

IMPLICIT EMOTION REGULATION IN INDIVIDUALS WITH NON-SUICIDAL
SELF-INJURY

by

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DEDICATION

To whom taught me to look for my own path, to my parents!

به کسانی تقدیم می کنم که به من آموختند راه خودم را جست و جو کنم، به پدر و مادر عزیزم!

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LIST OF ABBREVIATIONS

Abbreviation	Description
APR	Automatic positive reinforcement
BED	Binge eating disorder
BPD	Borderline personality disorder
CAE	Conflict adaptation effect
Cc	Congruent-congruent
Ci	Congruent-incongruent
DASS-21	Depression, Anxiety and Stress Scale-21
DERS	Difficulties in Emotion Regulation Scale
EC	Emotional conflict
ECT	Emotional Conflict Task
GAD	Generalized anxiety disorder
HRV	Heart rate variability
Ic	Incongruent-congruent
IER	Implicit emotion regulation

Abbreviation	Description
li	Incongruent-incongruent
ISAS	Inventory of Statements About Self-injury
MANCOVA	Multivariate analysis of covariance
MDD	Major depressive disorder
MINI	Mini International Neuropsychiatric Interview
NSSI	Non-suicidal self-injury
SB	Self-injurious behaviors
SBD	Suicidal behavior disorder
SCID	Structured Clinical Interview of DSM-V
WAIS-IV	Wechsler Adult Intelligence Scale-Fourth-Edition

ABSTRACT

Non-suicidal self-injury (NSSI) is a common problem in community and clinical populations, especially during adolescence and early adulthood. Non-suicidal self-injury is a gateway to suicide attempts, and it is comorbid with psychiatric disorders including depressive, anxiety and eating disorders. Extensive research shows that one of the most important predictors of NSSI is emotion dysregulation. In spite of the significant role of emotion dysregulation in the development and maintenance of NSSI, emotion dysregulation has been largely assessed by self-administered measures, and no studies have examined emotion regulation in NSSI with an objective measure. To address this gap in the literature, the purpose of current study was to explore implicit emotion dysregulation (automatic emotion regulatory processes) in individuals with NSSI using an experimental task: the Emotional Conflict Task, which is a variant of the Stroop Task. Another aim of the study was to understand the relationship between self-perceived emotion dysregulation (explicit emotion regulation) and implicit emotion regulation. The study compared individuals with a history of NSSI and a control group who did not have a history of any lifetime NSSI, suicide attempt, and history of any psychiatric disorders or use of psychotropic drugs. The results did not show any significant differences in implicit emotion regulation between NSSI and control group. In addition, explicit emotion dysregulation was not significantly related to implicit emotion regulation in the whole sample. The findings showed that participants with NSSI reported higher difficulties with emotion regulation and depressive, anxiety and stress symptoms.

I. INTRODUCTION

Non-suicidal self-injury (NSSI), defined as deliberate destruction of body tissue that is implemented without suicidal intent (Glenn & Klonsky, 2011; Sadeh et al., 2014), is a common psychological symptom, especially in adolescents and young adults (Groschwitz & Plener, 2012; Hasking, Momeni, Swannell, & Chia, 2008; Plener, Libal, Keller, Fegert, & Muehlenkamp, 2009). NSSI is associated with various psychological problems including suicide attempts, substance abuse, and externalizing and internalizing behaviors (Andover & Gibb, 2010; Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). Intensive research has explored predictors of NSSI, and the literature suggests that one of the most important predictors of NSSI is deficits in emotion regulation or difficulties dealing with negative emotions (Duggan, Heath, & Hu, 2015; Emery, Heath, & Mills, 2016; Tatnell & Hasking, & Newman, 2017). However, studies investigating emotion regulation in individuals with NSSI have used self-report measures to understand difficulties with emotion regulation in this population, and this work has failed to provide evidence for deficits in emotion regulation at a behavioral level.

One task designed to assess emotion regulation is Emotional Conflict Task (Etkin, Egner, Peraza, Kandel, & Hirsch, 2006), which assesses a specific type of emotion regulation; implicit emotion regulation. Implicit emotion regulation is a regulatory process that is implemented out of awareness, while explicit emotion regulation is an effortful and monitored process (Gyurak, Gross, & Etkin, 2011). The Emotional Conflict Task (ECT) is a variant of the Stroop paradigm assessing how individuals respond when they are exposed to incoming emotional information that is in conflict with semantic

information accompanied with it. For instance, a trial during the task could present a happy face, while the word “fear” is written over the face. The task is to ignore the semantic information in favor of attending to emotions expressed by the faces, and indicate the facial emotions (Etkin et al., 2006). Emotional conflict arises when the emotional words are not compatible with emotional faces during incongruent trials. This should cause a longer reaction time than seen in the congruent trials. Hence, the ECT measures emotional stimuli processing and attempts to resolve this conflict (implicit emotion regulation) at a behavioral level. Given the gap in the literature, examining implicit emotion regulation in individuals with NSSI would further our understanding of this problem.

In this section, recommended definitions and terms for NSSI, its prevalence, common methods, sex differences, comorbidities, and the differences and similarities between NSSI and suicide will be discussed first to understand NSSI better. Then, the functions of NSSI, especially explicit, implicit emotion regulation and ECT will be explained in more detail.

Definition of NSSI

In the literature, authors use different terms to refer to NSSI, including parasuicide, self-wounding, superficial/moderate self-mutilation and deliberate self-harm (Klonsky, 2009). All definitions of NSSI should be differentiated from self-injurious behaviors observed in people with neurodevelopmental disorders and from severe self-mutilation (e.g., limb amputation) seen in psychotic disorders (Klonsky, 2007). In psychotic disorders, self-mutilation is usually in response to command auditory hallucinations, while in neurodevelopmental disorders, self-injurious behaviors are a type of stereotypic behavior (American Psychiatric Association, 2013). Nevertheless, some authors contend that the

prevailing definition of NSSI, as mentioned above, is overly narrow because it only includes visible types of self-injury such as cutting and burning. These authors classify NSSI into two categories, direct and indirect, to widen the definition of NSSI (Germain, & Hooley, 2012). Examples of direct NSSI are cutting, scratching, burning, hitting, and interfering with wound healing and biting (Klonsky, 2011) while indirect NSSI includes risky behaviors such as disordered eating behavior, substance abuse and engagement in long-term abusive relationships (Germain, & Hooley, 2012). For the purpose of this proposal, the term NSSI will be used to refer specifically to direct self-injury, which includes harm to body surface.

Prevalence

NSSI is a common problem in the wider community, especially during adolescence and early adulthood. Eisenberg, Hunt, and Speer (2013) studied the prevalence of NSSI in university students from 26 schools in the United States. Fifteen percent of the students reported NSSI in the past year, with 6.0% of the students with NSSI reporting one or two episodes in the past year, 24.0% reporting one episode per month, 8.0% reporting two or three episodes per month and 1.0% engaged in NSSI nearly every day. A similar rate of prevalence was reported in a smaller sample of Canadian university students, with over 11.5% of students reporting NSSI. The age of onset of NSSI in 43.5% of the students was between 14 and 16 years old (Heath, Ross, Toste, Charlebois, & Nedecheva, 2009).

Klonsky (2011) assessed the prevalence of NSSI in 48 US states using a random dialing survey method. The lifetime and 12-month prevalence of NSSI were 5.9% and 0.9%, respectively, and individuals under 30 years old were more likely to engage in NSSI than individuals above 30 years old. NSSI was related to a history of receiving mental health

treatment and being unmarried, but was not related to sex or ethnicity. In addition, a study in Turkey (Somer, Bildik, Kabukçu-Başay, Güngör, Başay, & Farmer, 2015) examined the prevalence of NSSI in high school students ($N = 1656$), and found that 31.3% of the adolescents ($N = 519$, 57.8% female) had a lifetime history of at least one episode of NSSI. Age onset of NSSI was between 12 and 15 in the sample. As NSSI is a cross-cultural and cross-national psychological symptom linked with various psychiatric disorders, improving our understanding of this problem can ultimately help clinicians to enhance their interventions targeting NSSI.

Common methods of NSSI

Individuals with NSSI are more likely to use specific methods over others (Klonsky & Olino, 2008). Eisenberg et al. (2013) examined NSSI in American college and university students, and reported that the most common methods of NSSI were cutting (65.2%), followed by severe scratching (56.5%), punching (26.1%), burning (21.7%), and head banging (8.7%). However, some studies showed that other methods were more common than cutting. For instance, Baetens, Claes, Muehlenkamp, Grietens, and Onghena (2011) studied NSSI in Flemish students, and the results indicated that head banging (20.6%) and skin abrasion (16.0%) were more common than cutting (11.7%). Another study, conducted by Claes, Luyckx, and Bijttebier (2014) demonstrated that Flemish students used head banging (18.0%) and hitting oneself (12.2%) more often than cutting (5.5%).

Given the observed heterogeneity in common methods of NSSI, it may be important to know the frequently used NSSI methods in the sample, especially given evidence demonstrating that various levels of psychopathology are associated with different methods of NSSI. For example, people who use methods resulting in higher level of tissue damage

(e.g., cutting) are more likely to report psychiatric symptoms or receive clinical diagnoses (Klonsky & Olino, 2008; Orlando, Broman-Fulks, Whitlock, Curtin, & Michael, 2014; Somer, O., Bildik, T., Kabukçu-Başay, B., Güngör, D., Başay, Ö., & Farmer, 2015). Therefore, in the current study, common methods of NSSI in the sample were examined.

Sex differences

A review of literature shows that the prevalence and common methods of NSSI differ between males and females even though the findings are not consistent. Some evidence shows that males and females do not differ in prevalence or age of onset (Bryan, Rudd, Wertenberger, Young-McCaughon, & Peterson, 2015; Kaess et al., 2012; Manca, Presaghi, & Cerutti, 2014). However, some methods are more common in one sex than the other. Punching objects, like doors and walls, appears more common among males, whereas cutting and scratching were more commonly used by females (Camp, Desmet, & Verhaeghe, 2011). Cerutti, Manca, Presaghi, & Gratz, (2011) investigated NSSI in Italian adolescents, and found no sex differences in terms of the age of onset and frequency of NSSI, although the common methods differed. Burning with cigarettes and carving words into skin were more common among boys and girls, respectively. However, You, Leung, Fu and Lai (2011) investigated NSSI in Chinese students and found sex differences in prevalence. Their results showed that females reported greater lifetime history of NSSI than males (27% in females versus 21% in males).

Non-suicidal self-injury disorder

It is worth mentioning that although DSM-IV-TR considered self-injury as a criterion specific to borderline personality disorder (BPD), the DSM-V has introduced NSSI disorder as a condition in need of further study (American Psychiatric Association, 2013).

The DSM-V criteria for NSSI disorder consists of engagement in self-injury on five or more days in the last year without suicidal intent with self-harming behaviors resulting in pain, bruising or bleeding. Moreover, the purpose of engagement in self-injury should include one or more of the following: relief from negative emotions or thoughts, improving positive affect, and resolving interpersonal conflicts, and the expected results should occur during or shortly after the self-harming behavior. Furthermore, NSSI episodes are associated with one of the following criteria: interpersonal conflicts or negative thoughts or emotions (e.g., depression, anxiety and anger) occurring immediately before the NSSI episode, preoccupation with the NSSI behavior before acting upon it, and frequent thoughts about self-injury although one has not acted upon it. The behaviors are also not socially sanctioned, and interfere with individual's functioning (American Psychiatric Association, 2013).

Comorbidity

Recently, NSSI has been conceptualized as a transdiagnostic issue, as it is not considered as a symptom of a specific disorder (Bentley, Nock, & Barlow, 2014), and it is associated with a variety of psychiatric disorders. This transdiagnostic conceptualization is proposed even though DSM-V considers NSSI as a probable distinct disorder. Some of the studies exploring psychiatric disorders comorbid with NSSI are discussed below. In sum, previous studies demonstrated that NSSI is associated with depression, anxiety disorders and eating disorders, and these results suggest that NSSI is a transdiagnostic issue not related to a specific psychiatric disorder.

