Short communication

Classification of facial expressions of emotion and risk for suicidal ideation in children of depressed mothers: Evidence from cross-sectional and prospective analyses

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ABSTRACT

Background: Despite the increased risk for suicidal ideation (SI) in children of mothers with a history of major depressive disorder (MDD), little is known about specific risk factors for SI in these children. The present study is the first to our knowledge to examine the potential role of biases in the identification of facial expressions of emotion.
Methods: Participants were 202 children (aged 8–14 years) and their mothers (aged 24–55 years) that comprised three groups based on maternal history of MDD and children's history of SI: Mom MDD/Child SI ($n=35$); Mom MDD/No Child SI ($n=76$); and Controls (i.e., no mom MDD and no child SI; $n=91$).
Results: We found that children in the Mom MDD/Child SI group were more likely to misclassify full-intensity angry emotions as sad than children in the other groups. Among children in the two mother MDD groups, both the overall proportion of full-intensity angry emotions misclassified and the proportion of full-intensity angry emotions misclassified specifically as sad predicted the occurrence of SI over a 2-year follow-up, even after accounting for the impact of children's own diagnoses of MDD during the follow up.
Limitations: Our findings might not generalize to other negative emotions, such as fear or disgust.
Conclusion: This highlights specific emotion identification abnormalities that could be targeted in early suicide prevention efforts and suggests that these abnormalities are at least partially independent of children's risk for MDD.

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1. Introduction

As the third leading cause of death for 10–14 year olds (Centers for Disease Control and Prevention [CDC] 2012), suicide constitutes a major preventable problem in childhood and adolescence. Because rates of self-harming thoughts and behaviors increase dramatically during the transition from childhood to adolescence (e.g., Kessler et al., 2005), and suicidal ideation (SI) is one of the strongest predictors of future suicide attempts (Nock et al., 2008), it is important for suicide prevention and intervention efforts to understand the correlates of SI and the factors that might increase risk for SI in children over time.

Maternal history of depression is associated with increased risk for suicidal ideation and attempts (Hammerton et al., 2015) in their offspring, yet the mechanisms of this relation and risk factors for suicidal ideation in children remain unclear. The ability to

correctly identify facial expressions of emotion might be one of these potential mechanisms. Indeed, being able to accurately infer what others are thinking and feeling based on social cues, such as facial expressions, is important for adaptive and context-appropriate self-regulation. Although previous research in adult suicide attempters and children with depression suggests deficits in the recognition of emotions signaling aversive social cues, such as anger in adults and children (Jollant et al., 2008; van Beek and Dubas, 2008) and disgust in adults (Richard-Devantoy et al., 2013), it is unclear whether these findings generalize to children with a history of suicidal thinking. Even less is known about potential emotion recognition impairments in children with and without a history of suicidal thinking who are at risk for internalizing problems by virtue of maternal depression history. In addition, no studies to date have tested the predictive validity of emotion recognition in either suicide ideators or attempters of any age, despite the significant implications of such knowledge for suicide research and prevention.

The present study sought to address some of these gaps in the literature by conducting both retrospective (Do children with a history of SI exhibit processing biases?) and prospective (Do these

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biases predict the occurrence of SI during a 2-year follow-up?) analyses. We hypothesized that children of depressed mothers with a personal history of SI would experience deficits in the identification of angry facial expressions, as evidenced by lower sensitivity in detecting facial displays of anger and higher number of misclassification errors in the identification of angry faces. Further, we predicted that these deficits at baseline would predict time to the onsets of SI during the follow-up among children of depressed mothers with no current SI at baseline.

2. Methods

2.1. Participants

Participants were 202 mother-child pairs recruited from the community and comprised three groups based on maternal history of MDD and children's history of SI prior to the baseline assessment: Mom MDD/Child SI ($n=35$); Mom MDD/No Child SI ($n=76$); Controls (i.e., No Mom MDD and No Child SI; ($n=91$). At baseline, the average age of the mothers was 40.40 years ($SD=6.92$, $Range=24$–55) and the average age of the children was 10.90 years ($SD=1.93$, $Range=8$–14; 52.5% girls). See Table 1 for more details about the socio-demographic variables.

2.2. Assessments

The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; First et al., 1995) and the Schedule for Affective Disorders and Schizophrenia for School-Age Children – Present and Lifetime Version (K-SADS-PL; Kaufman et al., 1997) were used to assess for current and past DSM-IV Axis I disorders in mothers and their children, respectively. The SCID-I and K-SADS-L were administered at the baseline assessment and the K-SADS-L was administered again at each follow-up assessment every 6 months for 2 years. As part of the K-SADS-PL, trained interviewers assessed for the presence of SI in children by asking the questions "Sometimes children who get upset or feel bad, wish they were dead or feel they'd be better off dead. Have you ever had these types of thoughts?" and "Sometimes children who get upset or feel bad think about dying or even killing themselves. Do you have these thoughts?" The baseline assessment focused on children's lifetime history of SI and each follow-up assessment focused on any thoughts that had occurred since the previous interview.

