

Internalizing Symptoms Predict Children's Vagal Tone while Observing their Parents' Anger

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Introduction

- Throughout early childhood, children learn to identify and regulate their own emotions through witnessing their parents' emotion expression and regulation (Cole et al., 1994; Kopp, 1989).
- Family conflict, marital discord, and parental depression have been linked to internalizing problems in children, suggesting witnessing parents' negative emotions may be maladaptive (El-Sheik, 2006).
- Few studies have focused on child characteristics that contribute to individual differences in children's experiences of parents' negative emotions.
- One potential characteristic is cardiac vagal tone, an index of one's ability to regulate emotion (Leon-Hernandez, 2009). High vagal tone is adaptive and promotes healthy interactions with others (Porges, 2007).
- The purpose of this study is to examine whether individual differences in children's change in vagal tone while witnessing their parent express anger and sadness is moderated by their levels of internalizing problems.

Hypotheses

Hypothesis 1: In children with low internalizing problems, vagal tone will increase (from baseline) while witnessing their parents' **anger**, indicating good emotion regulation. In children with high internalizing problems, vagal tone will not change (from baseline) when witnessing their parents' anger, indicating poor emotion regulation.

Hypothesis 2: Similarly, in children with low internalizing problems, vagal tone will increase (from baseline) while witnessing their parents' **sadness**, indicating good emotion regulation. In children with high internalizing problems, vagal tone will not change (from baseline) when witnessing their parents' sadness, indicating poor emotion regulation.

Methods

Sample:

Internalizing Problems:

A sample of children prone to internalizing problems was recruited through two procedures:

- Researchers contacted parents of 4-6 year old children from the Georgia State Infant and Child Subject Pool.
- Interested parents responded to online web postings.

Sample demographics are presented in Table 1.

Gender	54.3% Male
Age	$M=5.65$ years
Ethnicity	Asian: 3% Black: 21.2% Hispanic: 3% White: 63.6% Other: 3% Multiracial: 6.1%

Measures:

Emotion Regulation:

- Electrocardiograms (ECG) were recorded using three 1-3/8" electrodes placed on the child's chest (See Figure 1).
- Raw ECG signals were recorded using Biopac MP150 data acquisition system and cleaned and scored using *AcqKnowledge* software according to established guidelines (Task Force of the European Society of Cardiology, 1996).

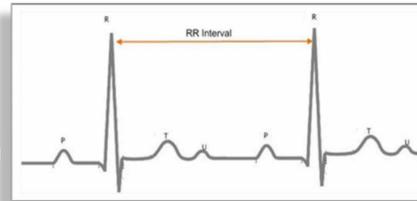
Figure 1. ECG placement.



Methods (Cont.)

- The root mean square of successive differences in R-R intervals (RMSSD) was used to index vagal tone (See Figure 2). This measure has been used by other research to index vagal influence during short intervals (e.g., Thayer & Ruiz-Padial, 2006).

Figure 2. Difference in duration of successive R intervals of the QRS complex (i.e., heart beat) were used to index vagal tone.



- Reliability checks of cleaning procedures showed greater than 99% agreement across scores.
- Interested parents completed screening measures by phone or online to determine eligibility. Questionnaires used for screening were:
 - A 7-item social anxiety scale from the *Revised Preschool Anxiety Scale* (R-PAS; Edwards, Rapee, Kennedy, & Spence, 2010)
 - A 16-item measure of negative feelings from the *Preschool Feelings Checklist* (PFC; Luby, Heffelfinger, Mrakotsky, & Hildebrand, 1999). Children were eligible if they had:
 - High risk** for internalizing problems, defined as:
 - Scores on the R-PAS that are >1 SD above the normative mean (Edwards et al., 2010) OR
 - Scores on the PFC that have been used by other researchers (Luby, Si, Belden, Tandon, & Spitznagel, 2009) to identify children at risk for depression.
 - Low risk** for internalizing problems, defined as:
 - Scores of 0 on the PFC AND scores 1 SD below the normative mean on the R-PAS
 - Other exclusionary criteria included children with chronic medical illnesses, neurological problems, PDD, language or cognitive delays.

Procedure:

Simulated Emotional Phone Call:

- The parent and child engage in a five-minute role-played emotional scenario in which the parent receives an emotional phone call (based on the Simulated Phone Argument Task by Davies et al., 2004).
- As the parent and child sit alone in a room, the parent receives a phone call from the experimenter, which the child perceives as a phone call from the mother's friend. The child colors a picture as the parent repeats statements from an audio recording played over the phone.
- The phone call has eight conditions each lasting 40 seconds including:
 - Four emotion conditions (happy, sad, happy, angry) during which the parent identifies the emotion or says other emotionally-consistent phrases (e.g., "that makes me so sad") in the appropriate emotional tone.
 - Four baseline conditions (one between each "emotion" phase), during which the parent pretends to be "on hold".
- This project will focus on the sad and angry conditions and the two baseline conditions that occur before them.