For instance, Gratz and Tull (2010) examined NSSI among inpatients with substance use disorder. Thirty percent of the participants had a history of NSSI, and the lifetime

average number of NSSI episodes was 8.9. Similarly, Andover, Pepper, Ryabchenko, Orrico, and Gibb (2005) studied depressive, anxiety and borderline personality symptoms in a non-clinical population. They showed that the participants with a history of NSSI reported a greater level of depressive and anxiety symptoms than participants without a NSSI history. The observed relationship between depression/anxiety and NSSI was no longer significant after controlling for BPD symptoms. Therefore, BPD symptoms likely account for the relationships between depression/anxiety and NSSI. In addition, Wilkinson, Kelvin, Roberts, Dubicka, and Goodyer (2011) studied psychological factors in depressed adolescents aged between 11 and 17 years old at baseline and at a 28-week follow-up. NSSI at baseline was one of the predictors of making a suicide attempt at follow-up, while the predictors of NSSI during the follow-up period were NSSI in the month before the baseline, and levels of hopelessness, depression and anxiety at the baseline assessment.

Moreover, individuals with eating disorders are also at risk of NSSI. A study by Paul, Schroeter, Dahme, and Nutzinger (2002) investigated NSSI among individuals with eating disorders and they found that the lifetime and 6-month prevalence of NSSI were 34.6% and 21.3%, respectively, in the sample. Furthermore, the patients with NSSI reported more traumatic events, dissociative symptoms and obsessive-compulsive thoughts and behaviors than those not engaged in NSSI. Finally, a meta-analysis conducted by Bentley, Cassiello-Robbins, Vittorio, Sauer-Zavala, and Barlow (2015) suggested relationships between NSSI and emotional disorders. Individuals with mood and anxiety disorders, not including bipolar and social anxiety disorders, were more likely to report NSSI than individuals without such psychiatric disorders, and panic and post-traumatic stress disorders showed the strongest relationship with NSSI.

Given this evidence, when psychological variables and psychopathology are investigated in individuals with NSSI, other psychiatric conditions associated with NSSI may impact on how individuals with NSSI respond to a self-report measure or perform on a behavioral tasks. In the present study, NSSI was assessed as a symptom associated with different psychiatric disorders not as a distinct disorder.

NSSI and suicide: Differences and similarities

Some authors (Nock, 2010; Germain, & Hooley, 2012) conceptualize NSSI and suicidal behavior (SB) as self-injurious behaviors (SIB). SIBs are defined as intentional engagement in any activity leading to psychological or physical harm. These authors propose a typological classification of SIB and consider SB and NSSI as two different forms of SIB. Suicidal behavior is distinguished from NSSI based on intention because, in contrast to NSSI, suicide is an intentional behavior to end one's life (Hamza, Stewart, & Willoughby, 2012). On the other hand, the proponents of the dimensional approach contend that NSSI and SB are different points on a single latent dimension, SIB (Orlando et al., 2014). Differences and similarities between NSSI and suicide have received attention in the recent years. Some of the important findings are discussed below. Briefly, NSSI and suicide are comorbid problems even though the age of onset of NSSI is earlier than suicide, and individuals with a history of suicide attempt report a higher frequency of NSSI, using more severe methods, and have lower self-esteem compared to individuals with only a history of NSSI.

Brausch, and Gutierrez (2010) studied differences in psychological factors between individuals with a history of NSSI only and those with a history of NSSI plus a suicide attempt. The findings indicated that the group with only a history of NSSI had higher self-

esteem, more parental support, and lower levels of negative self-evaluations and suicidal ideation than those who had made a suicide attempt. They concluded that these factors influenced the risk of engagement in suicide attempts in adolescents with NSSI. However, the two groups did not differ on peer support, disordered eating behaviors, body dissatisfaction, hopelessness and physical and somatic complaints.

Paul, Tsypes, Eidlitz, Ernhout, and Whitlock (2015) investigated NSSI and suicidal thoughts and behaviors (STBs) in college students between 18 and 29 years of age. They reported that participants with a history of NSSI were more likely to have had a past suicide attempt than participants without a history of NSSI. Moreover, the relationship between STBs and NSSI was positive and curvilinear. As the frequency of NSSI episodes increased, the risk for STBs peaked and then decreased. The maximum risk for STBs was related to 21-50 lifetime NSSI attempts for suicide plans and 11-20 lifetime NSSI attempts for suicidal ideation. The individuals with a history of suicide attempt were more likely to engage in NSSI to prevent committing suicide or hurting themselves with more severe methods.

A study investigating NSSI disorder and suicidal behavior disorder (SBD, from DSM-V) among adolescents ($N = 111$) clarified similarities and differences between NSSI and suicide. Thirty-seven percent ($N = 41$) of the sample met criteria for NSSI disorder, while 31.2% ($N = 43$) of the sample met criteria for lifetime SBD, and 27% had current SBD. The rate of co-occurrence of NSSI disorder and SBD was 18.9% ($N = 21$). Although the two clinical groups did not differ regarding sociodemographic factors and other diagnoses, the age of onset was significantly earlier for a NSSI episode than a suicide attempt (12.5 and 13.9 years, respectively). The first suicide attempt was reported one or two years after

the onset of NSSI in most of the participants. Moreover, the frequency of NSSI was higher and methods were more severe in the SBD group than in those with NSSI disorder (Fischer et al., 2014).

Although there is compelling support in favor of differences between suicide and NSSI, the Interpersonal Theory of Suicide (Joiner, Ribeiro, & Silva, 2012) considers NSSI as a gateway behavior to suicide attempts. This theory proposes that engagement in NSSI increases tolerance to pain and decreases fear of death through habituation; this in turn, leads into increased risk for suicide. Some studies provided support for the Interpersonal Theory of Suicide, reporting that pain persistence mediates the relationship between NSSI and suicide attempts. Also, people with a history of a suicide attempt are more likely to have more episodes of NSSI and engage in more severe methods. It seems that a greater episodes of NSSI and using more painful methods habituate these individuals to pain, making them more likely to attempt suicide in future.

For example, Law, Khazem, Jin, and Anestis, (2017) investigated the moderating role of physical pain persistence, defined as willingness to persist from the onset of pain to the maximum intensity of pain that can be tolerated, in the relationship between suicide and NSSI through two studies. The first study explored the effect of pain persistence on the relationship between NSSI frequency and past suicide attempts among 145 undergraduate students. The second study extended the results of the first study and examined the moderating role of distress and persistence tolerance in a clinical sample (mean age = 23.6) drawn from the community. Increased willingness to persist in pain was related to a stronger relationship between NSSI and suicide attempts in students. However, in the community sample, both distress and pain persistence moderated the relationship between

NSSI and suicidal behavior. Thus, it suggests that NSSI makes individuals more vulnerable to suicide attempts through pain persistence tolerance.

In a study of 397 female adolescents who were admitted to an acute residential program for NSSI or suicidal behaviors, Stewart et al. (2017) explored the factors that led to the transition from NSSI to suicidal ideation. The participants were categorized into three groups: adolescents without current suicidal ideation or a lifetime suicide attempt (non-ideators), adolescents with current suicidal ideation but no lifetime suicide attempt (suicide ideators), and adolescents with current suicidal ideation and at least one lifetime attempt (suicide attempters). Suicide attempters had a greater number of NSSI episodes, more engagement in risky behaviors (i.e., risky sexual behavior, substance abuse, rule breaking and illegal behavior) in the past month and were younger compared to non-ideators and ideators. In addition, they used more severe methods of NSSI (e.g., burning, skin scraping) as compared to non-attempters.

In conclusion, investigations into NSSI require differentiation between NSSI episodes and suicide attempts because suicide and NSSI are significantly associated with each other, and individuals with NSSI are likely at risk of suicide attempt due to habituation to pain. However, the intention of NSSI is different from suicide; the intention of suicide is ending one's life, while NSSI serves to deal with intrapersonal and interpersonal problems without ending life (Klonsky, 2009). Hence, recent studies have emphasized the functions of NSSI to explicate the reasons for engagement in NSSI.

Functions of NSSI: Why do people engage in NSSI?

A prominent issue in studying the underlying mechanisms of NSSI is identifying the functions of NSSI. Proposing effective treatments and interventions for NSSI is heavily

dependent on understanding why individuals engage in NSSI. One of the important models proposed to explain NSSI is the four functional model of NSSI (Nock, 2009), which assumes that four functional reinforcement processes develop and maintain NSSI. These processes fall into two dichotomous dimensions: positive versus negative and automatic (intrapersonal) versus social (interpersonal). As such, the four functional reinforcement processes are: automatic negative reinforcement (reduction in negative emotional or cognitive states due to engagement in NSSI), automatic positive reinforcement (increase in positive affect following NSSI), social negative reinforcement (avoidance of social situations or interpersonal demands using NSSI), and social positive reinforcement (access to resources that evokes attention and encourages help seeking behaviors following engagement in NSSI). In addition, the functional model of NSSI (Nock, 2009) hypothesized that intrapersonal (e.g., excessively aversive and negative emotions or poor distress tolerance) and interpersonal (e.g., poor relationship and problem-solving skills) vulnerabilities increase the risk of engagement in NSSI when individuals with those vulnerabilities are distressed. Emotion regulation, self-punishment and sensation-seeking are examples of intrapersonal functions to deal with negative emotions and cognitions, whereas interpersonal influences (e.g., an attempt to manipulate or impact others) and boundaries (e.g., an effort to create boundaries between self and others and/or have a sense of independent identity from others) are examples how NSSI might be used to overcome interpersonal conflicts or issues (Klonsky, 2009).

Previous studies provided support for the intrapersonal functions of NSSI. A clinical sample of adolescents with NSSI reported their NSSI thoughts and behaviors for 14 days via a personal digital assistant. Fifty-three percent of the participants endorsed automatic

positive reinforcement (APR) motivation for at least one NSSI behavior. Of these, 45% reported feeling satisfaction motivation, 31% felt stimulation, and 24% felt pain. APR motivation was significantly associated with longer duration of NSSI thoughts, more frequent NSSI thoughts and NSSI behaviors, alcohol abuse, and binge eating (Selby, Nock, & Kranzler, 2014).

Saraff and Pepper (2014) provide an argument for the intrapersonal functions of NSSI above and beyond interpersonal functions. Thirty-four percent of the college students in their study reported at least one episode of NSSI in the last year. Although interpersonal functions of NSSI were associated with lifetime NSSI frequency, a significant proportion of variance in lifetime frequency was explained by the intrapersonal functions of NSSI. In another study, Sadeh et al. (2014) investigated functions of NSSI in outpatient adolescents and young adults. They found that the participants were more likely to engage in NSSI for intrapersonal functions (e.g., affect regulation and self-punishment) than interpersonal functions. The most endorsed interpersonal function was creating interpersonal boundaries. A distinction between self, others and environment is made by marking the skin, thereby leads to a sense of identity and autonomy.

A review of the literature by Klonsky (2009) also provided evidence that intrapersonal functions of NSSI, especially emotion regulation, are primary reasons for engagement in NSSI, and individuals with NSSI are less likely to use NSSI for the interpersonal results of this behavior. Hence, the focus of this study will be emotion regulatory function of NSSI.

Emotion dysregulation and NSSI

As shown in previous studies, the intrapersonal functions of NSSI, especially the affect/emotion regulatory functions of NSSI, play an important role in the development and

maintenance of NSSI. Therefore, difficulties with emotion regulation have been examined repeatedly. Gyurak, Gross, and Etkin (2011) defined emotion regulation as a goal-directed process serving to alter the intensity, duration and type of emotions. They introduced two different areas of emotion regulation: implicit and explicit emotion regulation. Implicit emotion regulation (IER) includes automatic processes evoked by the stimuli, completed without monitoring, and can be implemented without awareness and insight. In contrast, explicit emotion regulation is associated with conscious and effortful attempt for initiation, monitored implementation and some degree of insight and awareness.

