Research

Emotional Dysregulation and Nonsuicidal Self-Injury: A Meta-Analytic Review

Jianing You[1,†], Yaxuan Ren[1], Xu Zhang[1], Zhilong Wu1, Sian Xu[1], Min-Pei Lin[2,†]

Abstract

Emotion dysregulation is generally agreed to be an important risk factor for non-suicidal self-injury (NSSI). It is not clear, however, which aspects of emotional dysregulation are more strongly related to NSSI. This article aimed to present a meta-analytic review of the associations between the different dimensions of emotional dysregulation and NSSI. In total, 42 studies with 46 samples were included in the meta-analyses. Results showed that higher levels of emotional dysregulation in all eight dimensions (i.e., lack of emotional awareness, lack of emotional clarity, non-acceptance of emotional responses, limited access to effective emotional regulation strategies, difficulties controlling impulses when experiencing negative emotions, difficulties engaging in goal-directed behaviors when experiencing negative emotions, inability to express emotions, and emotional reactivity) were associated with increased risk of NSSI, with the strength of the associations between emotional reactivity and limited access to effective emotional regulation strategies and NSSI being the strongest. Moreover, NSSI measure type significantly moderated the association between limited access to emotional regulation strategies and NSSI. Findings of this review highlight some limitations of the existing literature, such as the use of cross-sectional designs, the inclusion of predominantly individuals from western countries, and the lack of examination of the mechanisms underlying the emotional regulation function of NSSI. These limitations represent important directions for future research.

Keywords

Emotional dysregulation, Non-suicidal self-injury, Meta-analysis, Review

Introduction

Non-suicidal self-injury (NSSI), according to the Diagnostic and Statistical Manual of Mental Disorders [1], is defined as the "intentional self-inflicted damage to the surface of one's body of a sort likely to induce bleeding, bruising, or pain (e.g., cutting, burning, stabbing, hitting, excessive rubbing), with the expectation that the injury will lead to only minor or moderate physical harm (i.e., there is no suicidal intent)." (p.803). This behavior has become a major public health concern. A meta-analysis of the prevalence of NSSI among nonclinical samples revealed that 17.2% of adolescents, 13.4% of young adults, and 5.5% of adults have engaged in NSSI [2]. These rates are even higher among clinical samples of adolescents (30%-45%) [3,4] and adults (21%) [5]. Apart from the prevalence of NSSI, this behavior may also lead to a variety of negative consequences, including damaged

[1]Center for Studies of Psychological Application, Guangdong Key Laboratory of Mental Health and Cognitive Science, & School of Psychology, South China Normal University, China

[2]Department of Educational Psychology and Counseling, National Taiwan Normal University, Taipei City 106, Taiwan

[†]Author for correspondence: HMin-Pei Lin, Department of Educational Psychology and Counseling, National Taiwan Normal University, Taipei City, Taiwan, Tel: +886-2-77343770; Fax: +886-2-23413865; email: lmmpp@ntnu.edu.tw

Jianing You, School of Psychology, South China Normal University, Guangzhou, China, Tel: (86) 020-85216499; Fax: (86) 020-85216421; email: youjianing@gmail.com

relationships [6], self-directed negative emotions (e.g., shame and self-hatred) [7], and even suicide attempts [8,9]. Therefore, understanding the risk factors of NSSI has become an urgent task.

Emotional dysregulation is an important risk factor for NSSI. On the one hand, many models have conceptualized NSSI as an emotional regulation strategy, being used to regulate negative affects [10-13]. On the other hand, in addition to being added as its own condition in the DSM-5, NSSI is also a symptom of borderline personality disorder (BPD) [1], whose central feature is emotional dysregulation [14-16]. Despite the generally agreed role of emotional dysregulation in NSSI, it is unclear, however, to what extent different dimensions of emotional dysregulation are related to NSSI. This information is important in formulating effective prevention and intervention programs for NSSI.

The primary aim of the present article was to present a systematic meta-analytic review of the associations between different dimensions of emotional dysregulation and NSSI. We first began with a brief overview of the conceptualizations of emotional dysregulation. Then, we reviewed theoretical models linking emotional dysregulation to NSSI and empirical studies of these associations. Finally, we integrated empirical findings and offered recommendations for future research.

■ Conceptualization of Emotional Dysregulation

Conceptualizations of emotional dysregulation varied across studies. Generally, it is defined by two approaches. The first approach emphasizes the regulation of the experience and the expression of emotions per se. Under this approach, some researchers believe that emotional dysregulation refers to the failure in changing the reactivity of emotions and expressing emotions [17,18]. Other researchers, on the other hand, argue that successful emotion regulation does not change the experience of emotions; rather, it requires acceptance and valuing of emotional responses [15,19]. Accordingly, emotional dysregulation refers to unacceptance and devaluing of emotions. The second approach of conceptualizing emotional dysregulation emphasizes the regulation of behaviors when experiencing negative emotions [20]. Such regulation may include inhibiting impulsive behaviors and/or engaging in goal-directed behaviors. Correspondingly, unsuccessful regulation, or emotional dysregulation, is the inability or difficulties in inhibiting impulsive behaviors and/or engaging in goal-directed behaviors.

From both approaches, Gratz and Romer [21] extracted six dimensions in defining emotional dysregulation: (a) lack of awareness of emotional responses, (b) lack of clarity of emotional responses, (c) non-acceptance of emotional responses, (d) limited access to emotional regulation strategies perceived as effective, (e) difficulties controlling impulses when experiencing negative emotions; and (f) difficulties engaging in goal-directed behaviors when experiencing negative emotions. To more comprehensively conceptualize emotional dysregulation, we added another two components: an unwillingness to outwardly display emotions (i.e., emotional inexpressivity) and high emotional sensitivity, emotional intensity, and emotional persistence (i.e., emotional reactivity). Thus, the present study will use the eight dimensions in the conceptualization of emotional dysregulation.

■ Measurement of Emotional Dysregulation

Gratz and Roemer developed the Difficulties in Emotion Regulation Scale (DERS) to assess six dimensions of emotional dysregulation [21]. Apart from the DERS, other measurements also assess certain dimensions of the current conceptualization of emotional dysregulation. For example, the Difficulty Identifying Feelings subscale, the Difficulty Describing Feelings subscale in the Toronto Alexithymia Scale [22], and the Poor Awareness subscale in the Emotion Expression Scale for Children [23-24] measure the dimension of lack of clarity of emotional responses. The Externally-Oriented Thinking subscale in the Toronto Alexithymia Scale [22], the Negative Mood Regulation Scale [25], the Cognitive Emotion Regulation Questionnaire [26], the Reappraisal subscale in the Emotion Regulation Questionnaire [27], and the Emotion Regulation Coping subscale in the Children's Emotion Management Scales [28] assess the dimension of limited access to effective emotion regulation strategies. Additionally, the Expressive Reluctance in the Emotion Expression Scale for Children [23,24], the Emotion Expression Scale [29], and the Suppression subscale in the Emotion Regulation Questionnaire [27] assess the dimension of emotional inexpressivity. Finally, the Emotion Reactivity Scale [30] assess the dimension of emotional reactivity. Studies using all these scales to examine the relationship between emotional dysregulation and NSSI would be included in the present meta-analyses.

■ Emotional Dysregulation and NSSI

Emotional dysregulation as a risk factor for the engagement in NSSI has been conceptualized in many theoretical models. Specifically, Nock and Prinstein [12] has proposed a four-function model of NSSI. This model is rooted in the behavioral tradition and proposes that NSSI is maintained via four possible reinforcement processes. These processes differ along two dimensions: whether the consequent events are intrapersonal or interpersonal and whether the reinforcement is positive or negative. The two dimensions produce four functions of NSSI. They are intrapersonal positive reinforcement function (e.g. to feel something), intrapersonal negative reinforcement function (e.g., to relieve depression), interpersonal positive reinforcement function (e.g. to get attention) and interpersonal negative reinforcement function (e.g., to avoid punishment). Both of the intrapersonal functions may be especially pertinent in the case of individuals with emotional dysregulation. Indeed, some researchers demonstrated that the two intrapersonal functions may be combined into one affect regulation function [31].

Another model that highlights the role of emotional dysregulation in NSSI is the experiential avoidance model [10]. This model assumes that individuals who engage in NSSI do not accept or feel comfortable with their current internal experiences. They thus want to use NSSI to avoid, or escape from these unwanted experiences or those external conditions that elicit them. This model is also a behavioral model of NSSI, hypothesizing that NSSI is maintained and strengthened through the process of escape conditioning and negative reinforcement.

Apart from the four-function model and the experiential avoidance model that specifically address the engagement in NSSI, other models explaining the engagement in dysregulated behaviors in general also agree that emotional dysregulation may play a central role in the engagement in NSSI. For example, Linehan's biosocial theory of borderline personality disorder considers emotional dysregulation the key of borderline pathology [15]. Linehan believes that emotional dysregulation results from both biological underpinnings (e.g. difficulties in limbic reactivity and attention control) and invalidating family environment. Most borderline behaviors, including the engagement in NSSI, are the attempts on the part of the individual to regulate emotions or outcomes of emotional dysregulation.

