

Social Problem Solving in Adolescents Engaging in Non-Suicidal Self-Injury Compared  
with Adolescent Suicide Attempters

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## Abstract

The aim of the present study was to examine social problem solving skills among adolescents engaging in various self-injurious behaviors. Previous research has supported the claim that deficits in social problem solving skills are associated with engagement in non-suicidal self-injury (NSSI) and suicide attempts, but no research has been done comparing the two self-injury groups together. Data was collected from 176 adolescent females with history of mental health problems measuring their self-injurious behaviors and social problems solving skills. After answering various questions regarding their social problem solving skills over four social scenarios, participants experienced a stressful task and were then given the remaining four social scenarios. This manipulation was intended to simulate a state of high arousal – more like their physical state would be in the event a social problem had just occurred. Results suggested that adolescents who had reported attempting suicide experienced greater increases in avoidant problem solving strategies after the stressful task than adolescents who had only engaged in NSSI or those who had never injured themselves for any purpose. Implications of these findings, limitations of the current study, and directions for future research are discussed.

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Non-Suicidal Self-Injury (NSSI) refers to the deliberate and direct harm of oneself without suicidal intent. Common behaviors associated with NSSI are cutting, hair pulling, burning one's own skin, and suffocation for a short period of time. A recent systematic review of the literature indicates that 16-18% of adolescents injure themselves purposefully at least once in their lifetimes, which makes it especially important to identify who might be at risk for this behavior (Muehlenkamp, Claes, Havertape, & Plener, 2012). The negative consequences reach beyond physical pain. Those who engage in NSSI are also at higher risk for suicide and experience emotional and social consequences from their actions (Wilkinson & Goodyer, 2011). By contrast, suicidal behaviors refer to the deliberate harm of oneself with the intent of death. Suicide is the third leading cause of death in U.S. adolescents and one of the largest causes of mortality in the 10-24 age group worldwide (Nock, Green, Hwang, McLaughlin, Sampson, Zaslavsky, & Kessler, 2013; Patton, Coffey, Sawyer, Viner, Haller, Bose, Vos, Ferguson, & Mathers, 2009). Research has found that between four to six percent of all deaths in adolescence are caused by suicide (Nock et al., 2013; Patton et al., 2009). In addition, 9.7% of adolescents report that they have attempted suicide, 15.6% indicate that they have created a suicide plan, and 29.9% report that they have had suicidal thoughts at some point in their lives (Evans, Hawton, Rodham, & Deeks, 2005). Because these behaviors are widespread in the adolescent population, it is important to identify who may be at risk. By determining risk factors for self-injurious behaviors, professionals can work on effective preventative and treatment programs targeted towards those at risk. Due to the prevalence of these behaviors and the negative outcomes associated with them, understanding these behaviors is particularly important.

Preliminary research has shown that adolescents who report engaging in NSSI are more likely to have poor social problem solving skills (Andrews, Martin, Hasking, & Page, 2013; Andrews, Martin, & Hasking, 2012; Baetens, Claes, Muehlenkamp, Grietens, & Onghena, 2012). Problem solving skills are defined as the “cognitive-behavioral-affective process by which people identify discover, or invent effective or adaptive coping responses for specific problematic situations” (Grover, Green, Pettit, Monteith, Garza, & Venta, 2009). When solving social problems, adolescents use social information processing to make sense of their environment and formulate ways of handling social situations. If an adolescent experiences maladaptive cognitive or emotional processes during the decision making process, he or she could encounter difficulties that inhibit identification or implementation of effective solutions to social problems. This could then lead to selecting self-harm behaviors to regulate affect or accomplish a social goal. For example, in the response access or construction stage of social information processing – the stage where an adolescent would come up with a number of possible responses to the social problem, feelings of depression or hopelessness might result in accessing fewer or less effective responses to the current social situation (Crick & Dodge, 1994). This social problem solving deficit could then lead an adolescent to feel overwhelmed and engage in NSSI to regulate affect. Social problem solving deficits could be present at any stage of the social information processing model, leading to increased likelihood of self-injurious behaviors.

Research has tested the relationship between NSSI and social problem solving skills comparing different groups, and using different measures of social problem solving. Studies have compared social problem solving skills in groups of adolescents engaging in NSSI with community based samples of adolescents (Andrews, Martin, Hasking, 2012; Andrews et al.,

2013). Andrews et al. (2013) found that within a group of adolescents who had never engaged in NSSI behaviors, poor problem solving skills predicted the onset of those behaviors a year later even after adjusting for socio-demographic factors. Further research in a non-clinical community sample indicates that adolescents engaging in NSSI report more social problems and decreased levels of social competence than adolescents who do not engage in NSSI (Baetens et al., 2012). Although this study did not directly test social problem solving skills, these results indicate that adolescents engaging in NSSI might perceive more social problems and, because of deficient social competence, believe they have an inadequate ability to solve these problems. Another study assessing social problem solving skills in adolescents engaging in NSSI compared an NSSI group with psychiatric controls (Nock & Mendes, 2008). Results suggest that adolescents engaging in NSSI behaviors are less adept at choosing the most effective response to a hypothetical social problem (Nock & Mendes, 2008). They also rate themselves as having lower self-efficacy in regards to carrying out the most effective response than psychiatric controls (Nock & Mendes, 2008). This study used the Social Problem Solving Task (SPST) to measure social problem solving. This measure is designed to assess social problem solving skills at several points through adolescent social information processing by presenting participants with a series of hypothetical social dilemmas and asking them to answer several questions about how they would interpret and handle those dilemmas. The SPST differs from other measures used to assess the association between NSSI and social problem solving in that it does not rely merely on self-report, and therefore has increased external validity. The evidence for a relationship between social problem solving and NSSI is encouraging, but existing research is insufficient.

