

University of Memphis

University of Memphis Digital Commons

---

Electronic Theses and Dissertations

---

1-1-2019

**TARGETING SELF-CRITICAL THOUGHTS IN THE TREATMENT OF  
NON-SUCIDAL SELF-INJURY IN ADOLESCENTS: ACCENTUATE  
THE POSITIVE, ELIMINATE THE NEGATIVE**

William Ramsey

Follow this and additional works at: <https://digitalcommons.memphis.edu/etd>

---

**Recommended Citation**

Ramsey, William, "TARGETING SELF-CRITICAL THOUGHTS IN THE TREATMENT OF NON-SUCIDAL SELF-INJURY IN ADOLESCENTS: ACCENTUATE THE POSITIVE, ELIMINATE THE NEGATIVE" (2019). *Electronic Theses and Dissertations*. 2948.

<https://digitalcommons.memphis.edu/etd/2948>

This Dissertation is brought to you for free and open access by University of Memphis Digital Commons. It has been accepted for inclusion in Electronic Theses and Dissertations by an authorized administrator of University of Memphis Digital Commons. For more information, please contact [khggerty@memphis.edu](mailto:khggerty@memphis.edu).

TARGETING SELF-CRITICAL THOUGHTS IN THE TREATMENT OF NON-SUCIDAL  
SELF-INJURY IN ADOLESCENTS: ACCENTUATE THE POSITIVE, ELIMINATE THE  
NEGATIVE

by

William Andrew Ramsey, Jr

A Dissertation

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

Major: Counseling Psychology

The University of Memphis

August 2019

## DEDICATION

Thank you to my grandmother, Fermina Saldaña, for caring for me and, in turn, for teaching me to care for others. Thank you to my college mentor, Irmo Marini, for believing in my ability and encouraging me to pursue a doctorate. Thank you to my wife, Yanin Sanchez Mejorada, for tirelessly supporting me throughout this journey and being the best partner imaginable. Thank you to my mentor, Nicole Alberts, at St. Jude Children's Research Hospital for serving as a role model and supporting my development. Thank you to my dissertation co-chairs, Douglas Strohmer and Garry Del Conte, for their unending support in the conduct of this important research. Thank you to my professor, Kristopher Berlin, for enthusiastically introducing me to and mentoring me in structural equation modeling. Thank you to all the other individuals that were not specifically referenced in this dedication but made their impacts upon me in their own respective ways.

May we all experience Loving-Kindness.

May we all be happy.

May we all experience peace and ease of being.

May we all be well.

## Abstract

The primary purpose of this investigation was to examine the added benefit of directly targeting self-critical thoughts in the treatment of non-suicidal self-injury (NSSI) in youth undergoing Dialectical Behavior Therapy for Adolescents (DBT-A). This was a randomized study of 40 adolescents with recent engagement in NSSI at a partial hospitalization program using DBT-A. This study utilized an additive component treatment design with randomization to either DBT-A or DBT-A Plus. All study participants received the full DBT-A protocol, and those randomized to the DBT-A Plus condition received a brief cognitive intervention developed to decrease self-critical thoughts in adolescents. Of the 40 adolescents that enrolled in the study, 37 completed treatment. The sample included 30 females and 10 males with an average age of 14.92. Overall, study participants experienced mean level decreases in NSSI from baseline to posttreatment,  $-0.06, p = .019$ . Moreover, there was a significant interaction between assignment to treatment condition and changes in self-criticism,  $-0.24, p = .026$ . This indicated that the effect of changes in self-criticism on NSSI at posttreatment varied as a function of assignment to treatment condition. For the DBT-A Plus group, a 1-unit decrease in self-criticism led to 0.79 times fewer acts of NSSI at posttreatment, controlling for baseline NSSI. The results of this investigation provide additional support for the efficacy of DBT-A in reducing NSSI for our youth and underscore the import of directly targeting self-criticism in the treatment of NSSI. Researchers are encouraged to implement advances in statistical modeling procedures to more accurately analyze NSSI in order to advance psychological science and our understanding of how to treat this pernicious class of behaviors in adolescents.

Keywords: adolescents, dialectical behavior therapy, NSSI, self-criticism, self-injury, self-harm, psychotherapy

## Table of Contents

List of Tables	vi
Chapter	Page
1. Introduction	1
Non-Suicidal Self-Injury	2
Why Do People Engage in NSSI?	3
Four-Factor Functional Model of NSSI	3
The Role of Self-Criticism	4
Dialectical Behavior Therapy	5
Dialectical Behavioral Therapy for Adolescents	6
Dialectical Behavior Therapy for Adolescents in the Treatment of NSSI	7
Conceptual, Methodological, and Statistical Considerations	8
Current Investigation and Study Hypotheses	9
2. Methods	10
Participant Selection, Recruitment, and Randomization	10
Procedure	11
Patient Safety	11
Treatment	12
Dialectical Behavioral Therapy for Adolescents	12
Dialectical Behavior Therapy for Adolescents Plus	13
Treatment Adherence	14
Dialectical Behavior Therapy for Adolescents Adherence	14
Dialectical Behavior Therapy for Adolescents Plus Adherence	15
Measures	15
The Inventory of Statements About Self-Injury	15
Difficulties in Emotion Regulation Scale	16
The Forms of Self-Criticising/Attacking and Self-Reassuring Scale	17
The Suicidal Behaviors Questionnaire-Revised	17
The Symptom Checklist-90-Revised	18
Data Analytic Plan	18
Primary Analyses	21
Negative Binomial Latent Growth Curve Model	21
Negative Binomial Autoregressive Model	21
Secondary Analyses	22
3. Results	22
Negative Binomial Latent Growth Curve Model of NSSI	22
Negative Binomial Autoregressive Model for NSSI	24
Secondary Analyses	26
4. Discussion	26
Strengths and Limitations	30

Implications for Training and Treatment	32
Directions for Future Research	33
References	35
Figure 1. Path Diagram of a Linear Latent Growth Curve Model with Random Intercepts, Random Slopes, and Unconstrained Endogenous Dispersion	45
Figure 2. Effects of Treatment Condition and Changes in Self-Criticism on NSSI at Posttreatment	50

## List of Tables

### Table

1. Baseline Demographic, Diagnostic Data, and NSSI by Treatment Condition	46
2. Dependent Samples <i>t</i> -Tests from Baseline to Posttreatment by Treatment Condition for Dialectical Behavior Therapy for Adolescents ( $n = 21$ ) and Dialectical Behavior Therapy for Adolescents Plus ( $n = 19$ )	47
3. Negative Binomial Latent Growth Curve Model of NSSI with Maximum Likelihood Parameter Estimates and Robust Standard Errors ( $N = 40$ )	48
4. Correlations for Negative Binomial Autoregressive Model for NSSI ( $N = 40$ )	48
5. Negative Binomial Autoregressive Model for NSSI with Maximum Likelihood Parameter Estimates and Robust Standard Errors ( $N = 40$ )	49

## Targeting Self-Critical Thoughts in the Treatment of Non-Suicidal Self-Injury in Adolescents: Accentuate the Positive, Eliminate the Negative

Over the last decade, there has been growing interest in the study of non-suicidal self-injury (NSSI). Perhaps this interest can be attributed to the mounting base of evidence supporting the status of NSSI as a robust predictor of suicide attempts (Asarnow et al., 2011; Hamza, Stewart, & Willoughby, 2012; Klonsky, May, & Glenn, 2013; Victor & Klonsky, 2014; Wilkinson, Kelvin, Roberts, Dubicka, & Goodyer, 2011), and suicide is the second and third leading cause of death in individuals between the ages of 10 through 19 and 20 through 34, respectively (Heron, 2013). Recent research indicates prevalence rates between 33% and 38% in clinical samples of adolescents (Asarnow et. al, 2011; Jacobson, Muehlenkamp, Miller, & Turner, 2008) and between 18% and 21% in community samples of adolescents (Baetens, Claes, Muehlenkamp, Grietens, & Onghena, 2011; Brausch, & Gutierrez, 2010). Moreover, NSSI appears to occur across the world with similar rates of prevalence (Muehlenkamp, Claes, Havertape, & Plener, 2012).

There is evidence to suggest that psychological interventions (e.g., cognitive-behavioral therapy and Dialectical Behavior Therapy) are efficacious in decreasing NSSI in adolescents (see Brausch & Girresch, 2012; Brent, McMakin, Kennard, Goldstein, Mayes, & Douaihy, 2013; Ougrin, Tranah, Stahl, Moran, & Asarnow, 2015). However, methodological limitations in the literature (e.g., lack of well-controlled studies; nonrandomization of participants; and definitions of self-injurious behavior that do not discriminate with regard to suicidal intent) limit our ability to attribute treatment gain to the intervention (Glenn, Franklin, & Nock, 2015). Moreover, previous researchers have neglected directly targeting self-criticism in the treatment of NSSI, despite it being the second most commonly reported reason for engaging in NSSI (Bentley,



Nock, & Barlow, 2014; Glenn & Klonsky, 2013; Nock & Prinstein, 2004, 2005). The current investigation aimed to build upon previous findings by employing an additive component treatment design (Nock, Janis, & Wedig, 2008) to explore the benefit of incorporating an intervention targeting self-criticism in adolescents actively engaging in NSSI.

### **Non-Suicidal Self-Injury**

NSSI is classified as a “condition requiring further study” in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-V; American Psychiatric Association, 2013). NSSI can be conceptualized as a heterogeneous group of behaviors that fall upon a continuum, with NSSI at one end and suicidal self-injury (SSI) at the other. In order to meet the criteria for NSSI, an injury must meet the following criteria: intentional, self-inflicted mutilation of bodily tissue with no suicidal intent and outside of socially sanctioned practices (e.g., tattooing and piercing) (Hamza et al., 2012; Klonsky, Victor, & Saffer, 2014; Turner, Austin, & Chapman, 2014). Although NSSI and SSI are conceptually related, several factors serve to differentiate these constructs, such as, form, frequency, function, and intensity.

The onset of NSSI typically occurs in early adolescence between the ages of 12 and 14, and most studies have reported no differences in the prevalence of NSSI between males and females (Gratz, 2001; Nock & Prinstein, 2004, 2005). Common methods of NSSI include cutting, burning, and scratching, with intensity ranging from superficial abrasions to severe scarring of bodily tissue requiring medical treatment (Gratz, 2001). NSSI has a much higher incidence when compared with SSI. Nock and Prinstein (2004), for example, observed an average of 80 incidences of NSSI over a 12-month period in an adolescent inpatient unit, contrasted with 2.8 lifetime incidences of reported SSI within a similar sample (Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). Lastly, and perhaps most importantly, NSSI is

distinguished from SSI in that it is performed in the absence of suicidal intent (Hamza et al., 2012).

### **Why Do People Engage in NSSI?**

NSSI is conceptualized as a particularly effective, albeit maladaptive, coping strategy for regulating intense, aversive emotions (Andover & Morris, 2014; Bentley et al. 2014; Klonsky, 2007; Klonsky et al., 2014; Nock, 2010). That is, individuals engage in NSSI in the presence of negative cognitive, emotional, and physiological states in order to experience a sense of relief. From an operant conditioning perspective, this reinforcing pain-offset feature makes NSSI more likely to occur under similar circumstances in the future. Haines, Williams, Brain, and Wilson (1995) gathered convincing empirical support for this hypothesis through a novel, experimental investigation by incorporating the use of imaginal exposure and the measurement of physiological responses. Their findings heavily influenced the development of theoretical models seeking to explain why individuals engage in NSSI (see Messer & Fremouw, 2008).

### **Four-Factor Functional Model of NSSI**

Nock and Prinstein (2004) developed the four-factor functional model of NSSI (FFM) to explain the contingencies that maintain non-suicidal self-injurious behavior. Nock and Prinstein argued that the utilization of a functional approach of inquiry—that is, understanding the antecedents, contingencies, and contextual influences that promote and maintain a behavior—has led to innovations in the conceptualization, assessment, and treatment of a wide range of behavioral problems. Over a series of studies, Nock and Prinstein (2004, 2005) acquired strong empirical support for their hypothesized FFM of NSSI. The model is comprised of two dichotomous dimensions: positive reinforcement vs. negative reinforcement and intrapersonal reinforcement vs. interpersonal reinforcement.

