Nock & Banaji JCCP

DV = suicide ideation + suicide attempt

IAT = cutting + self

EM = n/a

(10) DOMAIN:A/1= race, B/2= ethnicityC/3 = gender-sexD/4 = food or drink

E/5 = other consumerF/6= politicalG/7 = drugs or tobacco

H/8 = self esteem J/9= personality/selfK/10 = clinical, pg 707

L/11= relationships M/12= other? (not a tony category)

(11) BEHAVIOR: single=1, average=2 pg 709

(12) IAT TYPE attitude=1, belief=2, self=3, not reported = 4 pg 709

(13) EM TYPE: attitude=1, belief=2, self=3, not reported = 4 n/a

(14) OVERALL METHOD: not=0, observed=1 pg 709

(15) METHOD: RepPast=1, future=2, emotion=3, judge=4, obs=5, neuro=6, other=7 pg 709

(16) SCORE: millisecond=0, log=1, algorithm=2, NotReported=3 pg 709

(17) words=0, pictures=1, NotReported=2 pg 709

(18) number of IATs: 1

(19) IAT ORDER: NotReported=0, iatfirst=1, iatsecond=2, iatthird=3

(20) EXPLICIT ORDER: NotReported=0, explicitfirst=1, expsecond=2, expIthird=3 n/a

(21) BEHAVIOR ORDER: NotReported=0, behfirst=1, behsecond=2, behthird=3

(22) IAT vs. behavior: NotReported=0, before=1, after=2, counter=3 pg 709 - for same session

(23) EXPLICIT vs. beh: NotReported=0, explicitfirst=1, expsecond=2, counter=3 n/a

(24) IAT SESSION: same=0, different=1 - p 709

(25) EXPLICIT SESSION: same=0, different=1 n/a

(26) IAT SOCIAL DESIRABILITY 1-7 6, pg 709

(27) EXPLICIT SOCIAL DESIRABILITY 1-7 n/a

(28) BEHAVIOR CONTROLLABLE: **1-10** 5, pg 709

(29) IAT SPECIFIC 1-7 5, pg 709

(30) EXPLICIT SPECIFIC 1-7 n/a

(31) OPPOSITION **1-5** 2.5, pg 709

(32) RACIAL 0=not, 1=racial pg 707

(33) type of iat: single=1, dual=2, personalized=3 pg 709

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Prediction of Suicide Ideation and Attempts Among Adolescents Using a Brief Performance-Based Test

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Suicide is a leading cause of death that is difficult to predict because clinical assessment has relied almost exclusively on individuals' self-report of suicidal thoughts. This is problematic because there often is motivation to conceal such thoughts. The authors tested the ability of the Self-Injury Implicit Association Test (SI-IAT), a reaction-time measure of implicit associations between self-injury and oneself, to detect and predict suicide ideation and attempts. Participants were adolescents who were nonsuicidal (n = 38), suicide ideators (n = 37), or recent suicide attempters (n = 14). Analyses revealed large between-group differences on the SI-IAT, with nonsuicidal adolescents showing large negative associations between self-injury and themselves, suicide ideators showing small positive associations, and suicide attempters showing large positive associations on this performance-based test. The SI-IAT accurately predicted current suicide ideation and attempt status as well as future suicide ideation, and it incrementally improved prediction of these outcomes above and beyond the use of known risk factors. Future research is needed to refine this assessment method and to further develop and examine performance-based assessment of suicide risk in clinical settings.

Keywords: suicide, self-injury, implicit association test, assessment, prediction

Nearly 1 million people kill themselves worldwide each year, equaling one death by suicide approximately every 40 s (Goldsmith, Pellmar, Kleinman, & Bunney, 2002; World Health Organization, 2005). Despite decades of clinical, scientific, and policy efforts aimed at improving methods for predicting and preventing suicide, the rates of suicidal thoughts and attempts have remained virtually unchanged (Kessler, Berglund, Borges, Nock, & Wang, 2005). A persistent barrier encountered by clinicians is that current clinical assessment methods rely almost exclusively on self-report of suicidal thoughts and intentions.

