacerbating negative affect<sup>31</sup> and depression,<sup>32</sup> and shows correlation with various psychiatric disorders, including anxiety<sup>33</sup> and substance abuse.<sup>34</sup> Individuals with repetitious rumination ultimately respond to stressors and fail to solve problems using adaptive coping strategies, amplifying the negative affect by focusing on internal thoughts and emotions.<sup>32</sup> Therefore, individuals ultimately fail to endure the state of extremely aversive negative affect and fall into a vicious cycle of conducting NSSI to regulate the state. Our results reconfirm the emotional cascade model, which suggests that when an emotional cascade between intense states of negative affectivity and a high level of rumination are repeated and amplified, cascade is stopped and dysregulated behaviors, such as NSSI, are attempted to distract from rumination.<sup>35</sup> In addition, our findings that rumination is a predictor of NSSI in ED patients are consistent with Selby, et al.<sup>36</sup> finding that unstable rumination interacting with high negative emotions is a predictor of NSSI engagement. In the past, Arbuthnott's study on university students proved the emotional cascade model in subjects with ED and NSSI, and our finding is meaningful in that we confirmed a similar result in a clinical sample.<sup>37</sup>

Our analysis also showed that comorbidity of purging behavior and a history of suicide attempts are also important predictors of NSSI in ED. The interpersonal-psychological theory of suicidal behavior suggests that individuals who experience

repeated numerous painful and/or provocative events habituate pain or injury.<sup>38</sup> These individuals ultimately are more willing to engage in injurious behaviors that induce pain. In the same context, it can be said that our findings support that individuals with painful purging symptomatology and/or injurious suicide attempt history habituate fear of pain and have a higher pain tolerance; thus, they are more likely to engage in NSSI.

Our study has several potential limitations. First, we were unable to evaluate a history of abuse or trauma. In following research, history of neglect, abuse, or trauma should be additionally evaluated and analyzed. Second, the study was conducted cross-sectionally. It would be helpful if prospective, longitudinal outcome studies of NSSI in subjects with EDs were to be conducted in the future. Third, there was a limitation due to the lack of information on length and frequency of psychiatric hospitalization among the study subjects.

This study highlights the importance of assessing NSSI and risk factors of NSSI among ED individuals. Not only do ED patients have serious and high incidence rates of NSSI clinically, but NSSI is also a chronic psychiatric disorder with high suicidality rate.<sup>39</sup> Therefore, it is of utmost importance to develop a therapeutic plan based on systematic evaluation of patient symptoms.

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## AUTHOR CONTRIBUTIONS

**Conceptualization:** Jaeun Ahn and Young-Chul Jung. **Data curation:** Jung-Hyun Lee. **Formal analysis:** Jaeun Ahn. **Funding acquisition:** Young-Chul Jung. **Investigation:** Jung-Hyun Lee. **Methodology:** Jaeun Ahn. **Project administration:** Young-Chul Jung. **Resources:** Jung-Hyun Lee. **Software:** Jaeun Ahn and Young-Chul Jung. **Supervision:** Young-Chul Jung. **Validation:** Young-Chul Jung. **Visualization:** Jaeun Ahn. **Writing—original draft:** Jaeun Ahn. **Writing—review & editing:** Jaeun Ahn and Young-Chul Jung. **Approval of final manuscript:** all authors.

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