On the other hand, social problem solving skills as a risk factor for suicide attempts is more thoroughly explored. An overwhelming amount of evidence supports the claim that poor social problem solving skills are associated with adolescent suicide attempts (Linehan, Camper, Chiles, Strosahl, & Shearin 1987; McAuliffe, Corcoran, Keeley, Arensman, Bille-Brahe, & de Leo, 2006; McLaughlin, Miller, & Warwick, 1996; McLeavey, Daly, Murry, O'Riordan & Taylor, 1987; Milnes, Owens, & Blenkiron, 2002; Speckens & Hawton, 2005). When compared to non-psychiatric controls and psychiatric controls, adolescent self-poisoning patients demonstrated worse problem solving skills (McLeavey et al., 1987). This study used an exhaustive list of valid and reliable self-report and behavioral measures to examine social problem solving including the Means End Problem Solving (MEPS) Procedure which uses hypothetical situations to assess effectiveness of chosen response, Optional Thinking Test which evaluates the number of generated responses, and the Self Rating Problem Solving (SRPS) Scale which is a self-report measure that addresses participants' perceptions of their problem solving skills (McLeavey et al., 1987). Significant differences indicating that adolescents who had engaged in self-injury had poorer social problem solving abilities were found between all groups on all measures (McLeavey et al., 1987). Research also posits that suicide attempters choose more passive problem solving methods than psychiatric controls suggesting that more avoidant or passive social problem solving strategies may be associated with suicidal behaviors above and beyond their association with suicidal ideation (Becker-Weidman et al., 2010; Linehan et al., 1987). In other words, more severe social problem solving deficits – particularly the use of avoidant coping strategies -- might distinguish adolescents that go on to attempt suicide from those who consider it but do not act on their thoughts.

Evidence for associations between social problem solving and suicide attempts is strong, but there are some mixed results in studies investigating whether problem solving deficits predict suicide attempts. Some evidence suggests that problem solving deficits predict recurring suicide attempts (Hawton, Kingsbury, Steinhardt, James, & Fagg, 1999), while other evidence finds no prospective association between the two (Grover et al., 2009). Despite finding that social problem solving was not a predictor of suicide attempts alone, Grover et al. (2009) found that problem solving skills moderated the effect of life event stress on suicide attempts. These results suggest that social stressors must be present for social problem solving deficits to predict future suicidal behaviors. Another study revealed that the association between life event stress and suicidal behaviors was less strong at high and average levels of effective problem solving (Linda, Marroquín, & Miranda, 2012). This suggests that given the presence of life stress, low social problem solving skills are more likely to predict future suicidal behaviors.

NSSI and suicide attempts are both shown to be associated with social problem solving deficits, but no existing research has compared the problem solving skills of adolescents engaging in only NSSI with those who have attempted suicide at least once in their lifetime. Research indicates that adolescents engaging in NSSI alone and adolescents who harm themselves with lethal intent show distinct differences in various preventative factors (Wichstrøm, 2009), depressive symptoms and suicidal ideation (Brausch & Gutierrez, 2010; Muehlenkamp & Gutierrez, 2004; Muehlenkam & Gutierrez, 2007) as well as social support, self-esteem, body satisfaction, disordered eating (Brausch & Gutierrez, 2010), and reasons for living (Muehlenkamp & Gutierrez, 2007). These results provide evidence for the claim that social problem solving abilities might differ among adolescents who engage in NSSI alone, and those who have attempted suicide. In other words, adolescents who engage in NSSI without a

suicide attempt show distinct psychosocial characteristics from those who have also attempted suicide suggesting that problem solving abilities could differ between these groups.

Further support for this claim is presented by research examining the differences between adolescents with one suicide attempt and those with multiple attempts. Studies have found that adolescents who have attempted suicide multiple times show more impairment in social problem solving abilities than adolescents who have attempted suicide only once (Dieserud, Røysamb, Braverman, Dalgard, & Ekeberg, 2003; Hawton et al., 1999; McAuliffe, Corcoran, Hickey, & McLeavey, 2008; McAuliffe et al., 2006).

In a sample of 836 patients admitted for deliberate self-harm (DSH), 56% reported repeating a suicide attempt in the year following the index episode (McAuliffe et al., 2006). A factor analysis revealed that passive-avoidant problem solving, a dimension associated with avoidance of problems and feelings of helplessness towards problems, was the problem solving dimension most strongly associated with repeated attempts (McAuliffe et al., 2006). Evidence indicates that more severe deficits in social problem solving are associated with an increased risk in repetition of suicide attempts in the future. Consequently, the severity of social problem solving deficits may be associated with severity of self-harm behaviors. It reasonably follows that adolescents engaging in NSSI, a self-harm behavior not as severe as a suicide attempt, might demonstrate less severe social problem solving deficits than suicide attempters.

A systematic review of the literature on social problem solving skills and suicide attempts indicates that in many studies, effects are not statistically significant after controlling for depression and hopelessness (Speckens & Hawton, 2005). One explanation of this finding is that hopelessness mediates the effect of social problem solving on suicidal behaviors. Evidence



suggests that hopelessness mediates the relationship between problem solving appraisal and suicidal ideation (Dixon, Heppner, & Rudd, 1994). However, this research measured suicidal ideation and not self-injurious behaviors. Furthermore, research has found that adolescents with depression have a more impaired baseline level of social problem solving skills than adolescents not suffering from depression (Becker-Weidman, Jacobs, Reinecke, Silva, & March, 2010). Roškar, Zorko, Bucik, and Marušić (2007) found no significant differences in social problem solving between a group of depressed adolescents, and adolescents who had engaged in suicidal behaviors. On the other hand, Pollock and Williams (2004) found that the association between problem solving and suicidal behavior was significant after controlling for depression and hopelessness; however, this study was done with adults, so the effects may not apply to the population of interest. The attenuation of effects after controlling for depression and hopelessness could be better explained by a number of different limitations in the existing research (Pollock & Williams, 1998).