Additionally, Selby and Joiner proposed an emotional cascade model [32]. This model argues that when people are experiencing extreme negative emotions, some of them tend to ruminate intensely about the event that initiates these negative feelings. Rumination, then in turn, amplifies negative emotions. Thus, negative emotions and ruminations may form an "emotional cascade", reciprocally aggravating each other over time. When the intensity of negative emotions exceeds one's tolerance level, one may engage in dysregulated behaviors (e.g., NSSI) to distract oneself from this feedback loop of negative emotions and ruminations. Underlying this model are the assumptions that individuals engaging in NSSI are likely to have high emotional reactivity, and difficulties in accepting their emotional responses (and thus they ruminate again and again), accessing to effective emotional regulation strategies, controlling impulses when experiencing negative emotions, and/or engaging in goal-directed behaviors when experiencing negative emotions.

Empirical studies on the link between emotional dysregulation and NSSI generally support their association. In qualitative reviews of functions and models of NSSI, researchers found converging and the strongest evidence for the affect regulation function [11,33]. Other studies also reported a positive correlation between emotional dysregulation in general and NSSI [34]. But which aspects of emotional dysregulation are more strongly related to NSSI is still unknown. Thus, the main goal of this review was to examine the differential associations between different dimensions of emotional dysregulation and NSSI. We also assessed whether the link between emotional dysregulation and NSSI differed across sample age groups (i.e., adolescents vs. adults), sample population groups (i.e., community samples vs. clinical samples), NSSI outcome types (i.e., binary NSSI outcome vs. continuous NSSI outcome), and NSSI assessment timeframe (i.e., NSSI over the past 12 months vs. NSSI over more than 12 months).

Method

■ Eligibility criteria and study selection

Given that the primary objective of the present meta-analysis was to examine the link between emotional dysregulation and NSSI, only empirical studies that examined the associations between any of the eight dimensions of emotional

dysregulation and NSSI would be included in this article. Studies that assessed only emotional dysregulation, assessed only NSSI, assessed other emotional problems (e.g. depressive and anxiety disorder) falling out of the present conceptualization of emotional dysregulation were not included. After jointly establishing these eligibility criteria, we selected the most widely used electronic search engines including Google Scholar, Web of Science, PubMed, and PsycInfo to search articles written in English published up to March 1st, 2017.

To provide the most comprehensive meta-analysis possible, we included a wide range of search terms. This is especially important because emotional dysregulation was a multi-faceted construct (i.e., eight dimensions in the present article) and research examining NSSI has used many different terms to describe these behaviors. Search terms included the combinations of the words related to NSSI (i.e., self-injury, self-harm, self-mutilation) with the words related to emotional dysregulation (i.e., emotional dysregulation, emotion regulation, emotional acceptance, emotional clarity, emotional strategies, emotional impulse, emotional awareness, emotional goals, emotional

responding, emotional willingness, emotional understanding, emotion expressiveness, emotion expressivity, emotion inexpressivity, emotion reactivity, and emotion intensity). A wildcard asterisk was used to allow for variation in these terms, and to maximize inclusivity.

The study selection process used in the present article was outlined in **Figure 1**. Through this process, we identified 3,418 unique published articles. We then read the abstracts of these articles to determine their eligibility. After this step, we retained 209 articles. Articles were excluded because they clearly did not meet inclusion criteria. Next, we read the full texts of the remaining published articles. At this point, we excluded 127 studies because they did not include assessments of both emotional dysregulation (i.e., the eight dimensions in the present study) and NSSI. For the remaining 82 studies that met our inclusion criteria, 47 of them did not contain necessary statistical information for the meta-analysis. We contacted authors of these articles and requested for relevant data. Seven authors replied and provided the necessary data. Thus, the 40 articles without necessary statistical information were excluded. Finally, 42 articles remained and are summarized in the
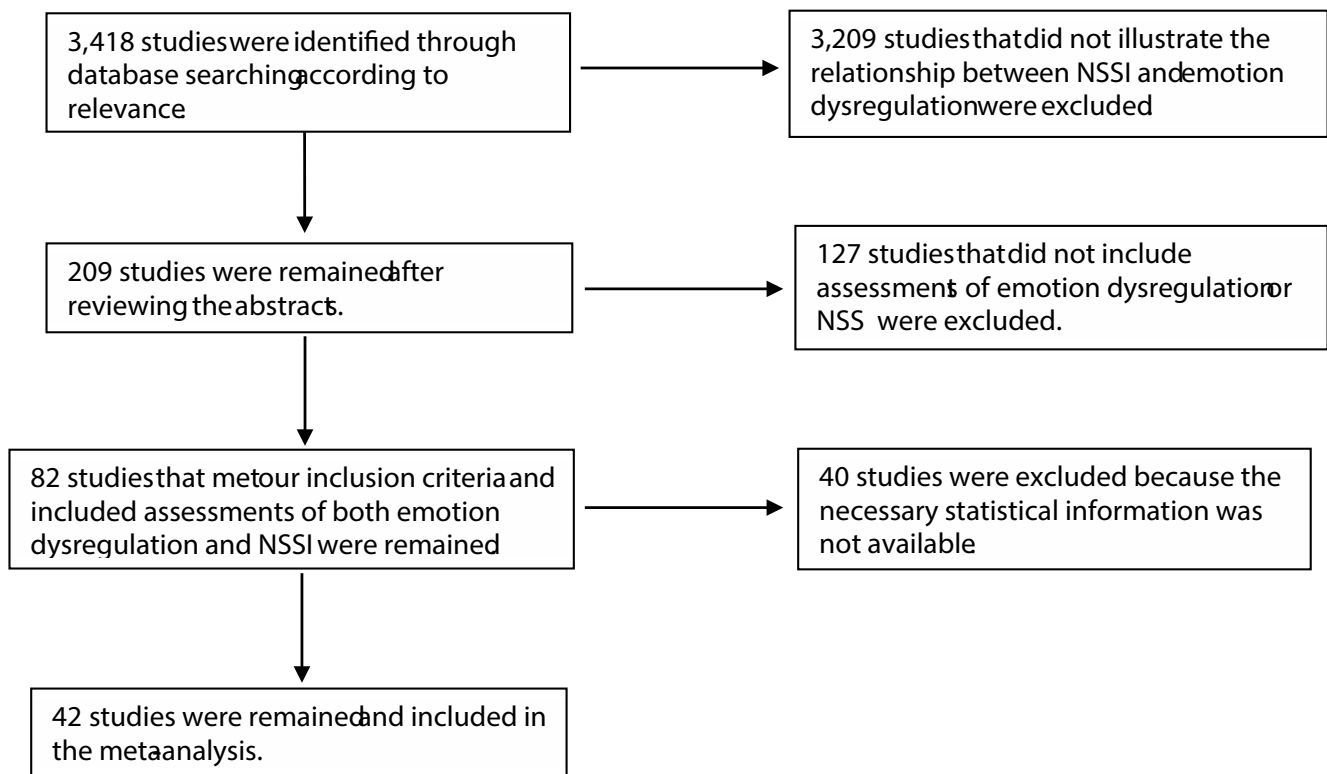

Figure 1: The study selection process used in the present meta-analysis.

meta-analysis. Authors examined each study and coded several study characteristics **(Table 1)**.

■ Meta-analytic procedure

Among the 42 remaining articles, four included separate samples (one included a low BPD group and a high BPD group, two included a female sample and a male sample, and one included a clinical sample and a community sample). Thus, the meta-analysis was performed with a total of 46 samples. We used the software Comprehensive Meta-Analysis Version 2 [35], following the procedures outlined by Card [36]. Pearson correlation coefficient (Pearson's r) was chosen as the effect size in the present study, because Pearson's r represents a useful and readily interpretable index of effect size for the

relationship between two variables [36]. In cases where Pearson's rs were not reported, they were derived whenever possible from available data in the study (e.g., means and standard deviations). In our meta-analysis, we began by calculating the effect size Pearson's r for each of the included samples. Next, we calculated the overall weighted effect size across the samples to obtain the typical effect size found in the empirical literature. We then evaluated the variability in effect sizes across studies, using the Q statistics (statistically testing heterogeneity) and the I^2 index (representing the amount of heterogeneity). I^2 values range from 0–100%, with 25% representing a small amount of heterogeneity, 50% a medium amount, and 75% a large amount [36]. Finally, we conducted moderator analyses to examine

Table 1: Study characteristics.

