



Shorter communication

Evidence for an emotion–cognition interaction in the statistical prediction of suicide attempts

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ABSTRACT

Suicidal behavior is a prevalent problem among adolescents and young adults. Although most theoretical models of suicide suggest that this behavior results from the interaction of different risk factors, most prior studies have tested only bivariate associations between individual risk factors and suicidal behaviors. The current study was designed to address this limitation by testing the effect of an emotion–cognition interaction on suicide attempts among youth. Specifically, we hypothesized that the interaction of emotion reactivity and problem-solving skills would statistically predict the probability of a recent suicide attempt among 87 adolescents and young adults. Results revealed a significant interaction, such that emotion reactivity was strongly associated with the probability of a suicide attempt among those with poor problem-solving skills, moderately associated among those with average problem-solving skills, and not significantly associated among those with good problem-solving skills. The next generation of studies on suicidal behavior should continue to examine how risk factors interact to predict this dangerous outcome.

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Suicide is an alarming public health problem that ranks as the third leading cause of death among adolescents and young adults (Centers for Disease Control, 1981–2006). As such, there is an urgent need to reduce the prevalence of suicidal behavior among youth. An important first step in preventing suicide is increasing the understanding of how this dangerous behavior develops. Prior studies have identified individual correlates of suicidal behavior (e.g., suicide attempts), including the presence and accumulation of mental disorders (Nock, Hwang, Sampson, & Kessler, 2010; Nock et al., 2009), high emotion reactivity (Nock, Wedig, Holmberg, & Hooley, 2008), cognitive inflexibility (Neuringer, 1964), and impulsive-aggression (Mann, Waternaux, Haas, & Malone, 1999). Although each of these factors is associated with presence of suicide attempts among adolescents or adults, in isolation each factor provides only a limited understanding of how or why this behavior emerges.

Risk factors for suicidal behavior most likely do not exert entirely independent effects. Instead, the *interaction* of such factors may be most important in the development of suicidal behavior. The presence of interactions would help to explain why most adolescents with certain individual risk factors (e.g., high emotion reactivity) do not attempt suicide. That is, it is only in the presence of other key predictors that suicidal behavior occurs. Prior studies

have demonstrated the importance of such interactions in the prediction of suicidal behavior (e.g., O'Connor, Rasmussen, & Hawton, 2010).

Theoretical models propose that emotion–cognition interactions, such as the interaction of high emotion reactivity and poor cognitive control, may lead to suicidal behavior. For example, escape models of suicide propose that people attempt to kill themselves because they: (1) experience high levels of emotional distress following challenging events that they find aversive and intolerable (e.g., high emotion reactivity) and (2) cannot generate and implement adaptive solutions or coping strategies (i.e., poor cognitive control); thus, they resort to suicide as a means of escaping their intolerable state (Baumeister, 1990; Linehan, 1993). Although this model of suicidal behavior is widely accepted, we are unaware of studies that have tested whether the proposed emotion–cognition interaction predicts suicidal behavior.

Even though emotion–cognition interactions have not been tested among suicide researchers, they have been examined in psychological science more broadly. Recent advances in developmental neuroscience suggest that emotional and cognitive factors often interact to facilitate adaptive functioning (Gray, 2004). If applied to the study of psychopathology, examining emotion–cognition interactions could provide insight into how maladaptive behaviors (e.g., suicide attempt) develop. Indeed, animal and human models suggest that emotion–cognition interactions may account for adolescent deficits in adaptive functioning due to developmental changes in emotion- and cognitive-related regions

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of the brain (e.g., Galvan et al., 2006; McCallum, Kim, & Richardson, 2010). Following suit, Steinberg (2007) proposed that high rates of adolescent risk-taking may result from the differential development of emotional and cognitive processes that characterize this period. That is, emotional processes develop at much faster rates than do cognitive-control processes, and this developmental lag may lead to adolescent maladaptive or risky behavior (Casey, Jones, & Hare, 2008; Galvan et al., 2006), such as suicidal behavior.

Here, we propose that an emotion–cognition interaction of two known risk factors for suicidal behavior – high emotion reactivity and poor problem-solving skills – is associated with an increased probability of suicide attempt among adolescents. Prior research has demonstrated a relation between emotion reactivity – the degree to which one experiences strong negative emotion in response to a stressful event – and suicidal behavior among adolescents (Nock et al., 2008), as well as a relation between poor interpersonal problem-solving skills and the occurrence of suicidal behavior (Pollock & Williams, 2004). However, other types of problem-solving skills (e.g., financial, academic, work-related) also may statistically predict suicide attempts. Thus, we hypothesize that those who experience both intense emotional reactions and have a poor ability to solve problems will have a greater probability of a suicide attempt than those who have one or the other but not both. We tested the generality of this proposed effect by examining whether this interaction also statistically predicts engagement in risky behavior more broadly (i.e., nonsuicidal self-injury, violent behavior, alcohol and substance use), or whether the effect is specific to suicidal behavior.

