Published in final edited form as:

Suicide Life Threat Behav. 2011 June ; 41(3): 277–286. doi:10.1111/j.1943-278X.2011.00027.x.

Intolerance to Delayed Reward in Girls with Multiple Suicide Attempts

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Abstract

Impulsivity has been conceptualized as influencing the expression of suicidal behavior. Adolescence is a developmental period characterized both by a relatively high rate of suicide attempts and a high level of impulsivity. The current study examined two behavioral measures (delay reward and disinhibition) and one self-report measure of impulsivity among girls with suicide attempt histories. Girls with multiple suicide attempts performed more impulsively on measures of delayed reward, and had higher self-ratings of depression and aggression than girls with either one or no suicide attempts. The multiple attempter girl's preference for immediate gratification may directly increase vulnerability to suicidal acts in the context of distressing states or indirectly increase risk by creating poor life experiences over time.

Keywords

suicide attempts; impulsivity; adolescence; girls

Adolescence is a developmental period characterized by an exceptionally high rate of non-lethal suicide attempts that are associated with psychosocial problems extending into adulthood. While suicide is the third leading cause of death among teens, suicide attempts occur at much higher rates than deaths, especially for adolescents (McIntosh, 2009). For instance, while the rates of suicide death are similar among both adolescents and the elderly, adolescents are 50 times more likely to attempt suicide (McIntosh, 2009). This translates to about 1.5 million suicide attempts annually among adolescents in the United States (CDC, 207, 2009). Not only are suicide attempts common during adolescence, those who attempt suicide are at much greater risk of experiencing ongoing difficulties extending into adulthood, including further psychopathology, ongoing relationship problems, and death by later suicide attempts (Brent, Beugher, Bridge, Chen, & Chiappetta, 1999; Groholt & Ekeberg, 2009; King et al., 2001; Wong et al., 2008). Because of the relatively high incidence of suicide attempts occurring during adolescence and the long-term consequence of this behavior, there is a great deal of research interest in better understanding characteristics surrounding suicide attempts occurring in the adolescent period.

Not only is adolescence characterized by a relatively high rate of suicide attempts, it is also a period of increased participation in impulsive behaviors. A host of neuro-biological and social changes occur during adolescence, increasing impulsivity and dysregulation of

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behavior relative to both child and adult developmental periods (Kelly Schochet, & Landry, 2004; Steinberg, 2008). While increased impulsivity is normative during adolescent development, there are a variety of sources of evidence suggesting that impulsivity is associated with suicidal behaviors, which may account for the relatively high rate of suicide attempts among adolescence. For instance, impulsivity is significantly higher among adolescent community-based and clinical samples with suicide attempts (Gorlyn, 2005; Horesh, 2001; Sanislow Grilo, Fehon, Axelrod, & McGlashan, 2003), increased impulsivity has been shown to be a predictor of future suicide attempts (Yen et al., 2009), and the relationship with impulsivity has been described in theories of suicide (Baumeister, 1990; Mann, Waternaux, Haas, & Malone, 1999).

While self-report, personality measures have provided much of the foundation of our understanding of the relationship of impulsivity with suicide and suicide attempts, increasingly the field of impulsivity utilized behavioral measures of impulsive behavior (e.g. Dick et al, 2010; Dougherty et al., 2005a, 2009; Gorlyn, Keilp, Tryon, & Mann, 2005; Reynolds et al., 2006, 2008). Among other reasons, these tools are gaining recognition because they are objective measures that can be used to assess distinct components of impulsive behavior (e.g. problems with delay of gratification and disinhibition) representing different underlying neural systems (Reynolds et al., 2008), and are sensitive to population differences across a variety of clinical phenomenon (e.g. substance abuse, Dick et al., 2010; bipolar disorder, Swann et al., 2009; personality disorder, McCloskey et al., 2009). To date, four studies have reported performance on behavioral measures of impulsivity among suicidal samples. Two studies have reported that adults who have a past history of multiple suicide attempts perform more impulsively on a continuous performance measure than those with single or no suicide attempt(s) (Dougherty et al., 2004; Wu et al., 2009). One study of adolescent psychiatric patients reported more impulsive performance on a continuous performance task by "suicidal" (including ideation or behavior) than non-suicidal or healthy controls (Kashden et al., 1993). Another adolescent study found those with a previous suicide attempt performed more impulsively on a continuous performance measure and this performance was related to the self-reported "severity" of suicidal behavior (assessed on a continuum from suicide ideation to mild and serious suicide attempts; Horesh, 2001). While each of these studies have used the continuous performance model of behavioral impulsivity, response disinhibition (i.e. stop tasks) and delayed reward tests are other common behavioral measures of impulsivity (Dougherty et al., 2005a) that have not been used with suicidal samples.