Methodological issues in the existing research could account for several inconsistencies in findings. Problems with the methodology including the use of many different constructs to measure self-injurious behaviors, and a number of different measures assessing social problem solving could explain this result. As Pollock and Williams (1998) noted, it is difficult to compare the research in this area because of methodological differences. This difficulty is still evident in the literature.

First, there is no standardized definition of self-injurious behaviors. The research on suicidal behavior examines constructs such as suicide attempts, parasuicide, and DSH. Although each has a similar definition, the definitions are not standardized, therefore potentially compromising results. Different definitions of these behaviors result in different ways of

assessing who qualifies as having attempted suicide, which can have major implications on results. For example, in examining prevalence rates of NSSI in an adolescent population, rates almost double when NSSI is assessed using behavioral-based assessments as opposed to using a single-item questionnaire (Muehlenkamp et al., 2012). This slight change in how to assess NSSI is associated with drastically different outcomes. Additionally, DSH in some studies includes adolescents that have engaged in self-harming behaviors without assessing whether or not suicidal intent was present. Because there are discernible differences between adolescents that engage in self-harm without lethal intent and those who are attempting suicide, the results of these studies might not accurately generalize to adolescent suicide attempters. There may also be participants in psychiatric control groups that engage in NSSI, which could confound the suicide attempter group's social problem solving scores and mask potentially significant results.

In addition to differences in how to define and assess self-harm behaviors, most of the existing research varies on how to assess social problem solving skills. A large variety of measures are used to measure social problem solving skills. Some measures, such as the Social Problem Solving Inventory (SPSI), Adolescent Coping Scale (ACS), and SRPS rely on adolescent self-report. Others such as the SPST, MEPS, and Optional Thinking Task, present adolescents with various hypothetical social problem scenarios and either require them to actively attempt to problem solve, or to answer questions about these scenarios. This presents a problem because even slight changes to the assessment of social problem solving skills may affect the results. For example, in the study conducted by Fremouw, Callahan, and Cashden (1993), the researchers added two new hypothetical, adolescent specific scenarios, and the analysis yielded non-significant results on the MEPS. It is possible that the addition of two

scenarios that had not been validated masked the effects of problem solving on suicidal behaviors.

Although each measure assesses social problem solving in general, each targets a different step in the social information processing model. In other words, while the Optional Thinking Task might best evaluate response generation, the MEPS might better evaluate the response decision step of the model (Crick & Dodge, 1994). Certain steps of this processing model might be more strongly associated with self-injurious behaviors than others, so while a measure of social problem solving might be valid, it may not be evaluating the most relevant part of social problem solving. This could explain many inconsistencies found between studies.

Age must also be considered in studying differences in social problem solving skills among adolescent self-injurers. Visits to the ER due to suicide attempts are most common between the ages of 15-19 (Ting, Sullivan, Boudreaux, Miller, & Camargo, 2012), but most adolescents who have engaged in NSSI reported starting from 13-15 (Muehlenkamp & Gutierrez, 2007). Older adolescents may be better able to solve social problems than their younger counterparts. Therefore, differences in the age of adolescents who endorse having engaged in self-injurious behaviors might confound results of previous studies.

The current study will improve the existing literature by providing clear definitions of various constructs, testing adolescents under more stressful conditions to increase external validity, and comparing adolescents attempting suicide with those who self-injure but have not attempted suicide. As demonstrated earlier, the body of literature that exists in regards to social problem solving and self-injury does not tend to measure the same social problem solving facets or the same type of self-injury. This study makes distinctions between NSSI and suicide attempts

very clear by defining NSSI as self-injury without suicidal intent and suicidal behaviors as self-injury with the intent to die. Furthermore, using the SPST, this study evaluates multiple aspects of social information processing in adolescence that might contribute to increased likelihood of self-injury. This measure of social problem solving is a behavioral test of social problem solving that does not merely rely on self-report which increases generalizability of the results as oftentimes an adolescent might not be aware of how he or she solves various social problems.

This study will also make an important addition to the literature in measuring an adolescent's problem solving under stressful conditions. In adolescence, the decision making process occurs much differently under conditions of low arousal and conditions of high arousal. In the presence of strong affective input, adolescents' decisions are riskier (Smith, Chein, & Steinberg, 2013). Further, research has shown that adolescents engaging in NSSI experience heightened physiological arousal following a stressful event (Nock & Mendes, 2008). It is likely that when a participant is asked to describe their social problem solving strategies in a hypothetical scenario, they are not experiencing heightened arousal as they would if the social problem were not merely hypothetical. Therefore, there are different aspects of the decision making process that might not be captured by previous studies regarding social problem solving. Introducing a stressor task will heighten the participants' arousal and as a result, their social problem solving skills may be affected in a way that has not been captured in previous studies but exists in real-life stressful situations. Further, with the heightened arousal shown by adolescent self-injurers, this increase in stress might affect each self-injurers and suicide attempters differently than it does adolescents who not self-injure. This study will compare the differences between adolescents in a "cold" condition (i.e. low arousal) and adolescents in a

“hot” condition (i.e. high arousal) while also measuring the increases or decreases of social problem solving scores after the stressful task for each self-injury group.