In Nock and Prinstein's (2004) sample of 108 inpatient adolescents, the intrapersonal-negative reinforcement subscale of the FFM was endorsed more than any of the other three subscales (i.e., the majority of people reported engaging in NSSI to regulate aversive affective, cognitive, and physiological states). The intrapersonal-positive subscale was endorsed second most frequently (i.e., engaging in NSSI to self-punish and generate desired feelings). And, there was no difference in the rates of endorsement between the positive and negative interpersonal reinforcement subscales (i.e., influencing the behavior of others).

### **The Role of Self-Criticism**

Perhaps the consistent endorsement of the intrapersonal-negative function of the FFM accounts for the majority of interventions targeting emotion regulation in the treatment of NSSI (Andover & Morris, 2014; Klonsky, 2007; Turner et al., 2014). There is also, however, strong support for the role of self-punishment as it is the second most reported reason for engaging in this behavior (Glenn & Klonsky, 2013; Nock & Prinstein, 2004, 2005). Moreover, self-criticism appears to be intricately interrelated to NSSI. For example, Glassman, Weierich, Hooley, Deliberto, and Nock (2007) found that self-criticism fully mediated the relationship between childhood emotional abuse and NSSI during adolescence. Moreover, self-criticism continued to predict NSSI, after controlling for depression. Gilbert et al. (2010) assessed the relationship between self-criticism and NSSI and determined that the self-persecutory form of self-criticism may be especially linked to self-harm. Moreover, there is some evidence to suggest that self-criticism has a causal relationship to NSSI (Hooley & St. Germain, 2013).

In a novel investigation, Hooley and St. Germain (2013) hypothesized that exposure to a brief cognitive intervention designed to decrease self-criticism would also decrease pain endurance in non-suicidal self-injurers. The researchers found evidence of significant decreases

in self-criticism following exposure to the intervention and that, on average, participants who received the cognitive intervention demonstrated greater increases in positive self-worth relative to participants assigned to the control conditions. Moreover, after participating in the experimental intervention, non-suicidal self-injurers experienced greater decreases in willingness to endure pain relative to individuals without histories of NSSI. These findings, coupled with the experimental nature of the design, underscore the role of addressing self-criticism in the treatment of NSSI. Researchers have predominantly opted to utilize cognitive-behavioral treatment protocols such as Dialectical Behavior Therapy (DBT; Glenn et al., 2015; Turner et al., 2014) in the treatment of NSSI without directly targeting the second most reported reason for engaging in NSSI. Given the scant research addressing self-criticism, the primary purpose of the current study was to assess the added benefit of directly targeting self-criticism in the treatment of NSSI for adolescents enrolled in DBT.

### **Dialectical Behavior Therapy**

DBT (Linehan, 1993) was developed in response to the needs of chronically suicidal women living with borderline personality disorder (BPD). DBT is perhaps best conceptualized as a cognitive and behavioral approach with some distinguishing features such as the demonstration of enhanced effectiveness across multiple clinically relevant outcomes, including the reduction of self-injurious behaviors. DBT is a highly flexible multistage, multimodal treatment that has been demonstrated as more effective than treatment as usual across multiple clinically relevant variables in two separate randomized clinical trials (Linehan, Armstrong, Suarez, Allmon, & Heard, 1991; Linehan et al., 2006). The section below further describes the features that distinguish DBT from other cognitive-behavioral approaches.

DBT (Linehan, 1993) is provided across four modes of therapy (i.e., individual therapy, group skills training, consultation group, and phone coaching) that serve the five following therapeutic functions: (1) enhancing patient motivation for treatment, (2) enhancing patient capability, (3) generalizing learned behavior to the patient's natural environment, (4) enhancing therapist capabilities and motivation to treat patients effectively, and (5) structuring the environment for success. DBT utilizes a stage model approach to dictate targets for treatment. For example, the pretreatment stage is characterized by an orientation of the patient to treatment and the collaborative development of agreed-upon treatment goals.

The following five areas are hierarchically targeted within the first stage of treatment: (1) the reduction of life-threatening behaviors, (2) the reduction of behaviors that interfere with therapy, (3) the reduction of behaviors that interfere with quality of life, (4) the acquisition the core DBT skills of mindfulness, interpersonal effectiveness, emotion regulation, and distress tolerance, and (5) progress toward the client's goals. The second stage of therapy typically involves helping the client to more fully experience emotion, whereas the third stage is more focused on helping the client to achieve a reasonable degree of happiness. The fourth and final stage is characterized by the development and pursuit of psychological insight, spirituality, and an expanded sense of awareness.

### **Dialectical Behavioral Therapy for Adolescents**

Miller, Rathus, and Linehan (2006) adapted the original DBT protocol in an effort to meet the needs of suicidal adolescents. The primary features that differentiate Dialectical Behavioral Therapy for Adolescents (DBT-A) include: (a) shortened treatment duration, (b) the inclusion of family members in skills training group, (c) the simplification of language in skills training materials, and (d) the addition of family meetings. Rathus and Miller (2002) gathered

preliminary support for the efficacy of their approach by conducting a quasi-experimental investigation that included 111 participants over a decade ago. The group that received DBT-A experienced fewer psychiatric hospitalizations; greater treatment completion; and decreased suicidal ideation, anxiety, depression, and emotional dysregulation relative to those in the treatment as usual condition.

**Dialectical Behavior Therapy for Adolescents in the Treatment of NSSI.** More recent studies have produced similar findings to support the effectiveness of DBT-A in the treatment of suicidal teens (Courtney & Flament, 2015; Fleischhaker, Böhme, Sixt, Brück, Schneider, & Schulz, 2011; Goldstein, Axelson, Birchler, & Brent, 2007; McCauley et al., 2018; Mehlum et al., 2014; Mehlum et al., 2016). Mehlum and colleagues (2014) hypothesized that DBT-A would be superior to enhanced usual care (EUC) in the reduction of self-harm behavior, suicidal ideation, and depressive symptoms in Norwegian adolescents over the course of a 19-week randomized clinical trial. Only the group that was assigned to the DBT-A intervention evidenced significant decreases in self-harm behavior across time on a logarithmic scale ( $\Delta$  slope = -1.28, 95% CI = -1.77, -0.80,  $p < .001$ ), and the between-group difference was significant, as well ( $\Delta$  slope = -0.92, 95% CI = -1.69, -0.15,  $p = .021$ ). Mehlum et al. (2016) reported the results of a one-year prospective follow-up study, and the DBT-A group maintained greater reductions in the frequency of self-harm behavior relative to the EUC group for a difference of - 9.4,  $p < .05$ . More specifically, the DBT-A group reported an average of 9 episodes of self-harm behavior in the initial 19-weeks of treatment and 5 episodes throughout the yearlong follow-up, whereas the EUC group reported 22.5 and 14.8 during the respective intervals.

McCauley and colleagues (2018) conducted a multisite randomized clinical trial to assess the efficacy of DBT-A compared with individual and supportive group therapy (ISGT) in

reducing suicide attempts and NSSI in American adolescents. The active component of the trial was conducted over a six-month period, and participants were followed-up for an additional six-month period. At the end of the six-month active portion of treatment, the DBT-A group experienced greater reductions in both suicide attempts and NSSI relative to the ISGT condition; analyses were based upon the use of a generalized linear mixed-effect model framework for ordinal data (*cf.* generalized linear model framework for count data; Cox, West, & Aiken, 2009). NSSI count was coded as 0, 1-3, 4-6, and 7 or greater. The odds of being at a higher ordinal level were less for the DBT-A group relative to the ISGT group at posttreatment (i.e., six-months),  $OR = 0.32, p < .05$ . Similarly, the odds of being at a higher ordinal level were less for DBT-A compared with the ISGT group at one-year follow-up,  $OR = 0.60, p < .05$ . Although this data analytic procedure improved on the use of previous investigations in which researchers analyzed NSSI as a continuous level outcome, it did not preserve the integrity of the data by modeling the variable in its original metric (i.e., counts as opposed to rank order). Cook and Gorraiz (2015) conducted a preliminary meta-analysis to assess the effectiveness of DBT-A in the treatment of NSSI, which evidenced a large effect size (Hedge's  $g = 0.81, 95\% CI = 0.59, 1.03$ ). These findings, however, should be interpreted with caution as Hedge's  $g$  has been shown to overestimate the impact of the effect to the broader population (Hedges & Olkin, 1985).

*Conceptual, Methodological, and Statistical Considerations.* Much of the research into NSSI has failed to distinguish between NSSI and SSI in the operationalization of this construct: for example, “deliberate self-harm,” “parasuicide,” “self-injurious behavior,” and “suicidal gestures” (Turner et al., 2014). The meta-analysis cited above (Cook & Gorraiz, 2015) included six studies with the following limitations: nonrandomization of study participants to condition; general lack of control groups; and small, homogenous samples of females presenting with BPD.

This body of research has been conducted primarily in small samples of females diagnosed with or evincing features of BPD (Glenn & Klonsky, 2013); however, NSSI frequently occurs independently of BPD (Glenn & Klonsky, 2013; Nock et al., 2006; Selby, Bender, Gordon, Nock, & Joiner, 2012). Lastly, NSSI is a count-level outcome, which means these data do not adhere to the properties of a normal distribution. That is, NSSI adheres to different distributional assumptions, such as, Poisson, negative binomial, zero-inflated Poisson, and zero-inflated negative binomial.

### **Current Investigation and Study Hypotheses**

Clinicians and researchers require investigations that offer conceptually consistent operationalizations of NSSI and include participants beyond individuals diagnosed with BPD, as this behavior frequently occurs outside of this diagnosis. This study builds upon previous research by examining the effects of treatment targeting NSSI delivered under more routine clinical care conditions with a more diverse sample, using the appropriate distributional assumptions. Moreover, we modeled NSSI in its original metric (i.e., counts), allowing us to preserve the integrity of our data, which would not be the case if we had modeled the data as binary or ordinal. Additionally, this is the first study to incorporate an additive component treatment design to assess the added benefit of directly targeting self-criticism in the treatment of NSSI for patients undergoing DBT-A. Based on previous research, the following variables were selected for the study: NSSI, depression, emotion regulation, self-criticism, and suicidal ideation. This investigation aimed to answer the following study hypotheses:

- (1) Study participants will experience linear, mean level decreases in NSSI scores from pretest to posttest (see Figure 1).



(2) NSSI scores at posttreatment will be predicted by reductions in difficulties with emotion regulation and self-criticism scores, controlling for NSSI scores at baseline, change in depression scores, demographic characteristics (i.e., age and sex), and number of days in treatment.

(3) There will be a significant interaction effect between treatment condition and self-criticism in the prediction of NSSI at posttreatment, controlling for NSSI scores at baseline; changes in depression, emotion regulation, and self-criticism scores; demographic characteristics (i.e., age and sex); and number of days in treatment. More specifically, the effect of reductions in self-criticism upon NSSI scores at posttest will be greater for the DBT-A Plus condition relative to the DBT-A group, holding all other variables constant.

(4) Study participants in both the DBT-A and DBT-A Plus condition will experience mean level decreases in depression, difficulties with emotion regulation, NSSI, self-criticism, and suicidal ideation scores from pretest to posttest.

## **Method**

### **Participant Selection, Recruitment, and Randomization**

A total of 40 participants were recruited September 7, 2017, through October 30, 2018 from a partial hospitalization program located in the mid-south region of the country that specializes in the treatment of multi-problem adolescents. The treatment center housed up to 19 patients at a time, with the average 7-week length of stay, or 35 days of treatment. The facility accepted insurance as well as out-of-pocket payment. Inclusion criteria included a history of at least two episodes of NSSI, at least one of which occurred in the last 16 weeks. Exclusion criteria included a diagnosis of schizophrenia spectrum and other psychotic disorders, intellectual

disability, or autism spectrum disorder. Study participants were randomized to treatment using a random number generator. Recruitment and assessment staff were blind to randomization status and sequence. Participants learned their treatment assignment at the first therapy session.