The present study was designed to extend research using behavioral measures of impulsivity with suicidal samples, by exploring performance on measures of delayed reward and disinhibition impulsivity among girls with multiple suicide attempts. Previous research has found clinically meaningful increases in symptoms of distress for those with multiple suicide attempts relative to those with either a single or no attempts (e.g. hopelessness, depression, and stress: Goldston et al., 1996; Rudd et al., 1996). While two studies reported relatively increases impulsivity on a continuous performance task for adults with multiple attempts than single attempters (Dougherty et al., 2004), no similar studies have been conducted using delayed reward and disinhibition measures among adolescents with suicide attempts.

Methods

Participants

Fifty-nine adolescent girls, ages 13 – 17 years, were recruited to take part in a study of impulsive behaviors. The inclusion criteria were good physical health, IQ > 70, and receiving treatment at the Child and Adolescent Inpatient Psychiatry Service at Wake Forest

University Baptist Medical Center, Winston-Salem, NC. Exclusion criteria were any psychiatric disorder (e.g., psychosis or autism) that would interfere with comprehension of study procedures.

This study was reviewed and approved by the Institutional Review Board of Wake Forest University Health Sciences. After a complete description of the study, written informed assent was obtained from the adolescent and consent was obtained from the guardian. Participants were paid \$30 for completing the interviews and study procedures.

Assessment of Suicide Attempts and Group Classification—History of suicide attempts were assessed in an interview format (Lifetime History of Aggression; Coccaro, Berman, & Kavoussi, 1997). First, participants were asked if they have intentionally harmed themselves either with the intent to die or with no intent to die. Positive responses to these two questions were followed up with further inquiry about the frequency of these behaviors and methods of self-harm. Acts with definite or ambivalent (i.e. more than no-intent) were coded as suicide attempts. While this measure is typically used to measure behaviors occurring in the context of anger or distress, self-harm questions were not limited to these states (i.e., all self-harm acts were rated).

Participants were classified into one of three groups based on their frequency of suicide attempts: (a) No Attempts – psychiatric inpatients with no previous suicide attempts, $n = 22$; (b) Single Attempt – psychiatric inpatients with only one previous suicide attempt, $n = 15$; and (c) Multiple Attempts – psychiatric inpatients with more than one previous suicide attempt (i.e., defined as an incident of actual self-harm behavior with the intent to cause death), $n = 22$. While impulsivity among the Multiple Attempts and Single Attempts groups was the primary comparison of interest, the No Attempts were included to provide a context for interpreting the range of scores.

Behavioral Impulsivity

Two Choice Impulsivity Paradigm—The Two Choice Impulsivity Paradigm (TCIP; Dougherty, Marsh, & Mathias, 2003a; Dougherty, Mathias, Marsh, & Jagar, 2005b) is a measure of delayed reward and requires 50 discrete choices between smaller more immediate rewards and larger more delayed rewards that are exchanged for actual money at the conclusion of the procedure. Girls made choices on a computer between circles associated with a 5 cent reward that could be earned after a delay of 5 seconds and squares associated with a 15 cent reward after a 15 second delay. The dependent variable for this task was the number of consecutive larger-later choices, which is an indicator of the tolerance to forgo more immediate reinforcement for longer-term reward (Dougherty et al., 2005a).

GoStop Impulsivity Paradigm—The GoStop Impulsivity Paradigm (GoStop; Dougherty et al., 2003b, 2005b) measured the failure to inhibit a response when a targeted "go" cue was unpredictably coupled with a "stop" cue. In this task, 5-digit numbers were presented in rapid sequence. Half of these numbers were target trials (matching stimuli) and half were filler trials (novel stimuli). Half of all target trials were actually "stop" trials, where the matching number presented in black (the go cue) changed to red (the stop cue) after the stimulus appeared. Participants were instructed to respond to target trials, while the matching number was still on the monitor and to withhold responding if the target turned from black to red (the stop-signal) and to filler trials. The dependent variable for this task was the ratio of responses to stop trials divided by target trial responses (i.e. response inhibition ratio), which is typically assessed at the 150 msec stop delay (e.g. Dougherty, Marsh-Richard, Hatzis, Nouvion, & Mathias, 2008; Stanford et al., 2009). A higher

proportion of response to the stop trials, relative to go trials, is interpreted as representing response disinhibition impulsivity (Dougherty et al., 2005a).

Clinical and Demographic Assessment

Standard instruments were administered to compare the groups on measures of clinical symptoms as a context for interpreting impulsive behavioral performance. Self-report measures of depression (Beck Depression Inventory-II; Beck, Steer, & Brown, 1996), hopelessness (Beck Hopelessness Scale; Beck & Steer, 1988), suicidal ideation (Beck Scale for Suicidal Ideation; Beck & Steer, 1991), aggression (Lifetime History of Aggression; Coccaro et al., 1997), and trait impulsiveness (Barratt Impulsiveness Scale, BIS-11; Patton, Stanford, & Barratt, 1995; Stanford et al., 2009) were collected from all participants. Additionally, a self-report measure of suicide intent (Beck Suicide Intent Scale; Beck, Schuyler, & Herman, 1974) was collected from the Single Attempt and Multiple Attempts groups.