Anestis et al. (2014) studied the relationships among explicit emotion regulation, suicide attempts, and NSSI in college students and inpatients with substance use disorder. Explicit emotion regulation was significantly associated with NSSI among college students and inpatients. Furthermore, NSSI mediated the relationship between explicit emotion regulation and suicide. Explicit emotion regulation was measured by the Difficulties with Emotion Regulation Scale (Gratz & Roemer, 2004), the Distress Tolerance Scale (Simons & Gaher, 2005), and the Short Grit Scale, a scale that assess pursuit of goals (Duckworth & Quinn, 2009).

A study using a two-week daily diary report methodology examined indices of emotion regulation in individuals with NSSI. The participants with NSSI reported higher negative affect and less positive affect than individuals without NSSI. The difference between the two groups on negative affect inertia (emotional inertia is considered as stability in emotion from one moment to another) was not significant. The study suggested that the experience of negative affect is transient in NSSI. However, there was less positive affect inertia in the NSSI group than the non-NSSI group, which indicated that positive affect was more

transient in the NSSI group. The NSSI group also showed less emotion differentiation. In addition, the results showed that NSSI was not related to emotional reactivity for either negative and positive affect (Bresin, 2014). However, higher negative affect in individuals with NSSI suggests that they have significant emotional intensity, which is an indication of emotion dysregulation. Emotional intensity is defined as an extreme emotional reaction to events that are less likely to provoke intense emotions in persons without emotion dysregulation. Lower emotional differentiation also suggests emotion dysregulation in people with NSSI because differentiation between emotions is considered a step of the emotion regulation process (Linehan, 1993).

Klonsky (2007) reviewed previous studies and suggested that they provided strong evidence for explicit emotion regulation and self-punishment functions for NSSI episodes. Evidence for anti-suicide (i.e., engagement in NSSI to avoid suicidal ideation and attempt) and interpersonal-boundaries functions were modest, despite the fact that weak evidence was found for the interpersonal functions. Of nine studies, only one study reported strong evidence for interpersonal functions. It is worthy to note that findings related to anti-dissociation (using NSSI to stop dissociation) are inconsistent. Although three studies found that NSSI stopped the dissociative feelings of numbness, death and feeling unreal again, five studies did not confirm the anti-dissociation function.

In sum, as suggested by the discussed studies, emotion regulation is an important function of NSSI. However, the most common measures used for the assessment of emotion dysregulation in individuals with NSSI are self-report measures, including daily diary methods, all measuring explicit emotion regulation. These methodologies are limited in that they are retrospective, potentially biased, and provide information more about how

people perceive their emotion regulation capabilities than about actual emotion regulation abilities. Moreover, a common method used for studying explicit emotion regulation in previous studies is that the participants were instructed to use different emotion regulation strategies in response to emotional stimuli. For instance, participants in such studies are asked to accept the current emotions in acceptance condition or to control emotions by inhibiting them in suppression condition (Germain & Kangas, 2015; Gross & Levenson, 1997). The major drawback of this method is that the instructions make the participants use an emotion regulatory strategy that may not be their habitual (or most efficacious) strategy. The other problem is that, in everyday situations, we usually regulate our emotions without awareness. An informative approach to the assessment of emotion dysregulation that resolves the aforementioned problems involve use of implicit emotion regulation, or IER, measures.

Emotional Conflict Task: Implicit emotion regulation

IER can be assessed by the Emotional Conflict Task (ECT), which is a variant of the classic Stroop task. The Stroop task presents names of color (words) that are printed in various colors (ink). The participant's objective is to indicate color of the ink while ignoring the words. Congruent trials match the ink with words (e.g., the word "Green" printed in green), whereas the incongruent trials present words that are not matched with the ink (e.g., the word "Green" printed in red). The Stroop effect refers to the longer time that takes participants to respond to incongruent trials compared to congruent trials (Lansbergen, Kenemans, & van Engeland, 2007). The Stroop effect is the result of two competing cognitive processes: one process sustains attention to the ink while the other process inhibits reading the word (Høst, 2015). In addition, the Stroop task leads to the

conflict adaptation effect (CAE). The CAE refers to faster reaction times for incongruent trials followed by incongruent trials compared to incongruent trials followed by congruent trials. The reaction time change is the consequence of adjustment to cognitive conflict (Høst, 2015, Larson, Kaufman, & Perlstein, 2009). Based on the Stroop paradigm, the ECT was designed to assess implicit emotion regulation. To elaborate, the ECT presents images of emotional faces (i.e., happy or fearful), and a word (i.e., “fear” or “happy”) written over the images that is either congruent (e.g., happy face with the word “happy”) or incongruent (e.g., happy face with the word “fear”) with the facial expressions (Etkin, Prater, Hoeft, Menon, & Schatzberg, 2010). Furthermore, the emotional task provides scores for four different combinations of congruent and incongruent presentations (i.e., congruent-congruent [Cc], incongruent-incongruent [Ii], incongruent-congruent [Ic] and congruent-incongruent [Ci]).

Reaction time and response accuracy are calculated for congruent and incongruent trials. It is assumed that emotional conflict (EC) occurs when the emotional words are not compatible with emotional faces during incongruent trials, leading to a longer reaction time compared to congruent trials. Therefore, the ECT can assess emotional stimuli processing and attempts to resolve this conflict (implicit emotion regulation) at behavioral level. The ECT provides several indices in addition to EC; congruent CAE, incongruent CAE (Høst, 2015), and overall adaptation. (Etkin, Egner, Peraza, Kandel, & Hirsch, 2006). Congruent CAE is the phenomena of shorter reaction times for congruent trials following congruent trials than reaction times for congruent trials following incongruent trials (Cc-Ic). A faster reaction time for incongruent trials following incongruent trials than for incongruent trial following congruent trial is considered incongruent CAE (Ii-Ci). Finally, overall adaptation

is summation of congruent and incongruent CAEs (Robison et al., 2015):

$$\text{Overall Adaptation} = (I_i - C_i) + (C_c - I_c).$$

As suggested by Robinson et al. (2015), faster responses (faster scores on overall adaptation) in clinical populations, as compared to healthy controls, indicate that the former group reacts to conflicting stimuli with more urgency, or they do not adapt to the stimuli or down-regulate compared to the healthy control group (HC). On the other hand, slower reactions in a clinical population imply that these individuals underperform and fail to speed up to an expected, normal pace.

Etkin, Egner, Peraza, Kandel, and Hirsch (2006) support the notion that emotional adaptation measured by the ECT is an indication of IER. They presumed that activation of an emotion regulatory mechanism by a previous incongruent trial generates emotional adaptation to the current incongruent trial, and this process is implicit because individuals are not aware of the emotion regulation process. The authors investigated the neural correlates of emotional conflict resolution using the ECT task and fMRI among healthy individuals. They posited that greater activity in the dorsomedial prefrontal cortex during incongruent-congruent trials than congruent-congruent (when conflict is greater) is an index of emotional monitoring, and higher activity in rostral cingulate during incongruent-incongruent trials (when conflict is minimal due to adaptation) indicates conflict resolution. Their findings supported their hypotheses, as higher activity in the rostral cingulate was associated with conflict resolution, and greater activity in the dorsomedial prefrontal cortex was related to emotional conflict monitoring. In addition, increased activity in the rostral cingulate with decreased activity in amygdala was observed during emotional adaptation or high conflict resolution, when incongruent trials preceded by an incongruent trial, and the

conflict was resolved faster due to adaptation.

IER also has been studied in several psychiatric disorders including binge eating disorder (BED), generalized anxiety disorder, and depression. For instance, Robinson et al. (2015) studied implicit emotion regulation via the ECT in individuals ($N = 43$) with BED who were receiving Cognitive Behavioral Therapy and Integrative Response Therapy versus a healthy control group ($N = 23$). The results showed no significant difference between groups in accuracy. The BED group showed faster performance on the ECT than the healthy control group, but the post-treatment performance of the BED group resembled healthy group performance on the ECT, even though the difference between the BED group's baseline and post-treatment performance on the ECT was not statistically significant. The authors concluded that the observed faster performance on the ECT was consistent with the affect regulation model of BED. In other words, individuals with binge eating try to reduce or escape from discomfort as quickly as possible. Of note, previous studies showed that difficulties with emotion regulation, such as limited access to emotion regulation strategies and lack of emotional clarity, were associated with binge eating episodes (Eichen, Chen, Boutelle, & McCloskey, 2017; Whiteside et al., 2007).

Etkin, and Schatzberg (2011) examined IER in individuals with generalized anxiety disorder only (GAD only), major depressive disorder only (MDD only), comorbid GAD and MDD and no psychopathology using the ECT and MRI. The groups did not differ on adaptation during congruent trials, and the participant's performance was faster for Ii trials than Ic trials within each group. Furthermore, the GAD only and comorbid groups had more difficulties with regulating the emotional conflict implicitly, assessed by reaction time to incongruent trials, than those in the MDD only or no psychopathology group.

Neuroimaging results demonstrated that individuals in the no psychopathology group evidenced neural activity related to emotional conflict adaptation (i.e. decreased activation in the amygdala as well as increased activity in the ventral cingulate). Nevertheless, this pattern was not observed in the comorbid group.

It is noteworthy that the studies conducted by Egner et al. (2006), Robinson et al. (2015), and Etkin, and Schatzberg (2011) did not provide objective information about the relationship between emotion regulation abilities and performance on ECT. However, the brain areas engaged in emotional conflict monitoring, adaptation and resolution (i.e., the amygdala, rostral cingulate and dorsomedial prefrontal cortex) are the regions linked with emotion regulation in other studies (Banks, Eddy, Angstadt, Nathan, & Phan, 2007; Wager, Davidson, Hughes, Lindquist, & Ochsner, 2008). Therefore, it is important to explore whether performance on the ECT is related to emotion regulation abilities as hypothesized by these authors.

II. PURPOSE AND HYPOTHESES OF THE CURRENT STUDY

To the best of my knowledge, IER in individuals with NSSI has not been studied, even though emotion dysregulation is of paramount importance in NSSI. Hence, it is unknown how individuals with NSSI regulate their emotions implicitly. Such an investigation would provide objective support for current NSSI models highlighting the role of emotion regulation, which may have clinical implications for the treatment of NSSI. As discussed by Robinson et al. (2015), cognitive regulation (e.g., cognitive restructuring in Cognitive-Behavioral Therapy) and explicit emotion regulation strategies (e.g., distress tolerance skills in Dialectical Behavior Therapy) are targeted in traditional psychological interventions. These interventions improve only explicit emotion regulation. If difficulties with IER in persons with NSSI are discovered, interventions directly targeting IER should be explored, especially in the light of recent research providing support for the potential efficacy of brief interventions aiming at enhancing IER (Christou-Champi, Farrow, and Webb, 2015)

In summary, there is ample evidence that emotion dysregulation is one of the most significant mechanisms of NSSI. However, evidence supporting the role of emotion dysregulation in NSSI primarily comes from self-report measures that assess explicit emotion regulation. To further our knowledge about emotion regulation difficulties at behavioral level in individuals with NSSI, the present study aimed to explore IER among individuals with a history of NSSI via the ECT, and compare their performance to individuals without a history of NSSI (control group). To remove the effects of confounding variables that may impact performance on the ECT, general psychological distress and cognitive functions were assessed and controlled for, in case the NSSI and

control groups differed on these potentially confounding variables. Resolving emotional conflict requires regions related to non-emotional (cognitive) functions such as attention. (Kane & Engle, 2002; Kondo, Osaka, & Osaka, 2004). Therefore, to control for the potentially confounding effects of cognitive functions and psychological distress on IER, cognitive functions were measured by Digit Span and Digit Symbol Coding subscales of Wechsler Adult Intelligence Scale-Fourth-Edition (WAIS-IV), while psychological distress was measured by Depression, Anxiety and Stress Scale-21 (DASS-21).