## **Procedure**

Potential participants were screened for NSSI upon entry into the treatment program. If screened positively, the patient and their parent were invited to a diagnostic interview in which the remaining inclusion criteria were assessed. At the onset of treatment, participants were randomly assigned to either the DBT-A or the DBT-A Plus condition within the partial hospitalization program. All participants received the full DBT-A protocol (i.e., individual therapy, family meetings, group therapy, phone coaching, and skills training), and participants assigned to the experimental condition received the experimental intervention in addition to the full DBT-A protocol. After the initial orientation to treatment, study participants were able access to phone coaching between sessions with the aim of generalizing more skillful behavior to settings outside of therapy. All program therapists participated in a weekly provider-focused consultation group led by a Linehan Board Certified DBT Clinician (i.e., third author) who was also the Clinical Director. Patients received ancillary non-manualized pharmacotherapy by a Board Certified Child and Adolescent Psychiatrist as indicated by each respective patient's treatment needs.

**Patient Safety.** The study was approved by the Institutional Review Board and complied with National Institute of Mental Health recommendations for intervention research with patients at high risk for suicidality (Lloyd-Richardson, Lewis, Whitlock, Rodham, & Schatten, 2015). All patients and parents provided written informed assent and consent, as appropriate. Primary therapists and study interventionists received suicide risk assessment and management training

before study commencement. Results from the baseline assessments of suicidality, self-harm, and symptom severity were available to both the clinical and research teams. Furthermore, primary therapists were immediately informed of patient's profiles indicative of high risk of self-harm or suicide.

## **Treatment**

**Dialectical Behavioral Therapy for Adolescents.** Upon entry into the program, study participants were assigned to a primary therapist who oriented the patient to the treatment program, before collaboratively developing a treatment plan consistent with the DBT-A stage model approach. The following behaviors are hierarchically targeted within the first stage of treatment: life threatening behaviors; therapy interfering behaviors; quality of life interfering behaviors; and the acquisition core DBT-A skills (i.e., mindfulness, interpersonal effectiveness, emotion regulation, distress tolerance, and middle path). All participants received the full DBT-A protocol (see Miller et al., 2006).

DBT-A was administered to each patient across multiple modes of therapy (i.e., individual therapy, family meetings, group skills training, problem-solving process-oriented therapy, and phone coaching). On a weekly basis, patients participated in an average of one-hour of individual therapy; one-hour family meeting; five-hours of DBT skills training; and five-hours of group therapy; and phone coaching was used by each patient at their discretion. Moreover, patient's parents attended one-and-a-half hours of adolescent multifamily skills group training per week, with the aim of providing family members with the same tools taught to their children. Psychiatric consultation was utilized as indicated by each patient's needs. See Del Conte, Lenz, and Hollenbaugh (2016) and Del Conte (2018) for a more in-depth review of the treatment protocol within the partial hospitalization program.

**Dialectical Behavior Therapy for Adolescents Plus.** The experimental intervention was administered by two counseling psychology doctoral students who were trained in the intervention and approved for clinical placements by the Clinical Director (i.e., third author) of the partial hospitalization program. Study interventionists were trained by the primary investigator and third author. Training consisted of providing the doctoral students with information concerning the format, rationale, and structure for the intervention. This was proceeded by practice sessions in which the interventionist facilitated the intervention with a confederate under live supervision. Training concluded with a feedback session once the primary investigator and third author were in agreement that the interventionist was able to conduct the intervention to fidelity.

The experimental intervention was modeled after a brief cognitive intervention developed to decrease self-critical thoughts in persons that engage in NSSI (Hooley & St. Germain, 2013). At the beginning of each session, the interventionist issued a handout to study participants assigned to the experimental condition that provided a rationale for learning to accentuate and illuminate positive aspects of oneself. Then, the interventionist discussed the rationale with each respective study participant to check for understanding, before proceeding with the intervention.

The intervention involved having participants assigned to the experimental condition complete a brief checklist of 20 common positive characteristics (e.g., caring, dependable, kind, loyal). Study participants were asked to select any characteristics that they believe apply to them. Understanding that being overly self-critical was a consideration, study participants were asked to select items that a close friend or family member might endorse about them. After a minimum of three positive characteristics were identified, the participant was asked to provide a brief narrative account of a time in which the study participant behaved in a manner congruent with

the identified positive characteristic. Participants were encouraged to identify and describe a specific event. For example, the interventionist offered statements, such as, “Tell me a story about a time you were kind or dependable.” The interventionist utilized additional prompts as necessary to facilitate a therapeutic dialogue (e.g., “Can you say more about that? How do you think your friend felt when you listened to them? What was it like for you to be kind and listen to your friend?”).

After each participant finished recounting an instance in which he or she behaved in a manner congruent with one of his or her selected positive characteristics, the participant was asked to process what it was like to recall this event in detail and share it with the study interventionist. In particular, the participant was asked to identify cognitions, emotions, images, or physiological responses to sharing their narrative. The interventionist modeled responses as necessary to facilitate the intervention (e.g., “It made me feel warm and happy to hear you being kind and supporting your friend.”) Moreover, the interventionist provided positive feedback and encouragement in response to the study participant’s narrative (e.g., “It sounds like you were kind and your friend appreciated your support.”) Each study participant assigned to the experimental condition participated in the experimental intervention once per week, excluding their first week in the program, for a total of four to six 15-minute sessions, throughout their course of treatment.

### **Treatment Adherence**

**Dialectical Behavior Therapy for Adolescents Adherence.** The Clinical Director (i.e., third author) at the partial hospitalization program facilitated a weekly DBT consultation group. In addition to attending DBT consultation group, primary therapists attended individual supervision with the Clinical Director on a weekly basis. At the time of this study, there were a

total of four licensed professional counselors serving as primary therapists in the partial hospitalization program. The Clinical Director had completed Advanced Intensive Training in Dialectical Behavior Therapy at the Linehan Institute and is a Linehan Board Certified DBT Clinician. One of the four program therapists had completed Advanced Intensive Training in DBT, and the other three had completed Foundational Training in DBT. Study therapists ranged between two and four years with regard to their experience practicing DBT.

**Dialectical Behavior Therapy for Adolescents Plus Adherence.** Study interventionists met with the Clinical Director (i.e., third author) for clinical supervision on a weekly basis. Moreover, the research team convened quarterly over the course of the investigation to monitor adherence to the IRB approved protocol. Both study interventionists had completed multiple clinical placements at the time of the investigation. Study interventionists ranged between two and four years with regard to their clinical experience.

## **Measures**

**The Inventory of Statements About Self-Injury.** Klonsky and Glenn (2009) developed this comprehensive self-report instrument to assess the forms, frequency (lifetime estimate), and functions of NSSI. The Inventory of Statements About Self-Injury (ISAS) measures the frequency of 12 different NSSI behaviors such as burning, cutting, severe scratching, and wound picking. An exploratory factor analysis yielded a robust 2-factor solution (i.e., interpersonal function vs intrapersonal function), congruent with work from Nock and Prinstein (2004). Coefficient alphas for the interpersonal and intrapersonal scale scores were .88 and .80, respectively among 235 young adults (18.5 years;  $SD = 1.1$ ) with a history of at least one NSSI behavior, indicating strong internal consistency. Additionally, ISAS scale scores correlated with clinical variables (e.g., depression, BPD, and suicidal ideation) in a manner consistent with

previous research, supporting the construct validity of the instrument (Klonsky & Glenn; Klonsky & Olino, 2008). Lastly, one-to-four week test–retest reliability in a sample of 59 college students (18.5 years;  $SD = 1.2$ ) indicated a Spearman correlation of .85 (Klonsky & Olino). The ISAS was adapted for the purpose of this study to assess the frequency of NSSI across a 2-month period at baseline and posttreatment.

**Difficulties in Emotion Regulation Scale.** Gratz and Roemer (2004) developed the Difficulties in Emotion Regulation Scale (DERS), a 36-item, self-report measure, to reflect difficulties within four dimensions of emotion regulation: (a) awareness and understanding of emotion, (b) acceptance of emotions, (c) the ability to engage in goal-directed behavior when experiencing negative emotions, and (d) access to emotion regulation strategies perceived as effective (p. 43). One’s lack of ability in one or all of these areas characterizes difficulties in emotion regulation. The DERS was developed and normed with a college sample of 357 participants (73% female) ranging in age from 18 to 55 years, with a mean age of 23.10 years ( $SD = 5.67$  years). DERS full-scale and subscale scores were significantly correlated in the expected direction with relevant constructs (e.g., emotional expressivity, experiential avoidance, mood regulation, and self-injury), supporting the construct validity of the instrument. Participants were asked to indicate how often each item applies to them using a 5-point Likert-type scale, where 1 is *almost never* (0–10%) and 5 is *almost always* (91–100%). Several items are reverse scored. The overall DERS scores demonstrated good internal consistency (Cronbach’s  $\alpha = .93$ ), all DERS subscale scores demonstrated adequate internal consistency (Cronbach’s  $\alpha > .80$ ), and the DERS subscale scores demonstrated adequate test-retest reliability over a period ranging from four to eight weeks ( $r$  ranging from .57 to .80).

**The Forms of Self-Criticising/Attacking and Self-Reassuring Scale.** Gilbert, Clarke, Hempel, Miles, and Irons (2004) developed this 22-item self-report measure to assess the forms of self-criticism and self-reassurance. Gilbert and colleagues conducted a principal components analysis with oblimin rotation for the Forms of Self-Criticising/Attacking and Self-Reassuring Scale (FSCSRS) assesses, which provided a three-factor solution (inadequate-self, hated-self, reassured-self). This three-factor solution was upheld through subsequent confirmatory factor analyses in both clinical and non-clinical samples (Baiao, Gilbert, McEwan, & Carvalho, 2015). Participants are asked to respond on a 5-point Likert scale ranging from 0 (*not at all like me*) to 4 (*extremely like me*). Sample items include “There is a part of me that feels I am not good enough” “I have become so angry with myself that I want to hurt or injure myself,” and “I am gentle and supportive with myself.” Cronbach’s alphas ranged from .87 to .91 for inadequate self, .82 to .89 for hated-self, and .82 to .88 for reassured-self (Baiao et al.). We utilized the hated-self subscale for study analyses as this particular dimension of self-criticism has been linked to NSSI (Gilbert et al., 2010).

**The Suicidal Behaviors Questionnaire-Revised.** Osman, Bagge, Gutierrez, Konick, Kopper, and Barrios (2001) developed the Suicidal Behaviors Questionnaire-Revised (SBQ-R)—a brief, four-item self-report inventory designed to assess four different dimensions of suicidality: lifetime suicide ideation and suicide attempts, frequency of suicidal ideation over the past 12-months, past communication of suicidal intent, and self-reported likelihood of suicidal behavior). The SBQ-R has been shown to be useful in differentiating between suicidal and nonsuicidal subgroups. Moreover, the SBQ-R has demonstrated a moderately high Cronbach’s  $\alpha$  of .88 in a sample of inpatient adolescents.



**The Symptom Checklist-90-Revised.** Derogates (1994) developed this 90-item self-report instrument to assess symptomology in community, outpatient, and inpatient psychiatric populations. The Symptom Checklist-90-Revised (SCL-90-R) evaluates current psychological symptom severity across nine dimensions: anxiety, depression, hostility, interpersonal sensitivity, obsessive-compulsive characteristics, paranoid ideation, phobic anxiety, psychoticism, and somatization. These nine dimensions can be combined into a global severity index, which provides an estimate of current level of psychological distress. Participants are asked to respond on a 5-point Likert-type scale ranging from 0 (*Not at all*) to 4 (*Extremely*), with higher scores denoting a greater severity of symptom endorsement. Sample items from the Depression Subscale include “Feeling no interest in things” and “Crying easily.” The Depression Subscale of the SCL-90-R demonstrated robust internal consistency (Cronbach’s  $\alpha = .90$ ) and adequate test–retest reliability ( $r = .82$ ) as well as satisfactory convergent validity with related measures. Due to previous research providing evidence for the relation between depression and NSSI (Cook & Gorraiz, 2015; Wilkinson et al., 2011), the data analytic strategy is particularly concerned with the evaluation of depression as an observed covariate.