To further characterize the sample, adolescents also completed measures of psychosocial history. All participants were interviewed using the Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (Kaufman et al., 1997) to assess psychiatric diagnoses and any history of abuse. Additionally, intelligence was assessed using the Wechsler Abbreviated Scale of Intelligence™ (WASI; Psychological Corporation, 1999) and socio-economic status was measured with the Four Factor Index of Social Status (Hollingshead, 1975).

Data Analyses

Chi-square tests were used to analyze the categorical variables of ethnicity, psychiatric disorder, abuse, and method of suicide attempt. One-way analyses of variance (ANOVA) were conducted for continuous demographic variables and dependent variables from the behavioral measures of impulsivity using Group as the between-subjects factor. Follow-up comparisons between individual groups were conducted using Student-Newman-Keuls test. The relationship between measures was tested using Pearson's correlation and step-wise linear regression. Analyses were conducted using PASW 17.0.2 (SPSS Inc., Chicago, IL). For each of the analyses alpha was set at .05 (two-tailed).

Results

Demographic Comparisons

The three groups did not differ on their demographic characteristics (Table 1). There were no significant group differences in terms of age, education, socio-economic status, intelligence, or ethnicity.

Psychiatric Diagnoses, History of Abuse, and Method of Suicide Attempt(s)

There were no significant differences in the distribution of the psychiatric diagnostic or abuse categories among the three groups of inpatients. Mood disorders were the most common psychiatric diagnoses and physical abuse was the most common form of maltreatment. Cutting/stabbing was the most common method of suicide attempt among the Multiple Attempts group, while drug overdose/poisoning was the most common method among the Single Attempt group. As might be expected given the higher rate of suicide attempts, there was a wider variety of suicide attempt methods among the Multiple Attempts group, which included significantly more cutting, asphyxiation, and drowning. The distribution of psychiatric diagnoses, history of abuse, and method of suicide attempt(s) for the three inpatient groups are presented in Table 2.

Laboratory-Measured Behavioral Impulsivity and Self-Reported Clinical Characteristics

Impulsive performance between the groups differed depending on the type of impulsivity assessed (Table 3). For the delayed reward procedure (Two Choice Impulsivity Paradigm) smaller values corresponded with more impulsive responding (i.e. less capacity to delay for reward). On this measure, the Multiple Attempts group showed more impulsive responding than all other groups, including those with only one suicide attempt. There was a significant main effect of group on impulsive responding for the number of consecutive larger-later choices and follow-up comparisons revealed significantly fewer consecutive choices for larger-later rewards made by the Multiple Attempts than the Single Attempt, and No Attempt groups, which did not differ from one another. There were no significant group differences in the measures of response inhibition (GoStop) or self-reported (BIS-11) impulsivity.

The Multiple Attempts group had higher self-ratings on some, but not all clinical symptoms. While the Multiple Attempts group reported significantly greater depression and greater lifetime history of aggression than the Single Attempt group, and greater suicidal ideation than the No Attempts group, the patients did not differ in self-reported suicide intent or hopelessness.

There were significant relationships between performance on the TCIP impulsivity measure and clinical characteristics. In particular, fewer consecutive longer-later choices on the TCIP was associated with higher self-ratings of depression ($r = -.31, p = .005$), aggression ($r = -.33, p = .003$), impulsivity ($r = -.45, p < .001$), and suicide intent ($r = -.26, p = .019$). In examining the relative capacity to predict group membership, these variables were entered into a stepwise regression; TCIP performance ($\beta = -.37, t = -3.02, p = .004$) and suicide ideation ($\beta = .29, t = 2.40, p = .020$) were the two significant contributors to this model ($F = 8.11, p = .001; R = .491$).

Discussion

This study examined different aspects of impulsive behavior as a function of adolescent girls' histories of suicide attempts. Despite similar demographic and psychiatric profiles, girls with multiple suicide attempts were differentiated from single or non-attempter psychiatric patients on measures of delayed reward impulsivity, depression, and aggression. The impulsivity differences observed were specific to delayed reward measures and not disinhibition or self-report measures. Delayed reward impulsivity was associated with depression and aggression, and was a significant predictor with suicide ideation of attempter status.

