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Research paper

Suicidal ideation and attentional biases in children: An eye-tracking study

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ABSTRACT

Background: Despite theoretical and empirical evidence for a heighted responsiveness to signals of social-threat in suicidal individuals, no studies to date have examined whether this responsiveness might also manifest in the form of specific biases in attention to interpersonal stimuli. The current study, therefore, examined the presence and nature of attentional biases for facial expressions of emotion in children with and without a history of suicidal ideation (SI).

Method: Participants were 88 children (44 with a history of SI and 44 demographically and clinically matched controls without such history) recruited from the community. The average age of children was 9.26 years (44.3% female; 67.0% Caucasian). Children's history of SI was assessed via structured interviews with children and their parent. Attentional biases were assessed using a dot probe task and included fearful, happy, and sad facial stimuli and focused on eye tracking and reaction time indices of attentional bias.

Results: Children with a history of SI exhibited significantly greater gaze duration toward fearful faces. The findings appeared to be at least partially independent of children's history of major depression or anxiety disorders or their current depressive or anxious symptoms.

Limitations: The study is limited by its cross-sectional design, which precludes any causal conclusions regarding the role of attentional biases in future suicide risk.

Conclusions: Our results suggest that children with a history of SI exhibit biases in sustained attention toward socially-threatening facial expressions. Pending replications, these findings might represent a new avenue of suicide risk assessment and intervention.

1. Introduction

Suicide is the second leading cause of death for 10- to 14-year-olds in the United States (Centers for Disease Control and Prevention, 2014) and thus constitutes a major public health concern. Despite the numerous efforts of researchers and clinicians to prevent suicidal thoughts and behaviors (STBs) and consequent deaths by suicide, there was a 45% increase in the suicide rates among females and a 16% increase in the suicide rates among males between 1999 and 2014, with those aged 10–14 having the greatest increase (National Center for Health Statistics, 2016). This suggests a strong and urgent need for better ways of identifying and examining the correlates and risk factors of STBs. Specifically, to develop more targeted suicide prevention and intervention efforts, we need a better understanding of the processes that make children more likely to think about suicide in the first place. This is essential because such early efforts might prevent the transition from suicidal thoughts to suicidal behavior in these at-risk children.

Cognitive models of psychopathology and suicide highlight the role of information processing biases (e.g., attention biases) in contributing to risk for these problems (e.g., Beck, 2008; Disner et al., 2011; Wenzel and Beck, 2008; Williams et al., 1997). In testing these theories, the majority of research has focused on attentional biases in depression and anxiety. These studies consistently demonstrate the presence of attentional biases for threat-relevant information in anxiety disorders, perhaps particularly in terms of initial orienting of attention, and attentional bias for depression-relevant information (e.g., sad faces) in depression, particularly in terms of increased sustained attention to, or difficulty disengaging attention from, these stimuli (for reviews, see Armstrong and Olatunji, 2012; Bar-Haim et al., 2007; Gibb et al., 2016; Peckham et al., 2010). This highlights the disorder-specific nature of attentional biases both in terms of focus (threat-relevant vs. depression-relevant) and time course (initial orienting vs. sustained attention).

In contrast, relatively little is known about attentional biases to interpersonal stimuli among individuals with a history of STBs. We cannot simply infer from the depression and anxiety literature because STBs are transdiagnostic and occur both in conjunction with depression

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and/or anxiety as well as in the absence of these disorders. However, there is evidence that biased processing of interpersonal information may increase risk for STBs transdiagnostically. Indeed, according to the neurocognitive model of suicidal behavior that attempts to integrate the "cry of pain" model of suicidal behavior (Williams and Pollock, 2001) with neuropsychological and neuroimaging findings for a more comprehensive and dynamic understanding of suicidal behavior (for a review, see Jollant et al., 2011), suicidal individuals might be particularly sensitive to social events. Specifically, the authors argue that biases in identifying, interpreting, and experiencing the social environment are implicated in the first step of the "suicidal process" due to the resulting inability of these individuals to correctly assign value to external events (Jollant et al., 2011). The authors argue that this altered modulation of value attribution is linked with deficiencies in regulating emotional and cognitive responses, which in turn might facilitate suicidal acts in emotional contexts (Jollant et al., 2011).

Supporting this theory, there is evidence that suicidal individuals tend to overvalue signals of social threat. Specifically, individuals with a suicide attempt history, compared to patient controls without such history, exhibit greater activity in the orbitofrontal cortex (OFC), a brain region implicated in deriving a value signal during reward processing (Wallis, 2007), in response to socially-threatening facial expressions (Jollant et al., 2008; Olie et al., 2015). Importantly, this difference was specific to socially-threatening facial expressions and was not observed for happy or neutral faces, suggesting specificity to signals of social threat in one's environment. This said, although it is unclear whether this attentional bias may be in the form of biases in initial allocation of attention, sustained attention, or both.