### **Data Analytic Plan**

Data were reviewed to assess for outliers, normality, kurtosis, skew, correlations, and multicollinearity with no significant violations observed for model covariates. We replaced the most extreme scores for NSSI at baseline and posttreatment to be one unit greater than the next most extreme case, consistent with recommendations provided by Tabachnik and Fidell (2013). With the use of a  $p < .001$  criterion for Mahalanobis distance, no multivariate outliers among cases were observed. No concerns were present with regard to multicollinearity,  $rs < .7$ . Means and standard deviations were computed for study variables. Differences between groups were

tested via Independent-Samples two-tailed *t*-Tests for continuous variables and Pearson  $\chi^2$  Tests for binary and categorical variables (see Table 1). The study was designed to have a sample size of 40 to power study analyses at 80%, accounting for a medium effect size ( $\eta^2 = .049$ ) for continuous outcomes. All significance tests were two-tailed, with  $p < .05$  considered to be statistically significant for primary analyses. Data analyses followed intention-to-treat; missing data for primary analyses were handled using full information maximum likelihood estimation, whereas missing data for secondary analyses were handled using multiple imputation. Primary analyses were performed with Mplus (Version 8.2) for Windows, whereas data screening and secondary analyses were performed via IBM SPSS Statistics 23.0 for Windows.

The primary outcome variables of interest in this study, NSSI, were count level variables assessed at baseline and posttreatment. Count refers to the number of specified events (i.e., frequency) that occur in a given interval of time, consisting of integers  $\geq 0$  (Karazsia & Van Dulmen, 2008). There are multiple distributional options that have been developed to model nonnormal distributions associated with count data: Poisson, negative binomial, zero-inflated Poisson, and zero-inflated negative binomial. Although count data are often modeled assuming a Poisson distribution (Atkins, Baldwin, Zheng, Gallop, & Neighbors, 2013), the assumptions associated with this model can be overly restrictive. For example, a Poisson distribution assumes equality of mean and variance as well as independence of observations. However, when the dependent variable exhibits greater variance than mean (i.e., overdispersion) and dependence of observations is assumed (i.e., repeated measurements with significant correlations across time), a negative binomial distribution is more appropriate with regard to model specification, identification, estimation, convergence, and interpretation.

The negative binomial regression can be expressed in the following form:  $\ln(\hat{\mu}) = b_0 + b_1X_1 + b_2X_2 + \dots + b_pX_p$  (Coxe et al., 2009, p. 125). In order to interpret the regression coefficient for NSSI in its original metric, as opposed to the natural logarithm of NSSI, we exponentiated both sides of the equation by the power of  $e$ , which can be simplified to  $\hat{\mu} = \exp(b_0 + b_1X_1 + b_2X_2 + \dots + b_pX_p)$ . Note that the former regression equation is in linear form as compared to the latter, which is interpreted as a multiplicative effect upon the predicted count. For clarification we can consider the interpretation of a single predictor (e.g.,  $X_1$ ): that is, for a 1-unit increase in  $X_1$ , the predicted count ( $\hat{\mu}$ ) is multiplied by the exponentiated unstandardized regression coefficient,  $\exp(b_1X_1)$ . Note that this interpretation for this negative binomial regression is different from ordinary least squares regression in that the former effect is multiplicative, whereas the latter effect is additive. For additional information on negative binomial regression and its interpretation, see Atkins et al., (2013), Coxe et al., (2009), and Karazsia and Van Dulmen (2008).

Due to the use of the log link function for our negative binomial regression, conventional model fit indices were not produced: for example, root-mean-square error of approximation (RMSEA), standardized root-mean-square residual (SRMR), comparative fit index (CFI), nor Tucker-Lewis index (TLI). Therefore, we assessed model fit via review of the Bayesian information criteria (BIC), chi-square goodness-of-fit tests, and chi-square difference tests. BIC compares fit between nested and non-nested models, with lower values indicative of better model fit (Kass & Raftery, 1995). The chi-square goodness-of-fit statistic assesses correspondence between observed data and model implied; higher chi-square value and  $p$ -values  $<.05$  are indicative of poor model correspondence (Bollen & Long, 1993). The Yuan-Bentler scaled chi-square was interpreted due to use of robust maximum likelihood (MLR) estimation with missing

data (Yuan & Bentler, 2000). The chi-square difference test was based on loglikelihood values and scaling correction factors obtained with the MLR estimator. We compared relative fit between baseline models (e.g., intercept-only) and theoretical models (e.g., linear change model).

### **Primary Analyses**

**Negative Binomial Latent Growth Curve Model.** Starting at baseline (i.e., zero), time was modeled based upon study participant's number of days in treatment (see Figure 1). We modeled the endogenous variables (i.e., T1 NSSI, T2 NSSI) as count level variables with negative binomial distributions; exogenous latent variables included latent initial status (i.e., intercept) and linear change slope. We created a sum score for NSSI based on self-reported estimates from the past two months, including the following ISAS (Klonsky & Glenn, 2009) items consistent with our operationalization of NSSI: Cutting, Biting, Burning, Pinching, Severe Scratching, Banging or Hitting Self, Interfering with Wound Healing, Rubbing Skin against Rough Surface, and Sticking Self with Needles. A unit loading identification constraint was imposed to scale endogenous dispersion to the first observed model variable (i.e., T1 NSSI; Kline, 2016).

**Negative Binomial Autoregressive Model.** The main analysis examined the structural relation among constructs in predicting NSSI at T2, after controlling for the autoregressive effect of NSSI at T1. The autoregressive coefficient can be conceptualized as a measure of stability in the construct across time (see Selig and Little, 2012). More specifically, we assessed the role of emotion regulation and self-criticism in the treatment of NSSI after estimating the autoregressive component of the model and controlling for age, sex, treatment condition, number of days in treatment, and depression. Moreover, we created an interaction term by composing the product of treatment condition by change in self-criticism. We modeled change scores for depression,

emotion regulation, and self-criticism. Model covariates were mean centered to improve interpretability. Binary variables (i.e., sex and treatment condition) were coded as 0 and 1 to provide an interpretable intercept.

### **Secondary Analyses**

We conducted a series of dependent-samples *t*-tests to assess within-group differences on outcomes at posttreatment. Due to the use of multiple pairwise comparisons,  $p = .01$  was considered significant to reduce the likelihood of type I error. Missing data were replaced using multiple imputation based on averaging 20 iterative Markov-Chain Monte Carlo imputations. Combining rules for univariate estimates adjusted for small-sample degrees of freedom were utilized as presented by Barnard and Rubin (1999). The pooling procedure was carried out using the SPSS syntax and manual by Van Ginkel (2010). See van Ginkel and Kroonenberg (2014) for further information on combining univariate and multivariate estimates in multiple imputation.

### **Results**

Of the 40 adolescents (30 females; 10 males) that enrolled in the study, 37 completed treatment, resulting in a 93% completion rate at posttest. The three individuals that did not complete treatment transitioned to higher levels of care and, thus, were unable to fully participate in this investigation. One of the participants was enrolled in the DBT-A Plus condition, whereas the other two participants were enrolled in the DBT-A condition. They completed 4, 8, and 13 days of treatment, respectively, whereas the average length of stay was 32.98 days ( $SD = 7.64$ ). Moreover, posttest data was not collected for an additional three study participants due to administrative oversight. Data were observed to be missing completely at random, per Little's MCAR test ( $\chi^2(163) = 192.27, p = .058$ ).

### **Negative Binomial Latent Growth Curve Model of NSSI**

In order to test our first hypothesis that study participants would experience linear changes in NSSI from baseline to posttreatment, we estimated a negative binomial latent growth curve model for NSSI. We first began by assessing model fit via review of the baseline (intercept-only) model, before comparing relative fit for the hypothesized model assessing linear change. The baseline model was over-identified ( $df > 0$ ) and provided a  $\chi^2(95) = 32.0, p > .999$ . Based on loglikelihood values for chi-square difference testing adjusted for MLR scaling correction factor, the negative binomial latent growth curve model of NSSI provided a  $\chi^2(3) = 18.60, p < .001$ . We proceeded to assess sample-size adjusted BIC values for the baseline model and linear change model, which were 602.20 and 594.45, respectively. Based upon evaluation of the chi-square difference test and the magnitude of difference in sample-size adjusted BIC values, we proceeded with interpretation of parameter estimates for the negative binomial latent growth curve model of NSSI (see Table 3).

In support of our hypothesis concerning linear change in NSSI from baseline to posttreatment, the multiplicative linear effect indicates that each day of treatment is associated with .94 times fewer acts of NSSI, adjusted for measurement error. The intercept for the negative binomial latent growth curve model NSSI exponentiated to provide the estimate in its original metric and adjusted for measurement error, provides an estimated average of 47.27 acts of NSSI in the past two months at baseline. The estimate of  $\alpha$  for NSSI at pretest for this model is 0.93,  $p < .001$ , indicative of overdispersion; the overdispersion in baseline NSSI, reflecting greater variance than mean, was interpreted to suggest that the negative binomial distribution was appropriately selected. The  $\alpha$  for NSSI at posttest is 0.28,  $p = .759$ , indicative of equidispersion. Although NSSI at posttreatment exhibited significant equidispersion, reflecting equality of mean and variance, the choice of the negative binomial distribution was appropriately chosen due to

the conceptual dependence of observations in NSSI at baseline and posttreatment. The lack of overdispersion in NSSI at posttest was interpreted to suggest that study participants demonstrated far less variability in NSSI at posttreatment.

### **Negative Binomial Autoregressive Model for NSSI**

In order to test our second hypothesis that study participants' scores in NSSI at posttest would be predicted by changes in emotion regulation and self-criticism, controlling for NSSI scores at baseline, change in depression scores, demographic characteristics (i.e., age and sex), as well as treatment condition and number of days in treatment, we estimated a negative binomial autoregressive model for NSSI. See Table 4 for correlations among variables for the negative binomial autoregressive model for NSSI. Moreover, we modeled an interaction term to assess for moderation between change in self-criticism and assignment to treatment condition in the prediction of NSSI at posttreatment as a test of our third hypothesis. First, we began by assessing model fit via review of the baseline (intercept-only) model, before comparing relative fit for the explanatory model including observed covariates.

The baseline model was over-identified ( $df > 0$ ) and provided a  $\chi^2(7) = 3.01, p = .884$ . The negative binomial autoregressive model for NSSI, based on loglikelihood values for chi-square difference testing, adjusted for MLR scaling correction factor, provided a  $\chi^2(14) = 21.10, p < .001$ , when compared with the baseline model. We proceeded to assess sample-size adjusted BIC values for the baseline model and autoregressive model, which were 1347.56 and 1336.24, respectively. Based upon evaluation of the chi-square difference test and the magnitude of difference in sample-size adjusted BIC values, we proceeded with interpretation of parameter estimates for the negative binomial autoregressive model for NSSI (see Table 5).

The intercept for the negative binomial autoregressive model provides an estimated average of 6.53 acts of NSSI at posttreatment over the past two months; the intercept was adjusted for measurement error and exponentiated to provide the estimate in its original metric, holding all other model variables constant. The autoregressive coefficient for NSSI at baseline demonstrates substantial variability, or change, over the course of treatment. The multiplicative difference in average number of NSSI behaviors performed for females versus males was 0.45, holding the interaction effect constant and controlling for the autoregressive effect; females engage in, on average, 0.45 times fewer acts of NSSI than males. The estimate of  $\alpha$  for this model is 0.981,  $p = .011$ , indicative of overdispersion. The overdispersion in posttreatment NSSI was interpreted to suggest that the negative binomial distribution was appropriately selected.

In support of our second and third hypotheses, there was a significant interaction between assignment to treatment condition and changes in self-criticism (see Figure 2 and Table 5). For the DBT-A Plus group, a 1-unit reduction in self-criticism led to 0.79 times fewer acts of NSSI at posttreatment, which was statistically different from zero at the  $p < .05$ . This indicated that the effect of changes in self-criticism on NSSI at posttreatment varied as a function of assignment to treatment condition. We proceeded with analyses of simple slopes to assess whether the relationship between changes in self-criticism and NSSI at posttreatment differed between groups,  $t(9) = -2.08$ ,  $p = .038$ . For the DBT-A Plus group, the simple slopes analysis revealed the following effect: a 1-point decrease in self-criticism was associated with 10.29 fewer instances of NSSI at posttest,  $p < .001$ . Conversely, for the DBT-A group, a 1-point decrease in self-criticism was associated with 7.37 fewer instances of NSSI at posttest,  $p = .167$ . Additionally, there was evidence of significant covariation among study variables (see Table 5). More specifically, there were medium associations between change in depression and changes in both emotion regulation



and self-criticism (see Table 4). Similarly, there was a medium association between the interaction effect and change in depression and a large association between the interaction effect and change in self-criticism.