Impulsivity is an important component of theories of suicidal behavior and appears to be an important feature distinguishing single from multiple attempters. The observed elevation in impulsivity among the multiple attempt group may reflect either a trait- and/or state-dependent influence of impulsivity on suicide attempts. A recent large scale study found, using trait measures, that the inability to appreciate the long-term consequences of behavior confer risk for suicide attempts (Klonsky & May, 2010); the current study found discounting of long-term consequences on a state-dependent measure of choice behavior. The trait- and state-dependent relationship of impulsivity with suicide attempts are described in theories of suicide and suicidal behavior. For instance, the interpersonal-psychological theory of suicidal behavior conceptualizes impulsivity as a general trait indirectly increasing suicide risk by creating more negative life events (Joiner, 2005). According to this model, suicidal behavior results from the co-occurrence of the desire and capability to engage in such behavior. Impulsivity can play a role in acquiring this capability because making impulsive, non-advantageous choices (as observed in the current behavioral measure in the lab) in life

can lead to adverse, painful life events. Experience with pain and habituation of fearfulness in the context of pain are viewed as creating an increased capability for suicide attempts. The relatively lower capability of delayed reward choices observed for the multiple attempter group in the current study may be a choice pattern likely to lead to adverse outcomes. Future research may consider the relationship of delayed reward performance and stressful life events among adolescents with suicide attempts.

Several other theories have taken a state-dependent perspective on the role of impulsivity in suicidal behavior. For instance, one model suggests serotonin dysfunction acts to increase impulsivity; when this occurs in conjunction with stress and symptoms of psychological distress (i.e. depression, hopelessness), suicide attempts are more likely to occur (Mann, Waternaux, Haas, & Malone, 1999). Another perspective has been that impulsivity may give rise to suicidal behavior as an action-oriented means to "escape" from aversive emotional and physiological states (Baumeister, 1990). In the context of both of these models, suicidal behavior occurs in a state where long-term goals or consequences are discounted and greater value is placed on behaviors having immediate rewards. In this context, suicide attempts are suggested to have reinforcing qualities in the short-term by reducing aversive states of heightened physiological and emotional arousal (Esposito et al., 2003). As Baumeister (1990; p. 90) puts it, during a suicidal episode, "the short run is all that seems to matter". This reduced ability to value or choose more advantageous delayed reward found for the multiple attempt group may make them more prone to the escape behavior described by Baumeister. While not measured in the current study, future research may consider delayed reward performance in the context of heightened emotional/physiological arousal described as important to the expression of suicidal behavior by Baumeister.

Measures of delayed reward may be useful for interventions aimed at reducing suicidal behaviors. One important intervention for suicidal individuals is to increase tolerance for distress and reduce the urge to act during heightened arousal by teaching that negative mood states are transient (Rudd, Joiner, & Rajab, 2001). The goal of this intervention is for the patient to select behaviors that are advantageous in the long run (e.g., health promoting behaviors) rather than those aimed at more immediate gratification for relief of distress (e.g., suicide attempt). While "real-world" choices are the target of this treatment, delayed-reward behavioral tasks may be a useful analog for tracking the course of this intervention and inform the clinician about an individual's capability for delayed reward choice behaviors.

In addition to the impulsivity differences, the girls with multiple attempts reported more depression and aggression than those with a single attempt. Although greater depression (Hawton, Kingsbury, Steinhardt, James, & Fagg, 1999) and aggression (Dougherty et al., 2004) have been reported for adults with multiple attempts, prior research in adolescents did not find a difference between single and multiple attempters ratings of these symptoms (Goldston et al., 1996). Further replication is needed to resolve these discrepancies. While the relationship of depression to suicide attempts is a highly replicated finding (Evans, Hawton, & Rodham, 2004), it has been suggested that depression is a risk factor for suicide attempts that is independent of impulsivity (Kingsbury, Hawton, Steinhardt, & James, 1999). In contrast, aggression and impulsivity tend to be strongly associated and interact to increase risk of suicide (Dumais et al., 2005). Finally, it was suicidal ideation, rather than depression and aggression, that predicted attempter status along with delayed reward impulsivity. Taken together, consideration of mood states, aggression, suicide ideation and impulsivity has the potential to provide greater explanatory power than their measurement individually. Indeed, suicide attempts are complex, multi-determined phenomena that require consideration of a range of emotional, behavioral, and cognitive factors (Rudd et al., 2001).

There were several limitations to this study which temper the generalizability of these findings. First, this study was conducted only with adolescent-age girls. Although adolescent girls in particular have a relatively high rate of suicide attempts (Goldston et al., 1998), it is unclear how the current results might generalize to boys or to adults. Second, although 59 girls participated, the sample size within each of the three groups was small and larger scale studies are needed to replicate these findings. Third, because of the cross-sectional nature of this study, causal inferences may not be made about the relationship of differences in delayed reward impulsivity, depression, and aggression to suicide attempts. Future prospective studies will need to explore how fluctuations in impulsivity and mood states correspond to suicide attempts over time, particularly very near the time of an attempt. Finally, there are other important clinical groups like adolescents with non-suicidal self-injury or suicide ideation without attempts that may be likely to also experience problems with impulsivity, and their impulsive performance may be expressed differently than those with suicide attempts.