The focus on interpersonal stimuli is not unique to Jollant et al.'s (2011) theory and a number of other prominent theories of suicide (e.g., Joiner, 2005; O'Connor, 2011) highlight the importance of social influences in suicide risk. However, despite theoretical rationale and empirical evidence for a heighted responsiveness to signals of social-threat in suicidal individuals, no studies to date have examined whether this responsiveness might also manifest in the form of specific biases in attention to interpersonal stimuli, such as positive or negative facial expressions, which represent powerful sources of social information (Darwin, 1872/1998). In addition, in line with the RDoC initiative, having a transdiagnostic behavioral marker of suicide risk in the form of a specific attentional bias might significantly contribute to suicide prevention and intervention efforts by providing a potential target for its modification.

The goals of the present study, therefore, were to extend previous research in two key ways. First, because rates of STBs increase dramatically during the transition from childhood to adolescence (e.g., Kessler et al., 2005), understanding early pre-pubertal markers of risk, such as specific biases in attention, would be highly beneficial for early suicide prevention and intervention. In the current study, therefore, we focused specifically on children with and without a history of suicidal ideation. Second, we directly examined attentional biases for interpersonal stimuli (facial expressions of emotion) within the context of a dot probe task (cf. MacLeod et al., 1986) using eye tracking, which allowed us to specifically examine potential biases in initial orienting of attention and sustained attention to emotional (sad, fearful, happy) versus neutral facial expressions. In choosing threat-relevant facial stimuli, we chose to focus on fearful rather than angry faces because research has shown that attentional biases are driven by a combination of heightened amygdala reactivity that is not effectively downregulated by prefrontal regions (Bishop, 2008; Disner et al., 2011) and fearful faces elicit greater amygdala activation than angry faces (for a review, see Fusar-Poli et al., 2008), suggesting that they may be stronger elicitors of threat-relevant attentional biases. Importantly, to examine the specificity of the findings to SI, we used a demographically and clinically matched sample of children. Based on the theory and research reviewed above, we hypothesized that children with a history of SI, compared to children with no history of SI, would exhibit biased attention toward fearful, but not sad or happy, faces. Given the lack of previous research in this area, we made no hypotheses about the specificity of our findings to initial versus sustained attention to fearful faces.

2. Methods

2.1. Participants

Participants in this study were 88 children recruited from the community. Using a 1:1 matching ratio, we had 44 children with a history of SI and 44 children with no history of SI. The two groups were equated on (i) age, (ii) sex, (iii) race, (iv) household income, (v) lifetime MDD or anxiety diagnosis history, and (vi) current levels of depressive and anxious symptoms. The only inclusion criteria were that children be between the ages of 7 and 11 years and, per parent report, have no learning or developmental disorders that would preclude completing the study protocol. The average age of the children was 9.26 years (SD = 1.40) and 44.3% were female. In terms of race, 67.0% of the children were Caucasian, 14.8% were African American, 17.0% were Biracial, and 1.1% were Asian/Pacific Islander. In terms of ethnicity, 10.2% of the children were Hispanic. The demographic and clinical characteristics of the SI and no SI groups are presented in Table 1.

2.2. Measures

2.2.1. Diagnoses and symptoms

The Schedule for Affective Disorders and Schizophrenia for School-Age Children – Present and Lifetime Version (K-SADS-PL; Kaufman et al., 1997) was administered by trained interviewers to assess for current and past DSM-IV Axis I disorders. A total of 7 children (8.0%) met criteria for a lifetime history of MDD and a total of 7 children (8.0%) met criteria for a lifetime history of at least one anxiety disorder. Specifically, 4 children (4.5%) had a history of separation anxiety disorder, 4 children (4.5%) had a history of generalized anxiety disorder, 3 children (3.4%) had a history of social phobia, 2 children (2.3%) had a history of posttraumatic stress disorder, 1 child (1.1%) had a history of obsessive-compulsive disorder, 1 child (1.1%) had a history of panic disorder, and 1 child (1.1%) had a history of agoraphobia. Symptoms of depression were assessed using the Children's Depression Inventory (CDI; Kovacs, 1981) and symptoms of anxiety were assessed using the Multidimensional Anxiety Scale for Children (MASC; March et al., 1997). The CDI and MASC in our sample exhibited internal consistency of α = .79 and .84, respectively.

2.2.2. History of suicidal ideation

As part of the K-SADS-PL assessment, the interviewers assessed for the presence of suicidal ideation (SI) in children by asking the questions

Table 1
Descriptive statistics for children in the two SI groups.

	Children with SI (n = 44)	Children without SI (n = 44)	$r_{effect\ size}$
Age	9.19 (1.43)	9.33 (1.39)	−.05
Sex (% female)	43.2%	45.5%	−.02
Race (% Caucasian)	65.9%	68.2%	−.02
Household Income (median)	25,001–30,000	20,001–25,000	.01
Lifetime MDD dx	11.4%	4.5%	.13
Lifetime anxiety dx	11.4%	4.5%	.13
CDI	9.61 (7.60)	10.12 (4.57)	−.11
MASC	52.25 (17.63)	51.87 (12.90)	−.001

Note. SI = Suicidal ideation. MDD = Major Depressive Disorder. Dx = Diagnosis. CDI = Children's Depression Inventory. MASC = Multidimensional Anxiety Scale for Children.
*p < ; .05.