Lastly, no previous studies have compared social problem solving in adolescents engaging in NSSI with those injuring for suicidal purposes. This study will combine the two separate bodies of literature to determine if social problem solving deficits are a feature of self-injurious behaviors such as NSSI and suicide attempts, or if they are merely a feature of extremely depressed adolescents. Based on previous research, I predict that before the stressful induction task, the differences in various problem solving scores will not differ significantly between self-injury groups when controlling for depressive symptoms and age. However, following a stressful induction task, I predict that adolescent social problem solving skills will differ at all three levels of the independent variable such that adolescents who had attempted suicide will have more social problem solving deficits than those who engage in NSSI only and the psychiatric controls, and the adolescents who had engaged in NSSI only will have more social problem solving deficits than the psychiatric control group. As an exploratory hypothesis, this study will compare the differences in social problem solving scores within subjects after a stressful induction task among self-injury groups.

## Methods

### Participants

Participants included 176 adolescent females with a history of mental health concerns (e.g. mood disorders, anxiety disorders, substance use disorders) in the previous two years. They ranged in age from 12-16 years old ( $M = 14.13$ ,  $SD = 1.40$ ). In this sample, 61.6% identified as Caucasian, 26.1% as African-American, 2.2% as Latino American, 1.4% as Asian-American and 8.7% as belonging to mixed or other ethnic groups.

Participants were recruited from local inpatient units (approximately 40%) and community advertisements (e.g. flyers, commercials, e-mails). All potential participants were screened via a phone interview with a trained post-baccalaureate research assistant. Inclusion criteria consist of being 12-16 years of age and of the female gender, and having a caregiver able to take part in the study and a history of mental health concerns in the past two years. These inclusion criteria were intended to recruit a sample of adolescents with higher risk of self-injurious behaviors. Potential participants were excluded if they reported any active psychosis, mental retardation or pervasive developmental disorder because participants experiencing those conditions may have different responses to social stressors therefore compromising results. Participants were paid 175 dollars for their participation in this portion of the study.

### Procedures

Data for this study were drawn from a large, ongoing longitudinal project measuring youth cognitive and behavioral responses to interpersonal stressors. The data used for these analyses were taken from all the participants who completed the measures of self-injurious behaviors and social problem solving before and after a stressor task. In total, 220 adolescents

completed baseline data. Some participants ( $n = 44$ ) were excluded due to missing data leaving a sample of 176 adolescents. Analyses reveal no significant differences on main study variables between the participants that completed all the measures and those left out of the analyses due to missing data.

Adolescents were invited to the laboratory to complete a series of interviews and questionnaires at an initial baseline assessment. All participants were welcomed and consented by a team of trained research assistants who described in detail how the lab visit would proceed. Participants were then administered a semi-structured interview by a trained post-baccalaureate research assistant that assessed self-injurious thoughts and behaviors. After a series of questionnaires, the adolescents were invited into an observation room where they completed measures of social problem solving. A trained research assistant presented each participant with social scenarios and asked them a series of questions regarding their thoughts, potential behaviors, and self-efficacy in each scenario (see Measures). After completing the first four social problem solving scenarios, adolescents completed a modified Trier Social Stressor Task (TSST; Kirschbaum et al. 1993).

The TSST was administered to increase the arousal of the participant to simulate a “hot” condition that an adolescent might actually feel in a truly stressful social situation (Smith, Chein, & Steinberg, 2013). Participants were told to create and perform an audition speech for an upcoming MTV reality TV series about how to make friends and interact with peers. The audition speech was a full three minutes long with a one minute preparation period beforehand. While preparing for and delivering the speech, participants were oriented towards a camera connected to a closed-circuit “feedback screen” that displayed their live image. A trained, male research assistant acting as a judge sat in the room while the participant prepared and ultimately

delivered her speech. She was told that the male judge would be present in the room to evaluate the quality of her performance. During the speech, the male judge would tell the participant that she still had time and to please continue after every fifteen seconds of silence. The participant received no feedback for her performance on this task.

Almost immediately after completing the speech, the remaining four scenarios of the social problem solving task were administered. The order of which four scenarios were administered before or after the TSST was counterbalanced.

### **Measures**

*Self-injurious behaviors.* Self-injurious behaviors were identified in this study using the Self Injurious Thoughts and Behaviors Interview, a semi-structured clinical interview (SITBI; Nock et al., 2007). This interview is designed to examine the self-injurious thoughts and behaviors of adolescents. The SITBI was used to determine whether adolescents have ever engaged in NSSI (e.g. Have you ever done something to purposefully hurt yourself without intending to die?) or attempted suicide (e.g. Have you ever made an actual attempt to kill yourself in which you had at least some intent to die?). Adolescents were then categorized as having engaged in NSSI only, engaged in NSSI and attempted suicide, attempted suicide but never engaged in NSSI, and never taken part of any of these behaviors. These made the groups for comparison in this study. The psychometrics of this measure had been previously established (Nock et al., 2007). The SITBI is widely used in community and clinical samples to measure self-injurious behaviors.

*Depressive symptoms.* Depressive symptoms were assessed using the Mood and Feelings Questionnaire, a self-report measure that was designed for children and adolescents 8-18 years of



age (MFQ; Costello & Angold, 1988). The measure contains 33 items describing depressive symptoms in the past 2 weeks. Participants were told to indicate how true (0 = not true, 1 = sometimes, 2 = mostly true) each statement (e.g. "I felt miserable or unhappy") was to them. The MFQ has shown good psychometric properties in both clinical and non-clinical samples (Daviss, Birmaher, Melhem, Axelson, Michaels, & Brent, 2006). For the purposes of this study, the total score was calculated as the mean score across all 33 items.