Conclusions

Research on adolescent suicide attempts is important because of both high costs incurred for treatment and increased risk for future death by suicide. Identification of factors that distinguish single suicide attempters from a more life-course persistent pattern of suicidal behavior is an important component in suicide prevention and intervention. Symptoms of depression and aggression are important aspects of understanding the distinction between single and multiple attempters as is tolerance to delay gratification.

Acknowledgments

This project was funded by grants from the National Institute of Mental Health (R01-MH065566 and R01-MH077684). Dr. Dougherty gratefully acknowledges support from the William & Marguerite Wurzbach Distinguished Professorship and the University of Texas Star Program.

We gratefully acknowledge the assistance of Kristen Prevette in collection of data from which this manuscript was prepared.

References

- Beck, AT.; Schuyler, D.; Herman, I. Development of suicidal intent scales. In: Beck, A.; Resnik, H.; Lettieri, D., editors. *The Prediction of Suicide*. Bowie, MD: Charles Press; 1974. p. 45-56.
- Beck, AT.; Steer, R. *Beck Hopelessness Scale Manual*. San Antonio TX: The Psychological Corporation; 1988.
- Beck, AT.; Steer, R. *Manual for the Beck Scale of Suicidal Ideation*. San Antonio TX: The Psychological Corporation; 1991.
- Beck, AT.; Steer, R.; Brown, GK. *Beck Depression Inventory Manual*. 2nd Ed.. San Antonio TX: The Psychological Corporation; 1996.
- Brent DA, Beugher M, Bridge J, Chen T, Chiappetta L. Age- and sex-related risk factors for adolescent suicide. *Journal of the American Academy of Child and Adolescent Psychiatry*. 1999; 38:1497–1505. [PubMed: 10596249]
- Baumeister RF. Suicide as escape from self. *Psychological Review*. 1990; 97:90–113. [PubMed: 2408091]
- CDC - Center for Disease Control and Prevention. *Youth Risk Behavior Surveillance—United States, 2007. Surveillance Summaries, June 6. MMWR 2008. 2007; 57 No. SS-4.*
- CDC - Center for Disease Control and Prevention. *2007 Population Estimate detailed table United States. 2009. T6-2007*
- Coccaro EF, Berman ME, Kavoussi RJ. Assessment of life history of aggression: Development and psychometric characteristics. *Psychiatry Research*. 1997; 73:147–157. [PubMed: 9481806]