### **Secondary Analyses**

We conducted a series of dependent-samples *t*-tests to test our fourth hypothesis concerning whether adolescents in each respective treatment group experienced decreases in depression, difficulties with emotion regulation, NSSI, self-criticism, and suicidal ideation. We found mixed evidence in support of this hypothesis; see Table 2 for parameter estimates. Significant differences and large effect sizes were observed from baseline to posttreatment in both groups for depression and self-criticism; however, only the DBT-A group experienced significant change in emotion regulation at the  $p < .01$ . Neither group evidenced significant reductions in NSSI nor suicidal ideation from baseline to posttreatment at the  $p < .01$ .

### **Discussion**

The primary purpose of this investigation was to examine the added benefit of directly targeting self-critical thoughts in the treatment of NSSI in adolescents undergoing DBT-A. We first began by assessing whether there was significant change observed in the group as a whole, modeling our outcome variable in its original metric (i.e., NSSI counts). After determining that there were mean level changes in NSSI from baseline to posttreatment, we proceeded with analyses to determine which covariates predicted NSSI at posttreatment. Then, we proceeded to determine whether the effect of self-criticism on NSSI at posttreatment varied significantly as a function of assignment to treatment condition—the primary purpose for conducting this investigation. This was followed by an analysis of simple slopes to assess whether the relationship between changes in self-criticism and NSSI at posttreatment differed between

groups. Lastly, we assessed within group changes for each respective group in order to determine whether treatment had its intended effect upon depression, emotion regulation, self-criticism, and suicidal ideation.

Our first hypothesis was supported regarding adolescents experiencing linear decreases in engagement in NSSI from baseline to posttreatment. Although conventional fit statistics were not available for review due to the use of a generalized linear modeling procedure, the hypothesized negative binomial latent growth curve model for NSSI evinced an improvement in fit relative to the baseline (intercept-only) model. Adolescents engaged in an average of 47.26 acts of NSSI over the past two months at baseline and an average of 6.53 acts of NSSI over the past two months at posttreatment; these parameters were adjusted for measurement error and exponentiated to provide the estimates in their original metric, holding all other model variables constant. Each day of treatment attended was associated with .94 times fewer acts of NSSI performed by adolescents. Moreover, adolescents demonstrated greater variability in NSSI frequency at baseline than at posttreatment. These results are consistent with previous research investigating the use of DBT-A in the treatment of NSSI (Cook & Gorraiz, 2015; Courtney & Flament, 2015; Fleischhaker et al. 2011; Mehlum et al., 2014, Mehlum et al., 2016; McCauley et al., 2018). Our study adds to the literature by using a negative binomial latent growth curve model to estimate change in NSSI, which allowed us to preserve the integrity of the data and report upon the outcome in its original metric (i.e., counts of NSSI).

Evidence in support of our second hypothesis concerning the prediction of NSSI at posttreatment was mixed. Although neither regression coefficient between changes in self-criticism nor emotion regulation significantly predicted NSSI at posttreatment, the patterns of covariation among these theoretically selected variables did. Similar to our negative binomial

latent growth curve model for NSSI, our negative binomial autoregressive model for NSSI also demonstrated an improvement in fit relative to its baseline model. The only significant predictors of adolescent's engagement in NSSI at posttreatment were NSSI at baseline (i.e., autoregressive effect), sex, and the interaction effect representing the product of assignment to treatment condition and changes in self-criticism. Additionally, covariance between changes in depression and emotion regulation as well as changes in depression and self-criticism significantly predicted engagement in NSSI at posttreatment. Accordingly, our hypothesis concerning the prediction of NSSI at posttreatment via changes in emotion regulation and self-criticism was partially supported. These findings are consistent with the FFM of NSSI developed by Nock and Prinstein (2004) in that understanding the antecedents, contingencies, and contextual influences that promote and maintain NSSI can lead to improved conceptualization, assessment, and treatment. Although not formally assessed via statistical analysis for the sake of model parsimony, learning interpersonal effectiveness strategies, a core DBT-A skill, plausibly impacts adolescent engagement in NSSI. Again, Nock and Prinstein (2004, 2005) indicated interpersonal positive and negative reinforcement as the third and fourth most common functions for engaging in NSSI. Moreover, the addition of family involvement and parents skills training may also impact adolescent engagement in NSSI as it may promote reinforcement of more salutary methods of communicating their needs and preferences to their primary caregivers.

In this study, we proposed that directly targeting self-critical thoughts in the treatment of NSSI would yield added benefit, and the significant interaction effect in our negative binomial autoregressive model for NSSI provided support for our third hypothesis. The significant interaction effect indicated that study participants assigned to the DBT-A Plus condition, on average, experienced greater reductions in self-criticism relative to the DBT-A group, and this

cross-over interaction effect predicted fewer acts of NSSI at posttreatment (see Figure 2). That is, individuals with greater reductions in self-criticism were more likely to experience greater reductions in NSSI at posttreatment. Although the interaction effect was significant, only the simple main effect for the DBT-A Plus group yielded a significant difference with regard to the impact of changes in self-criticism in predicting NSSI at posttreatment. We interpreted this to mean that the concerted effort of directly targeting self-criticism in the DBT-A Plus group had its intended effect of reducing NSSI above and beyond that of the DBT-A group—a theoretical prediction consistent with the FFM of NSSI (Nock & Prinstein, 2004, 2005). These results were consistent with findings from Hooley and St. Germain (2013) in that greater reductions in self-criticism resulted in greater reductions in one's willingness to engage in behavior that caused physical pain to self. Moreover, there was evidence of significant covariation among the interaction effect and changes in both depression as well as self-criticism. Covariation among the interaction effect and changes in self-criticism was not surprising as self-criticism was one of the terms included in the interaction. Similarly, the covariation and moderate association between changes in depression and self-criticism was not necessarily surprising, but, perhaps more importantly, these results underscore the importance of including salient empirical correlates in the prediction of NSSI (Asarnow et al., 2011; Hamza et al., 2012; Wilkinson et al., 2011).

We found mixed evidence in support of our fourth hypothesis concerning whether treatment had its intended effect in reducing depression, difficulties with emotion regulation, NSSI, self-criticism, and suicidal ideation in adolescents. Perhaps most notably, study participants did not experience significant decreases in suicidal ideation at posttreatment. In fact, at posttreatment, our study participants scored akin to suicidal adolescents in an inpatient setting (Osman et al., 2001). Further review of the items that compose the SBQ-R suggests that the

instrument may have little utility in assessing changes in suicidality as two of the four questions query static information (i.e., lifetime suicide ideation and suicide attempts as well as past communication of suicidal intent). Similarly, the SBQ-R assesses frequency of suicidal ideation over the past 12-months, which may have not been sensitive enough to detect change over the average 32.98 days of treatment for this sample. With regard to NSSI, we did not observe significant change for either group when the threshold for significance was set to  $p = .01$ . Note that these data were treated as continuous for the purpose of this dependent samples *t*-test. This analysis was intended to be more descriptive and exploratory in nature; that is, these results were intended to be compared with the more appropriate analysis in which we assessed mean level change via the negative binomial latent growth curve model.

Both groups experienced large reductions in both depression and self-criticism across treatment, with the DBT-A plus group evidencing the greatest changes. Lastly, the DBT-A group experienced large reductions with respect to difficulties with emotion regulation at posttreatment, whereas the DBT-A Plus group did not evidence significant reductions. This finding is surprising given that both groups received the full DBT-A protocol; however, it may be due to the Bonferroni-type correction used to control for multiple pairwise comparisons. Overall, our results were consistent with previous findings as reported by Del Conte and associates (2016) in their evaluation of DBT-A within a partial hospitalization program. These results have implications for training and treatment as well as future research; however, they must be considered in light of this study's strengths and limitations.

### **Strengths and Limitations**

This study built upon the literature base supporting the use of DBT-A and integrated findings concerning the importance of addressing self-criticism in the treatment of NSSI.

Moreover, the selection of study variables was theoretically driven, largely based upon the FFM of NSSI (Bentley et al. 2014; Nock & Prinstein, 2004, 2005). Our criteria for inclusion were broader than those for many previous investigations as recruitment was not contingent upon a diagnosis of BPD. Again, this is important as there is evidence to suggest that NSSI occurs outside of BPD (Glenn & Klonsky, 2013; Nock et al., 2006; Selber et al., 2012). Additionally, this study was conducted under more routine practice conditions. That is, it was conducted in a naturalistic setting as opposed to a laboratory setting, which promotes its ecological validity. Considering adolescents are at an important developmental stage in life, the relatively brief length of stay is a major strength of this investigation, as it creates less interruption to their activities of daily living, such as school attendance as well as participation in extracurricular activities and social interactions. Lastly, this investigation made use of methodological advancements by more accurately analyzing count variables with overdispersion as encouraged by Depaoli, Agtarap, Choi, Coburn, and Yu (2018).

Despite the strengths discussed above, this study was not without its limitations. Firstly, NSSI was assessed retrospectively and, thus, was subject to limitations associated with historical recall. However, NSSI was a focal point of therapy for self-injurers, reviewed on a weekly basis in individual therapy sessions as well as via completion and review of weekly DBT Diary Cards, which may have tempered this effect. Additionally, although study therapists ranged between two and four years of experience practicing DBT and completed either Foundational Training in DBT or advanced training in DBT, our study lacked a formal assessment of treatment adherence. To this point, the Clinical Director (i.e., third author) was Linehan Board Certified in DBT and facilitated a weekly DBT consultation group for study therapists and study interventionists. Similarly, both study therapists and study interventionists participated in individual supervision

with the Clinical Director on a weekly basis. Although the findings reported above are promising, the inability of follow-up evaluation circumvented an assessment to determine whether these results persisted. Moreover, as the sample size was relatively small, these results should be interpreted with caution. Similarly, as the sample was composed primarily of Caucasian adolescent females, it is uncertain how these findings may generalize to individuals from different races, ethnicities, genders, and ages. Nevertheless, these findings appear to be consistent with previous research concerning the use of DBT-A in the treatment of NSSI (Cook & Gorraiz, 2015; Courtney & Flament, 2015; Fleischhaker et al. 2011; Mehlum et al., 2014, Mehlum et al., 2016; McCauley et al., 2018). Lastly, the lack of a nonactive control group inhibits our ability to determine whether the effect of the experimental intervention was attributable to the intervention and not some third variable, such as a placebo effect or time with study interventionist. However, the significant interaction between assignment to treatment condition and change in self-criticism may allay these concerns to some degree. Similarly, study participants spent a total of 60- to 90-minutes with the study interventionist over the course of treatment.

### **Implications for Training and Treatment**

DBT-A is garnering significant support for its efficacy in the treatment of NSSI and, therefore, clinicians and practitioners working with adolescents may consider training in this therapeutic modality. DBT-A overtly teaches emotion regulation, distress tolerance, and interpersonal effectiveness skills, including skills training for parents and caregivers. Its use of a stage model in which NSSI and suicidal behaviors are the first targets of treatment may make it an ideal modality in treating this pernicious class of behaviors. The importance of treating NSSI cannot be overstated due to its association with both attempted and completed suicides.

Clinicians and practitioners should be educated on the prevalence of NSSI and its relation to suicide. NSSI is an effective, albeit maladaptive, coping strategy for regulating intense, aversive emotions. Clinicians and practitioners must be made aware that NSSI is a multidetermined behavior carried out in the service of multiple functions—the two most common being emotion regulation and self-punishment—to comprehensively address the contingencies that reinforce this class of behaviors. Clinicians and practitioners should consider the use of a functional approach of inquiry in the treatment of NSSI to gain an understanding of the antecedents, contingencies, and contextual influences that promote and maintain the behavior. This approach dovetails with DBT-A with its built-in use of chain analyses and can be used to collaboratively set targets for treatment with their patients. Non-suicidal self-injurers tend to be highly self-critical and engage in NSSI as a form of remuneration to alleviate cognitive dissonance associated with their perceived sense of self (i.e., deserving of punishment). The results of this investigation underscore the import of directly targeting self-criticism in the treatment of NSSI. Clinicians and practitioners should help adolescents to accentuate and integrate the positive aspects of themselves, as non-suicidal self-injurers are particularly prone to perseverate and punish themselves for the perceived negative aspects of themselves.