Study author(s) (year)	N	Mean age	Sample age group	Sample population group	NSSI measure	ED measure	NSSI assessment time frame	NSSI outcome type
Adrian et al. [70]	99	16.08	Adolescents	Clinical	SHBQ	DERS/EESC		Continuous
Anderson & Crowther [71]	164	18.86	Adults	Community	DSHI	DERS/TAS	Lifetime	Binary
Eichen et al. [72]	483	20.61	Adults	Community	FASM	DERS	12-month	Binary
Emery et al. [73]	86		Adults	Community	HIDS	DERS	Lifetime	Binary
Evren and Evren [74]	136	36.42	Adults	Clinical		TAS		Binary
Franklin et al. [75]	72	19.09	Adults	Community	FASM	DERS	12-month	Binary
Franklin et al. [76]	42	21.86	Adults	Community	SITBI	DERS/ERS	Lifetime	Binary
Garisch & Wilson [77]	319	16.67	Adolescents	Community	Survey instrument	TAS	Lifetime	Binary
Garisch & Wilson [78]	1162	16.35	Adolescents	Community	DSHI	TAS	Lifetime	Binary
Gholamrezaei et al. [79] Female	317		Adults	Community	HIDS	DERS	Lifetime	Continuous
Gholamrezaei et al. [79] Male	237		Adults	Community	HIDS	DERS	Lifetime	Continuous
Glenn & Klonsky [81]	198	15.13	Adolescents	Clinical	ISAS	DERS	Lifetime	Binary
Gomez-Exposito et al. [82]	78		Adults	Community	ISAS	ERS	Lifetime	Binary
Gratz [83]	85	28.57	Adults	Clinical	Single-item measure	DERS	Lifetime	Binary
Gratz et al. [84] Female	260		Adults	Community	DSHI	DERS	Lifetime	Continuous
Gratz & Roemer [85] Male	97		Adults	Community	DSHI	DERS	Lifetime	Continuous
Gratz & Roemer [86]	249	23.29	Adults	Community	DSHI	DERS	Lifetime	Binary
Gratz & Tull [87]	61	44.45	Adults	Clinical	DSHI	DERS	Lifetime	Binary
Heath et al. [88]	249	23.29	Adults	Community	DSHI	EES	Lifetime	Continuous
Holly[89] high BPD	100		Adults	Community	DSHI	DERS/EES	Lifetime	Binary
Gratz and Tull [87] low BPD	292		Adults	Community	DSHI	DERS/EES	Lifetime	Binary
Heath et al. [88]	46	20.24	Adults	Community	DSHI	DERS	Lifetime	Binary
Holly [89]	200	19.49	Adults	Community	HIDS	DERS	Lifetime	Binary
In-Albon et al. [90]	59		Adolescents	Clinical	FASM	DERS	12-month	Binary
Kranzler et al. [91]	148	21.48	Adults	Community	DSHI	DERS	Lifetime	Continuous
Levesque et al. [92]	797	19.65	Adults	Community	OSI	DERS	6-month	Continuous
Ludtke et al. [93]	72	16.08	Adolescents	Clinical	DSM-5	TAS	Lifetime	Binary
Martin et al. [94]	455	40.11	Adults	Clinical	DSHI	DERS	Lifetime	Binary
Muehlenkamp et al. [95]	1855	19.7	Adults	Community	DSHI	DERS	Lifetime	Binary
Nock et al. [96]	87	17	Adolescents	Clinical/Community	SITBI	ERS	12-month	Binary
Perez et al. [97]	218	15.93	Adolescents	Clinical	DSHI	DERS	Lifetime	Binary
Pisetsky et al. [98]	110	33.5	Adults	Clinical	SITBI	DERS	Lifetime	Binary
Selby et al. [99]	142	18.75	Adults	Community	FASM	CERQ	Lifetime	Continuous

Study author(s) (year)	N	Mean age	Sample age group	Sample population group	NSSI measure	ED measure	NSSI assessment time frame	NSSI assessment type
Selby et al. [100]	47	24.3	Adults	Community	Interview	CERQ	2-week	Continuous
Sim et al. [101]	131	14.84	Adolescents	Clinical	SIBI	EESC	Lifetime	Continuous
Slee et al. [102]	90	24.2	Adults	Clinical	Interview	DERS	3-month	Continuous
Tatnell et al. [103]	2637	13.93	Adolescents	Community	SHBQ	ERQ	Lifetime	Binary
Thomassin et al. [104]	95	14.22	Adolescents	Clinical	DSHI	CEMS	Lifetime	Continuous
Tresno et al. [105]	313	19	Adults	Community	DSHI	NMRS	Lifetime	Continuous
Verrocchio et al. [106] Clinical	77	29.32	Adults	Clinical	DSHI	TAS	Lifetime	Continuous
Verrocchio et al. [106] Control	77	28.12	Adults	Community	DSHI	TAS	Lifetime	Continuous
Vieira et al. [107]	66	25.38	Adults	Clinical	SIQ-TR	DERS	Lifetime	Continuous
Voon et al. [108]	2637	13.9	Adolescents	Community	SHBQ	ERQ	Lifetime	Binary
Williams & Hasking [109]	289	22.52	Adults	Community	Self-made scale	ERQ	Lifetime	Continuous
Yurkowski et al. [110]	1153	19.35	Adults	Community	OSI	DERS	6-month	Continuous
Zelkowttz et al. [111]	355	18.62	Adults	Community	ISAS	DERS/ERS	Lifetime	Continuous

Notes: N=the number of participants included in the present meta-analyses

CEMS=Children's Emotion Management Scales; CERQ=The Cognitive Emotion Regulation Questionnaire; DERS=Difficulties with Emotion Regulation Scale; DSHI=Deliberate Self-Harm Inventory; EES=Emotion Expression Scale; EESC=The Emotion Expression Scale for Children; ERQ=Emotion Regulation Questionnaire; ERS=The Emotion Reactivity Scale; HIDS=The How I Deal with Stress Questionnaire; ISAS=The Inventory of Statements About Self-Injury; NMRS=Negative Mood Regulation Scale; OSI=Ottawa Self-Injury Inventory; SIQ-TR=The Self-Injury Questionnaire—Treatment Related; SIBI=Self-Injurious Behavior Interview; SITBI=Self-Injurious Thoughts and Behaviors Interview; TAS=Toronto Alexithymia Scale.

the impacts of our proposed moderators (i.e., sample age group, sample population group, NSSI outcome types, and NSSI assessment timeframe) on this variability, estimating effect sizes for each moderator level. A random-effects model was administered for all analyses, because results obtained from the random-effects models are more conservative and generalizable than those from the fixed-effects models [36]. To test for publication bias, Orwin's fail-safe N [37] was used. This method estimates the number of studies with an average effect size of 0 that would have to exist for their inclusion in the meta-analysis to lower the observed mean effect size to a non-meaningful level (i.e., r=0.1).

Results

■ The relationship between NSSI and emotional dysregulation

To specifically examine whether different dimensions of emotional dysregulation were related to NSSI with different magnitudes, meta-analyses of the relationships between NSSI and each of the eight dimensions of emotional dysregulation were conducted. A summary of the results are presented in **Table 2**. All eight mean effect sizes were significant at 0.001 level. The largest mean effect size was observed for emotional reactivity (r=0.324, a medium effect), following by limited access to effective emotional regulation strategies (r=0.246, a medium effect).

All the other mean effect sizes were small: for non-acceptance of emotional responses, r=0.211; for difficulties controlling impulses when experiencing negative emotions, r=0.198; for difficulties engaging in goal-directed behaviors when experiencing negative emotions, r=0.172; for emotional inexpressivity, r=168; for lack of clarity of emotional responses, r=0. 162; and for "lack of awareness of emotional responses", r=0.078 (with many studies reported a negative relationship between "lack of awareness of emotional responses" and NSSI). These results indicated that individuals who had more difficulties in all eight dimensions of emotional regulation, especially in reducing emotional reactivity and getting access to emotion regulation strategies, tended to engage in NSSI more frequently. Additionally, as suggested by the Q and I^2 statistics **(Table 2)**, all the mean effect sizes were heterogeneous, suggesting a need to explore the potential moderators of these mean effect sizes.

■ Moderator analyses

We conducted four moderator analyses, respectively for sample age group (i.e., adults vs. adolescents), sample population group (i.e., community vs. clinical samples), NSSI outcome type (i.e., binary NSSI outcome vs. continuous NSSI outcome), and NSSI assessment time frame (i.e., NSSI over the past 12 months vs. NSSI over more than 12 months). Results are presented in **Table 3-6**.

Table 2: Summary of the meta-analytic results of the correlation coefficients between emotional dysregulation and NSSI.

	Non-acceptance	Goals	Impulse	Awareness	Strategies	Clarity	Inexpressivity	Reactivity
N	28	28	29	27	39	35	8	4
Mean weighted effect size (r)	0.211	0.172	0.198	0.078	0.246	0.162	0.168	0.324
95% confidence interval	0.162-0.259	0.130-0.214	0.158-0.238	0.040-0.116	0.198-0.293	0.118-0.206	0.107-0.227	0.134-0.491
Z-test of the mean effect size	8.293***	7.916***	9.476***	4.027***	9.749***	7.146***	5.369***	3.270***
Standard error	0.006	0.004	0.004	0.003	0.008	0.005	0.005	0.036
Heterogeneity - Q (df)	115.010(27)***	80.407(27)***	79.288(28)***	58.184(26)***	285.098(38)***	141.692(34)***	25.597 (7)***	12.027(3)**
Heterogeneity -I^2	76.524%	66.421%	64.686%	55.314%	86.671%	76.004%	72.653%	75.056%
Orwin's failsafe N	31	20	28	5	60	2	5	9

Notes: N=number of observed studies

Non-acceptance=Non-acceptance of emotional responses; Goals=difficulties engaging in goal-directed behavior when experiencing negative emotions; Impulse=difficulties in controlling impulse when experiencing negative emotions; Awareness=lack of emotional awareness; Strategies=limited access to effective emotion regulation strategies; Clarity=lack of emotional clarity. Inexpressivity=the extent to which people are unwilling to outwardly display their emotions; Reactivity=emotion sensitivity, emotion intensity, and emotion persistence

** $p<0.05$; *** $p<0.001$

Q=Q statistics (statistically testing heterogeneity); I^2=I^2 index (representing the amount of heterogeneity)

Orwin's failsafe N=the number of studies with an average effect size of 0 that would have to exist for their inclusion in the meta-analysis to lower the observed mean effect size to $r=0.1$ level

In the first moderator analyses **(Table 3)**, sample age group moderated the relationships of difficulties engaging in goal-directed behaviors when experiencing negative emotions and lack of emotional clarity to NSSI, with the mean effect sizes drawn from adult samples being significantly smaller than that from adolescent samples. In the second moderator analyses for sample population group **(Table 4)**, only the strength of the association between difficulties engaging in goal-directed behaviors when experiencing negative emotions and NSSI changed as a function of the sample population group. The mean effect size drawn from clinical samples was significantly larger than that from community samples. In the third moderator analyses **(Table 5)**, NSSI outcome type moderated the relationships of nonacceptance of emotional responses, difficulties engaging in goal-directed behaviors when experiencing negative emotions, limited access to emotional regulation strategies, emotional reactivity, and emotional inexpressivity to NSSI, with studies using binary outcomes of NSSI engagement generating significantly larger mean effect sizes than studies using continuous outcomes of NSSI engagement. In the fourth moderator analyses **(Table 6)**, we only found the moderating effect of NSSI assessment timeframe in the relationship between difficulties engaging in goal-directed behaviors when experiencing negative emotions and NSSI, with studies assessing NSSI over more than 12 months generating a significantly larger

mean effect size than studies assessing NSSI over the past 12 months.