Building upon the similarities between BED and NSSI, as both problems are considered as SIB to deal with negative emotions (Whiteside et al., 2007; Germain, & Hooley, 2012), it was hypothesized that NSSI group's performance on ECT would resemble the performance of those with BED as described by Robinson et al. (2015). In other words, it was expected that the NSSI group would demonstrate faster responses (shorter reaction time) on overall adaptation, EF, congruent and incongruent CAE. Since previous studies (Etkin & Schatzberg, 2011; Robinson et al., 2015) did not find differences between clinical and non-clinical groups in the accuracy rate of the responses, it was predicted that the NSSI group would not differ from the control group in accuracy for congruent, incongruent, Cc, Ci, Ic and Ii trials.

A secondary goal of this study was to investigate the relationship between self-reported emotion dysregulation, via the Difficulties in Emotion Regulation Scale (Gratz, and Roemer, 2004) and implicit emotion regulation, as assessed by performance on ECT. It was hypothesized that scores on DERS were correlated negatively with EC, congruent/incongruent CAE and overall adaptation scores.

III. METHOD

Participants

The participants were recruited from the Texas State University undergraduate and graduate population, and this study included two groups: the NSSI group and the control group. The NSSI group consisted of individuals with at least one NSSI attempt during the last year, whereas the control group included the students without a lifetime NSSI attempt, suicide attempt, or history of any psychiatric disorders or use of psychotropic drugs. The participants in both groups had normal or corrected to normal vision. The original sample included 32 and 28 participants in the control and NSSI group, respectively. Eight participants were excluded from the control group due to either missing data or random responses, while six participants were dropped from the NSSI group for the same reasons. The mean age of final sample was 20.26 ($SD = 2.26$). The control group included 13 females and 11 males, respectively, whereas the NSSI group included 19 females and 3 males. The ethnic background of the participants is presented in Table 1.

Table 1. Ethnicity background of the participants for NSSI and control group

	Control	NSSI
White	8 (33.3%)	7 (31.8%)
African-American	5 (20.8%)	2 (4.5%)
Hispanic/Latino	9 (37.5%)	12 (54.5%)
Asian/Pacific Islander	-	2 (9.1%)
Biracial/multiracial	2 (8.3%)	-

Measures

Emotional Conflict Task

The ECT was modified by Etkin et al. (2006) to measure the effects of emotional conflict. In this paradigm, emotional conflict is the result of incompatibility between task-relevant and task irrelevant emotional components of a stimulus. In the present study, the task included 161 presentations of fearful or happy faces selected from Ekman and Friesen' database (1976) with the words "happy" or "fear" written over them. There were ten faces with five of each sex, and the size of the pictures were 384 by 570 pixels. The words were written around the nose in red color with font of 14. The contrast and illumination of the pictures were equated across all stimuli.

The stimuli were presented for 1000 milliseconds (ms), and the intervals between stimuli varied from 3000 to 5000 ms in a pseudorandom order. Trial types for word, gender and facial expression were counterbalanced. The participants were instructed to indicate the

emotions of faces as quickly and accurately as possible while ignoring the words written over them by pressing a button with their middle and right index fingers. The task was developed in and administered by Super Lab 5 (Cedrus, San Pedro, CA) on a 21-inch monitor. The reaction times for each trial were recorded.

Inventory of Statements About Self-injury (ISAS)

The lifetime frequency of 12 NSSI behaviors were assessed by the first section of the ISAS. The assessed behaviors were: hitting self/banging, burning, biting, cutting, curving, needle-sticking, wound picking, hair pulling, pinching, severe scratching, rubbing skin against rough surfaces and swallowing chemicals. For each behavior, the participant was asked to report the estimated number of times they engaged in each behavior. Age of onset and approximate date of the most recent NSSI attempt were asked by two open-ended questions (Klonsky & Glenn, 2009). The second part of the ISAS measuring functions of NSSI was not administered because the questions were not relevant to the aims of this study. Using a sample of 761 college students, Klonsky, and Olino (2008) showed that ISAS had good psychometric properties. The internal consistency and test-retest (one to four-week interval) reliability of 12 NSSI behaviors were 0.84 and 0.85, respectively. Item-total correlations for the behaviors were between 0.22 (swallowing chemicals) and 0.60 (banging/hitting self), with a median of 0.52 (Klonsky, & Olino, 2008).

Mini International Neuropsychiatric Interview (MINI)

The MINI was developed as a brief structured diagnostic interview to screen for psychiatric disorders using the DSM-III-R criteria. The initial version demonstrated good inter-rater reliability (kappa values between 0.53 and 0.78), except for current drug dependence, with a kappa of 0.43. The MINI also has appropriate test-retest reliability of

above 0.75 for most of the subscales, except for current mania ($r = 0.40$). The reliability and validity of MINI have been studied in different countries, with support for its psychometrics (Sheehan et al., 1997). The MINI has been revised based on changes in DSM criteria. The last version is the MINI 7.0.0 which includes DSM-V and ICD-10 criteria for a wide variety of psychiatric disorders. Since suicide behavior disorder is a condition needing further study in the DSM-V, it was not assessed in the present study. The Borderline Personality Disorder subscale of Structured Clinical Interview of DSM-V for Personality Disorder was administered to assess BPD, since the SCID-II is a widely used semi-structured diagnostic interview which assess personality disorders based on DSM criteria (First, Spitzer, Gibbon, & Williams, 1995). The validity and reliability of SCID for DSM, including inter-rater and test-retest reliability, has been supported in different countries and populations (Lobbestael, Leurgans, Arntz, & Wiley, 2011; Wong & Chow, 2011; Zanarini & Frankenburg, 2001).

Digit Span

The Digit Span subscales of the WAIS-IV were used to assess immediate recall. This task includes two different tests: forward and backward Digit Span. For Forward Span, the participant repeated the two number sequence given by the examiner. When the response is correct, the next trial adds a new digit, and assessment continues until the participant fails two trials in row or repeats the last trial with 8 digits. Forward Digit Span assesses the efficiency of attention, and it is sensitive to poor attentiveness, distraction, and poor concentration. The task for backward Digit Span is to repeat the digits given by the examiner in reverse order, with the same number of possible digits as in forward Digit Span. Good performance on backward Digit Span requires the ability to store the data

briefly and manipulate it mentally, as compared to forward Digit Span. Digit Span has good psychometric properties with an internal consistency of 0.93, and a stability coefficient of 0.83. In addition, the correlation between scores on this task in WAIS-III and WAIS-IV is 0.75 (Manual of WAIS-IV, 2008).

Digit Symbol Coding

Digit Symbol Coding is another WAIS-IV subscale that measures psychomotor speed, mental efficiency, attention, and concentration that are not associated with education and learning (Gary Groth-Marnat, 2003; Lezak, Howieson, Bigler, & Tranel, 2012). Digit Symbol Coding includes numbers from 0 to 9 which are paired with different nonsense symbols. Also, there are rows with small blank sequences which are paired randomly with the numbers from 0 to 9, and the task is to fill in the blank spaces with the symbols associated with the key. The score is the number of squares that are filled in correctly in a specific time (120 seconds). This task is a valid and reliable test with stability coefficient of 0.86 and internal consistency of 0.86. The Coding scores in WAIS-IV is highly associated with ones in WAIS-III ($r = 0.85$) (Manual of WAIS-IV, 2008).

Depression Anxiety and Stress Scale-21 (DASS-21)

DASS-21 is a self-report measure designed to assess symptoms of depression, anxiety and stress. This scale has three subscales (i.e., Depression, Anxiety and Stress), and each subscale is 7 items. Each item is on a 4-point Likert scale (0 = “Did not apply to me at all, 3 = “Applied to me very much, or most of the time”). The score for each scale ranges from 0 to 42 since the score is multiplied by two (Tran, Tran, & Fisher, 2013). The psychometric properties of this scale are strong, and have been studied across various populations. For instance, Antony, Bieling, Cox, Enns, and Swinson (1998) investigated the psychometric

properties of DASS-21 in a community sample and individuals with panic disorder, obsessive-compulsive disorder, social phobia, specific phobia and major depressive disorder. Exploratory factor analysis suggested three-factor solution which explained 67% of the variance. The internal consistency of DASS-21 was appropriate with Cronbach's alpha of 0.94, 0.87, and 0.91 for Depression, Anxiety and Stress, respectively.

Moreover, the three-factor structure of DASS-21 has been supported by a study done in Italy using a non-clinical group and two clinical groups (depressive and anxious groups). As expected by authors, the depressed group's scores on Depression was higher than the anxious group while the anxious group scored higher on Anxiety compared to the depressed group. However, the non-clinical group indicated lower scores on Depression and Anxiety than the clinical samples. These results suggested appropriate criterion-oriented validity of DASS-21.

In addition, a study by Henry, and Crawford (2005) demonstrated the validity and reliability of DASS-21 in a non-clinical adult population with mean age of 41. Internal consistencies of Depression, Stress Anxiety were 0.88, 0.90, 0.82, respectively. Moreover, they studied relationship between DASS-21 and the Positive and Negative Affect Scale (PANAS). A positive relationship of 0.69 was reported between total score on DASS-21 and the Negative Affect subscale of PANAS, whereas the relationship between the Positive Affect subscale of PANAS and total score on DASS-21 was negative (Henry, & Crawford, 2005).

Difficulties in Emotion Regulation Scale (DERS)

The DERS is a 36-item self-report measure developed by Gratz, and Roemer (2004) that assesses 6 dimensions of emotion dysregulation: Acceptance (negative attitudes about

negative emotions), Goals (deficit in engagement in goal directed behaviors while experiencing negative emotions), Impulse Control (inability to control impulses and urges), Awareness (difficulties in attending to negative emotions and acknowledging them), Strategies (perceived effectiveness of available emotion regulation strategies), and Clarity (knowing what kinds of emotions one is experiencing). Gratz and Roemer (2004) provided support for the validity and reliability of DERS. Using a sample of 373 undergraduate students aged between 15 and 55 years old, they reported that 6 factors emerged in exploratory factor analysis, explaining 55.7% of the total variance. The internal consistency of the total DERS score was 0.93 with Cronbach's alpha between 0.84 and 0.89 for the subscales. The total score on the DERS was significantly correlated with frequency of NSSI in men ($r = 0.26$) and women ($r = 0.20$) indicating predictive validity of DERS. The 6-factor structure of DERS as well as its internal consistency and construct validity have been supported by other studies in community and clinical samples (Perez, Venta, Garnaat, & Sharp, 2012; Weinberg, & Klonsky, 2009).

Procedure

Students were invited to participate in the study through flyers posted in public campus locations, instructors' advertisements on their TRACS websites, and the Student Counselling Center. An initial screening was done by phone call. Eligible students participated in a single, 90-minute session that began with the informed consent process. Depending on initial screening, the participants were assigned to the NSSI or control group. For those in the NSSI group, NSSI behaviors were further examined by the ISAS. Afterwards, the participants performed the ECT, followed by Digit Span and Digit Symbol Coding. To avoid the potential effects of fatigue on performance of the ECT, Digit Span or

Digit Symbol Coding, the diagnostic interviews (MINI, SCID-BPD), DERS and DASS-21 were administered at the end of the session. Moreover, the diagnostic interview may activate emotions and cognitions that interfere with performance on ECT, especially in individuals with NSSI. For the participants in non-NSSI group, the same process was followed, although the ISAS was not administered for this group due to lack of NSSI history. All participants received either \$15 or course extra credit in exchange for their participation.

Data analysis

To understand the sample characteristics, mean age, gender and ethnicity background of the NSSI and control groups were calculated. Then, *t*-test and chi-square tests were conducted to explore age, gender and ethnicity differences between the NSSI and control groups.