### **Directions for Future Research**

Future researchers are encouraged to implement advances in statistical modeling procedures (e.g., negative binomial regression) to more accurately analyze NSSI (i.e., a count variable with overdispersion) to advance psychological science and our understanding of how to treat this pernicious class of behaviors in adolescents. Moreover, researchers might consider the assessment of DBT Diary Cards to provide multiple measurements across time. This consideration is important as capturing additional assessments would allow for the estimation of



more complex growth curves, such as quadratic, cube, exponential, latent basis curves, polynomial, or penalized spline regression. The use of ecological momentary assessment might be considered (Nock, Prinstein, & Sterba, 2009) to reduce error associated with historical recall. Moreover, the advent of mobile health applications, such as Calm Harm (Krauss, 2018), and increasing access to such technology may reduce prohibitive costs associated with ecological momentary assessment, while achieving a similar effect. Recruitment of larger sample sizes is encouraged to allow for statistical analyses such as the use of growth mixture modeling to include predictors of change or panel designs to assess the influence of cross-lagged effects (Selig & Little, 2012). Lastly, future researchers should consider the use of measures more sensitive to change in suicidal ideation as this is an important outcome of interest in the treatment of our youth.

### **Acknowledgments**

The authors would like to thank Sonia Torres, graduate student, for her tireless and meticulous data entry. The authors would also like to thank Dr. Michael Mackay, The University of Memphis, for his statistical and methodological consultation.

### **Declaration of Conflicting Interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### **Funding**

The author(s) received no financial support for the research, authorship, and/or publication of this article.

## References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author. <https://doi.org/10.1176/appi.books.9780890425596>
- Andover, M. S., & Morris, B. W. (2014). Expanding and clarifying the role of emotion regulation in nonsuicidal self-injury. *Canadian Journal of Psychiatry, 59*, 569-575. <https://doi.org/10.1177/070674371405901102>
- Asarnow, J. R., Porta, G., Spirito, A., Emslie, G., Clarke, G., Wagner, K. D., ... & Brent, D. A. (2011). Suicide attempts and nonsuicidal self-injury in the treatment of resistant depression in adolescents: findings from the TORDIA study. *Journal of the American Academy of Child & Adolescent Psychiatry, 50*, 772-781. <http://dx.doi.org/10.1016/j.jaac.2011.04.003>
- Atkins, D. C., Baldwin, S. A., Zheng, C., Gallop, R. J., & Neighbors, C. (2013). A tutorial on count regression and zero-altered count models for longitudinal substance use data. *Psychology of Addictive Behaviors, 27*, 166-177. <https://doi.org/10.1037/a0029508>
- Baetens, I., Claes, L., Muehlenkamp, J., Grietens, H., & Onghena, P. (2011). Nonsuicidal and suicidal self-injurious behavior among Flemish adolescents: A web-based survey. *Archives of Suicide Research, 15*, 56-67. <http://dx.doi.org/10.1080/13811118.2011.540467>
- Baião, R., Gilbert, P., McEwan, K., & Carvalho, S. (2015). Forms of self-criticising/attacking & self-reassuring scale: Psychometric properties and normative study. *Psychology and Psychotherapy: Theory, Research and Practice, 88*, 438-452. <https://doi.org/10.1111/papt.12049>
- Barnard, J., & Rubin, D. B. (1999). Miscellanea. Small-sample degrees of freedom with multiple imputation. *Biometrika, 86*, 948-955. <https://doi-org.ezproxy.memphis.edu/10.1093/biomet/86.4.948>

- Bentley, K. H., Nock, M. K., & Barlow, D. H. (2014). The four-function model of nonsuicidal self-injury: Key directions for future research. *Clinical Psychological Science, 2*, 638-656. <https://doi.org/10.1177/2167702613514563>
- Bollen, K.A. and J.S. Long (eds). 1993. Testing Structural Equation Models. Newbury Park, CA: Sage.
- Brausch, A. M., & Girresch, S. K. (2012). A review of empirical treatment studies for adolescent nonsuicidal self-injury. *Journal of Cognitive Psychotherapy, 26*, 3-18. <https://doi.org/10.1891/0889-8391.26.1.3>
- Brausch, A. M., & Gutierrez, P. M. (2010). Differences in non-suicidal self-injury and suicide attempts in adolescents. *Journal of Youth and Adolescence, 39*, 233–242. <http://dx.doi.org/10.1007/s10964-009-9482-0>
- Brent, D. A., McMakin, D. L., Kennard, B. D., Goldstein, T. R., Mayes, T. L., & Douaihy, A. B. (2013). Protecting adolescents from self-harm: A critical review of intervention studies. *Journal of the American Academy of Child & Adolescent Psychiatry, 52*, 1260-1271. <https://doi.org/10.1016/j.jaac.2013.09.009>
- Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155. <http://dx.doi.org/10.1037/0033-2909.112.1.155>
- Cook, N. E., & Gorraiz, M. (2015). Dialectical behavior therapy for nonsuicidal self-injury and depression among adolescents: Preliminary meta-analytic evidence. *Child and Adolescent Mental Health, 21*, 81-89. <http://dx.doi.org/10.1111/camh.12112>
- Courtney, D. B., & Flament, M. F. (2015). Adapted dialectical behavior therapy for adolescents with self-injurious thoughts and behaviors. *The Journal of Nervous and Mental Disease, 203*, 537-544. <http://dx.doi.org/10.1097/NMD.0000000000000324>

- Coxe, S., West, S. G., & Aiken, L. S. (2009). The analysis of count data: A gentle introduction to Poisson regression and its alternatives. *Journal of Personality Assessment, 91*, 121-136.  
<https://doi.org/10.1080/00223890802634175>
- Del Conte, G. (2018). Partial hospitalization programs and settings. In K. M. Hollenbaugh & M. S. Lewis (Eds.) *Dialectical behavior therapy with adolescents across settings, treatments, and diagnoses* (pp. 63-84). New York, NY: Routledge.
- Del Conte, G., Lenz, A. S., & Hollenbaugh, K. M. (2016). A pilot evaluation of dialectical behavior therapy for adolescents within a partial hospitalization treatment milieu. *Journal of Child and Adolescent Counseling, 2*, 16-32.  
<http://dx.doi.org/10.1080/23727810.2015.1134008>
- Depaoli, S., Agtarap, S., Choi, A. Y., Coburn, K. M., & Yu, J. (2018). Advances in quantitative research within the psychological sciences. *Translational Issues in Psychological Science, 4*, 335-339. <http://dx.doi.org/10.1037/tps0000183>
- Derogatis, L. R., & Unger, R. (2010). Symptom Checklist-90-Revised. *Corsini Encyclopedia of Psychology*. <http://dx.doi.org/10.1002/9780470479216.corpsy0970>
- Fleischhaker, C., Böhme, R., Sixt, B., Brück, C., Schneider, C., & Schulz, E. (2011). Dialectical behavioral therapy for adolescents (DBT-A): A clinical trial for patients with suicidal and self-injurious behavior and borderline symptoms with a one-year follow-up. *Child Adolescent Psychiatry Mental Health, 5*, 1-10. <http://dx.doi.org/10.1186/1753-2000-5-3>
- Gilbert, P., Clarke, M., Hempel, S., Miles, J. N., & Irons, C. (2004). Criticizing and reassuring oneself: An exploration of forms, styles and reasons in female students. *British Journal of Clinical Psychology, 43*, 31-50. <https://doi.org/10.1348/014466504772812959>

- Gilbert, P., McEwan, K., Irons, C., Bhundia, R., Christie, R., Broomhead, C., & Rockliff, H. (2010). Self-harm in a mixed clinical population: The roles of self-criticism, shame, and social rank. *British Journal of Clinical Psychology, 49*, 563-576.  
<http://dx.doi.org/10.1348/014466509X479771>
- Glassman, L. H., Weierich, M. R., Hooley, J. M., Deliberto, T. L., & Nock, M. K. (2007). Child maltreatment, non-suicidal self-injury, and the mediating role of self-criticism. *Behaviour Research and Therapy, 45*, 2483-2490. <http://dx.doi.org/10.1016/j.brat.2007.04.002>
- Glenn, C. R., & Klonsky, E. D. (2013). Nonsuicidal self-injury disorder: an empirical investigation in adolescent psychiatric patients. *Journal of Clinical Child & Adolescent Psychology, 42*, 496-507. <http://dx.doi.org/10.1080/15374416.2013.794699>
- Glenn, C. R., Franklin, J. C., & Nock, M. K. (2015). Evidence-based psychosocial treatments for self-injurious thoughts and behaviors in youth. *Journal of Clinical Child & Adolescent Psychology, 44*, 1-29. <https://doi.org/10.1080/15374416.2014.945211>
- Goldstein, T. R., Axelson, D. A., Birmaher, B., & Brent, D. A. (2007). Dialectical behavior therapy for adolescents with bipolar disorder: A 1-year open trial. *Journal of the American Academy of Child & Adolescent Psychiatry, 46*, 820-830.  
<http://dx.doi.org/10.1097/chi.0b013e31805c1613>
- Gratz, K. L. (2001). Measurement of deliberate self-harm: Preliminary data on the deliberate self-harm inventory. *Journal of Psychopathology and Behavioral Assessment, 23*, 253-263.  
<https://doi.org/10.1023/A:1012779403943>
- 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. *Journal of Psychopathology and Behavioral Assessment*, 26, 41-54.  
<https://doi.org/10.1023/B:JOBA.0000007455.08539.94>

Haines, J., Williams, C. L., Brain, K. L., & Wilson, G. V. (1995). The psychophysiology of self-mutilation. *Journal of Abnormal Psychology*, 104, 471-489. <https://doi.org/10.1037/0021-843X.104.3.471>

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, 482-495. <http://dx.doi.org/10.1016/j.cpr.2012.05.003>

Hedges, L.V., & Olkin, I. (1985). *Statistical methods for meta-analysis*. San Diego, CA: Academic Press.

Heron M. 2013. Deaths: Leading causes for 2010. National vital statistics reports; vol 62 no 6. Hyattsville, MD: National Center for Health Statistics.

Hooley, J. M., & Germain, S. A. S. (2013). Nonsuicidal self-injury, pain, and self-criticism does changing self-worth change pain endurance in people who engage in self-injury?. *Clinical Psychological Science*, 2, 297-305. <http://dx.doi.org/10.1177/2167702613509372>.

Jacobson, C. M., Muehlenkamp, J. J., Miller, A. L., & Turner, J. B. (2008). Psychiatric impairment among adolescents engaging in different types of deliberate self-harm. *Journal of Child and Adolescent Psychology*, 37, 363–375.  
<http://dx.doi.org/10.1080/15374410801955771>

Karazsia, B. T., & Van Dulmen, M. H. (2008). Regression models for count data: Illustrations using longitudinal predictors of childhood injury. *Journal of Pediatric Psychology*, 33, 1076-1084. <https://doi.org/10.1093/jpepsy/jsn055>

- Kass, R. E., & Raftery, A. E. (1995). Bayes factors. *Journal of the American Statistical Association*, 90, 773-795. <http://dx.doi/abs/10.1080/01621459.1995.10476572>
- Kline, R. B. (2016). *Principles and practices of structural equation modeling* (4th ed.). New York: The Guildford Press.
- Klonsky, E. D. (2007). The functions of deliberate self-injury: A review of the evidence. *Clinical Psychology Review*, 27, 226-239. <http://dx.doi.org/10.1016/j.cpr.2006.08.002>
- 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, 215-219. <http://dx.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. *Journal of Consulting and Clinical Psychology*, 76, 22. <https://doi.org/10.1037/0022-006X.76.1.22>
- Klonsky, E. D., May, A. M., & Glenn, C. R. (2013). The relationship between nonsuicidal self-injury and attempted suicide: Converging evidence from four samples. *Journal of Abnormal Psychology*, 122, 231-237. <http://dx.doi.org/10.1037/a0030278>
- Klonsky, E. D., Victor, S. E., & Saffer, B. Y. (2014). Nonsuicidal self-injury: What we know, and what we need to know. *Canadian Journal of Psychiatry*, 59, 565-568. <https://doi.org/10.1177/070674371405901101>
- Krauss, N. (2018). About Calm Harm. Retrieved from <https://calmharm.co.uk/>
- Linehan, M. (1993). *Cognitive-behavioral treatment of borderline personality disorder*. New York, NY: Guilford Press.