- Corruble E, Hatem N, Damy C, Falissard B, Guelfi JD, Reynaud M, Hardy P. Defense styles, impulsivity, and suicide attempts in major depression. *Psychopathology*. 2003; 36:279–284. [PubMed: 14646450]
- Dawes MA, Mathias CW, Richard DM, Hill-Kapturczak N, Dougherty DM. Adolescent suicidal behavior and substance use: Developmental mechanisms. *Substance Abuse: Research and Treatment*. 2008; 2:13–28. [PubMed: 20651946]
- Dick DM, Smith G, Olausson P, Mitchell SH, Leeman RF, O'Malley SS, Sher K. Understanding the construct of impulsivity and its relationship to alcohol use disorders. *Addiction Biology*. 2010; 15:217–226. [PubMed: 20148781]
- Dougherty, DM.; Marsh, DM.; Mathias, CW. Two Choice Impulsivity Paradigm (Version 1.0) [Manual]. San Antonio, TX: Neurobehavioral Research Laboratory and Clinic, University of Texas Health Science Center; 2003a.
- Dougherty DM, Marsh DM, Mathias CW, Swann AC. The conceptualization and role of impulsivity: Bipolar Disorder and Substance Abuse. *Psychiatric Times*. 2005a; 22:32–35.
- Dougherty DM, Marsh-Richard DM, Hatzis ES, Nouvion SO, Mathias CW. A test of alcohol dose effects on multiple behavioral measures of impulsivity. *Drug and Alcohol Dependence*. 2008; 96:111–120. [PubMed: 18378098]
- Dougherty, DM.; Mathias, CW.; Marsh, DM. GoStop Impulsivity Paradigm (Version 1.0). San Antonio, TX: Neurobehavioral Research Laboratory and Clinic, University of Texas Health Science Center; 2003b. [Manual]
- Dougherty, DM.; Mathias, CW.; Marsh, DM. Laboratory measures of impulsivity. In: Coccaro, EF., editor. *Aggression: Psychiatric Assessment and Treatment*. Medical Psychiatric Series No. 22. New York: Marcel Dekker Publishers; 2003c. p. 247-265.
- Dougherty DM, Mathias CW, Marsh-Richard DM, Furr RM, Nouvion SO, Dawes MA. Distinctions in behavioral impulsivity: Implications for substance abuse research. *Addictive Disorders and Their Treatment*. 2009; 8:61–73. [PubMed: 20535237]
- Dougherty DM, Mathias CW, Marsh DM, Jagar AA. Laboratory behavioral measures of impulsivity. *Behavioral Research Methods and Instruments*. 2005b; 37:82–90.
- Dougherty DM, Mathias CW, Marsh DM, Papageorgiou TD, Swann AC, Moeller FG. Laboratory measured behavioral impulsivity relates to suicide attempt history. *Suicide and Life-Threatening Behavior*. 2004; 34:374–385. [PubMed: 15585459]
- Dumais A, Lesage AD, Lalovic A, Seguin M, Tousignant M, Chawky N, Turecki G. Is violent method of suicide a behavioral marker of lifetime aggression? *American Journal of Psychiatry*. 2005; 162:1375–1378. [PubMed: 15994723]
- Esposito C, Spirito A, Boergers J, Donaldson D. Affective, behavioral, and cognitive functioning in adolescents with multiple suicide attempts. *Suicide and Life-Threatening Behavior*. 2003; 33:389–399. [PubMed: 14695054]
- Evans E, Hawton K, Rodham K. Factors associated with suicidal phenomena in adolescents: A systematic review of population based studies. *Clinical Psychology Review*. 2004; 24:957–979. [PubMed: 15533280]
- Goldston, DB.; Daniel, SS.; Mathias, CW.; Dougherty, DM. Suicidal and non-suicidal self-harm behaviors in adolescent substance use disorders. In: Kaminer, Y.; Bukstein, O., editors. *Adolescent Substance Abuse: Psychiatric Comorbidity and High Risk Behaviors*. New York, NY: Routledge: Taylor & Francis Group; 2007. p. 323-354.
- Goldston DB, Daniel S, Reboussin D, Kelley A, Levers C, Brunstetter R. First-time suicide attempters, repeat attempters, and previous attempters on an adolescent inpatient psychiatry unit. *Journal of the American Academy of Child and Adolescent Psychiatry*. 1996; 35:631–639. [PubMed: 8935210]
- Goldston DB, Daniel SS, Reboussin BA, Reboussin DM, Kelley AE, Frazier PH. Psychiatric diagnoses of previous suicide attempters, first-time attempters, and repeat attempters on an adolescent inpatient psychiatry unit. *Journal of the American Academy of Child and Adolescent Psychiatry*. 1998; 37:924–932. [PubMed: 9735612]
- Gorlyn M, Keilp JG, Tryon WW, Mann JJ. Performance test correlates of component factors of impulsiveness. *Personality and Individual Differences*. 2005; 38:1549–1559.