Reaction time corresponding to error and post-error trials were removed, and only reaction times for correct responses were included in data analysis (Etkin et. al., 2006). Afterwards, mean reaction time was calculated for congruent, incongruent, Cc, Ci, Ic and Ii trials. Then, EC, congruent/incongruent CAE, and overall adaptation were computed. Initial data analyses indicated that overall adaptation, congruent and incongruent CAE had one extreme outlier in the NSSI group. Hence, the individual was excluded from analyses. Number of correct responses for congruent/incongruent, Cc, Ci, Ic, Ii and the number of un-responded trials were calculated, and natural log transformation was used for congruent, Cc, and the number of un-responded trials since their distributions were not normally distributed.

Before conducting multivariate analysis of covariance (MANCOVA) testing to

understand performance on the ECT, group differences in forward/backward Digit Span, Digit Symbol Coding and total DASS-21 scores, were examined by multiple independent sample *t*-tests. Then, MANCOVA was used to understand differences between the groups in overall adaption, congruent/incongruent CAE and EC, while controlling for gender and DASS-21 scores. A second MANCOVA was performed to examine differences in DASS-21 and DERS scores, after adjusting for gender. Number of correct trials on congruent, incongruent, Cc, Ci, Ic, Ii and number of un-responded trials were compared across the groups.

Finally, relationships between explicit emotion regulation (DERS) and implicit emotion regulation indices (overall adaptation, EF, congruent/incongruent CAE) were investigated by Pearson-Product Moment correlation.

IV. RESULTS

Demographics

The mean age of participants in the control group was 19.83 ($SD = 1.66$), and the NSSI group had a mean age of 20.73 ($SD = 2.75$). An independent t -test showed no significant difference in age across the groups ($t(33.939) = -1.322, p = 0.195$), while a Chi-square test showed a significant difference in gender across the two groups ($\chi^2(1) = 5.62, p = 0.018$). The control group included more males ($N = 11$) than the NSSI group ($N = 3$), while the NSSI group included more females ($N = 19$) than the control group ($N = 13$). Therefore, gender was entered into the MANCOVA models as a covariate. However, no differences in ethnicity were found between groups ($\chi^2(4) = 7.088, p = 0.131$).

NSSI behaviors

The most common lifetime NSSI methods were cutting (68.2%), banging/hitting self (50.0%), and burning (27.3%) followed by pinching (22.7%), carving (18.2%), biting (18.2%), needle-sticking (18.2%), rubbing skin against rough surfaces (13.6%), severe scratching (13.65), hair pulling (13.6%), and swallowing dangerous chemicals (9.1%). The mean of number of lifetime NSSI attempts was 250, with wide variance in the NSSI group ($SD = 391.47$). The minimum and maximum number of NSSI attempts were 3, and 1305, respectively. Furthermore, the mean age of NSSI onset was 13.248 ($SD = 2.72$) with a minimum age of six and a maximum age of 17. The mean time since the most recent NSSI attempt was 9.33 weeks before participating in the study ($SD = 9.05$), with a minimum and maximum of one and 36 weeks before the in-person session, respectively. Moreover, seven individuals (31.8%) in the NSSI group reported at least one lifetime suicide attempt.

Psychiatric history

Of the participants within the NSSI group, nine participants (40.9%) reported a history of receiving psychotherapy, while seven (31.8%) reported that they were currently on psychiatric medication. The psychiatric diagnostic history of the NSSI individuals is presented in Table 2. Some of the participants met criteria of more than one psychiatric disorder. No participants in the control group reported any psychiatric disorder.

Table 2. Psychiatric disorders in the NSSI group

Psychiatric disorders	
Major depressive disorder (Past)	8 (36.4%)
Major depressive disorder (recurrent)	2 (9.1%)
Bipolar II disorder	2 (9.1%)
Bipolar I disorder	1 (4.5%)
Panic disorder (lifetime)	5 (22.7%)
Panic disorder (current)	1 (4.5%)
Agoraphobia	4 (18.2%)
Social anxiety disorder	5 (22.7%)
Obsessive compulsive disorder	3 (13.6%)
Post-traumatic stress disorder	4 (18.2%)
Alcohol abuse	1 (4.5%)
Substance abuse disorder	1 (4.5%)
Bulimia nervosa	2 (9.1%)
Generalized anxiety disorder	9 (40.9%)
Antisocial personality disorder	1 (4.5%)
Attention deficit/hyperactive disorder	4 (18.2%)
Borderline personality disorder	2 (9.1%)

Group differences on forward/backward Digit Span, Digit Symbol Coding and DASS-21

The independent t -test results showed that the groups did not differ on forward Digit Span ($t(44) = -1.374, p = 0.176$), backward Digit Span ($t(44) = -1.065, p = 0.293$), and Digit Symbol Coding ($t(44) = 0.485, p = 0.63$). However, the difference on DASS-21 scores was statistically significant ($t(44) = -6.24, p = 0.001$), such that the NSSI group indicated higher scores on DASS-21 ($M = 50.36, SD = 13.46$) than the control group ($M = 28.63, SD = 9.56$). As such, only the DASS-21 was included as a covariate in the MANCOVA models because other variables were not different across the groups.

Group Differences on number of correct trials for congruent, incongruent, Cc, Ci, Ic and Ii and un-responded trials, controlling for gender and DASS-21

The effect of group in the overall model was not statistically significant (Wilks's $\Lambda = 0.861, p = 0.567$) after controlling for gender and DASS-21 scores. The NSSI group did not differ from the control group on the number of correct trials for congruent, incongruent, Cc, Ci, Ic, Ii and the number of un-responded trials. The means and standard deviations of the dependent variables are presented in Table 3. Since psychological symptoms are highly associated with NSSI in the literature (Andover et al., 2005), DASS-21 scores were dropped from the model to resolve any possible multi-collinearity issues. However, the new model did not evidence a significant main effect of group after adjusting for gender (Wilks's $\Lambda = 0.811, p = 0.327$).

Table 3. Mean and standard deviation of number of correct trials for congruent, incongruent, Cc, Ci, Ic, Ii and un-responded trials

	Control		NSSI	
	Mean	SD	Mean	SD
Incongruent	55.250	15.537	58.818	14.853
Congruent	4.170	0.224	4.201	0.190
Cc	3.336	0.308	3.363	0.273
Ci	25.167	8.385	26.000	8.706
Ic	26.000	8.536	27.636	9.0793
Ii	20.875	8.543	22.955	9.945
Un-responded	3.144	1.058	2.749	0.975

Group Differences on EC, incongruent/ congruent CAE, and overall adaptation controlling for gender and DASS-21

The MANCOVA model did not indicate a significant effect of group on EC, incongruent/ congruent CAE, and overall adaptation (Wilks's Λ . = 0.907, p = 0.277) after controlling for gender and DASS-21. The means and standard deviations of the dependent variables in the model are captured in Table 4. The DASS-21 scores were dropped from the model as it was done for number of correct trials, and the new model showed that the main effect of group was not still statistically significant (Wilks's Λ . = 0.165, p = 0.501).

Table 4. Mean and standard deviation of number of correct trials for overall adaptation, EC, and incongruent/congruent trials

	Control		NSSI	
	Mean	SD	Mean	SD
Overall adaptation	14.638	45.742	17.346	34.430
EC	-65.410	47.710	-46.598	33.131
Incongruent CAE	10.744	41.658	20.554	37.718
Congruent CAE	3.893	39.974	-3.207	45.022

Relationship between explicit emotion regulation and implicit emotion regulation indices (EC, congruent/incongruent CAE, overall adaptation)

A Pearson correlation test was conducted to understand how explicit emotion dysregulation was related to IER. Since the sample size was small in each group, the correlation analyses were performed for the whole sample, instead of separately by group. These correlations indicated that perceived emotion dysregulation was not associated with the implicit emotion regulation indices, as shown in Table 5.

Table 5. Correlation coefficients for implicit emotion regulation indices and explicit emotion regulation

	Overall adaptation	Congruent CAE	Incongruent CAE	CE
DERS	0.224	-0.059	0.275	-0.349

Group Differences on DERS and DASS-21 controlling for gender

The overall MANCOVA model indicated that the main effect of group was statistically significant (Wilks's $\Lambda = 0.425$, $p = 0.001$) with a strong effect size ($\eta^2 = 0.575$). For the DERS, the effect of group was significant after adjusting for gender ($F(1,42) = 12528.555$,

$p = 0.001$) such that the NSSI group had higher scores ($M = 102.61$, $SD = 22.53$) than the control group ($M = 68.21$, $SD = 15.98$). Group membership accounted for 44% of the variance in DERS scores. Additionally, the groups were statistically different in terms of scores on the DASS-21 ($F(1, 42) = 6136.468$, $p = 0.001$), and the corresponding effect size was 0.536. The NSSI group reported higher depression, anxiety, and stress symptoms ($M = 51.29$, $SD = 13.46$) compared to the control group ($M = 28.63$, $SD = 9.56$).

V. DISCUSSION

The primary aim of the current study was to examine implicit emotion regulation in individuals with NSSI using the ECT. Implicit emotion regulation is an automatic regulatory process to change, modify or sustain a specific emotional state (Gyurak, Gross, & Etkin, 2011). To control factors potentially influencing performance on ECT, cognitive factors (i.e., attention, psychomotor speed) and psychological symptoms (i.e., depression, anxiety and stress) were measured. Another aim of the study was to explore relationship between explicit and implicit emotion regulation.

As hypothesized, mean of accuracy for congruent, incongruent, Cc, Ci, Ic and number of un-responded trials were not different across the groups after controlling for gender and depression, anxiety, and stress symptoms. These findings are consistent with previous studies (Etkin, Egner, Peraza, Kandel, & Hirsch, 2006; Robinson et al. 2015). It suggests that individuals with NSSI did not differ from members of the control group regarding perception of emotions. However, it is not clear if they identify their emotions in everyday experiences with the same accuracy, especially in those situations that are more personally relevant or emotional. The results should be replicated, since the sample size was small in this study.

Another finding of this study was that the NSSI group did not significantly differ from the control group in terms of IER indices, including EF, incongruent/congruent CAE and overall adaptation. This was despite the hypothesis that the NSSI group would show faster reaction times for those indices. The lack of differences may be due to small sample size of the study; the work may have had insufficient power to find differences between the groups. Nevertheless, the lack of evidence about difficulties with IER at behavioral level in

the NSSI group can be the consequence of compensatory process for resolving IER deficits at neural levels. Etkin and Schatzberg (2011) studied IER in patients with depression and did not find differences in IER between the depressed and control groups at a behavioral level, as indicated by the non-significant difference on overall adaptation. Nevertheless, functional MRI results showed a deficit in the depressed group: a decrease in amygdala activity accompanied by an increase in ventral cingulate activity. These structures are related to emotional conflict adaptation. This deficit was compensated for by increasing activity in the anterior lateral prefrontal area that is responsible for successful emotional adaptation. Furthermore, another assumption can be inefficiency of ECT in discovering IER. The intervals between trials were long varying from 3000 ms to 5000 ms, and it might have been compromised the Stroop effect. Future studies improving the task or designing new tasks that measure IER can be more informative.

In contrast with my hypothesis, explicit emotion regulation measured by DRES was not significantly related to EC, congruent/incongruent CAE or overall adaptation. It suggests that self-perceived emotion dysregulation is not associated with IER at a behavioral level. However, a larger sample size can provide more compelling evidence about the relationship between explicit and implicit emotion regulation.

Finally, the study explored differences in explicit emotion dysregulation, depression, anxiety and stress, and the results provide evidence for higher levels of emotion dysregulation and psychological symptoms in the NSSI group than the control group, after adjusting for gender. Higher scores on emotion dysregulation in the NSSI group conflicts with the lack of difference between the groups in IER. Future studies examining performance on ECT while measuring neural activity in areas engaged in emotion

regulation (i.e., anterior lateral prefrontal cortex, rostral cingulate, and dorsomedial prefrontal cortex) will clarify if the compensatory process shown in depressed people are responsible for a lack of evidence for IER deficits in individuals with NSSI. Higher levels of depression, anxiety and stress are in line with prior studies indicating higher depressive and anxiety symptoms in individuals with NSSI (Bentley et al., 2015; Andover et al., 2005).