Discussion

The results of this review suggest that individuals who engage in NSSI experienced greater emotional dysregulation than those who do not engage in NSSI. These differences were significant in all eight dimensions of emotional dysregulation, with the differences in the dimensions of emotional reactivity and lack of effective emotional regulation strategies being the most pronounced. Despite the significant overall relationships, the magnitudes of the associations between emotional dysregulation and NSSI appear to be small to modest. Below, we discuss the main results of this meta-analysis.

First, our findings underscore the importance of assessing associations between different dimensions of emotional dysregulation and NSSI. All dimensions of emotional dysregulation, as defined in the present article, were associated with NSSI engagement, but different dimensions of emotional dysregulation varied in their strengths of associations with NSSI. In the present meta-analysis, we found that the dimension of emotional reactivity to be the most strongly related to NSSI engagement. Emotional reactivity refers to "the extent to which an individual experiences emotions (a) in response to a wide array of stimuli (i.e., emotional sensitivity), (b) strongly or intensely

Table 3: Summary of the moderator analyses for sample age group.

Variables	Adolescent			Adult				
	N	r	95% CI	N	r	95% CI	Q-value (df=1)	p-value
Non-acceptance	4	0.308***	0.197-0.411	24	0.195***	0.143-0.245	3.345	0.067
Goals	4	0.251***	0.172-0.327	24	0.160***	0.116-0.204	3.911	0.048
Impulse	4	0.187*	0.005-0.356	25	0.195***	0.154-0.235	0.008	0.931
Awareness	4	0.122	-0.063-0.299	23	0.069***	0.033-0.105	0.308	0.579
Strategies	8	0.261***	0.175-0.343	31	0.243***	0.181-0.303	0.118	0.732
Clarity	8	0.240***	0.134-0.341	27	0.131***	0.094-0.167	3.684	0.055
Inexpressivity	4	0.146***	0.083-0.207	4	0.192**	0.049-0.327	0.349	0.555
reactivity	1	0.442***	0.263-0.592	4	0.271***	0.132-0.399	2.366	0.124

Notes: Non-acceptance=non-acceptance of emotional responses; Goals=difficulties engaging in goal-directed behavior when experiencing negative emotions; Impulse=difficulties in controlling impulse when experiencing negative emotions; Awareness=lack of emotional awareness; Strategies=limited access to effective emotion regulation strategies; Clarity=lack of emotional clarity. Inexpressivity=the extent to which people are unwilling to outwardly display their emotions; Reactivity=emotion sensitivity, emotion intensity, and emotion persistence

N=number of observed samples for "adolescent" or "adult" samples

r=mean weighted effect size for "adolescent" or "adult" samples

** p<0.01; *** p<0.001

Q-value=Q value for the heterogeneity accounted for by between-group (sample age groups) differences

Table 4: Summary of the moderator analyses for sample population group.

Variables	Clinical			Community				
	N	r	95% CI	N	r	95% CI	Q-value (df=1)	p-value
Non-acceptance	10	0.270***	0.177-0.358	18	0.175***	0.128-0.222	3.162	0.075
Goals	10	0.245***	0.181-0.306	18	0.132***	0.093-0.171	8.681	0.003
Impulse	10	0.179***	0.104-0.252	19	0.207***	0.158-0.255	0.382	0.536
Awareness	10	0.085	-0.012-0.180	17	0.069**	0.031-0.108	0.082	0.774
Strategies	14	0.260***	0.119-0.390	25	0.223***	0.181-0.264	0.249	0.618
Clarity	14	0.146**	0.049-0.240	21	0.168***	0.118-0.218	0.163	0.686
Inexpressivity	2	0.244**	0.094-0.384	6	0.154***	0.089-0.217	1.205	0.272
reactivity	1	0.442***	0.263-0.592	3	0.278**	0.074-0.460	2.087	0.352

Notes: Non-acceptance=non-acceptance of emotional responses; Goals=difficulties engaging in goal-directed behavior when experiencing negative emotions; Impulse=difficulties in controlling impulse when experiencing negative emotions; Awareness=lack of emotional awareness; Strategies=limited access to effective emotion regulation strategies; Clarity=lack of emotional clarity. Inexpressivity=the extent to which people are unwilling to outwardly display their emotions; Reactivity=emotion sensitivity, emotion intensity, and emotion persistence

N=number of observed samples for "clinical" or "community" samples

r=mean weighted effect size for "clinical" or "community" samples

** p<0.01; *** p<0.001

Q-value=Q value for the heterogeneity accounted for by between-group (sample age groups) differences.

(i.e., emotional intensity), and (c) for a prolonged period of time before returning to baseline level of arousal (i.e., emotional persistence)" [30]. Experiencing a high level of emotional reactivity may reflect a failure in the regulation of emotional experience. Extreme behavioral problems, such as the engagement in NSSI, may represent efforts to avoid or escape from the aversive experience of heightened emotional reactivity [12,13,30].

The second most strongly NSSI-related dimension is limited access to effective emotional regulation strategies. This aspect of emotional dysregulation refers to both the belief and the actual experience that there is little that can be done to regulate emotions effectively, once an individual is upset. With this belief and/or

previous experience, an individual may engage in NSSI as a method of emotional regulation, or a way of self-punishment for being unable to regulate emotions effectively, or a means of gaining the lost sense of control for the current situations.

The strength of the association between nonacceptance of emotional responses and NSSI ranks the third. This dimension of emotional dysregulation reflects a tendency to have negative secondary emotional responses to one's negative emotions, or nonaccepting reactions to one's distress. The relationship between nonacceptance of emotional responses and NSSI suggest that when individuals are upset, they may feel guilty, ashamed, embarrassed, angry, or irritated for

Table 5: Summary of the moderator analyses for NSSI measure type.

Variables	Binary			Continuous				
	N	r	95% CI	N	r	95% CI	Q-value (df=1)	p-value
Non-acceptance	18	0.256***	0.179-0.330	10	0.151***	0.117-0.184	5.964	0.015
Goals	17	0.219**	0.151-0.284	11	0.100***	0.067-0.142	9.626	0.002
Impulse	18	0.221***	0.154-0.286	11	0.174***	0.142-0.205	1.591	0.207
Awareness	17	0.090	0.048-0.132	10	0.064	-0.009-0.137	0.375	0.541
Strategies	22	0.295***	0.220-0.366	17	0.196***	0.161-0.230	5.563	0.018
Clarity	22	0.184***	0.119-0.247	13	0.128***	0.081-0.174	1.883	0.170
Inexpressivity	4	0.118***	0.057-0.178	4	0.241***	0.147-0.330	4.634	0.031
reactivity	3	0.403***	0.280-0.513	1	0.130*	0.026-0.231	11.157	0.001

Notes: Non-acceptance=non-acceptance of emotional responses; Goals=difficulties engaging in goal-directed behavior when experiencing negative emotions; Impulse=difficulties in controlling impulse when experiencing negative emotions; Awareness=lack of emotional awareness; Strategies=limited access to effective emotion regulation strategies; Clarity=lack of emotional clarity. Inexpressivity=the extent to which people are unwilling to outwardly display their emotions; Reactivity=emotion sensitivity, emotion intensity, and emotion persistence

N=number of observed samples for "binary" or "continuous" type

r=mean weighted effect size for "binary" or "continuous" type

** p<0.01; *** p<0.001

Q-value=Q value for the heterogeneity accounted for by between-group (NSSI measure types) differences

Table 6: Summary of moderator analyses for NSSI assessment time frame.