*Social problem solving.* The SPST, a performance based measure, was used to measure social problem solving skills in the adolescents of this sample (SPST; Nock, 2006). This measure evaluates social problem solving skills in four social domains across eight scenarios. During the SPST, a trained research assistant reads social scenarios involving potential problems with a romantic partner, peers, a teacher/boss, and a parent. They are then told to perform various problem solving tasks that examined different phases of social information processing. For example, participants were told to generate as many potential responses to the scenario as possible in 30 seconds (response generation), and to choose the one they would most likely select (response selection). The SPST also evaluates self-efficacy of a model response on a 5 point Likert scale (0-4). Participants' responses were coded by a team of trained coders blind to participants' mental health history using a revised version of a manualized coding system (Nock, 2006). For this study, responses were coded based on response generation, response content, and perceived self-efficacy. As with previous studies using the SPST, the content of responses were coded (1= negative response; 2 = neutral response; 3 = positive or effective response). Any response showing hostile, aggressive, or self-disparaging content was considered a negative response; passive, avoidant, or unclear responses were coded as neutral; accommodating, agreeable, or appropriately assertive responses were coded as positive or effective. In previous

research, this coding scheme has revealed adequate inter-rater reliability for each construct examined (Nock & Mendes, 2008).

### **Data Analytic Plan**

*Preliminary Analyses.* Preliminary analyses included computing primary variables, descriptive statistics, and correlations. Pre-stress and post-stress variables for each facet of problem solving were created by averaging the mean score across four scenarios before the stressful task and after the stressful task. For example, for response generation, the number of responses given by the adolescent for each scenario was averaged across four scenarios before the stressful task to create the pre-stress response generation variable. For self-efficacy, the reported self-efficacy was averaged across the four scenarios after the stressful task to create the post-stress self-efficacy variable. Response content was created by finding the mean score of all responses reported by the adolescents for the four scenarios before the stressful task, and the four scenarios after the stressful task to create a pre-stress and post-stress variable. Lastly, for avoidance behavior, the number of times an avoidant behavior was coded within the adolescents' chosen response for each scenario was averaged across all four scenarios before and after the stressful task to create two pre- and post-stress avoidance behavior variables.

Significant correlations between the four facets of social problem solving, depressive symptoms, and age were conducted. Also, between self-injurious groups, I calculated all means and standard deviations of age and the composition of each group's ethnicity. To determine if there are any significant differences between groups that might confound results, one-way ANOVAs were run.

*Social Problem Solving Skills between Groups.* To test the hypothesis that before a stressful task, the means between self-injurious groups will not be significantly different, I ran four one-way ANOVAs with each of the four social problem solving facets. I also ran four one-way ANOVAs with each of the four post-stress problem solving variables to test the hypothesis that the means between self-injurious groups would be significantly different. The ANOVAs were then all run again adding both age and depressive symptoms as covariates to test if the results held controlling for these important variables. Lastly, to test the exploratory hypothesis regarding differences between groups in either increases or decreases in social problem solving skills after the stressful induction task, repeated measures mixed ANOVAs were run. I used repeated measures to test whether problem solving deficits become worse under conditions of high arousal in those who self-injure whereas in those who do not, the stress might not affect social problem solving scores. A repeated-measures mixed ANOVA compared within subject differences by between group differences. I ran four repeated measures mixed ANOVA tests to measure each facet of social problem solving.

## **Results**

### **Preliminary Analyses**

Means and standard deviations are presented in Table 1 for all primary variables. As expected, the sample means reflected high levels of depressive symptoms. The majority of the participants did not report engaging in self-injurious behaviors ( $N = 102$ ). Of the remaining adolescents, twenty percent indicated having engaged in NSSI ( $N = 36$ ), and twenty-two percent indicated having engaged in NSSI and attempted suicide ( $N = 38$ ). Out of all of the participants,

only eight reported attempting suicide without having engaged in NSSI. These adolescents were left out of the subsequent analyses.

An ANOVA was conducted to examine potential differences in age between the three self-injury groups, and statistically significant differences in age were found,  $F(2,173) = 7.58, p = .001$ . A Tukey HSD post-hoc test revealed that those who reported having engaged in NSSI only ( $M = 14.96, SD = 1.34$ ) and those who reported having attempted suicide as well ( $M = 15.20, SD = .93$ ) were older than the adolescents who reported no self-injurious behaviors ( $M = 14.30, SD = 1.45$ ). However, no differences were found among each of the self-injury groups.

Another ANOVA was conducted to examine differences in depressive symptoms between the suicide attempt, no self-injury, and NSSI only groups. Results indicated that depressive symptoms differed significantly among self-injury groups,  $F(2,173) = 33.45, p = .001$ . A Tukey HSD post-hoc analysis revealed that more depressive symptoms were reported for adolescents who had attempted suicide ( $M = .87, SD = .41$ ) than those who had only engaged in NSSI ( $M = .55, SD = .36$ ) or had never engaged in any self-injurious behaviors ( $M = .34, SD = .31$ ). Furthermore, adolescents with no history of self-injury reported less depressive symptoms than adolescents with a history of NSSI.

Correlations were conducted to determine the relationships between all primary variables (see Table 2). As expected, results revealed significant relationships between the primary social problem solving variables pre- and post-stress. Pre-stress response content was strongly associated with post-stress response content, and results revealed the same for response generation pre- and post-stress. However, pre-stress self-efficacy and post-stress self-efficacy were associated somewhat less strongly which suggests that perceived social problem solving

abilities are most inconsistent after the stress induction. Response content was related to response generation such that higher scores on response content were associated with a lower number of responses generated. Response content is not associated with self-efficacy at a statistically significant level. The same relationships between these variables are seen pre- and post-stress. This suggests that while these variables all assess aspects of social problem solving, they are measuring distinct constructs.

Age was not associated with any of the primary social problem solving variables.

Depressive symptoms, on the other hand, had a negative association with response content and self-efficacy before the stressful speech task, but were not related to response generation. After the stressful task, adolescents' depressive symptoms were not associated with their self-efficacy.