Limitations

The major limitation of the study was that the sample size was very small limiting interpretation of the results. Moreover, the NSSI group was predominantly female, and the findings may not be generalizable to males with NSSI. Larger sample sizes that include roughly equal numbers of men and women would provide the chance to investigate gender differences. This would further our knowledge about NSSI behaviors. However, if even larger sample sizes cannot find any difference in IER across NSSI and control group, neuroimaging measures will enhance our understanding of emotion regulatory process at neural levels. Third limitation of the study was that comorbid psychiatric disorders were diverse in the NSSI group. Previous studies have shown that different psychiatric disorders have a distinguishable pattern of influences on ECT. For instance, individuals with BED have faster reaction times on ECT than control group members, whereas people with GAD react slower to ECT than control group members, and depressed people do not differ from a healthy control group (Etkin and Schatzberg, 2011). Hence, it is not clear how the psychiatric disorders comorbid with NSSI in the sample of participants affected ECT performance. Further studies that controlled for psychiatric disorders should be considered. Moreover, the severity of NSSI was very diverse in the sample such that the lifetime

frequency of NSSI attempts ranged from 3 to 1305. Future studies should control for the level of severity as indicated by frequency of NSSI in the past year. In addition, including participants with clinical levels of NSSI may show how these people perform differently on ECT compared to a control group. Ultimately, only happy and scared facial expression were used as emotional stimuli in the current study; however, individuals with NSSI may have problems with regulating other negative emotions such as anger or sadness, and this warrants further investigation.

Conclusion

The findings showed that NSSI participants reported deficits in emotion regulatory processes that were not consistent with their performance on the ECT. The study needs to be replicated, given the limitations noted above. Changes in the ECT task design such as including other negative emotions (e.g. anger and sadness) may improve the ability to detect IER deficits related to NSSI. Measuring gaze behaviors while attending and responding to ECT can also help us understand how NSSI affects perception of emotions at basic processing levels. Finally, recording brain activity using MRI, fMRI and EEG is another way to improve this work, especially given evidence that frontal/temporal alpha asymmetry are associated with emotion dysregulation (Choi, Sekiya, Minote, and Watanuki, &, 2016; Hannesdóttir, Doxie, Bell, Ollendick, & Wolfe, 2010; Vendemia & Rodriguez, 2010). Regardless of the limitations of this study, it highlights the importance of examining IER in NSSI since it is a transdiagnostic symptom related to various psychiatric disorders.

APPENDIX SECTION

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APPENDIX A: DEMOGRAPHIC INFORMATION

What is your age in years?

How do you usually describe yourself? (Select the ONE group that you MOST identify as)

White/non-Hispanic

Black/non-Hispanic

Hispanic/Latino/a

Asian or Pacific Islander

American Indian, Alaskan Native, or Native Hawaiian

Biracial or Multiracial

Other _____

Which gender do you most identify with?

Male

Female

Transgendered

APPENDIX B: PSYCHIATRIC BACKGROUND INTERVIEW

1. Have you ever been treated with psychotherapy for this/these psychiatric disorder?
2. Please circle YES if currently in psychological treatment, and No if not.
3. Have you ever been treated with psychiatric medications for this/these psychiatric disorder?
4. Please circle YES if currently receiving psychiatric medication, and NO if not.

APPENDIX C: INITIAL SCREEN

1. Do you have normal or corrected-to-normal vision?
2. Have you ever diagnosed with neurological problems like epilepsy, multiple sclerosis, brain tumor etc.?
3. Have you ever done these behaviors at least once during the last year intentionally (on purpose) but without suicide intent (not for suicidal reasons)

Cutting
Biting
Burning
Carving
Pinching
Pulling hair
Severe scratching
Banging or hitting self
Interfering with wound healing (e.g., picking scabs)
Rubbing skin against rough surface
Sticking self with needles
Swallowing dangerous substances
Other

4. Have you ever attempted suicide in your life?
5. Have you ever been diagnosed with a psychiatric disorder? (by a psychologist or psychiatrist).

APPENDIX D: INVENTORY OF STATEMENTS ABOUT SELF-INJURY (ISAS) – SECTION I.BEHAVIORS

This questionnaire asks about a variety of self-harm behaviors. Please only endorse a behavior if you have done it intentionally (i.e., on purpose) and without suicidal intent (i.e., not for suicidal reasons).

1. Please estimate the number of times in your life you have intentionally (i.e., on purpose) performed each type of non-suicidal self-harm (e.g., 0, 10, 100, 500):

Cutting	_____	Severe Scratching	_____
Biting	_____	Banging or Hitting Self	_____
Burning	_____	Interfering w/ Wound Healing (e.g., picking scabs)	_____
Carving	_____	Rubbing Skin Against Rough Surface	_____
Pinching	_____	Sticking Self w/ Needles	_____
Pulling Hair	_____	Swallowing Dangerous Substances	_____
Other _____, _____			

***** **Important:** If you have performed one or more of the behaviors listed above, please complete the final part of this questionnaire. If you have not performed any of the behaviors listed above, you are done with this particular questionnaire and should continue to the next.

2. If you feel that you have a *main* form of self-harm, please circle the behavior(s) on the first page above that you consider to be your main form of self-harm.

3. At what age did you:

First harm yourself?

Most recently harm yourself? _____
(approximate date – month/date)

APPENDIX E: DIFFICULTIES WITH EMOTION REGULATION SCALE (DERS)

	Almost never				Almost always
I am clear about my feelings	1	2	3	4	5
I pay attention to how I feel	1	2	3	4	5
I experience my emotions as overwhelming and out of control	1	2	3	4	5
I have no idea how I am feeling	1	2	3	4	5
I have difficulty making sense out of my feelings	1	2	3	4	5
I am attentive to my feelings	1	2	3	4	5
I know exactly how I am feeling	1	2	3	4	5
I care about what I am feeling	1	2	3	4	5
I am confused about how I feel	1	2	3	4	5
When I'm upset, I acknowledge my emotions	1	2	3	4	5
When I'm upset, I become angry with myself for feeling that way	1	2	3	4	5
When I'm upset, I become embarrassed for feeling that way	1	2	3	4	5
When I'm upset, I have difficulty getting work done	1	2	3	4	5

	Almost never				Almost always
When I'm upset, I become out of control					
When I'm upset, I believe that I will remain that way for a long time	1	2	3	4	5
When I'm upset, I believe that I'll end up feeling very depressed	1	2	3	4	5
When I'm upset, I believe that my feelings are valid and important	1	2	3	4	5
When I'm upset, I have difficulty focusing on other things	1	2	3	4	5
When I'm upset, I feel out of control	1	2	3	4	5
When I'm upset, I can still get things done	1	2	3	4	5
When I'm upset, I feel ashamed with myself for feeling that way	1	2	3	4	5
When I'm upset, I know that I can find a way to eventually feel better	1	2	3	4	5
When I'm upset, I feel like I am weak	1	2	3	4	5
When I'm upset, I feel like I can remain in control of my behaviors	1	2	3	4	5

	Almost never				Almost always
When I'm upset, I feel guilty for feeling that way	1	2	3	4	5
When I'm upset, I have difficulty concentrating	1	2	3	4	5
When I'm upset, I have difficulty controlling behaviors	1	2	3	4	5
When I'm upset, I believe there is nothing I can do to make myself feel better.	1	2	3	4	5
When I'm upset, I become irritated with myself for feeling that way	1	2	3	4	5
When I'm upset, I start to feel very bad about myself	1	2	3	4	5
When I am upset, I believe that wallowing in it is all I can do	1	2	3	4	5
When I'm upset, I lose control over my behavior	1	2	3	4	5
When I'm upset, I have difficulty thinking about anything else	1	2	3	4	5
When I'm upset, I take time to figure it out what I am really feeling	1	2	3	4	5

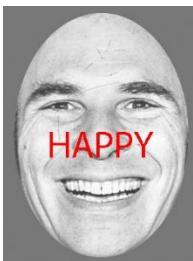
	Almost never				Almost always
When I'm upset, it takes me a long time to feel better	1	2	3	4	5
When I'm upset, my emotions feel overwhelming	1	2	3	4	5

APPENDIX F: DEPRESSION ANXIETY AND STRESS SCALE-21

	Did not apply to me at all			Applied to me very much
I found it hard to wind down	1	2	3	4
I was aware of dryness of my mouth	1	2	3	4
I couldn't seem to experience any positive feeling at all	1	2	3	4
I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion	1	2	3	4
I found it difficult to work up the initiative to do things	1	2	3	4
I tended to over-react to situations	1	2	3	4
I experienced trembling (e.g., in the hands)	1	2	3	4
I felt that I was using a lot of nervous energy	1	2	3	4
I was worried about situations in which I might panic and make a fool of myself	1	2	3	4
I felt that I had nothing to look forward to	1	2	3	4

	Did not apply to me at all			Applied to me very much
I found myself getting agitated	1	2	3	4
I found it difficult to relax	1	2	3	4
I felt down-hearted and blue	1	2	3	4
I felt I was close to panic	1	2	3	4
I was intolerant of anything that kept me from getting on with what I was doing	1	2	3	4
I was unable to become enthusiastic about anything	1	2	3	4
I felt I wasn't worth much as a person	1	2	3	4
I felt that I was rather touchy	1	2	3	4
I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)	1	2	3	4
I felt scared without any good reason	1	2	3	4
I felt that life was meaningless	1	2	3	4

APPENDIX G: EXAMPLES OF EMOTIONAL CONFLICT TASK STIMULI



APPENDIX H: DIGIT SYMBOL CODING

Coding

1	2	3	4	5	6	7	8	9
└)	^	—		┐	⌋	└	└

Demo Sample

6	8	3	9	5	4	1	7	2	1	4	8	2	7	6	9	3	5
8	3	1	9	2	5	6	4	3	7	2	9	8	1	4	7	6	5
9	1	2	4	7	2	5	6	9	5	8	6	4	3	1	7	8	3
1	3	9	6	3	9	7	5	1	4	2	8	7	2	8	5	6	4
7	6	4	1	3	2	8	1	7	9	2	5	3	4	8	6	5	9
8	1	9	5	1	4	2	6	9	8	7	3	5	6	4	7	2	3
3	6	8	9	1	8	4	7	5	2	9	6	7	1	5	2	3	4
6	4	1	9	5	7	3	6	8	3	2	7	5	8	4	2	9	1

APPENDIX I: DIGIT SPAN

3. Digit Span



Start

Ages 16-90:

Forward: Item 1

Backward: Sample Item, then Item 1

Sequencing: Sample Item, then Item 1



Discontinue

Forward: After scores of 0 on both trials of an item

Backward: After scores of 0 on both trials of an item

Sequencing: After scores of 0 on both trials of an item



Score

Score 0 or 1 point for each trial.