Variables	Over the past 12 months			Over more than 12 months				
	N	r	95% CI	N	r	95% CI	Q-value (df=1)	p-value
Non-acceptance	6	0.203***	0.135-0.269	21	0.208***	0.143-0.272	0.208	0.901
Goals	6	0.109***	0.051-0.165	21	0.187***	0.133-0.240	3.837	0.050
Impulse	6	0.143***	0.066-0.219	22	0.214***	0.164-0.263	2.345	0.126
Awareness	6	0.105**	0.032-0.176	20	0.061**	0.017-0.104	1.035	0.309
Strategies	7	0.226***	0.172-0.279	30	0.255***	0.196-0.313	0.509	0.476
Clarity	6	0.089	- 0.008-0.184	27	0.181***	0.127-0.234	2.725	0.099
Inexpressivity	-	-	-	-	-	-	-	-
reactivity	2	0.362***	0.205-0.500	3	0.278**	0.074-0.460	0.454	0.501

Notes: Non-acceptance=non-acceptance of emotional responses; Goals=difficulties engaging in goal-directed behavior when experiencing negative emotions; Impulse=difficulties in controlling impulse when experiencing negative emotions; Awareness=lack of emotional awareness; Strategies=limited access to effective emotion regulation strategies; Clarity=lack of emotional clarity. Inexpressivity=the extent to which people are unwilling to outwardly display their emotions; Reactivity=emotion sensitivity, emotion intensity, and emotion persistence

N=number of observed samples for "NSSI over the past 12 months" or "NSSI over more than 12 months" type

r=mean weighted effect size for "NSSI over the past 12 months" or "NSSI over more than 12 months" type

** p<0.01; *** p<0.001

Q-value=Q value for the heterogeneity accounted for by between-group (NSSI assessment time frame types) differences

feeling that way, and so they engage in NSSI to get rid of those self-directed negative emotions or to punish themselves for feeling that way.

Additionally, although with a small to modest magnitude, NSSI is also significantly associated with the dimension of emotional inexpressivity. Emotional inexpressivity refers to the difficulties in the outward display of emotions [29]. It is possible that individuals who engage in NSSI are in deny of their painful emotions. Or, they may have difficulties verbalizing or articulating their feelings [38]. NSSI engagement may then be a way to express one's inner distress and facilitate one's verbal and emotional contacts.

Our meta-analysis also shows that NSSI associates with two dimensions of emotional dysregulation: having difficulties controlling impulses when experiencing negative emotions and having difficulties engaging in goal-directed behaviors when experiencing negative emotions, similarly in strength. These two dimensions, in Gratz and Roemer's original conceptualization of emotional dysregulation [21], actually comprised one single dimension, and are similar in meaning with the construct of negative urgency in the impulsivity domain [39]. Their associations with NSSI are in line with the theory suggesting that when experiencing intense negative emotions, individuals may engage in coping behaviors that provide immediate relief from distress, at the expense of long-term regulatory goals [40].

Given that NSSI serves as an effective way of reducing negative emotions [41], individuals who have difficulties controlling impulses and seeing the long-term goals may engage in NSSI. They would rather sacrifice the long-term gains for the immediate relief from intense emotional distress.

Finally, NSSI associates with lack of clarity of emotional responses and lack of awareness of emotional responses with the smallest magnitude. These two dimensions of emotional dysregulation focus on the regulation of emotion itself, and were considered as one dimension in Gratz and Roemer's original conceptualization of emotional dysregulation [21]. Lack of emotional clarity refers to that individuals do not know and are not clear about the emotions they are experiencing. Lack of emotional awareness refers to the tendency not to attend, acknowledge, validate, or care about the emotions. Their weak associations with NSSI may reflect that individuals with NSSI do not have much difficulty in understanding their emotional experiences. Or, the weak associations may also be due to that individuals lacking emotional awareness and clarity have difficulties answering the questions regarding whether they are aware of and clear about the emotions they are experiencing.

Despite the differential associations between different dimensions of emotional dysregulation and NSSI, emotional dysregulation in general associates with NSSI with a moderate strength. With regard to individual dimensions, only the dimension of emotional reactivity associates with NSSI with a modest effect size. All the other dimensions associate with NSSI with small effect sizes. Given that emotion regulation is the most strongly supported function of NSSI [11,33], one may speculate that emotional dysregulation be associated with NSSI strongly. The observed small to modest effect sizes across studies may be accounted for by two possibilities.

First, emotional dysregulation assessed in most studies is a trait rather than a state. The decision to engage in NSSI, however, is often made in the context of an intense emotion dysregulated state. The actual responses to negative emotions during an intense emotion dysregulated state may be different from the reports of emotional dysregulation trait during a relatively calm state when completing the questionnaires. Thus, it will be worthwhile for researchers to induce various negative emotions (e.g., sadness, anger, anxiety)

before assessing emotional dysregulation to determine the strength of the association between emotional dysregulation and NSSI. In one study, researchers have used an impromptu public speech task to induce acute stress, and examined changes in pain perception after the task in participants with and without a history of NSSI, as well as the role of emotional dysregulation in the relationship between NSSI engagement and diminished pain perception [42]. Although the researchers demonstrated that the speech task successfully induced distress and decreased pain perception, and emotional dysregulation partially accounted for the diminished pain perception in participants with NSSI, they assessed the trait emotional dysregulation before participants completing the speech task. Moreover, making an impromptu public speech is unlike the typical situations when individuals engage in NSSI. Research showed that individuals often engage in NSSI after an interpersonal conflict [43]. Thus, tasks involving interpersonal distress, e.g., the social exclusion tasks, may be better in inducing the state of emotional dysregulation typically occurred before NSSI.

A second possibility is that NSSI and emotional dysregulation do indeed associate with each other weakly or modestly. Giving weight to this possibility is the fact that only a minority of individuals who experience emotional dysregulation engage in NSSI. This suggests that emotional dysregulation may be a necessary but not a sufficient condition for the engagement in NSSI. In Linehan's biosocial theory of BPD [15] and Nock's integrated model of NSSI [44], emotional dysregulation is considered a general risk factor for a variety of maladaptive behaviors. To engage in NSSI, one must possess both emotional dysregulation and NSSI specific vulnerability factors. In Nock's integrated model, he proposed six hypotheses regarding NSSI specific risk factors. These hypotheses are: social learning hypothesis, self-punishment hypothesis, implicit attitude/identification hypothesis, social signaling hypothesis, pain analgesia/opiate hypothesis, and pragmatic hypothesis. However, to our knowledge, no studies have examined the interaction effects of emotional dysregulation and NSSI specific vulnerability factors, and such studies should be conducted in the future.

In this meta-analytic review, we also conducted moderator analyses examining whether the associations between emotional dysregulation and NSSI differ across age groups, population groups, NSSI outcome type, and NSSI

assessment timeframe. Results showed that the magnitude of the relationship between having difficulties engaging in goal-directed behaviors when experiencing negative emotions and NSSI was significantly larger in adolescents than in adults. This may be because adolescents possess more NSSI specific risk factors than adults. For example, adolescents are generally more impulsive than adults [45]. Thus, according to the pragmatic hypothesis in the integrated model of NSSI [44], when they experience emotional dysregulation in terms of having difficulties engaging in goal-directed behaviors, adolescents are more likely to choose rapid, effective, and easily implemented methods, such as NSSI, as the means of emotional regulation. Additionally, adolescents are more easily influenced by their peers than adults are [46,47]. Based on the social learning hypothesis, adolescents are thus more likely to imitate their friends' NSSI behaviors. Additionally, the mean effect size of the relationship between lack of emotional clarity and NSSI was also larger in adolescents than in adults. Apart from possessing more NSSI specific risk factors, adolescents also attach more importance to the clarity of emotions, because it is important for their development of self-identity [48,49]. When they cannot figure out what they are feeling or sense that their feelings are invalid or unimportant, adolescents may be more likely than adults to get frustrated and engage in NSSI.

Another moderator analyses showed that the magnitude of the relationship between having difficulties engaging in goal-directed behaviors when experiencing negative emotions and NSSI was significantly larger in clinical samples than in community samples. This difference may also be due to that clinical samples possess more NSSI specific risk factors (e.g., impulsivity, relationship problems, self-disturbance) and/or live in more harmful environment (e.g., have little control over their life, have few social support) than community samples. The combination of emotional dysregulation with these NSSI specific vulnerability factors may increase the likelihood of engaging in NSSI among clinical samples. Additionally, these results may be explained by cautions due to that the studies with clinical samples involve a variety of patient populations, including substance-dependent patients [38, 50-52], anxiety disorder patients [50,53,54], eating disorder patients, depressive disorder patients [53, 55], and NSSI patients [56,57], etc. So the comorbid (psychiatric) conditions may contribute (directly or indirectly) to NSSI, and

may thus confounding the study's association.

Taken together, results from both moderator analyses of sample age group and sample population group further stress the need to explore the combined effects of emotion dysregulation with NSSI specific risk factors on the engagement in NSSI, as well as the effect of emotion dysregulation on NSSI above and beyond other NSSI risk factors.

The third moderator analyses revealed that the magnitudes of the relationships of five dimensions of emotional dysregulation (i.e., limited access to emotional regulation strategies, having difficulties engaging in goal-directed behaviors when experiencing negative emotions, nonacceptance of emotional responses, emotional reactivity, and emotional inexpressivity) to NSSI were significantly larger in studies using binary outcomes of NSSI engagement than those using continuous NSSI outcomes. This does not necessarily imply that binary measures of NSSI are better than continuous measures. Rather, the significant differences may be due to that NSSI is a low base rate behavior and continuous indicators of NSSI in the population may lack sufficient variations. Future studies are still encouraged to use continuous measures of NSSI and conduct two sets of analyses: one set with a binary NSSI outcome (i.e., 0 representing no NSSI vs. 1 representing having engaged in NSSI) in the whole sample and the other with a continuous NSSI outcome in those who report the engagement in NSSI.