### **Social Problem Solving Differences Between Self-Injurious Groups Before the Stress Induction**

A one-way ANOVA was conducted for each of the primary social problem solving variables to examine the mean differences between no self-injury, NSSI only, and suicide attempt groups before the speech task (see Table 3). Results revealed significant between group differences in response content,  $F(2,176) = 3.67, p = .02$ . A post-hoc test revealed that adolescents who have attempted suicide had significantly lower scores in response content than adolescents who did not report engaging in any self-injurious behaviors, but did not differ significantly from adolescents who reported engaging in NSSI only. The mean differences in content scores between adolescents engaging in NSSI only and those not engaging in any self-injurious behaviors were not significantly different. In other words, adolescents who attempted suicide reported more negative problem solving strategies than their counterparts who did not

engage in any self-injury, but their scores were not significantly different from adolescents who have engaged in NSSI but have not attempted suicide. After controlling for adolescents' depressive symptoms, significant differences on response content scores between groups disappeared,  $F(2,175) = .46, p = .62$ . Therefore, after taking into account the relationship between depressive symptoms and response content, participants engaging in self-injurious behaviors did not differ significantly from participants who had never engaged in NSSI or suicide attempts.

There were no significant differences between groups in number of responses generated ( $F(2,177) = 1.54, p = .22$ ) or perceived self-efficacy ( $F(2,177) = 2.46, p = .09$ ); however, results reporting the mean differences in self-efficacy revealed a non-significant trend in the predicted direction. Participants who had previously attempted suicide reported that they would be less effective in implementing a positive problem solving strategy than all other participants, but differences in self-efficacy scores did not quite reach significance ( $p = .07$ ).

### **Social Problem Solving Differences Between Self-Injurious Groups After the Stress**

#### **Induction**

In order to test the effect of self-injury group on social problem solving variables after the stressful speech task, one-way ANOVAs were conducted. Mean scores for response content were significantly different between groups after the stressful task,  $F(2,174) = 6.33, p < .001$ . A post-hoc test suggested that adolescents who attempted suicide reported significantly lower scores on response content than both adolescents who engaged in NSSI only ( $p = .03$ ) and adolescents who reported no self-injurious behaviors ( $p < .01$ ). The content scores of adolescents who had engaged in NSSI only did not differ significantly from adolescents who had not engaged in any

self-injurious behaviors,  $p = .96$ . This suggests, similar to results pre-stress, that adolescents who had attempted suicide performed worse on the social problem solving task than adolescents who had never injured themselves. However, adolescents who had attempted suicide also performed significantly worse than adolescents who had engaged in NSSI. This difference was not found before the stressful induction task. After including depressive symptoms and age as covariates, mean differences among all self-injury groups were not significant,  $F(2,174) = 1.57, p = .21$ .

There were no significant mean differences in scores of self-efficacy between self-injury groups, and in contrast to the pre-stress findings, there was not a non-significant trend in the predicted direction,  $F(2,171) = .30, p = .74$ . However, for post-stress response generation, although the mean number of responses were not significantly different among self-injury groups ( $F(2,171) = 2.69, p = .07$ ), results revealed a trend in the opposite direction than was predicted. Adolescents who had attempted suicide gave more potential responses to the scenario than adolescents who had not engaged in any self-injurious behavior although this finding did not reach significance ( $p = .07$ ). Another one-way ANOVA was conducted controlling for depressive symptoms and age. With the inclusion of those two covariates, there were no significant differences or non-significant trends in the number of responses generated between the self-injury groups,  $F(2,171) = 1.12, p = .33$ .

### **Social Problem Solving Differences Between Self-Injurious Groups Over Time**

A repeated-measures, mixed ANOVA was conducted with the three self-injury groups as the between subjects factor and time before and after the stressful task as the within subjects factor and with age as a covariate. Three ANOVAs were conducted for response content, response generation, self-efficacy, and avoidance behavior of the chosen response. For response

content, results revealed no significant interaction between self-injury group and time,  $F(2,173) = 2.00$ ,  $p = .14$ . Similarly, time did not seem to differentially affect response generation  $F(2,173) = 1.63$ ,  $p = .20$ , avoidance behavior,  $F(2,174) = 1.79$ ,  $p = .17$ , or self-efficacy ( $F(2,173) = 2.48$ ,  $p = .09$ ) among groups at a statistically significant level. However, a non-significant trend was revealed for self-efficacy suggesting that adolescents who had attempted suicide reported greater increases in self-efficacy scores after the stressful task compared to the NSSI only or no self-injury groups.

After adding depressive symptoms as a covariate, the interaction between time and self-injurious groups remained non-significant for response content ( $F(2,171) = 1.74$ ,  $p = .18$ ) and response generation ( $F(2,171) = 2.02$ ,  $p = .14$ ) and the trending significance for self-efficacy was attenuated ( $F(2,171) = 1.25$ ,  $p = .29$ ). Once adolescents' depressive symptoms and age were taken into account, there were no significant differences in scores before and after the stressful speech task depending on what kind of self-injurious behaviors, if any, the adolescent endorsed. However, most interestingly, after controlling for age and depressive symptoms, avoidance behavior showed a significant interaction between self-injurious groups over time,  $F(2,171) = 3.23$ ,  $p = .04$ . Adolescents who have attempted suicide showed higher increases in avoidant responses after the stressful task compared to the other groups whose mean scores declined slightly (Table 3).

## Discussion

This study measured social problem solving differences between adolescents who reported never having engaged in self-injurious behaviors, those only having engaged in NSSI, and those who had attempted suicide at least once. This study was unique in its investigation of



social problem solving between a group of adolescents who had engaged in NSSI only, and adolescents who had attempted suicide. It also was unique in including a “hot” and “cold” condition. The goal was to integrate two separate but similar bodies of research that investigate the relationship of social problem solving skills with either NSSI or suicide attempts in adolescence, and add to the understanding of proximal risk factors of self-injurious behaviors. A better understanding of the relationship that social problem solving skills play in self-injurious behaviors provides a more informed basis to any potential prevention or treatment.