This is problematic because suicidal individuals often conceal or deny such thoughts in order to avoid unwanted intervention efforts, such as involuntary hospitalization, or to facilitate release from such settings. Suicidal thoughts may go unreported for other reasons as well. For instance, suicidal thoughts typically are transient in nature and may be absent during clinical interview but then resurface shortly thereafter, such as following discharge from a secure psychiatric setting. Some individuals may even lack introspective awareness of the thoughts and feelings that drive suicidal behavior and thus lack the ability to inform others of their presence. Prior research has indicated that although 50%–69% of those who die by suicide communicate suicidal thoughts or intent to others in some way before they die (Coombs et al., 1992; Robins, Gassner, Kayes, Wilkinson, & Murphy, 1959), 78% of patients who die by suicide explicitly deny suicidal thoughts in their last communications before killing themselves (Busch, Fawcett, & Jacobs, 2003). Moreover, the risk of suicide death is significantly elevated immediately following hospital discharge, presumably shortly after patients denied suicidal intent (Goldacre, Seagroatt, & Hawton, 1993; Qin & Nordentoft, 2005). Overall, individuals who kill themselves shortly after denying suicidal thoughts and intent might (a) purposely conceal the presence of existing suicidal thoughts and intentions from clinicians, (b) fail to experience such thoughts during clinical assessment only to have them resurface shortly thereafter, or (c) lack conscious awareness of such thoughts. Whatever the reason in any particular case, it is clear that new clinical assessment methods are sorely needed that are not based solely on individuals' self-report of suicidal thoughts.

Cognitive and social scientists recently have developed indirect, performance-based methods of measuring individuals' implicit thoughts about various constructs in ways that do not rely on self-report (Fazio & Olson, 2003). The Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) is one such method used primarily to examine implicit associations people hold about nonclinical constructs such as racial prejudice (Olsson, Ebert, Banaji, & Phelps, 2005; Rudman, Ashmore, & Gary, 2001), gender stereotypes (Nosek, Banaji, & Greenwald, 2002), and ethical beliefs (Banaji, Bazerman, & Chugh, 2003). The IAT has several strengths that make it particularly well-suited for the assessment of psychopathology in general (Palfai & Wagner, 2004; Teachman, Gregg, & Woody, 2001) and of self-injury propensity in particular. It has been shown to have strong reliability (Cunningham, Preacher, & Banaji, 2001; Greenwald & Nosek, 2001), construct validity (Lane, Banaji, Nosek, & Greenwald, in press), and sensi-

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diagnoses). Given their associations with suicide ideation and attempts, we focused specifically on disorders of mood (major depression, bipolar), anxiety (panic, separation anxiety, phobias, generalized anxiety, and obsessive-compulsive), impulse control (oppositional defiant, conduct, attention deficit/hyperactivity), eating (bulimia, anorexia), and substance use (alcohol, drugs).

Suicide ideation and suicide attempts. Suicide ideation and attempts were assessed using multiple methods. All participants were administered the Self-Injurious Thoughts and Behaviors Interview (SITBI; Nock, Holmberg, Photos, & Michel, in press), a structured clinical interview that assesses the presence, frequency, severity, age-of-onset, and other characteristics of a broad range of self-injurious thoughts and behaviors including suicide ideation and suicide attempts. The SITBI has strong interrater reliability (average κ = .99), test–retest reliability over a 6-month period (average κ = .70), and construct validity as demonstrated by strong relations with other measures of suicide ideation (average κ = .54) and suicide attempt (κ = .65; Nock et al., in press). Several study variables were derived from responses to the SITBI. First, participants were classified into one of the three mutually exclusive study groups on the basis of their responses to items regarding the presence of suicide ideation and attempts in the year preceding the baseline assessment (i.e., "Have you had thoughts of killing yourself in the past year?" "Have you made an actual attempt to kill yourself in the past year in which you had at least some intent to die?"). Second, given that past suicidal behavior has been shown to be the best predictor of future suicidal behavior (Joiner et al., 2005; Joiner & Rudd, 2000), we created variables of prior history of suicide ideation and suicide attempts (i.e., presence of each of these constructs at any time prior to the year preceding the baseline interview). Third, the SITBI was readministered by telephone 6 months after the baseline interview to assess the presence of suicide ideation and attempts in the 6 months following the baseline interview.