The final moderator analyses of NSSI assessment timeframe showed that the magnitude of the association between having difficulties engaging in goal-directed behaviors when experiencing negative emotions and NSSI was significantly larger in studies assessing NSSI over more than 12 months than those assessing NSSI over the past 12 months. One possible explanation for this finding is that in contrast to measures of NSSI over a longer time span, assessments limited to the past 12 months likely would not identify a proportion of individuals with a past history of NSSI. These individuals, nevertheless, may still have difficulties engaging in goal-directed behaviors when experiencing negative emotions. Thus, classification of these individuals as non-injurers may lower the observed association between emotional dysregulation and NSSI.

■ Limitations and future directions

As we discussed above, assessing trait emotional

dysregulation when participants are calm to predict their engagement in NSSI when they are experiencing emotional distress, and neglecting the effects of NSSI specific risk factors when examining the relationship between emotional dysregulation and NSSI may represent two limitations of the extant literatures. Apart from these, the existing studies also have several other limitations. Addressing these limitations may represent important directions for future research. The first one is that studies are largely cross-sectional. It is thus impossible to know whether emotional dysregulation occurs before the engagement in NSSI or the reverse. Although most theoretical models suggest that individuals first experience emotional dysregulation and then engage in NSSI as an emotion regulation strategy [10,13,15,32], it is also likely that after the engagement in NSSI, individuals feel guilty or ashamed for doing so [7]. Feeling guilty or ashamed is an indicator of non-acceptance of emotional responses. Previous research has demonstrated that NSSI significantly predicted negative emotions over time [58]. But the experience of negative emotions is not equated with emotional dysregulation. The temporal relationship between emotional dysregulation and NSSI is still unclear. Future studies should use multi-wave longitudinal designs or ecological momentary designs to disentangle the complex temporal relationships between different dimensions of emotional dysregulation and NSSI.

Another important direction for future research is to explore whether the relationship between emotional dysregulation and NSSI holds cross-culturally. Although we found that the link between emotional dysregulation and NSSI was robust across participants from various countries, such as the United States [42,51], Canada [59-61], Italy [52], Germany [55-56], New Zealand [62-63], and the Netherland [57], these countries are all western countries and participants in these studies were predominantly identified as Caucasian. Only two studies being reviewed involved non-western samples: one involved Turkish [38], and the other Japanese [64]. Thus, results of the present review may not be generalized to non-western cultures. However, the relationship between emotional dysregulation and NSSI may differ across cultures. Some previous studies examining the association between NSSI and perceived parental control may well demonstrate the cultural difference. Specifically, studies among

western samples (i.e., Belgian and US samples) found that adolescents' engagement in NSSI and other maladaptive behaviors was associated with a perception of a decreased amount of parental control [65,66], while a study among Chinese adolescents showed that engagement in NSSI was associated with an increase in perceived parental control [6]. Researchers explained that this inconsistency may reflect cultural differences in parenting and parent-child relationship [6]. According to Linehan [15], parenting and family environment may also affect one's emotional regulation ability. Thus, cultural differences in parenting and emotion expression rules may have an impact on the relationship between emotional dysregulation and NSSI. Future studies among large samples of non-western populations are in great need to reveal whether the link between emotional dysregulation and NSSI varies cross-culturally.

It should also be noted that although the established link between emotional dysregulation and NSSI supports the affect regulation function of NSSI, how NSSI serves this function is still unknown. Researchers have proposed potential mechanisms, including distraction from negative affect, endorphin release, and self-care [11,67], to explain how NSSI serves the affect regulation function. Other researchers also suggested that seeing blood in NSSI may relieve tension [68,69]. These hypotheses, however, need to be tested in well-designed experimental studies. Additionally, as we discussed previously, the relationship between emotional dysregulation and NSSI may also imply other functions of NSSI. For example, individuals who experience emotional dysregulation may engage in NSSI for self-punishment or gaining the sense of control. Furthermore, this study is primarily overemphasizing description and neglects the etiological mechanisms of the association between emotion regulation and NSSI. Therefore, further studies are needed to ascertain the exact functions NSSI serves when it is used for emotional regulation and to explore the mechanisms underlying the emotional regulation function of NSSI.

In conclusion, the results of our review suggest that individuals who experience emotional dysregulation, especially those who have heightened emotional reactivity and those who difficulties in accessing effective emotional regulation strategies, are at increased risks for the engagement in NSSI. Although this finding is obtained largely from cross-sectional studies, it

may still offer important clinical implications. For example, the association between limited access to effective emotional regulation strategies and NSSI provides an insight for the identification of the NSSI treatment targets. Specifically, an important target of NSSI treatment may be to teach individuals appropriate emotional regulation strategies, and to make sure that they are able to use these strategies proficiently when upset. Another target of NSSI treatment may be to correct individuals' false belief that they cannot adequately cope with distress and instill the sense of self-efficacy of successful emotion regulation. Additionally, given the third strongest association between nonacceptance of emotional response and NSSI, helping individuals accept and validate their own emotional experiences may also be beneficial to reducing and preventing NSSI.

Acknowledgement

The authors would like to thank Ana Isabel Vieirafor, Ph.D., Christine Levesque, Ph.D., Dawn M. Eichen, Ph.D., Kim Yurkowski, Ph.D., Johan Bjureberg, Ph.D., Marc Stewart Wilson, Ph.D., Molly Adrian, Ph.D., and Tina In-Albon, Ph.D. providing additional information about their studies included in the meta-analysis.

References

1. American Psychiatric Association. Diagnostic and manual of mental disorders (5th ed.). Washington, DC: American Psychiatric Association (2013).

2. Swannell SV, Martin GE, Page A, *et al*. Prevalence of non-suicidal self-Injury in nonclinical samples: systematic review, meta-analysis and meta-regression. *Suicide. Life. Threat. Behav* 44(3), 273-303 (2015).

3. Cloutier P, Martin J, Kennedy A, *et al*. Characteristics and co-occurrence of adolescent non-suicidal self-injury and suicidal behaviours in pediatric emergency crisis services. *J. Youth. Adolesc* 39(3), 259-269 (2010).

4. Darche MA. Psychological factors differentiating self-mutilating and non-self-mutilating adolescent inpatient females. *Psychiatric. Hospital* 21(1), 31-35 (1990).

5. Briere J, Gril E. Self-mutilation in clinical and general population samples: Prevalence, correlates and functions. *Am. J. Orthopsychiatry* 68(4), 609-620 (1998).

6. You J, Jiang Y, Zhang M, *et al*. Perceived parental control, self-criticism and non-suicidal self-injury among adolescents: Testing the reciprocal relationships by a three-wave cross-lag model. *Arch. Suicide. Res* 21(3), 379-391 (2017).

7. Laye-Gindhu A, Schonert-Reichl KA. Non-suicidal self-harm among community adolescents: understanding the "whats" and "whys" of self-harm. *J. Youth. Adolesc* 34(5), 447-457 (2005).

8. Guan K, Fox KR, Prinstein MJ. Non-suicidal self-injury as a time-invariant predictor of adolescent suicide ideation and attempts in a diverse community sample. *J. Consult. Clin. Psychol* 80(5), 842-849 (2012).

9. You JN, Lin MP. Predicting suicide attempts by time-varying frequency of non-suicidal self-injury among Chinese community adolescents. *J. Consult. Clin. Psychol* 83(3), 524-533 (2015).

10. Chapman AL, Gratz KL, Brown MZ. Solving the puzzle of deliberate self-harm: The experiential avoidance model. *Behav. Res. Ther* 44(3), 371-394 (2006).

11. Klonsky ED. The functions of deliberate self-injury: a review of the evidence. *Clin. Psychol. Rev* 27(2), 226-239 (2007).

12. Nock MK, Prinstein MJ. A functional approach to the assessment of self-mutilative behavior. *J. Consult. Clin. Psychol* 72(5), 885-890 (2004).

13. Nock MK, Prinstein MJ. Contextual features and behavioral functions of self-mutilation among adolescents. *J. Abnorm. Psychol* 114(1), 140-146 (2005).

14. Lieb K, Zanarini MC, Schmahl C, *et al*. Borderline personality disorder. *Lancet* 364(1), 453-461 (2004).

15. Linehan MM. Cognitive-behavioral treatment of borderline personality disorder. New York: Guildford Press (1993).

16. Siever LJ, Torgersenb S, Gundersonc JG, *et al*. The borderline diagnosis III: identifying endophenotypes for genetic studies. *Biol. Psychiatry* 51(12), 964-968 (2002).

17. Gross JJ. The emerging field of emotion regulation: an integrative review. *Rev. Gen. Psychol* 2(3), 271-299 (1998).

18. Kopp CB. Regulation of distress and negative emotions: a developmental view. *Dev. Psychol* 25(5), 343-354 (1989).

19. Cole PM, Michel MK, Teti LO. The development of emotion regulation and dysregulation: A clinical perspective. *Monogr. Soc. Res. Child. Dev* 59 (2-3), 73-100 (1994).

20. Gratz KL. Targeting emotional dysregulation in the treatment of self-injury. *J. Clin. Psychol* 63(11), 1091-1103 (2007).

21. Gratz KL, Romer L. Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure and initial validation of the difficulties in emotion regulation scale. *J. Psychopathol. Behav. Assess* 26(4), 41-54. (2004).

22. Bagby R, Parker J, Taylor G. The twenty-item Toronto Alexithymia Scale-I. Item selection and cross-validation of the factor structure. *J. Psychosom. Res* 38(1), 23-32 (1994).