DSF, DSB, and DSS

Total raw score for Forward, Backward, and Sequencing, respectively

LDSF, LDSB, and LDSS

Number of digits recalled on last trial scored 1 point on Forward, Backward, and Sequencing, respectively

Forward

Item	Trial	Response	Trial Score	Item Score
1.	9-7		0 1	0 1 2
	6-3		0 1	
2.	5-8-2		0 1	0 1 2
	6-9-4		0 1	
3.	7-2-8-6		0 1	0 1 2
	6-4-3-9		0 1	
4.	4-2-7-3-1		0 1	0 1 2
	7-5-8-3-6		0 1	
5.	3-9-2-4-8-7		0 1	0 1 2
	6-1-9-4-7-3		0 1	
6.	4-1-7-9-3-8-6		0 1	0 1 2
	6-9-1-7-4-2-8		0 1	
7.	3-8-2-9-6-1-7-4		0 1	0 1 2
	5-8-1-3-2-6-4-7		0 1	
8.	2-7-5-8-6-3-1-9-4		0 1	0 1 2
	7-1-3-9-4-2-5-6-8		0 1	

LDSF
(Max = 9)

Digit Span Forward (DSF)
Total Raw Score
(Maximum = 16)

Backward

Item	Trial	Current Response	Response	Trial Score	Item Score
S.	7-1	1-7			
	3-4	4-3			
1.	3-1	1-3		0 1	0 1 2
	2-4	4-2		0 1	
2.	4-6	6-4		0 1	0 1 2
	5-7	7-5		0 1	
3.	6-2-9	9-2-6		0 1	0 1 2
	4-7-5	5-7-4		0 1	
4.	8-2-7-9	9-7-2-8		0 1	0 1 2
	4-9-6-8	8-6-9-4		0 1	
5.	6-5-8-4-3	3-4-8-5-6		0 1	0 1 2
	1-5-4-8-6	6-8-4-5-1		0 1	
6.	5-3-7-4-1-8	8-1-4-7-3-5		0 1	0 1 2
	7-2-4-8-5-6	6-5-8-4-2-7		0 1	
7.	8-1-4-9-3-6-2	2-6-3-9-4-1-8		0 1	0 1 2
	4-7-3-9-6-2-8	8-2-6-9-3-7-4		0 1	
8.	9-4-3-7-6-2-1-8	8-1-2-6-7-3-4-9		0 1	0 1 2
	7-2-8-1-5-6-4-3	3-4-6-5-1-8-2-7		0 1	

LDSB
(Max = 8)

Digit Span Backward (DSB)
Total Raw Score
(Maximum = 16)

CONTINUING

WAIS-IV Record Form 5

REFERENCES

- American Psychiatric Association. (2013). *American Psychiatric Association Diagnostic and statistical manual of mental disorders: DSM-5*. Washington, DC: American Psychiatric Association.
- Andover, M. S., Pepper, C. M., Ryabchenko, K. A., Orrico, E. G., & Gibb, B. E. (2005). Self-mutilation and symptoms of depression, anxiety, and borderline personality disorder. *Suicide and Life-Threatening Behavior*, 35(5), 581–591.
- Andover, M. S., & Gibb, B. E. (2010). Non-suicidal self-injury, attempted suicide, and suicidal intent among psychiatric inpatients. *Psychiatry Research*, 178(1), 101–105.
<https://doi.org/10.1016/j.psychres.2010.03.019>
- Anestis, M. D., Kleiman, E. M., Lavender, J. M., Tull, M. T., & Gratz, K. L. (2014). The pursuit of death versus escape from negative affect: An examination of the nature of the relationship between emotion dysregulation and both suicidal behavior and non-suicidal self-injury. *Comprehensive Psychiatry*, 55(8), 1820–1830. <https://doi.org/10.1016/j.comppsy.2014.07.007>
- Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and a community sample. *Psychological Assessment*, 10(2), 176–181. <https://doi.org/10.1037/1040-3590.10.2.176>
- Baetens, I., Claes, L., Muehlenkamp, J., Grietens, H., & Onghena, P. (2011). Non-suicidal and suicidal self-injurious behavior among Flemish adolescents: A web-survey. *Archives of Suicide Research*, 15(1), 56–67.
- Banks, S. J., Eddy, K. T., Angstadt, M., Nathan, P. J., & Phan, K. L. (2007). Amygdala – frontal connectivity during emotion regulation, 303–312. <https://doi.org/10.1093/scan/nsm029>
- Bentley, K. H., Cassiello-Robbins, C. F., Vittorio, L., Sauer-Zavala, S., & Barlow, D. H. (2015). The association between nonsuicidal self-injury and the emotional disorders: A meta-analytic review. *Clinical Psychology Review*, 37, 72–88. <https://doi.org/10.1016/j.cpr.2015.02.006>
- Bentley, K. H., Nock, M. K., & Barlow, D. H. (2014). The Four-Function Model of nonsuicidal self-Injury. <https://doi.org/10.1177/2167702613514563>

- Brausch, A. M., & Gutierrez, P. M. (2010). Differences in non-suicidal self-injury and suicide attempts in adolescents. *Journal of Youth and Adolescence*, 39(3), 233–242. <https://doi.org/10.1007/s10964-009-9482-0>
- Bresin, K. (2014). Five indices of emotion regulation in participants with a history of nonsuicidal self-injury: A: Daily diary study. *Behavior Therapy*, 45(1), 56–66. <https://doi.org/10.1016/j.beth.2013.09.005>
- Bryan, C. J., Rudd, M. D., Wertenberger, E., Young-McCaughon, S., & Peterson, A. (2015). Nonsuicidal self-injury as a prospective predictor of suicide attempts in a clinical sample of military personnel. *Comprehensive Psychiatry*, 59, 1–7. <https://doi.org/10.1016/j.comppsy.2014.07.009>
- Camp, I. Van, Desmet, M., & Verhaeghe, P. (2011). Gender differences in non-suicidal self-injury: Are they on the verge of leveling off? *2nd International Conference on Behavioral, Cognitive and Psychological Sciences*, 23, 28–34.
- Cerutti, R., Manca, M., Presaghi, F., & Gratz, K. L. (2011). Prevalence and clinical correlates of deliberate self-harm among a community sample of Italian adolescents. *Journal of Adolescence*, 34(2), 337–347. <https://doi.org/10.1016/j.adolescence.2010.04.004>
- Choi, D., Sekiya, T., Minote, N., & Watanuki, S. (2016). Relative left frontal activity in reappraisal and suppression of negative emotion: Evidence from frontal alpha asymmetry (FAA). *International Journal of Psychophysiology*, 109, 37–44.
- Christou-Champi, S., Farrow, T. F. D., & Webb, T. L. (2015). Automatic control of negative emotions: Evidence that structured practice increases the efficiency of emotion regulation. *Cognition & Emotion*, 0(0), 1–13. <https://doi.org/10.1080/02699931.2014.901213>
- Claes, L., Luyckx, K., & Bijttebier, P. (2014). Non-suicidal self-injury in adolescents: Prevalence and associations with identity formation above and beyond depression. *Personality and Individual Differences*, 61–62, 101–104. <https://doi.org/10.1016/j.paid.2013.12.019>
- Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the Short Grit Scale (Grit–S). *Journal of Personality Assessment*, 91(2), 166–174. <https://doi.org/10.1080/00223890802634290>

- Duggan, J., Heath, N., & Hu, T. (2015). Non-suicidal self-injury maintenance and cessation among adolescents : A one-year longitudinal investigation of the role of objectified body consciousness , depression and emotion dysregulation, 9(21),1–13. <https://doi.org/10.1186/s13034-015-0052-9>
- Eichen, D. M., Chen, E., Boutelle, K. N., & McCloskey, M. S. (2017). Behavioral evidence of emotion dysregulation in binge eaters. *Appetite*, 111, 1–6. <https://doi.org/10.1016/j.appet.2016.12.021>
- Eisenberg, D., Hunt, J., & S. N. (2013). Mental health in American colleges and universities: Variation across student subgroups and across campuses. *The Journal of Nervous and Mental Disease*, 201(1), 60–67.
- Emery, A. A., Heath, N. L., & Mills, D. J. (2016). Basic psychological need satisfaction , emotion dysregulation , and non-suicidal self-Injury engagement in young adults : An application of Self-Determination Theory, 45(3), 612–623. <https://doi.org/10.1007/s10964-015-0405-y>
- <https://doi.org/10.1016/j.neuron.2006.07.029>
- Etkin, A., Egner, T., Peraza, D. M., Kandel, E. R., & Hirsch, J. (2006b). Resolving Emotional Conflict: A role for the rostral anterior cingulate cortex in modulating activity in the amygdala. *Neuron*, 51(6), 871–882. <https://doi.org/10.1016/j.neuron.2006.07.029>
- Etkin, A., Prater, K. E., Hoeft, F., Menon, V., & Schatzberg, A. F. (2010). Failure of anterior cingulate activation and connectivity with the amygdala during implicit regulation of emotional processing in generalized anxiety disorder. *American Journal of Psychiatry*, 167(5), 545–554. <https://doi.org/10.1176/appi.ajp.2009.09070931>
- Etkin, A., & Schatzberg, A. F. (2011). Common abnormalities and disorder-specific compensation during implicit regulation of emotional processing in generalized anxiety and major depressive disorders. *American Journal of Psychiatry*, 168(9), 968–978. <https://doi.org/10.1176/appi.ajp.2011.10091290>
- Fischer, G., Ameis, N., Parzer, P., Plener, P. L., Groschwitz, R., Vonderlin, E., Kaess, M. (2014). The German version of the self-injurious thoughts and behaviors interview (SITBI-G): A tool to assess non-suicidal self-injury and suicidal behavior disorder. *BMC Psychiatry*, 14(1), 265. <https://doi.org/10.1186/s12888-014-0265-0>
- Gary Groth-Marnat. (2003). *HANDBOOK OF PSYCHOLOGICAL ASSESSMENT* (4th ed.). Hoboken, New Jersey: John Wiley and Sons.

- Germain, S. A. St, and Hooley, J. M. (2012). Direct and indirect forms of non-suicidal self-injury: Evidence for a distinction. *Psychiatry Research - Neuroimaging*, 197(1), 78–84.
- Germain, C. L., & Kangas, M. (2015). Trait anger symptoms and emotion regulation: The effectiveness of reappraisal, acceptance and suppression strategies in regulating anger. *Behaviour Change*, 32(1), 35–45. <https://doi.org/10.1017/bec.2014.28>
- Glenn, C. R., & Klonsky, E. D. (2011). One-Year Test-Retest Reliability of the Inventory of Statements about Self-Injury (ISAS). *Assessment*, 18(6), 375–378. <https://doi.org/10.1177/1073191111411669>
- Gratz, K. L., & Tull, M. T. (2010). The relationship between emotion dysregulation and deliberate self-harm among inpatients with substance use disorders. *Cognitive Therapy and Research*, 34(6), 544–553.
- Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation : Development , factor structure , and initial validation of the Difficulties in Emotion Regulation Scale, 26(1),41-45.
- Groschwitz, R. C., & Plener, P. L. (2012). The Neurobiology of non-suicidal self-injury (NSSI): A review. *Suicidology Online*, 3, 24–32.
- Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: The acute effects of inhibiting negative and positive emotion. *Journal of Abnormal Psychology*, 106(1), 95–103.
- Gyurak, A., Gross, J. J., & Etkin, A. (2011). Explicit and implicit emotion regulation: A dual-process framework. *Cognition & Emotion*, 25(3), 400–12. <https://doi.org/10.1080/02699931.2010.544160>
- Hamza, C. A., Stewart, S. L., & Willoughby, T. (2012). Examining the link between nonsuicidal self-injury and suicidal behavior: A review of the literature and an integrated model. *Clinical Psychology Review*, 32(6), 482–495. <https://doi.org/10.1016/j.cpr.2012.05.003>
- Hannesdóttir, D. K. Doxie, J., Bell, M. A., Ollendick, T. H., Wolfe, C. D. (2010) A longitudinal study of emotion regulation and anxiety in middle childhood: Associations with frontal EEG asymmetry in early childhood. *Developmental Psychobiology*, 52(2):197–204.