- Groholt B, Ekeberg O, Haldorsen T. Adolescent suicide attempters: What predicts future suicidal acts? *Suicide and Life-Threatening Behavior*. 2006; 36:638–650. [PubMed: 17250468]
- Hawton K, Kingsbury S, Steinhardt K, James A, Fagg J. Repetition of deliberate self-harm by adolescents: The role of psychological factors. *Journal of Adolescence*. 1999; 22:369–378. [PubMed: 10462427]
- Hollingshead, AB. Four Factor Index of Social Status. New Haven, CT: Department of Sociology, Yale University; 1975.
- Horesh N. Self-report vs. computerized measures of impulsivity as a correlate of suicidal behavior. *Crisis*. 2001; 22:27–31. [PubMed: 11548817]
- Joiner, TE. Why people die by suicide. Cambridge, MA: Harvard University Press; 2005.
- Kashden J, Fremouw WJ, Callahan TS, Franzen MD. Impulsivity in suicidal and nonsuicidal adolescents. *Journal of Abnormal Child Psychology*. 1993; 21:339–353. [PubMed: 8335767]
- Kaufman J, Birmaher B, Brent D, Rao U, Flynn C, Moreci P, Williamson D, Ryan N. Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL): Initial reliability and validity data. *Journal of the American Academy of Child and Adolescent Psychiatry*. 1997; 36:980–988. [PubMed: 9204677]
- Kelley AE, Schochet T, Landry CF. Risk taking and novelty seeking in adolescence: introduction to part I. *Annals of the New York Academy of Sciences*. 2004; 1021:27–32. [PubMed: 15251871]
- King RA, Schwab-Stone M, Flisher AJ, Greenwald S, Kramer RA, Goodman SH, Lahey BB, Shaffer D, Gould MS. Psychosocial and risk behavior correlates of youth suicide attempts and suicidal ideation. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2001; 40:837–846. [PubMed: 11437023]
- Kingsbury S, Hawton K, Steinhardt K, James A. Do adolescents who take overdoses have specific psychological characteristics? A comparative study with psychiatric and community controls. *Journal of the American Academy of Child and Adolescent Psychiatry*. 1999; 38:1125–1131. [PubMed: 10504811]
- Klonsky ED, May A. Rethinking impulsivity in suicide. *Suicide and Life-Threatening Behavior*. 2010; 40:612–619. [PubMed: 21198330]
- Lane SD, Cherek DR, Pietras CJ, Tcheremissine OV. Measurement of delay-discounting using trial-by-trial consequences. *Behavioural Processes*. 2003; 64:287–303. [PubMed: 14580699]
- Mann JJ, Waternaux C, Haas GL, Malone KM. Toward a clinical model of suicidal behavior in psychiatric patients. *American Journal of Psychiatry*. 1999; 156:181–189. [PubMed: 9989552]
- McCloskey MS, New AS, Siever LJ, Goodman M, Koenigsberg HW, Flory JD, Coccaro EF. Evaluation of behavioral impulsivity and aggression tasks as endophenotypes for Borderline Personality Disorder. *Journal of Psychiatric Research*. 2009; 43:1036–1048. [PubMed: 19232640]
- McIntosh, JL. U.S.A. suicide 2006: Official final data. Washington, DC: American Association of Suicidology; 2009. dated April 19, 2009, downloaded from <http://www.suicidology.org>.
- Miranda R, Scott M, Hicks R, Wilcox HC, Munfakh JLH, Shaffer D. Suicide attempt characteristics, diagnoses, and future attempts: Comparing multiple attempters to single attempters and ideators. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2008; 47:32–40. [PubMed: 18174823]
- Parellada M, Saiz P, Moreno D, Vidal J, Llorente C, Álvarez M, García-Portilla P, Ruiz-Sancho A, Arango C, Bobes J. Is attempted suicide different in adolescent and adults? *Psychiatry Research*. 2008; 157:131–137. [PubMed: 17888518]
- Patton JH, Stanford MS, Barratt ES. Factor structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology*. 1995; 51:768–774. [PubMed: 8778124]
- Psychological Corporation. Wechsler Abbreviated Scale of Intelligence® (WASI) Manual. San Antonio, TX: Harcourt Brace and Company; 1999.
- Reynolds P, Eaton P. Multiple attempters of suicide presenting at an emergency department. *Canadian Journal of Psychiatry*. 1986; 31:328–330.
- Reynolds B, Ortengren A, Richards JB, de Wit H. Dimensions of impulsive behavior: Personality and behavioral measures. *Personality and Individual Differences*. 2006; 40:305–315.

- Reynolds B, Penfold RB, Patak M. Dimensions of impulsive behavior in adolescents: laboratory behavioral assessments. *Experimental and Clinical Psychopharmacology*. 2008; 16:124–131. [PubMed: 18489016]
- Rudd MD, Joiner T, Rajab MH. Relationships among suicide ideators, attempters, and multiple attempters in a young-adult-sample. *Journal of Abnormal Psychology*. 1996; 105:541–550. [PubMed: 8952187]
- Rudd, MD.; Joiner, T.; Rajab, MH. *Treatment Manuals for Practitioners*. New York, NY, US: Guilford Press; 2001. Treating suicidal behavior: An effective, time-limited approach.
- Sanislow CA, Grilo CM, Fehon DC, Axelrod SR, McGlashan TH. Correlates of suicide risk in juvenile detainees and adolescent inpatients. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2003; 42:234–240. [PubMed: 12544184]
- Stanford MS, Mathias CW, Dougherty DM, Lake SL, Anderson NE, Patton JH. Fifty years of the Barratt Impulsiveness Scale: An update and review. *Personality and Individual Differences*. 2009; 47:385–395.
- Steinberg L. A social neuroscience perspective on adolescent risk-taking. *Developmental Review*. 2008; 28:78–106. [PubMed: 18509515]
- Swann AC, Lijffijt M, Lane SD, Moeller FG. Severity of bipolar disorder is associated with impairment of response inhibition. *Journal of Affective Disorders*. 2009; 116:30–36. [PubMed: 19038460]
- Witte TK, Merrill KA, Stellrecht NE, Bernert RA, Hollar DL, Schatschneider C, Joiner TE Jr. "Impulsive" youth suicide attempters are not necessarily all that impulsive. *Journal of Affective Disorders*. 2008; 107:107–116. [PubMed: 17804082]
- Wong JPS, Stewart SM, Claassen C, Lee PWH, Rao U, Lam TH. Repeat suicide attempts in Hong Kong community adolescents. *Social Science and Medicine*. 2008; 66:232–241. [PubMed: 17919796]
- Wu C-S, Liao S-C, Lin K-M, Tseng MM-C, Wu EC-H, Liu S-K. Multi-dimensional assessments of impulsivity in subjects with history of suicidal attempts. *Comprehensive Psychiatry*. 2009; 50:315–321. [PubMed: 19486729]
- Yen S, Shea MT, Sanislow CA, Skodol AE, Grilo CM, Edelen MO, Stout RL, Morey LC, Zanarini MC, Markowitz JC, McGlashan TH, Daversa MT, Gunderson JG. Personality traits as prospective predictors of suicide attempts. *Acta Psychiatrica Scandinavica*. 2009; 120:222–229. [PubMed: 19298413]