Method

Participants

Participants were 87 adolescents and young adults (12–19 years old, $M = 17.03$, $SD = 1.91$) recruited for a laboratory-based study on self-injurious behavior. Advertisements were placed in local psychiatric clinics, on community bulletin boards, on the Internet, and in local newspapers calling for adolescents interested in participating “in a study aimed at understanding self-harm behaviors”. Seven subjects did not complete all assessments and therefore were excluded from the analyses. Fifty six percent ($n = 49$) of the remaining 87 participants engaged in self-injurious behavior in the past year (suicidal and nonsuicidal), 29% ($n = 14$) of whom attempted suicide. Participants were mostly female (78.2%) and White (72.4%). Approximately 60% of participants met criteria for at least one DSM-IV disorder (total number of disorders $M = 1.32$, $SD = 1.66$), including mood disorders (31.0%), anxiety disorders (39.1%), substance use disorders (18.4%), disruptive behavior disorders (10.3%), and eating disorders (5.7%).

Procedure

Participants who responded to advertisements traveled with their parents to Harvard University, where they were given a comprehensive description of the study and provided written informed consent/assent to participate. Participants were informed that their information would be kept confidential, unless study assessors learned that the adolescent, parent, or someone else was in danger of being harmed, in which case necessary precautions (e.g., informing parent, contacting a local hospital) would be undertaken. Participants also were informed that their participation was voluntary and could be withdrawn at any time; no participants refused to participate or withdrew from the study.

The Harvard University institutional review board approved all measures and procedures. Measures were administered during one

assessment session in a psychology laboratory. All measures administered to the adolescent were done in the absence of the parent to increase the likelihood of honest responding. One Ph.D. level clinical psychologist (MKN), two predoctoral clinical psychology graduate students, and two post-baccalaureate research assistants administered assessments; all assessors were highly trained prior to data collection, audio- and video-taped during each assessment, and closely supervised. At completion of the study, all participants were debriefed, assessed for risk, and paid \$100 for their participation.

Measures

Emotion reactivity

Emotion reactivity was assessed using the Emotion Reactivity Scale (ERS; Nock et al., 2008), a 21-item self-report measure of emotion reactivity (e.g., “I tend to get emotional very easily,” “When I experience emotions, I feel them very strongly/intensely,” “When I am angry/upset, it takes me much longer than most people to calm down”). Participants rate items on a 0–4 Likert scale (0 = “not at all like me” to 4 = “completely like me”). This measure has been shown to have strong internal consistency ($\alpha = 0.94$) as well as good construct and criterion-related validity (Nock et al., 2008).

Problem-solving skills

Problem-solving skills were evaluated using the Delis–Kaplan Executive Function Systems Tower Task (DKEFS; Delis, Kramer, Kaplan, & Holdnack, 2004), which is a well-established neuropsychological test of executive functioning skills. The DKEFS Tower Task and other tower tasks (e.g., Tower of Hanoi, Tower of London) have demonstrated good validity (Sullivan, Riccio, & Castillo, 2009) and are frequently used as measures of problem-solving ability (Kaller, Rahm, Spreer, Mader, & Unterrainer, 2008; Unterrainer, Kaller, Halsband, & Rahm, 2006; Yochim, Baldo, Kane, & Delis, 2009). Tower tasks are not merely measures of intelligence but of problem-solving skills and planning ability more specifically, as demonstrated in the current study ($r = .27$ verbal IQ; $r = .23$ nonverbal IQ) and in other studies examining real-world functioning (e.g., Unterrainer et al., 2006). For example, Unterrainer et al. (2006) found that chess and non-chess players differed in problem-solving abilities (as measured by a tower task) but did not differ in level of fluid intelligence or verbal/visuospatial working memory.

The DKEFS Tower Task requires that the participant move five disks of varying size across three pegs so that disks are moved onto a designated peg and stacked according to size in the least number of moves possible. A move-accuracy ratio (total moves made by participant divided by minimum number of moves needed to complete the task) was calculated to assess the level of problem-solving skills (Delis et al., 2004).

Suicidal behavior

Presence of suicidal behavior was assessed using the Self-Injurious Thoughts and Behaviors Interview (SITBI; Nock, Holmberg, Photos, & Michel, 2007), a commonly-used structured clinical interview (e.g., Heilbron & Prinstein, 2010; Walsh, 2007; Washburn, Juzwin, Styer, & Aldridge, 2010). The SITBI assesses characteristics of self-injurious thoughts and behaviors, including suicidal thoughts, plans, gestures, and attempts, as well as non-suicidal thoughts and behaviors. Participants report on presence, frequency, lethality, and functions of each of these thoughts and behaviors. In the current study, answers to the following items were dichotomized to assess past-year presence of suicidal behavior: “Have you ever made an actual attempt to kill yourself in which you had at least some intent to die?” and “How many times

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