- Hasking, P., Momeni, R., Swannell, S., & Chia, S. (2008). The nature and extent of non-suicidal self-injury in a non-clinical sample of young adults. *Archives of Suicide Research : Official Journal of the International Academy for Suicide Research*, 12(3), 208–218.
<https://doi.org/10.1080/13811110802100957>
- Heath, N. L., Ross, S., Toste, J. R., Charlebois, A., & Nedecheva, T. (2009). Retrospective analysis of social factors and nonsuicidal self-injury among young adults. *Can J Behav Sci*, 41(3), 180–186.
<https://doi.org/10.1037/a0015732>
- Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample, 44(2), 227–239.
<https://doi.org/10.1348/014466505X29657>
- Høst, K. H. (2015). Exploring the emotional conflict task: Associations with clinical status and age (master's thesis). University of Oslo, Problemveien, Norway.
- Joiner, T. E., Ribeiro, J. D., & Silva, C. (2012). Nonsuicidal self-injury, suicidal behavior, and their co-occurrence as viewed through the lens of the Interpersonal Theory of Suicide. *Current Directions in Psychological Science*, 21(5), 342–347. <https://doi.org/10.1177/0963721412454873>
- Kaess, M., Parzer, P., Mattern, M., Plener, P. L., Bifulco, A., Resch, F., & Brunner, R. (2012). Adverse childhood experiences and their impact on frequency, severity, and the individual function of nonsuicidal self-injury in youth. *Psychiatry Research*, 206(2–3), 265–272.
<https://doi.org/10.1016/j.psychres.2012.10.012>
- Kane, M. J., & Engle, R. W. (2002). The role of prefrontal cortex in working-memory capacity, executive attention, and general fluid intelligence: An individual-differences perspective. *Psychonomic Bulletin & Review*, 9(4), 637–671. <https://doi.org/10.3758/BF03196323>
- Klonsky, E. D. (2007). The functions of deliberate self-injury: A review of the evidence. *Clinical Psychology Review*, 27(2), 226–239. <https://doi.org/10.1016/j.cpr.2006.08.002>
- Klonsky, E. D. (2009). The functions of self-injury in young adults who cut themselves: Clarifying the evidence for affect-regulation. *Psychiatry Research*, 166(2–3), 260–268.
<https://doi.org/10.1016/j.psychres.2008.02.008>

- Klonsky, E. D. (2011). Non-suicidal self-injury in United States adults: prevalence, sociodemographics, topography and functions. *Psychological Medicine*, 41(2011), 1981–1986.
<https://doi.org/10.1017/S0033291710002497>
- Klonsky, E. D., & Glenn, C. R. (2009). Assessing the functions of non-suicidal self-injury: Psychometric properties of the Inventory of Statements about Self-injury (ISAS). *Journal of Psychopathology and Behavioral Assessment*, 31(3), 215–219. <https://doi.org/10.1007/s10862-008-9107-z>
- Klonsky, E. D., & Olino, T. M. (2008). Identifying clinically distinct subgroups of self-Injurers among young adults : A latent class analysis, 76(1), 22–27. <https://doi.org/10.1037/0022-006X.76.1.22>
- Kondo, H., Osaka, N., & Osaka, M. (2004). Cooperation of the anterior cingulate cortex and dorsolateral prefrontal cortex for attention shifting, 23, 670–679.
<https://doi.org/10.1016/j.neuroimage.2004.06.014>.
- Lansbergen, M. M., Kenemans, J. L., van Engeland, H. (2007). Stroop interference and attention-deficit/hyperactivity disorder: A review and meta-analysis. *Neuropsychology*, 21(2), 251-262.
- Larson, M. J., Kaufman, D. A. S., & Perlstein, W. M. (2009). Neural time course of conflict adaptation effects on the Stroop task. *Neuropsychologia*, 47 (3), 663-670.
- Law, K. C., Khazem, L. R., Jin, H. M., & Anestis, M. D. (2017). Non-suicidal self-injury and frequency of suicide attempts: The role of pain persistence. *Journal of Affective Disorders*, 209, 254–261.
<https://doi.org/http://doi.org/10.1016/j.jad.2016.11.028>
- Lezak, M. D., Howieson, D. B., Bigler, E. D., & Tranel, D. (2012). *Neuropsychological Assessment*. Oxford University Press.
- Lobbestael, J., Leurgans, M., Arntz, A., & Wiley, J. (2011). Inter-rater reliability of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID I) and Axis II Disorders (SCID II), 79(5), 75–79.
- Manca, M., Presaghi, F., & Cerutti, R. (2014). Clinical specificity of acute versus chronic self-injury: Measurement and evaluation of repetitive non-suicidal self-injury. *Psychiatry Research*, 215(1), 111–119. <https://doi.org/10.1016/j.psychres.2013.10.010>
- Nock, M. K. (2010). Self-injury. *Annual Review of Clinical Psychology*, 6, 339–363.

- Nock, M. K. (2009). Why do people hurt themselves?: New insights into the nature and functions of self-injury. *Current Directions in Psychological Science*, 18(2), 78–83. <https://doi.org/10.1111/j.1467-8721.2009.01613.x>
- Nock, M. K., Joiner, T. E., Gordon, K. H., Lloyd-richardson, E., & Prinstein, M. J. (2006). Non-suicidal self-injury among adolescents : Diagnostic correlates and relation to suicide attempts, 144, 65–72. <https://doi.org/10.1016/j.psychres.2006.05.010>
- Orlando, C. M., Broman-Fulks, J. J., Whitlock, J. L., Curtin, L., & Michael, K. D. (2014). Nonsuicidal self-injury and suicidal self-injury: A taxometric investigation. *Behavior Therapy*, 46(6), 824–833. <https://doi.org/10.1016/j.beth.2015.01.002>
- Paul, E., Tsypes, A., Eidlitz, L., Ernhout, C., & Whitlock, J. (2015). Frequency and functions of non-suicidal self-injury: Associations with suicidal thoughts and behaviors. *Psychiatry Research*, 225(3), 276–282. <https://doi.org/10.1016/j.psychres.2014.12.026>
- Paul, T., Schroeter, K., Dahme, B., & Nutzinger, D. O. (2002). Self-injurious behavior in women with eating disorders. *American Journal of Psychiatry*, 159(3), 408–411. <https://doi.org/10.1176/appi.ajp.159.3.408>
- Perez, J., Venta, A., Garnaat, S., & Sharp, C. (2012). The Difficulties in Emotion Regulation Scale : Factor structure and association with nonsuicidal self-Injury in adolescent inpatients, 393–404. <https://doi.org/10.1007/s10862-012-9292-7>
- Plener, P. L., Libal, G., Keller, F., Fegert, J. M., & Muehlenkamp, J. J. (2009). An international comparison of adolescent non-suicidal self-injury (NSSI) and suicide attempts: Germany and the USA. *Psychological Medicine*, 39(9), 1549. <https://doi.org/10.1017/S0033291708005114>
- Robinson, A., Safer, D. L., Austin, J. L., & Etkin, A. (2015). Does implicit emotion regulation in binge eating disorder matter? *Eating Behaviors*, 18, 186–191. <https://doi.org/10.1016/j.eatbeh.2015.05.011>
- Rossi, A., Alberio, R., Porta, A., Sandri, M. E., Tansella, M., Amaddeo, F. (2004). The Reliability of the Mini-International Neuropsychiatric Interview-Italian Version. *Journal of Clinical Psychopharmacology*, 24(5), 561–563.

- Sadeh, N., Londahl-Shaller, E. A., Piatigorsky, A., Fordwood, S., Stuart, B. K., McNiel, D. E., Yaeger, A. M. (2014). Functions of non-suicidal self-injury in adolescents and young adults with borderline personality disorder symptoms. *Psychiatry Research*, 216(2), 217–222.
<https://doi.org/10.1016/j.psychres.2014.02.018>
- Saraff, P. D., & Pepper, C. M. (2014). Functions, lifetime frequency, and variety of methods of non-suicidal self-injury among college students. *Psychiatry Research*, 219(2), 298–304.
<https://doi.org/10.1016/j.psychres.2014.05.044>
- Selby, E. A., Nock, M. K., & Kranzler, A. (2014). How does self-injury feel? Examining automatic positive reinforcement in adolescent self-injurers with experience sampling. *Psychiatry Research*, 215(2), 417–423. <https://doi.org/10.1016/j.psychres.2013.12.005>
- Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Janavs, J., Weiller, E., Keskiner, A., Dunbar, G. C. (1997). The validity of the Mini International Neuropsychiatric Interview (MINI) according to the SCID-P and its reliability. *European Psychiatry*, 12(5), 232–241. [https://doi.org/10.1016/S0924-9338\(97\)83297-X](https://doi.org/10.1016/S0924-9338(97)83297-X)
- Simons, J. S., & Gaher, R. M. (2005). The Distress Tolerance Scale: Development and validation of a self-report measure. *Motivation and Emotion*, 29(2), 83–102. <https://doi.org/10.1007/s11031-005-7955-3>
- Somer, O., Bildik, T., Kabukçu-Başay, B., Güngör, D., Başay, Ö., & Farmer, R. F. (2015). Prevalence of non-suicidal self-injury and distinct groups of self-injurers in a community sample of students. *Social Psychiatry and Psychiatry Epidemiology*, 50(7), 1163–1171. <https://doi.org/10.1007/s00127-015-1060-z>
- St. Germain, S. A., & Hooley, J. M. (2012). Direct and indirect forms of non-suicidal self-injury: Evidence for a distinction. *Psychiatry Research*, 197(1–2), 78–84.
<https://doi.org/10.1016/j.psychres.2011.12.050>
- Stewart, J. G., Esposito, E. C., Glenn, C. R., Gilman, S. E., Pridgen, B., Gold, J., & Auerbach, R. P. (2017). Adolescent self-injurers: Comparing non-ideators, suicide ideators, and suicide attempters. *Journal of Psychiatric Research*, 84, 105–112. <https://doi.org/10.1016/j.jpsychires.2016.09.031>

- Tatnell, R., & Hasking, P. (2017). Multiple mediation modelling exploring relationships between specific aspects of attachment , emotion regulation , and non-suicidal self-injury, *Australian Journal of Psychology*, 1742-9536. <https://doi.org/10.1111/ajpy.12166>
- Tran, T. D., Tran, T., & Fisher, J. (2013). Validation of the Depression Anxiety Stress Scales (DASS) 21 as a screening instrument for depression and anxiety in a rural community-based cohort of northern Vietnamese women. *BMC Psychiatry*, 13(24), 1–7. <https://doi.org/10.1186/1471-244X-13-24>
- Vendemia, J. M. C., & Rodriguez, P. D. (2010). Repressors vs. low- and high-anxious coping styles: EEG differences during a modified version of the emotional Stroop task. *International Journal of Psychophysiology*, 78(3), 284-294.
- Wager, T. D., Davidson, M. L., Hughes, B. L., Lindquist, M. A., & Ochsner, K. N. (2008). Prefrontal-subcortical pathways mediating successful emotion regulation. *Neuron*, 59(6). <https://doi.org/10.1016/j.neuron.2008.09.006>
- Whiteside, U., Chen, E., Neighbors, C., Hunter, D., Lo, T., & Larimer, M. (2007). Difficulties regulating emotions: Do binge eaters have fewer strategies to modulate and tolerate negative affect? *Eating Behaviors*, 8(2), 162–169. <https://doi.org/http://dx.doi.org/10.1016/j.eatbeh.2006.04.001>
- Wilkinson,P.,Kelvin,R.,Roberts,C., Dubicka,B., & Goodyer, I. (2011). Clinical and psychosocial predictors of suicide attempts and nonsuicidal self-injury in the Adolescent Depression Antidepressants and Psychotherapy Trial (ADAPT), 495-501. *American Journal of Psychiatry*, 168(5).
- Wong, H. M., & Chow, L. M. (2011). Borderline Personality Disorder Subscale (Chinese Version) of the Structured Clinical Interview for DSM-IV Axis II Personality Disorders : a Validation study in Cantonese- speaking Hong Kong Chinese, *East Asian Archives of Psychiatry*, 21(2), 52–58.
- You, J., Leung, F., Fu, K., & Lai, C. M. (2011). The prevalence of nonsuicidal self-injury and different subgroups of self-injurers in Chinese adolescents. *Archives of Suicide Research*, 15(1), 75–86.
- Zanarini, M. C., & Frankenburg, F. R. (2001). Attainment and maintenance of reliability of axis I and II disorders over the course of a longitudinal study. *Comprehensive Psychiatry*, 42(5), 369–374. <https://doi.org/http://dx.doi.org/10.1053/comp.2001.24556>