- Linehan, M. M., Armstrong, H. E., Suarez, A., Allmon, D., & Heard, H. L. (1991). Cognitive-behavioral treatment of chronically parasuicidal borderline patients. *Archives of General Psychiatry*, 48, 1060-1064. <http://dx.doi.org/10.1001/archpsyc.1991.01810360024003>
- Linehan, M. M., Comtois, K. A., Murray, A. M., Brown, M. Z., Gallop, R. J., Heard, H. L., ... & Lindenboim, N. (2006). Two-year randomized controlled trial and follow-up of dialectical behavior therapy vs therapy by experts for suicidal behaviors and borderline personality disorder. *Archives of General Psychiatry*, 63, 757-766. <http://dx.doi.org/10.1001/archpsyc.63.7.757>
- Lloyd-Richardson, E. E., Lewis, S. P., Whitlock, J. L., Rodham, K., & Schatten, H. T. (2015). Research with adolescents who engage in non-suicidal self-injury: Ethical considerations and challenges. *Child and Adolescent Psychiatry and Mental Health*, 9, 1-14. <https://doi.org/10.1186/s13034-015-0071-6>
- McCauley, E., Berk, M. S., Asarnow, J. R., Adrian, M., Cohen, J., Korslund, K., ... & Linehan, M. M. (2018). Efficacy of dialectical behavior therapy for adolescents at high risk for suicide: A randomized clinical trial. *JAMA Psychiatry*, 75, 777-785. <https://doi.org/10.1001/jamapsychiatry.2018.1109>
- Mehlum, L., Ramberg, M., Tørmoen, A. J., Haga, E., Diep, L. M., Stanley, B. H., ... & Grøholt, B. (2016). Dialectical behavior therapy compared with enhanced usual care for adolescents with repeated suicidal and self-harming behavior: Outcomes over a one-year follow-up. *Journal of the American Academy of Child & Adolescent Psychiatry*, 55, 295-300. <https://doi.org/10.1016/j.jaac.2016.01.005>
- Mehlum, L., Tørmoen, A. J., Ramberg, M., Haga, E., Diep, L. M., Laberg, S., ... & Grøholt, B. (2014). Dialectical behavior therapy for adolescents with repeated suicidal and self-harming



- behavior: A randomized trial. *Journal of the American Academy of Child & Adolescent Psychiatry*, 53, 1082-1091. <http://dx.doi.org/10.1016/j.jaac.2014.07.003>
- Messer, J. M., & Fremouw, W. J. (2008). A critical review of explanatory models for self-mutilating behaviors in adolescents. *Clinical Psychology Review*, 28, 162-178. <http://dx.doi.org/10.1016/j.cpr.2007.04.006>
- Miller, A. L., Rathus, J. H., & Linehan, M. M. (2006). *Dialectical behavior therapy with suicidal adolescents*. New York, NY: Guilford Press.
- Muehlenkamp, J., Claes, L., Havertape, L., Plener, P. (2012) International prevalence of adolescent non-suicidal self-injury and deliberate self-harm. *Child Adolescent Psychiatry and Mental Health*, 6, 1-10. <http://dx.doi.org/10.1186/1753-2000-6-10>
- Nock, M. K. (2010). Self-injury. *Annual Review of Clinical Psychology*, 6, 339-363. <https://doi.org/10.1146/annurev.clinpsy.121208.131258>
- Nock, M. K., & Prinstein, M. J. (2004). A functional approach to the assessment of self-mutilative behavior. *Journal of Consulting and Clinical Psychology*, 72, 885-890. <http://dx.doi.org/10.1016/j.beth.2007.05.005>
- Nock, M. K., & Prinstein, M. J. (2005). Contextual features and behavioral functions of self-mutilation among adolescents. *Journal of Abnormal Psychology*, 114, 140. <http://dx.doi.org/10.1037/0021-843X.114.1.140>
- Nock, M. K., Janis, I. B., & Wedig, M. M. (2008). Research designs. In A. M. Nezu & C. M. Nezu (Eds.) *Evidence-based outcome research: A practical guide to conducting randomized controlled trials for psychosocial interventions* (pp. 201-218). <https://doi.org/10.1093/med:psych/9780195304633.003.0010>

- 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. *Psychiatry Research, 144*, 65-72. <https://doi.org/10.1016/j.psychres.2006.05.010>
- Nock, M. K., Prinstein, M. J., & Sterba, S. K. (2009). Revealing the form and function of self-injurious thoughts and behaviors: A real-time ecological assessment study among adolescents and young adults. *Journal of Abnormal Psychology, 118*, 816-827. <https://doi.org/10.1037/a0016948>
- Osman, A., Bagge, C. L., Gutierrez, P. M., Konick, L. C., Kopper, B. A., & Barrios, F. X. (2001). The Suicidal Behaviors Questionnaire-Revised (SBQ-R): Validation with clinical and nonclinical samples. *Assessment, 8*, 443-454. <https://doi.org/10.1177/107319110100800409>
- Ougrin, D., Tranah, T., Stahl, D., Moran, P., & Asarnow, J. R. (2015). Therapeutic interventions for suicide attempts and self-harm in adolescents: Systematic review and meta-analysis. *Journal of the American Academy of Child & Adolescent Psychiatry, 54*, 97-107.
- Rathus, J. H., & Miller, A. L. (2002). Dialectical behavior therapy adapted for suicidal adolescents. *Suicide and Life-Threatening Behavior, 32*, 146-157. <http://dx.doi.org/10.1521/suli.32.2.146.24399>
- Selby, E. A., Bender, T. W., Gordon, K. H., Nock, M. K., & Joiner, T. E., Jr. (2012). Non-suicidal self-injury (NSSI) disorder: A preliminary study. *Personality Disorders: Theory, Research, and Treatment, 3*, 167-175. <https://doi.org/10.1037/a0024405>
- Selig, J. P., & Little, T. D. (2012). Autoregressive and cross-lagged panel analysis for longitudinal data. In B. Laursen, T. D. Little, & N. A. Card (Eds.), *Handbook of Developmental Research Methods* (pp. 265-278). New York, NY, US: The Guilford Press.

- Tabachnick, B., & Fidell, L. (2013). *Using multivariate statistics*. Boston, MA: Pearson Education.
- Turner, B. J., Austin, S. B., & Chapman, A. L. (2014). Treating nonsuicidal self-injury: A systematic review of psychological and pharmacological interventions. *The Canadian Journal of Psychiatry*, *59*, 576-585. <https://doi.org/10.1177/070674371405901103>
- van Ginkel J. R. MI-MUL2.SPS [Computer code] and MI-MUL2.pdf [Software manual] 2010 Retrieved April 7th, 2019, from <http://www.socialsciences.leiden.edu/educationandchildstudies/childandfamilystudies/organisation/staffcfs/van-ginkel.html>
- van Ginkel, J. R., & Kroonenberg, P. M. (2014). Analysis of variance of multiply imputed data. *Multivariate Behavioral Research*, *49*, 78-91. <https://doi.org/10.1080/00273171.2013.855890>
- Victor, S. E., & Klonsky, E. D. (2014). Correlates of suicide attempts among self-injurers: A meta-analysis. *Clinical Psychology Review*, *34*, 282-297. <https://doi.org/10.1016/j.cpr.2014.03.005>
- 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). *American Journal of Psychiatry*, *168*, 495-501. <http://dx.doi.org/10.1176/appi.ajp.2010.1005071>
- Yuan, K.H. & Bentler, P.M. (2000). Three likelihood-based methods for mean and covariance structure analysis with nonnormal missing data. In M.E. Sobel & M.P. Becker (eds.), *Sociological Methodology* (pp. 165-200). Washington, D.C: ASA. <https://doi.org/10.1111/0081-1750.00078>

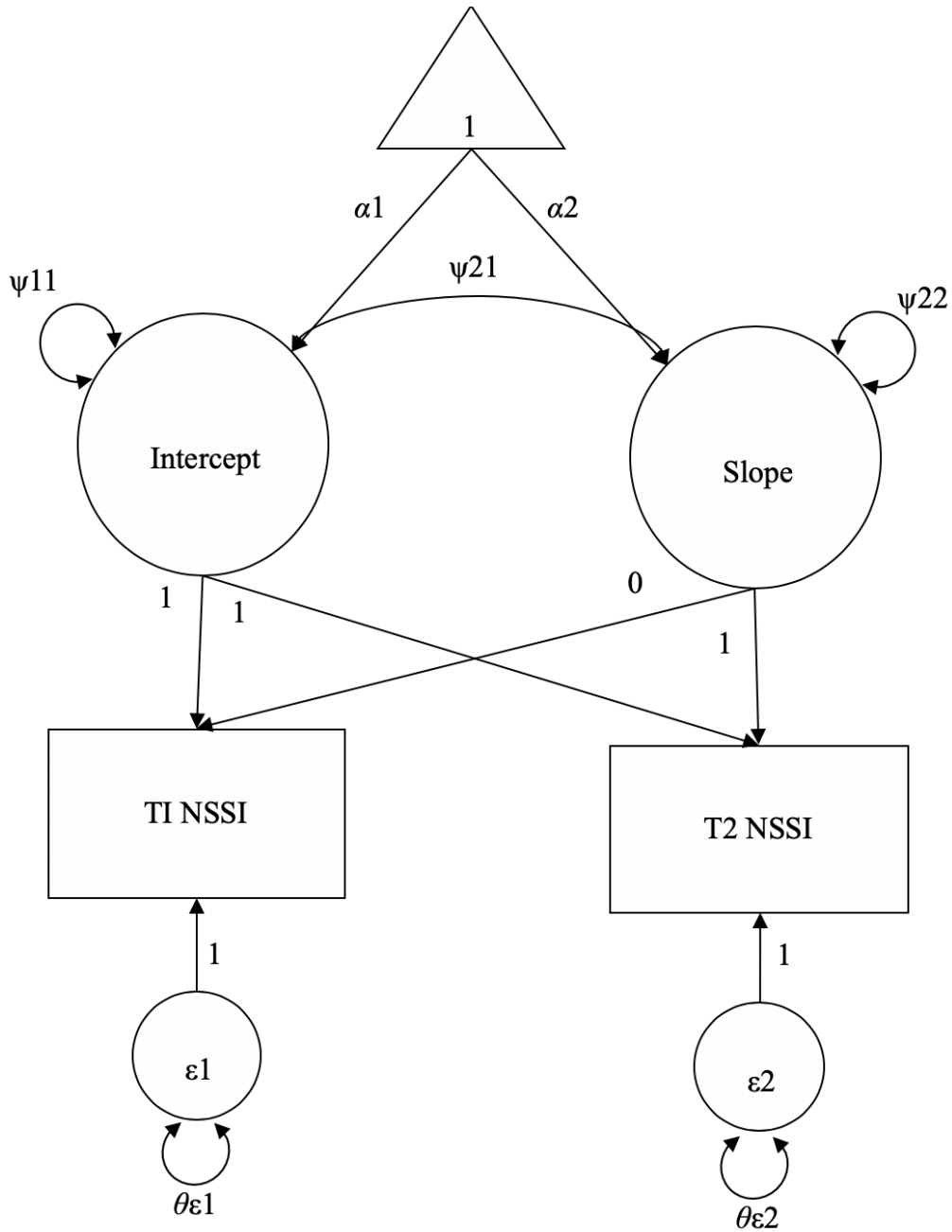


Figure 1. Path Diagram of a Linear Latent Growth Curve Model with Random Intercepts, Random Slopes, and Unconstrained Endogenous Dispersion.