In addition to the SITBI, all participants completed the Beck Scale for Suicide Ideation (BSI; Beck & Steer, 1991), a 21-item self-report measure of the presence and severity of current suicide ideation. The BSI is a widely used measure of suicide ideation that has strong psychometric properties, which have been demonstrated in adult as well as adolescent samples (Allan, Kashani, Dahlmeier, Taghizadeh, & Reid, 1997; Nock & Kazdin, 2002). Scores on the BSI supported the suicide group classifications made using the SITBI, with nonsuicidal individuals reporting less suicide ideation (M = 1.1, SD = 2.6) than the suicide ideation (M = 5.8, SD = 5.9) and suicide attempt (M = 13.0, SD = 8.5) groups, $F(2, 86) = 26.30$, $p < .001$.

SI-IAT. The SI-IAT was developed, administered, and scored according to recommended IAT procedures (Greenwald, Nosek, & Banaji, 2003; Nosek, Greenwald, & Banaji, 2005). Participants sat alone at a desktop computer and were instructed to classify stimuli that appeared in the center of the computer screen as quickly as possible by pressing the following two corresponding keys: "e" for stimuli to be classified on the left of the screen and "i" for stimuli to be classified on the right (see https://implicit.harvard.edu/implicit/ for demonstration tests). The IAT rests on the assumption that it should be easier to make the same behavioral response (i.e., a key press) to concepts that are strongly associated relative to concepts that are weakly associated.

In the SI-IAT examined in this study, participants were presented with a series of images that are either self-injury related (i.e., pictures of skin that has been cut) or neutral (i.e., pictures of noninjured skin) and were asked to classify these as quickly as possible as representing the concepts "cutting" or "no cutting." Although this focus on cutting is likely to also be relevant to individuals who engage in NSSI (Nock & Prinstein, 2004, 2005), we intentionally focused on this single and simple stimulus in this first test of the SI-IAT given that it is unambiguously related to self-injury (i.e., stimuli such as firearms and tall buildings are more complex and may not be perceived as self-injurious related even by many suicidal individuals) and thus limits confusion and variability in the test procedures. This decision also was made on the basis of concerns that have been raised about the potential iatrogenic effects of presenting adolescents who have a history of suicidal behavior with stimuli that are explicitly suicide-related (Shaffer et al., 1990). Participants also are presented with words that are either self-relevant (e.g., *I, Mine*) or other-relevant (e.g., *They, Them*) and are asked to classify these as quickly as possible as representing the attributes "me" or "not me." Correct classifications are followed by the presentation of the next stimulus and incorrect classifications are followed by the presentation of a red "X" below the stimulus, which remains until the correct key press is made.

In the first critical test block (presented in random order), participants must press the same computer key in response to both "cutting" and "me" stimuli, and the other computer key for "no cutting" and "not me" stimuli. In the second critical test block, the opposite sorting is performed, pairing "cutting/not me" on the same computer key and "no cutting/me" on the other. Response latencies in these two blocks are recorded and analyzed using the most recently prescribed IAT scoring algorithm (Greenwald et al., 2003). The relative strength of the association between self-injury and oneself is indexed by calculating a D score for each participant by subtracting the average response latency of the "cutting/me" test block from the average response latency of the "cutting/not me" test block and dividing by the standard deviation of response latency for all trials. Thus, positive D scores represent relatively faster responding (i.e., stronger associations) when self-injury and oneself are paired, whereas negative D scores represent relatively slower responding (i.e., weaker associations) when self-injury and oneself are paired.

Procedures

Participants completed all of the measures described above during one baseline visit. Six months later, participants were contacted via telephone and were readministered the SITBI to evaluate the predictive validity of the SI-IAT. Follow-up data were obtained for 73 (82.0%) of the participants. Six participants could not be located, 7 did not respond to repeated requests for an interview, and 3 refused to participate in the follow-up interview. There were no significant differences between those who participated in follow-up interviews and those who did not on any of the key study variables: age, sex, ethnicity; presence or number of psychiatric disorders; presence of suicide ideation or attempts at the baseline interview; or score on the SI-IAT.