Findings suggest that adolescents who reported having attempted suicide displayed increases in the number of avoidant strategies they report in response to a stressor as compared to adolescents who reported having engaged in NSSI only or those who reported never having engaged in self-injurious behaviors. Furthermore, adolescents who had never engaged in self-injury and those who had only engaged in NSSI endorsed less avoidant strategies after the stressful task. Most importantly, this finding persists after controlling for levels of depressive symptoms and age. This outcome suggests that avoidant behavior strategies are attributable to the type of self-injury an adolescent endorses as opposed to how depressed they are. One interpretation of this finding is that in a stressful interpersonal context, those who have attempted suicide are more likely to employ avoidant problem solving strategies compared to other adolescents. This finding is consistent with previous research that suggests that adolescents who have attempted suicide report that their interpersonal problems are more unsolvable, and employ more passive-avoidant problem solving strategies (Becker-Weidman et al., 2010; Linehan et al., 1987; McAuliffe et al., 2006). When faced with a stressful social scenario, adolescent suicide attempters may do their best to avoid the problem which then is never resolved. This persistent social stress might then eventually lead to self-destructive behaviors. This fits with previous

theoretical conceptions of suicidal behavior that explain suicide as a mechanism to avoid and escape negative affect. This avoidance of negative affect may be present before the ultimate decision to attempt, and could be prevalent in other cognitive tasks such as social problem solving. Prevention and treatment efforts may focus on encouraging the adolescents to be more proactive in solving social problems despite their increased levels of stress. It is important to consider that there were no significant mean differences among groups in the hot or cold condition. While suicide attempters showed significantly larger increases in choosing avoidant strategies in response to stressful social scenarios after the stress induction, the number of avoidant strategies chosen was statistically no different than non-suicidal self-injurers or controls. Future research should explore avoidant problem solving strategies in adolescent suicide attempters further using a more extensive measure of avoidant problem solving strategies.

Consistent with prior research, more severe social problem solving deficits were seen in adolescents who had attempted suicide compared to adolescents who had never injured themselves (Linehan et al., 1987; McAuliffe et al., 2006; Speckens & Hawton, 2005). However, although the content of their responses were more negative, self-efficacy and the number of responses to social problems generated did not differ significantly among groups. Furthermore, these differences might better be attributed to levels of depression than self-injurious behaviors. When controlling for depressive symptoms, all significant differences and non-significant trends disappeared entirely. Although this result was not predicted, it is consistent with the previous systematic review (Speckens & Hawton, 2005). These findings contradict Pollock and Williams (1998) who suggest that the insignificance of the results after controlling for depression might be attributed to methodological differences. Suicide attempt and self-injury were clearly defined and

many aspects of social problem solving were explored in this study. However, higher increases in avoidant chosen responses were found in the suicide attempt group even after controlling for depressive symptoms. Avoidant strategies might be an important factor to consider in prevention efforts and treatment options for adolescents displaying risk for suicidal behaviors.

Adolescents who had engaged in NSSI only showed no significant differences in social problem solving skills from adolescents who had no history of self-injury. These results are inconsistent with prior research, and do not support the hypotheses (Nock & Mendes, 2008). Even prior to controlling for age and depression, the means between the psychiatric control group and the NSSI only group are very similar. This implies that in past studies comparing adolescents having engaged in NSSI to community samples or psychiatric controls, the differences in social problem solving skills might be significant because of the inclusion in their NSSI sample of adolescents that had attempted suicide. When eliminating from the sub-sample of adolescent suicide attempters and isolating only adolescents that reported engaging in NSSI, results reveal remarkable similarity to the control group. This is striking because, consistent with prior research, adolescents who reported engaging in NSSI only reported higher levels of depression than their counterparts without a history of self-injury, and lower levels of depression than the suicide attempt group (Brausch & Gutierrez, 2010). Although the results somewhat support that adolescents who engage in NSSI constitute a subgroup of adolescents with distinct psychosocial characteristics from suicide attempters or psychiatric controls, social problem solving does not seem to be a psychosocial variable associated with engagement in self-injurious behaviors without suicidal intent. In sum, this study adds to the literature on social problem solving in adolescents engaging in NSSI by suggesting that perhaps the deficits are more related

to the inclusion of adolescents engaging in suicidal behaviors and their extremely elevated depressive symptoms than NSSI behaviors themselves.

While the inclusion of suicide attempters within NSSI samples designed to measure the social problem solving skills between groups explains the inconsistencies within the research studying adolescents engaging in NSSI, the inclusion of NSSI within samples purporting to measure suicidal adolescents might diminish the results, and create inconsistencies in that body of literature. Yet, as this study and the systematic review of the literature seem to suggest, social problem solving deficits between self-injurious groups did not remain after controlling for depression (Speckens & Hawton, 2005). This does not undermine the importance of teaching more effective problem solving skills to severely depressed adolescents in stressful conditions. While social problem solving deficits might not be uniquely related to self-injury, they are found in adolescents displaying severe suicidal behaviors, and need to be addressed in treatment.