23. Penza-Clyve S, Zeman J. Initial validation of

the emotion expression scale for children (EESC). *J. Clin. Child. Adolesc. Psychol* 31(4), 540-547 (2002).

24. Zeman J, Shipman K, Suveg C. Anger and sadness regulation: predictions to internalizing and externalizing symptoms in children. *J. Clin. Child. Adolesc. Psychol* 31(3), 393-398 (2002).

25. Catanzaro SJ, Mearns J. Mood-related expectancy, emotional experience and coping behavior. In I. Kirsch (Ed.), How expectancies shape experience. Washington DC: American Psychological Association (1999).

26. Garnefski N, Kraaij V, Spinhoven P. Negative life events, cognitive emotion regulation and emotional problems. *Pers. Individ. Dif* 30(8), 1311-1327 (2001).

27. Gross JJ, John OP. Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *J. Pers. Soc. Psychol* 85(2), 348-362 (2003).

28. Zeman J, Shipman K, Penza-Clyve S. Development and initial validation of the children's sadness management scale. *J. Nonverbal. Behav* 25(3), 187–205 (2001).

29. Kring AM, Smith DA, Neale JM. Individual differences in dispositional expressiveness: Development and validation of the Emotional Expressivity Scale. *J. Pers. Soc. Psychol* 66(5), 934-949 (1994).

30. Nock MK, Wedig MM, Holmberg EB, *et al*. The emotion reactivity scale: development, evaluation and relation to self-injurious thoughts and behaviors. *Behav .Ther* 39(2), 107-116 (2008).

31. You J, Lin MP, Leung F. Functions of non-suicidal self-injury among Chinese community adolescents. *J. Adolesc* 36(4), 737-745 (2013).

32. Selby EA, Joiner TE Jr. Cascades of emotion: The emergence of borderline personality disorder from emotional and behavioral dysregulation. *Rev. Gen. Psychol* 13(3), 219-229 (2009).

33. Messer JM, Fremouw WJ. A critical review of explanatory models for self-mutilating behaviors in adolescents. *Clin. Psychol. Rev* 28(1), 162-178 (2008).

34. Fox KR, Franklin JC, Ribeiro JD, *et al*. Meta-analysis of risk factors for non-suicidal self-injury. *Clin. Psychol. Rev* 42(1), 156-167 (2015).

35. Borenstein M, Hedges L, Higgins J, *et al*. Comprehensive meta-analysis version 2. Englewood, NJ: Biostat (2005).

36. Card NA. Applied meta-analysis for social science research. New York: The Guilford Press (2012).

37. Orwin RG. A fail-safe N for effect size in meta-analysis. *J. Educ. Behav. Stat* 8(2), 157-159 (1983).

38. Evren C, Evren B. Self-mutilation in substance-dependent patients and relationship with childhood abuse and neglect, alexithymia and temperament and character dimensions of personality. *Drug. Alcohol. Depend* 80(1), 15-22 (2005).

39. Whiteside SP, Lynam DR. The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Pers. Individ. Dif* 30(4), 669–689 (2001).

40. Cyders MA, Smith GT. Emotion-based dispositions to rash action: positive and negative urgency. *Psychol. Bull* 134(6), 807–828 (2008).

41. Klonsky ED, Glenn CR. Assessing the functions of non-suicidal self-injury: psychometric properties of the inventory of statements about self-injury (ISAS). *J. Psychopathol. Behav. Assess* 31(3), 215-219 (2009).

42. Franklin JC, Aaron RV, Arthur MS, *et al*. Non-suicidal self-injury and diminished pain perception: the role of emotional dysregulation. *Compr. Psychiatry* 53(6), 691-700 (2012).

43. You J, Ma C, Lin MP, *et al*. Comparing among the experiences of self-cutting, hitting and scratching among Chinese adolescents attending secondary schools: An interview study. *Behav. Disord* 40(2), 122-137 (2015).

44. Nock MK. Self-Injury. *Annu. Rev. Clin. Psychol* 6(1), 339-363 (2010).

45. Lerner RM, Steinberg L. Handbook of adolescent psychology (3rd ed.). Hoboken, New Jersey: John Wiley & Sons Inc. (2009).

46. Brown BB. Peer groups and peer cultures at the threshold: The developing adolescent. Cambridge, MA: Harvard University Press (1990).

47. Chen X, Chang L, He Y, *et al*. The peer group as a context: moderating effects on relations between maternal parenting and social and school adjustment in Chinese children. *Child. Dev* 76(2), 417-434 (2005).

48. Neacsiu AD, Herr NR, Fang CM, *et al*. Identity disturbance and problems with emotion regulation are related constructs across diagnoses. *J. Clin. Psychol* 71(4), 346-361 (2015).

49. Monell E, Hogdahl L, Mantilla EF, *et al*. Emotional dysregulation, self-image and eating disorder symptoms in University Women. *J. Eat. Disord* 3(1), 44 (2015).

50. Adrian M, Zeman J, Erdley C, *et al*. Emotional dysregulation and interpersonal difficulties as risk factors for non-suicidal self-injury in adolescent girls. *J. Abnorm .Child. Psychol* 39(3), 389-400 (2010).

51. Gratz KL, Tull MT. The relationship between emotional dysregulation and deliberate self-harm among inpatients with substance use disorders. *Cognit. Ther. Res* 34(6), 544-553 (2010).

52. Verrocchio MC, Counti C, Fulcheri M. Deliberate self-harm in substance-dependent patients and relationship with alexithymia and personality disorders: a case-control study. *J. Biol. Regul. Homeost. Agents* 24(4), 461-469 (2010).

53. Martin A, White H, Flanagan TJ, *et al*. A multisite study of the association between emotional dysregulation and deliberate self-harm among substance use disorder inpatients. *Addict. Disord. Their* 10(4), 191-198 (2011).

54. Sim L, Adrian M, Zeman J, *et al*. Adolescent deliberate self-harm: linkages to emotion regulation and family emotional climate. *J. Res. Adolesc* 19(1), 75-91 (2009).

55. Linehan, M. (1993). Cognitive-behavioral treatment of borderline personality disorder. New York: Guilford Press.

56. Ludtke J, In-Albon T, Michel C, *et al*. Predictors for DSM-5 non-suicidal self-injury in female adolescent inpatients: The role of childhood maltreatment, alexithymia, and dissociation. *Psychiatry. Res* 239(1), 346-352 (2016).

57. In-Albon T, Ruf C, Schmid M. Proposed diagnostic criteria for the DSM-5 of non-suicidal self-injury in female adolescents: Diagnostic and clinical correlates. *Psychiatry. J* 2013(1), 159-208 (2013).

58. Slee N, Spinhoven P, Garnefski N, *et al*. Emotion regulation as mediator of treatment outcome in therapy for deliberate self-harm. *Clin. Psychol. Psychother* 15(4), 205-216 (2008).

59. You J, Leung F, Fu K. Exploring the reciprocal relations between non-suicidal self-injury, negative emotions and relationship problems in Chinese adolescents: A longitudinal cross-lag study. *J. Abnorm. Child. Psychol* 40(5), 829-836 (2012).

60. Emery AA, Heath NL, Mills DJ. Basic psychological need satisfaction, emotional dysregulation and non-suicidal self-injury engagement in young adults: An application of self-determination theory. *J. Youth Adolesc* 45(3), 612-623 (2016).

61. Heath NL, Toste JR, Nedecheva T, *et al*. An examination of non-suicidal self-injury among college students. *J. Ment. Health. Couns* 30(2), 137-156 (2008).

62. Yurkowski K, Martin J, Levesque C, *et al*. Emotional dysregulation mediates the influence of relationship difficulties on non-suicidal self-injury behavior in young adults. *Psychiatry. Res* 228(3), 871-878 (2015).

63. Garisch JA, Wilson MS. Vulnerabilities to deliberate self-harm among adolescents: The role of alexithymia and victimization. *Br. J. Clin. Psychol* 49(2), 151-162 (2010).

64. Garisch JA, Wilson MS. Prevalence, correlates and prospective predictors of non-suicidal self-injury among New Zealand adolescents: Cross-sectional and longitudinal survey data. *Child. Adolesc. Psychiatry. Ment. Health* 9(1), 1-11 (2015).

65. Tresno F, Ito Y, Mearns J. Risk factors for non-suicidal self-injury in Japanese college students: the moderating role of mood regulation expectancies. *Int. J. Psychol* 48(6), 1009-1017 (2013).

66. Baetens I, Claes L, Martin G, *et al.* Is non-suicidal self-injury associated with parenting and family factors? *J. Early. Adolesc* 34(3), 387-405 (2014).

67. Huh D, Tristan J, Wade E, *et al.* Does problem behavior elicit poor parenting? A prospective study of adolescent girls. *J. Res. Adolesc* 21(2), 185-204 (2006).

68. Franklin JC, Puzia ME, Lee KM, *et al.* The nature of pain offset relief in non-suicidal self-injury: A laboratory study. *Clin. Psychol. Sci* 1(2), 110-119 (2013).

69. Glenn CR, Klonsky ED. The role of seeing blood in non-suicidal self-injury. *J. Clin. Psychol* 66(4), 466-473 (2010).