Results

Data Analysis Plan: Repeated-measures (2x2) ANOVAs were used to test the hypotheses.

Hypothesis 1: Tests of Within-Subjects Effects in Anger Condition

- The interaction between internalizing problems and condition predicting vagal tone was significant, $F(1,31)=4.63, p=.039, \eta^2=.13$.
- Children with **low** risk of internalizing problems had a significant change in vagal tone from the baseline condition to the anger condition, $F(1,9)=8.189, p=.019, \eta^2=.48$.
- Children with **high** risk of internalizing problems did not have significant change in vagal tone from the baseline condition to the anger condition, $F(1,22)=.062, p=.806, \eta^2=.03$.

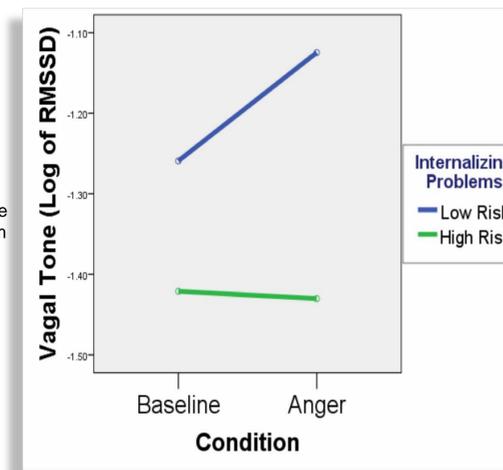


Figure 3. Low Risk children showed a significant change in vagal tone from the baseline to the angry condition while High Risk children showed no significant change.

Hypothesis 2: Tests of Within-Subjects Effects in Sad Condition

- The interaction between internalizing problems and condition predicting vagal tone was not significant, $F(1,30)=.026, p=.872, \eta^2=.001$.
- Children with **low** risk of internalizing problems did not have a significant change in vagal tone from the baseline condition to the sad condition, $F(1,9)=.461, p=.514, \eta^2=.49$.
- Children with **high** risk of internalizing problems did not have significant change in vagal tone from the baseline condition to the sad condition, $F(1,21)=.147, p=.705, \eta^2=.07$.

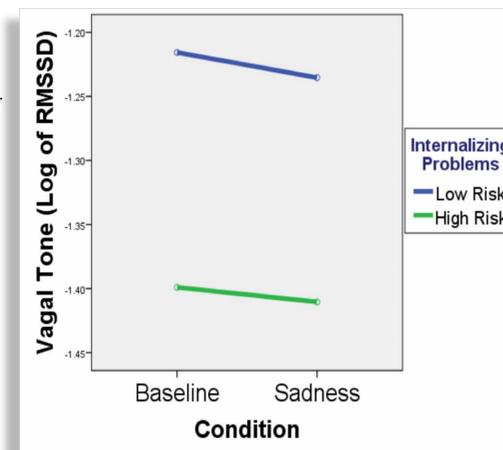


Figure 4. Neither Low Risk nor High Risk children showed a significant change in vagal tone from baseline to the sad condition.

Discussion

- Our results suggest that a child's risk for internalizing problems is associated with their ability to regulate emotions while witnessing others' negative emotions, particularly anger.

1. Internalizing Risk predicts Regulation to Parents' Anger

- Children's emotion regulation during others' angry displays may be particularly important when considering children's risk for internalizing problems.
- Previous studies indicate that children become distressed when observing anger expressed by family members (Cummings, Iannotti, & Zahn-Waxler, 1985).
- Research suggests that correctly processing anger is difficult for preschool aged children and may be particularly difficult for children from negative home environments.
- Children's abilities to accurately identify others' angry displays develops around age 10, whereas abilities to correctly identify sad or happy displays develops around age 5 (Durand, Gallay & Seigneuric, 2007).
- Children of highly negative mothers are less accurate than children of less negative mothers at identifying anger (Raver & Spagnola, 2008).
- Preschool aged children overattribute themselves as the cause of their mother's anger (Covell & Abramovitch, 1987).
- Children's interpretations of self-blame for their parent's anger may cause guilt and shame emotions, which are associated with internal distress (Luby, 2006).

2. Internalizing Risk does not predict Regulation to Parents' Sadness

- Children have less direct experience with adult's sadness than with their anger (Denham & Gout, 1992).
- Results suggest that witnessing others' sadness may require less emotion regulation capacities from children than witnessing others' anger. This may be specific parents' anger, as it may have particular relevance to the child (e.g., children may have more experience being the focus of parents' anger than their sadness).
- Alternatively, it is possible that parents had more difficulty feigning sadness than anger during the phone conversation, which could explain findings.

3. Future Directions

- Little is known about why some children from negative family environments develop psychopathology, while others do not. Future studies should investigate poor emotion regulation as a mechanism of risk for internalizing problems in these children.
- Our study was conducted in a controlled lab setting. Future research may investigate monitoring children's vagal tone in more realistic settings

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