This study was unique in comparing social problem solving skills between groups of adolescents who have attempted suicide or only engaged in NSSI. More research needs to be done to integrate the two bodies of research examining adolescents engaging in NSSI and adolescents attempting suicide respectively on multiple psychosocial factors. The number of adolescents who had attempted suicide without having engaged in some form of self-injury beforehand was startlingly low, constituting a mere four percent of the sample. NSSI clearly constitutes a serious risk factor for further suicidal behaviors, and studying risk factors common to both is an important in understanding which adolescents might go on to engage in detrimental self-injurious behaviors. Particularly, this study provides preliminary evidence of an increase in avoidant strategies in a stressful state in adolescent suicide attempters but not adolescents engaging only in NSSI. Yet, although this study is the first to differentiate adolescents engaging

in non-suicidal versus suicidal self-injury and despite the substantial sample size, the social problem solving measure used was not designed to focus on avoidant behaviors. Further research is needed to explore passive-avoidant problem solving particularly, and uncover potential mediators in the relationship between avoidant problem solving strategies and self-injurious behaviors. Another limitation in the measure of the SPST is that practice effects might occur after the stressful induction as participants have already completed four scenarios. Also, the participants might answer some questions, such as the self-efficacy or chosen response questions, based on what they believe the researcher wants to hear. However, measuring the content of responses might circumvent this effect. This study has other limitations due to a lack of statistical power. First, the statistical analyses did not use an adjusted alpha rate. Also, it would be beneficial in a follow up study with more participants per self-injury group to measure ethnic differences. The study's design using only females increased the chances of finding adolescents engaging in suicidal behavior, but also limits the generalizability of the results. The design was beneficial for the purposes of this study – a preliminary analysis between self-injury groups was examined. However, future research may also use a longitudinal design to determine whether avoidant problem solving strategies predict subsequent self-injurious behaviors, and include a more diverse and larger sample of adolescents to increase statistical power and the generalizability of the results.

This study was unique in its contribution to the literature on self-injury by comparing social problem solving skills in a clinical sample of adolescents reporting different types of self-injury. Further, it examined the effects of stress on social problem solving among groups. The results of this study suggest that under stressful conditions, adolescents who have attempted suicide will be more likely to utilize passive-avoidant problem solving strategies than

adolescents who engage in NSSI only or adolescents who have never engaged in self-injury above and beyond their depressive symptoms.

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*Table 1.* Sample-wide Means (and standard deviations) for Primary Variables

	<i>M (SD)</i>	Range
<b>Social Problem Solving (Pre-Stress)</b>		
Response Content	2.43 (.35)	(1.60 - 3.00)
Self-Efficacy	2.93 (.55)	(1.50 - 4.00)
Response Generation	3.29 (1.21)	(1.25 - 7.50)
Avoidant Behavior	.25 (.51)	(.00 – 2.00)
<b>Social Problem Solving (Post-Stress)</b>		
Response Content	2.42 (.38)	(1.40 - 3.00)
Self-Efficacy	2.76 (.67)	(.00 - 4.00)
Response Generation	3.00 (1.18)	(1.00 - 8.00)
Avoidant Behavior	.22 (.51)	(.00 – 3.00)
Depression	.49 (.34)	(.00 - 1.93)
Age (Rounded)	14.63 (1.38)	(12.00 - 17.00)

*Table 2* Bivariate Associations Among Primary Variables

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	1	2	3	4	5	6	7	8
Social Problem Solving (Pre-Stress)								
1. Response Content	-							
2. Response Generation	-.35**	-						
3. Self-Efficacy	.09	-.10	-					
Social Problem Solving (Post-Stress)								
4. Response Content	.64**	-.29**	.07	-				
5. Response Generation	-.31**	.73**	-.11	-.45**	-			
6. Self-Efficacy	.08	-.02	.36**	.09	-.11	-		
7. Depressive Symptoms	-.21**	.09	-.32**	-.28**	.12	-.11	-	
8. Age	-.10	.05	-.10	-.06	.08	-.03	.19	-

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\*p &lt; .05; \*\* p &lt; .01

*Table 3.* Social Problem Solving Means Pre- and Post-Stress Among Different Self-Injurious Groups with and without Depression and Age as Covariates

	Mean Scores without Covariates			Mean Scores with Depression and Age as Covariates		
	No Self-Injurious Behaviors	NSSI Only	Suicide Attempt	No Self-Injurious Behaviors	NSSI Only	Suicide Attempt
	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SE)</i>	<i>M(SE)</i>	<i>M(SE)</i>
<b>Response Content</b>						
Pre-Stress	2.48 (.30) <sup>a</sup>	2.40 (.34) <sup>ab</sup>	2.31 (.44) <sup>b</sup>	2.45 (.04)	2.41(.06)	2.40(.06)
Post-Stress	2.47 (.34) <sup>a</sup>	2.45 (.35) <sup>a</sup>	2.23 (.45) <sup>b</sup>	2.44 (.04)	2.47(.06)	2.32 (.07)
<b>Response Generation</b>						
Pre-Stress	3.15 (1.10)	3.38 (.92)	3.44 (1.49)	3.17 (.12)	3.38 (.20)	3.38 (.22)
Post-Stress	2.91 (1.10)	2.92 (.81)	3.40 (1.18)	2.95 (.12)	2.90 (.20)	3.30 (.22)
<b>Self-Efficacy</b>						
Pre-Stress	2.99 (.48)	2.91 (.49)	2.77 (.67)	2.91 (.05)	2.94 (.09)	2.96 (.09)
Post-Stress	2.70 (.67)	2.76 (.70)	2.79 (.64)	2.64 (.07)	2.80 (.11)	2.95(.12)
<b>Avoidant Behavior</b>						
Pre-Stress	.25 (.50)	.28 (.57)	.21 (.47)	.29 (.05)	.26 (.09)	.12 (.09)
Post-Stress	.21 (.44)	.14 (.43)	.33 (.74)	.21 (.05)	.14 (.09)	.35 (.10)

*Note.* NSSI = Non-suicidal self-injury; mean scores within the same row with different subscripts differ at  $p < .0$