Table 1

Demographic Characteristics

Characteristics	Group						Analyses	
	No Attempt (<i>n</i> = 22)		Single Attempt (<i>n</i> = 15)		Multiple Attempts (<i>n</i> = 22)			
	Mean	(SD)	Mean	(SD)	Mean	(SD)	<i>F</i>	<i>p</i>
Age (years)	15.0	(1.2)	15.1	(1.3)	14.9	(1.4)	0.1	.879
Education (years)	9.2	(1.3)	9.5	(1.4)	9.1	(1.7)	0.5	.777
Socioeconomic Status	32.6	(13.5)	27.1	(13.2)	26.6	(12.2)	1.2	.321
Intelligence score	96.4	(9.5)	94.4	(14.2)	93.1	(11.3)	0.4	.676
	Number	(%)	Number	(%)	Number	(%)	χ^2	<i>p</i> [*]
Ethnicity								
Caucasian	20	(90.9)	11	(73.3)	17	(77.3)	6.2	.450
African American	2	(9.1)	3	(20.0)	2	(9.1)		
Hispanic	0	(0.0)	1	(6.7)	1	(4.5)		
Other	0	(0.0)	0	(0.0)	2	(9.1)		

* Fisher's Exact Test

Table 2

Psychiatric Status, Abuse History, and Method of Suicide Attempt(s)

	Group						Analyses	
	No Attempt (n = 22)		Single Attempt (n = 15)		Multiple Attempts (n = 22)			
	Number	(%)	Number	(%)	Number	(%)	χ^2	p
Psychiatric Diagnostic Category								
Mood	14	(63.6)	9	(60.0)	16	(72.7)	0.7	.691
Disruptive Behavior	8	(36.4)	4	(26.7)	9	(40.9)	0.8	.671
Anxiety	5	(22.7)	2	(13.3)	7	(31.8)	1.7	.427
Substance Use	5	(22.7)	0	(0.0)	3	(13.6)	3.9	.140
Eating	1	(4.5)	0	(0.0)	2	(9.1)	1.5	.461
Abuse Category								
Physical	6	(27.3)	3	(20.0)	4	(18.2)	0.6	.757
Sexual	4	(18.2)	2	(13.3)	3	(13.6)	0.2	.910
Neglect	2	(9.1)	0	(0.0)	1	(4.5)	1.4	.486
Suicide Attempt Method								
Cutting/Stab			2	(13.3)	16	(72.7)	12.6	<.001
Asphyxiation			1	(6.7)	8	(36.6)	4.3	.039
Blunt Trauma			0	(0.0)	4	(18.2)	3.1	.080
Overdose/Poison			12	(80.0)	14	(63.6)	1.1	.285

Table 3
Comparisons of Behavioral Impulsivity and Self-Reported Clinical Characteristics

	Group						Post-Hoc Comparisons	
	<i>a</i> No Attempts (<i>n</i> = 22)		<i>b</i> Single Attempt (<i>n</i> = 15)		<i>c</i> Multiple Attempts (<i>n</i> = 22)			
	Mean	(SD)	Mean	(SD)	Mean	(SD)	<i>F</i>	<i>p</i>
Behavioral Impulsivity								
Two Choice Impulsivity Paradigm	20.6	(14.2)	20.9	(17.9)	9.3	(7.8)	5.01	<.001
GoStop Impulsivity Paradigm	35.8	(22.2)	37.6	(20.4)	43.2	(24.9)	0.63	.54
Self-Reported Clinical Characteristics								
Barratt Impulsiveness Scale	74.7	(11.9)	77.0	(10.5)	79.9	(9.1)	1.33	.27
Lifetime History of Aggression [§]	18.5	(7.1)	17.3	(7.4)	22.7	(7.2)	3.07	.05
Beck Suicide Intent Scale	--		12.0	(3.7)	14.3	(6.6)	1.21	.24
Beck Scale for Suicidal Ideation	3.6	(6.1)	6.9	(8.8)	10.9	(10.2)	4.07	.02
Beck Depression Inventory	20.0	(11.6)	13.9	(6.5)	24.0	(9.7)	3.21	.05
Beck Hopelessness Scale	5.7	(4.4)	5.1	(4.5)	6.0	(5.3)	0.04	.96

[§] Lifetime History of Aggression total score, excluding the suicide or self-harm items.