Table 1. Baseline Demographic, Diagnostic Data, and NSSI by Treatment Condition

<b>Variable</b>	<b>DBT-A (n = 21)</b>	<b>DBT-A Plus (n = 19)</b>	<b>Total (N = 40)</b>	<b>Statistic</b>	<b>p</b>
Female	18 (85.70)	12 (63.20)	30 (75.00)	$\chi^2(1) = 2.71$	.100
Age, mean (SD)	15.19 (1.83)	14.63 (1.86)	14.92 (1.85)	$t_{38} = -.96$	.345
<b>Race/ethnicity</b>					
White	19 (85.70)	18 (85.70)	37 (92.50)	$\chi^2(2) = 2.93$	.231
African American	2 (9.50)	0 (0.00)	2 (5.00)		
Asian American	0 (0.00)	1 (5.30)	1 (2.50)		
Hispanic	0 (0.00)	1 (5.30)	1 (2.50)		
<b>Primary Psychiatric Diagnoses</b>					
Bipolar and Related Disorders	1 (4.8)	2 (10.50)	3 (7.50)	$\chi^2(2) = 1.35$	.510
Depressive Disorders	19 (90.50)	17 (89.5)	36 (90.00)		
Substance-Related and Addictive Disorders	1 (4.80)	0 (0.00)	1 (2.50)		
<b>Secondary Psychiatric Diagnoses</b>					
Anxiety Disorders	1 (4.80)	7 (36.80)	8 (20.00)	$\chi^2(6) = 10.02$	.124
Depressive Disorders	2 (9.50)	0 (0.00)	2 (5.00)		
Neurodevelopmental Disorders	6 (28.60)	5 (26.30)	11 (27.50)		
Substance-Related and Addictive Disorders	3 (14.30)	0 (0.00)	3 (7.50)		
Trauma- and Stressor-Related Disorders	2 (9.50)	2 (10.50)	4 (10.00)		
Other	2 (9.50)	2 (10.50)	4 (10.00)		
None	5 (23.80)	3 (15.8)	8 (20.00)		
NSSI (Baseline), Mean (SD)	46.37 (51.57)	35.52 (41.31)	40.68 (46.18)	$t_{38} = .737$	.465 <sup>a</sup>
NSSI (Lifetime), Mean (SD)	222.37 (235.15)	221.52 (307.49)	221.93 (272.04)	$t_{38} = 0.01$	.992
Number of Previously Attempted Suicides, Mean (SD)	1 (1.48)	1.05 (2.53)	1.03 (2.02)	$t_{38} = 0.08$	.936
Family History of Mental Health	15 (71.40)	18 (94.70)	33 (82.50)	$\chi^2(1) = 3.27$	.070
History of Substance Abuse	8 (38.10)	6 (31.60)	14 (35.00)	$\chi^2(1) = .19$	.666
Family History of Substance Abuse	13 (61.90)	10 (52.60)	23 (57.50)	$\chi^2(1) = .38$	.538

Note. Data are presented as number (percentage) of participants unless otherwise indicated.

<sup>a</sup> Bootstrap 95% CI = (-.16.56, 42.58), based on 1000 bootstrap samples and equal variances assumed—Levene’s Test for equality of variances  $F(38) = .02, p = .887$ .

Table 2. Dependent Samples *t*-Tests from Baseline to Posttreatment by Treatment Condition for Dialectical Behavior Therapy for Adolescents (*n* = 21) and Dialectical Behavior Therapy for Adolescents Plus (*n* = 19)

Variable	DBT-A ( <i>n</i> = 21)		<i>p</i>	Cohen's <i>D</i>	DBT-A Plus ( <i>n</i> = 19)		<i>p</i>	Cohen's <i>D</i>
	Mean	SD <sup>a</sup>			Mean	SD <sup>a</sup>		
Depression (SCL-90-R)								
Baseline	29.66	13.28	.007	0.86	32.51	15.09	.002	0.98
Posttreatment	18.25				17.72			
Emotion Regulation (DERS)								
Baseline	119.70	21.07	< .001	1.27	126.24	31.86	.042	0.51
Posttreatment	93.04				109.99			
NSSI (ISAS)								
Baseline	45.44	40.12	.011 <sup>c</sup>	0.59	43.81	40.57	.030 <sup>c</sup>	0.63
Posttreatment <sup>b</sup>	11.06				13.88			
Self-Criticism (FSCSRS)								
Baseline	12.95	4.95	.003	0.81	14.00	4.77	< .001	0.92
Posttreatment	8.94				9.60			
Suicidal Ideation (SBQ-R)								
Baseline	12.18	2.19	.236	0.34	12.54	2.96	.436	0.22
Posttreatment	11.44				11.90			

*Note.* DERS; Difficulties in Emotion Regulation Scale; ISAS = Inventory of Statements About Self-Injury; FSCSRS = Forms of Self-Criticizing/Attacking and Self-Reassuring Scale; SBQ-R = Suicidal Behaviors Questionnaire-Revised. SCL-90-R = Symptom Checklist-90-Revised.

<sup>a</sup> SD is provided for change in mean from baseline to posttest.

<sup>b</sup> Due to missing observations, *n* is slightly lower in some cells.

<sup>c</sup> *p* is reported as an estimate based upon 1000 bootstrap samples to adjust for non-normality.

Table 3. Negative Binomial Latent Growth Curve Model of NSSI with Maximum Likelihood Parameter Estimates and Robust Standard Errors ( $N = 40$ )

Parameter	Unstandardized	SE	<i>p</i>
<u>Mean structure</u>			
$\Delta \rightarrow$ IS	3.50	0.27	< .001
$\Delta \rightarrow$ LC	-0.06	0.03	.019
<u>Covariance structure</u>			
<u>Variances and covariance</u>			
Latent growth factors			
IS	0.49	0.53	.351
LC	0.01	0.00	.192
IS $\curvearrowright$ LC	0.02	0.01	.107
<u>Dispersion</u>			
NSSI (Pretest)	0.93	0.21	< .001
NSSI (Posttest)	0.28	0.90	.759

*Note.* Standardized estimates for measurement errors are proportions of unexplained variance. IS = Initial Status; LC = Linear Change.

Table 4. Correlations for Negative Binomial Autoregressive Model for NSSI ( $N = 40$ )

Covariate	1	2 <sup>c</sup>	3	4	5	6	7	8	9	10
1. NSSI at T1	1									
2. NSSI at T2 <sup>c</sup>	.59 <sup>b</sup>	1								
3. Age	-.20	-.19	1							
4. Sex	.05	-.16	.23	1						
5. Treatment Type	-.12	-.08	.15	.26	1					
6. Days of Attendance	.12	.15	-.03	-.22	-.10	1				
7. $\Delta$ Depression	.11	.03	.07	.25	-.11	.11	1			
8. $\Delta$ Self-Criticism	-.06	-.06	.18	.26	-.04	.13	.43 <sup>a</sup>	1		
9. $\Delta$ Emotion Regulation	.13	.14	-.04	.16	.19	-.08	.37 <sup>a</sup>	.14	1	
10. Interaction	-.19	-.18	.21	.32 <sup>a</sup>	.22	.13	.37 <sup>a</sup>	.92 <sup>b</sup>	.15	1

<sup>a</sup> Correlation is significant at the 0.05 level (2-tailed).

<sup>b</sup> Correlation is significant at the 0.01 level (2-tailed).

<sup>c</sup>  $N = 32$  for NSSI at T2.

Table 5. Negative Binomial Autoregressive Model for NSSI with Maximum Likelihood Parameter Estimates and Robust Standard Errors ( $N = 40$ )

Parameter	Unstandardized	SE	Standardized
Regression Coefficients			
NSSI at T2 (Intercept)	1.29**	0.47	0.86
NSSI at T2 →			
NSSI at T1	0.01**	0.01	0.44
Age	0.30	0.18	0.37
Sex	-0.80*	0.37	-0.23
Treatment Type	0.63	0.45	0.21
Days of Attendance	0.03	0.03	0.17
$\Delta$ Depression	0.02	0.03	0.23
$\Delta$ Self-Criticism	-0.06	0.06	-0.21
$\Delta$ Emotion Regulation	0.01	0.02	0.20
Interaction (Treatment Type x $\Delta$ Self-Criticism)	-0.24*	0.12	-0.72
Covariances			
$\Delta$ Emotion Regulation ↗↘			
Days of Attendance	-41.01	70.67	-0.16
$\Delta$ Self-Criticism ↗↘			
Days of Attendance	15.31	9.91	0.37
$\Delta$ Emotion Regulation	22.47	41.32	.012
$\Delta$ Depression ↗↘			
Days of Attendance	33.87	31.24	0.29
$\Delta$ Emotion Regulation	287.55**	99.95	0.55
$\Delta$ Self-Criticism	45.63**	16.37	0.52
Interaction ↗↘ (Treatment Type x $\Delta$ Self-Criticism)			
Days of Attendance	9.61	6.92	0.28
$\Delta$ Emotion Regulation	5.27	28.86	0.03
$\Delta$ Self-Criticism	17.56**	0.01	0.69
$\Delta$ Depression	18.13*	18.13	0.25
Dispersion			
NSSI at T2	0.98*	0.38	---

*Note.* The delta symbol ( $\Delta$ ) was used to indicate change from baseline to posttest. The double-sided arrow symbol (↗↘) was used to denote the covariance between model covariates in the prediction of NSSI at time 2, after controlling for the NSSI at time 1. \* $p < .05$ ; \*\* $p < .01$ .



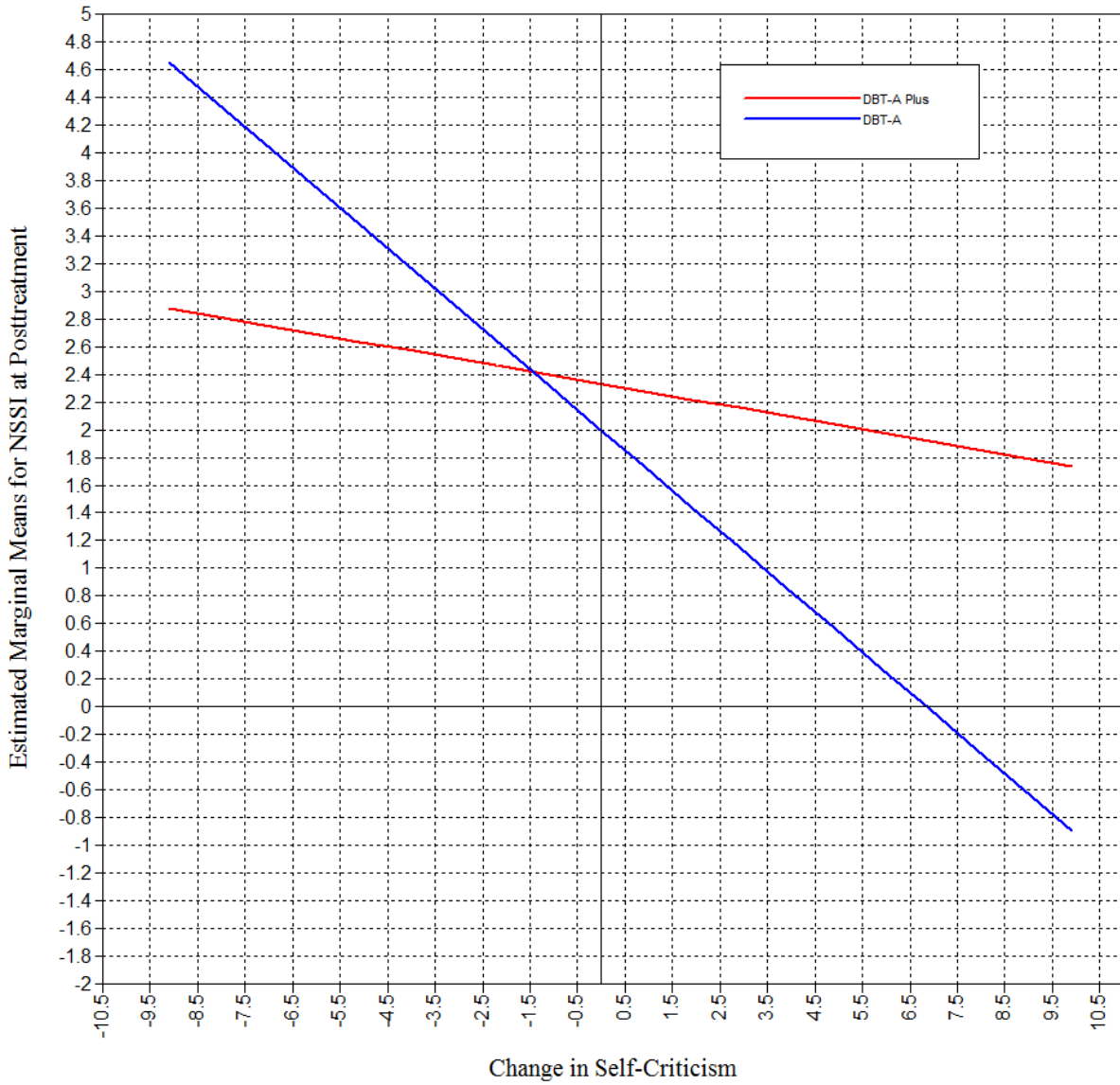


Figure 2. Effects of Treatment Condition and Changes in Self-Criticism on NSSI at Posttreatment