A Morphed Faces Task was used to assess sensitivity to, and misclassification of, facial expressions of emotion. The stimulus set consists of full-color pictures of actors taken from a standardized stimulus set (Matsumoto and Ekman, 1988) displaying a variety of emotions (e.g., sad, happy, angry, neutral). The stimuli were created by morphing

a neutral expression and an emotional expression (i.e., happy, sad, angry, and neutral) from each actor to form a continuum of 10% increments, and the participant was asked to indicate which emotion was being presented. Consistent with previous research (e.g., Jenness et al., 2015), responses were averaged across low (10–30%), medium (40–60%), and high (70–90%) morph levels for each emotion type.

3. Results

3.1. Cross-sectional analyses

To test our cross-sectional hypotheses, we used two 3 (Group: Mom MDD/Child SI, Mom MDD/Child SI, Controls) × 3 (Target Emotion: Angry, Happy, Sad) × 3 (Morph level: Low, Medium, High) repeated measures ANOVAs, one focused on correctly classified faces (sensitivity analysis) and the other focused on misclassifications. Focusing first on the sensitivity analyses, neither the group main effect nor the interactions involving group were significant (lowest $p=.08$). However, differences emerged in emotion misclassification. Specifically, we found main effects of Emotion, $F(2, 398)=4.37$, $p=.01$, $\eta_p^2=.02$, and Morph, $F(2, 398)=62.38$, $p<.001$, $\eta_p^2=.24$, as well as significant Group × Morph, $F(4,398)=3.56$, $p=.007$, $\eta_p^2=.03$, and Group × Emotion × Morph, $F(8, 796)=2.15$, $p=.03$, $\eta_p^2=.02$, interactions. Examining the Group × Emotion interaction separately at each Morph level, it was significant at high, $F(4,398)=2.52$, $p=.04$, $\eta_p^2=.03$, but not medium, $F(4,398)=1.74$, $p=.14$, $\eta_p^2=.02$, or low, $F(4, 398)=1.44$, $p=.22$, $\eta_p^2=.01$, morph levels. Within high Morph, there was a significant main effect of group for misclassification of angry, $F(2, 199)=5.09$, $p=.01$, $\eta_p^2=.05$, but not happy, $F(2, 199)=1.01$, $p=.37$, $\eta_p^2=.01$, or sad, $F(2, 199)=.25$, $p=.78$, $\eta_p^2=.003$, faces, such that children in the Mom MDD/SI group were more likely to misclassify angry faces ($M=.026$) than were children in the Mom MDD/No SI ($M=.014$) or Control ($M=.011$) groups. Examining this further, we found that the misclassification effects were specific to children in the Mom MDD/SI group being more likely than other children to misclassify high morph angry faces as sad, $F(2, 199)=6.71$, $p=.002$, $\eta_p^2=.06$, but not happy, $F(2, 199)=.35$, $p=.71$, $\eta_p^2=.003$.

3.2. Prospective analyses

Next, we used survival analyses to test the hypotheses that the significant emotion misclassification findings reported above would also predict time to the onsets of SI during the follow up among children of depressed mothers with no current SI at baseline. In our sample, 26 (23.92%) children of depressed mothers without current SI during the baseline assessment reported SI at some point during the 2-year follow-up. We found that the overall proportion of high morph angry faces misclassified generally, $Wald=4.77$, $p=.03$, as well as the proportion of high morph angry faces misclassified specifically as sad, $Wald=4.00$, $p=.045$, prospectively predicted a shorter time to onset of SI in these children (see Fig. 1). To test the robustness of these findings, and because a number of these children also developed episodes of MDD during the follow-up ($n=10$), we conducted follow-up analyses to determine whether these effects would be maintained even after statistically controlling for the occurrence of MDD. The effects of both the overall proportion of angry faces misclassified at high levels of morph, $Wald=5.98$, $p=.01$, and the proportion of angry faces misclassified specifically as sad at high levels of morph, $Wald=4.96$, $p=.03$, were maintained, suggesting that the predictive validity of this misclassification effect was at least partially independent of children's risk for MDD.

Table 1
Demographic characteristics of the sample.

	Mom MDD/ Child SI ($n=35$)	Mom MDD/No Child SI ($n=76$)	Controls ($n=91$)	F/χ^2
Age at baseline	10.51 (1.85)	11.09 (2.01)	10.89 (1.88)	1.08
Sex (% female)	45.7%	48.7%	58.2%	2.29
Race (% Caucasian)	71.4%[a]	73.7%[a]	91.2%[b]	10.97**
Household Income (median)	$35–40,000[a]	$40–45,000[a]	$70–75,000[b]	11.00**
Maternal Education (% graduated college)	31.4%	38.2%	53.8%	5.79

Note. MDD=Major depressive disorder. SI=Suicidal ideation. Means or percentages with different superscripts differ significantly.

** $p < .01$.