70. Adrian M, Zeman J, Erdley C, *et al.* Emotional dysregulation and interpersonal difficulties as risk factors for non-suicidal self-injury in adolescent girls. *J. Abnorm. Child. Psychol* 39(3), 389-400 (2010).

71. Anderson NL, Crowther JH. Using the experiential avoidance model of non-suicidal self-injury: understanding who stops and who continues. *Arch. Suicide. Res* 16(2), 124-134 (2012).

72. Eichen DM, Kass AE, Fitzsimmons-Craft EE, *et al.* Non-suicidal self-injury and suicidal ideation in relation to eating and general psychopathology among college-age women. *Psychiatry. Res* 235(1), 77-82 (2016).

73. Emery AA, Heath NL, Mills DJ. Basic psychological need satisfaction, emotional dysregulation and non-suicidal self-injury engagement in young adults: An application of self-determination theory. *J. Youth Adolesc* 45(3), 612-623 (2016).

74. Evren C, Evren B. Self-mutilation in substance-dependent patients and relationship with childhood abuse and neglect, alexithymia and temperament and character dimensions of personality. *Drug. Alcohol. Depend* 80(1), 15-22 (2005).

75. Franklin JC, Aaron RV, Arthur MS, *et al.* Non-suicidal self-injury and diminished pain perception: The role of emotional dysregulation. *Compr. Psychiatry* 53(6), 691-700 (2012).

76. Franklin JC, Puzia ME, Lee KM, *et al.* The nature of pain offset relief in non-suicidal self-injury: a laboratory study. *Clin. Psychol. Sci* 1(2), 110-119 (2013)

77. Garisch JA, Wilson MS. Vulnerabilities to deliberate self-harm among adolescents: the role of alexithymia and victimization. *Br. J. Clin. Psychol. Psychology* 49(2), 151-162 (2010).

78. Garisch JA, Wilson MS. Prevalence, correlates, and prospective predictors of non-suicidal self-injury among New Zealand adolescents: Cross-sectional and longitudinal survey data. *Child. Adolesc. Psychiatry. Ment. Health* 9(1), 1-11 (2015).

79. Gholamrezaei M, Heath N, Panaghi L. Non-suicidal self-injury in a sample of university students in Tehran, Iran: Prevalence, characteristics and risk factors. *Int .J .Cult. Ment. Health* 10(2), 136-149 (2016).

80. Glenn CR, Blumenthal TD, Klonsky ED, *et al.* Emotional reactivity in non-suicidal self-injury: divergence between self-report and startle measures. *Int. J. Psychophysiol* 80(2), 166-170 (2011).

81. Glenn CR, Klonsky ED. Nonsuicidal self-injury disorder: an empirical investigation in adolescent psychiatric patients. *J. Clin. Child. Adolesc. Psychol* 42(4), 496-507 (2013).

82. Gomez-Exposito A, Wolz I, Fagundo AB, *et al.* Correlates of non-suicidal self-injury and suicide attempts in bulimic spectrum disorders. *Front. Psychol* 7(1), 1244 (2016).

83. Gratz KL. Risk factors for deliberate self-harm among female college students: the role and interaction of childhood maltreatment, emotional inexpressivity and affect intensity/reactivity. *Am. J. Orthopsychiatry* 76(2), 238-250 (2006).

84. Gratz KL, Breetz A, Tull MT. The moderating role of borderline personality in the relationships between deliberate self-harm and emotion-related factors. *Personal. Ment* 4(2), 96-107 (2009).

85. Gratz KL, Romer L. Multidimensional assessment of emotion regulation and dysregulation: development, factor structure, and initial validation of the difficulties in emotion regulation scale. *J. Psychopathol. Behav. Assess* 26(4), 41-54 (2004).

86. Gratz KL, Roemer L. The relationship between emotional dysregulation and deliberate self-harm among female undergraduate students at an urban commuter university. *Cogn. Behav. Ther* 37(1), 14-25 (2008).

87. Gratz KL, Tull MT. The relationship between emotional dysregulation and deliberate self-harm among inpatients with substance use disorders. *Cognit. Ther. Res* 34(6), 544-553 (2010).

88. Heath NL, Toste JR, Nedecheva T, *et al.* An examination of non-suicidal self-injury among college students. *J. Ment. Health. Couns* 30(2),

137-156 (2008).

89. Holly S. Non-suiciadal Self-injury among university students: examining emotion regulation, self-control, and social learning. McGill University (2011).

90. In-Albon T, Ruf C, Schmid M. Proposed diagnostic criteria for the DSM-5 of non-suicidal self-injury in female adolescents: Diagnostic and clinical correlates. *Psychiatry. J* 2013(1), 159-208 (2013).

91. Kranzler A, Fehling KB, Anestis MD, *et al.* Emotional dysregulation, internalizing symptoms, and self-injurious and suicidal behavior: structural equation modeling analysis. *Death. Stud* 40(6), 358-366 (2016).

92. Levesque C, Lafontaine MF, Bureau JF. The mediating effects of emotion regulation and dyadic coping on the relationship between romantic attachment and non-suicidal self-injury. *J. Youth. Adolesc* 45(2), 1-11 (2016).

93. Ludtke J, In-Albon T, Michel C, *et al.* Predictors for DSM-5 non-suicidal self-injury in female adolescent inpatients: the role of childhood maltreatment, alexithymia, and dissociation. *Psychiatry. Res* 239(1), 346-352 (2016).

94. Martin A, White H, Flanagan TJ, *et al.* A multisite study of the association between emotional dysregulation and deliberate self-harm among substance use disorder inpatients. *Addict. Disord. Their* 10(4), 191-198 (2011).

95. Muehlenkamp JJ, Kerr PL, Bradley AR, *et al.* Abuse subtypes and non-suicidal self-injury: preliminary evidence of complex emotion regulation patterns. *J. Nerv. Ment. Dis* 198(4), 258-263 (2010).

96. Nock MK, Wedig MM, Holmberg EB, *et al.* The emotion reactivity scale: Development, evaluation and relation to self-injurious thoughts and behaviors. *Behav. Ther* 39(2), 107-116 (2008).

97. Perez J, Venta A, Garnaat S, *et al.* The difficulties in emotion regulation scale: Factor structure and association with non-suicidal self-injury in adolescent inpatients. *J. Psychopathol. Behav. Assess* 34(3), 393-404 (2012).

98. Pisetsky EM, Haynos AF, Lavender JM, *et al.* Associations between emotion regulation difficulties, eating disorder symptoms, non-suicidal self-injury, and suicide attempts in a heterogeneous eating disorder sample. *Compr. Psychiatry* 73(1), 143-150 (2016).

99. Selby EA, Anestis MD, Bender TW, *et al.* An exploration of the emotional cascade model in borderline personality disorder. *J. Abnorm. Psychol* 118(2), 375-387 (2009).

100. Selby EA, Franklin J, Carson-Wong A, *et al.* Emotional cascades and self-injury: Investigating instability of rumination and negative emotion. *J. Clin. Psychol* 69(12), 1213-1227 (2013).

101. Sim L, Adrian M, Zeman J, *et al.* Adolescent deliberate self-harm: linkages to emotion regulation and family emotional climate. *J. Res. Adolesc* 19(1), 75-91 (2009)

102. Slee N, Spinhoven P, Garnefski N, *et al.* Emotion regulation as mediator of treatment outcome in therapy for deliberate self-harm. *Clin. Psychol. Psychother* 15(4), 205-216 (2008).

103. Tatnell R, Hasking P, Newman L, *et al.* Attachment, emotion regulation, childhood abuse and assault: examining predictors of NSSI among adolescents. *Arch. Suicide. Res* 11(1), 1-11 (2016).

104. Thomassin K, Shaffer A, Madden A, *et al.* Specificity of childhood maltreatment and emotion deficit in non-suicidal self-injury in an inpatient sample of youth. *Psychiatry. Res* 244(1), 103-108 (2016).

105. Tresno F, Ito Y, Mearns J. Risk factors for non-suicidal self-injury in Japanese college students: the moderating role of mood regulation expectancies. *Int. J. Psychol* 48(6), 1009-1017 (2013).

106. Verrocchio MC, Counti C, Fulcheri M. Deliberate self-harm in substance-dependent patients and relationship with alexithymia and personality disorders: a case-control study. *J. Biol. Regul. Homeost. Agents* 24(4), 461-469 (2010).

107. Vieira AI, Ramalho S, Brandao I, *et al.* Adversity, emotion regulation and non-suicidal self-injury in eating disorders. *Eat. Disord* 24(5), 440-452 (2016).

108. Voon D, Hasking P, Martin G. Change in emotion regulation strategy use and its impact on adolescent non-suicidal self-injury: A three-year longitudinal analysis using latent growth modeling. *J. Abnorm. Psychol* 123(3), 487-498 (2014).

109. Williams F, Hasking P. Emotion regulation, coping and alcohol use as moderators in the relationship between non-suicidal self-injury and psychological distress. *Prev. Sci* 11(1), 33-41 (2010).

110. Yurkowski K, Martin J, Levesque C, *et al.* Emotional dysregulation mediates the influence of relationship difficulties on non-suicidal self-injury behavior in young adults. *Psychiatry. Res* 228(3), 871-878 (2015).

111. Zelkowitz RL, Cole DA, Han GT, *et al.* The incremental utility of emotion regulation but not emotion reactivity in non-suicidal self-injury. *Suicide. Life. Threat. Behav* 46(5), 545-562 (2016).