Elucidating Mechanisms Underlying Hostile Interpretation Bias in Irritable Youth

Analyse DeSousa1,2, Simona Haller PhD3, Ellen Leibenluft MD3, Melissa Brotman PhD3, Matt Jones PhD4, Joel Stoddard MD1,2
1Pediatric Mental Health Institute, Children’s Hospital Colorado; 2School of Medicine, University of Colorado (Anschutz); 3Emotion and Development, NIMH; 4Institute of Cognitive Science, University of Colorado (Boulder)

Introduction
- Irritability is an impairing symptom that spans mental disorders and is the most common presenting complaint to pediatric mental health professionals.
- Few evidence-based therapies exist for irritability. The first step towards developing interventions is to find a cognitive target the intervention may act on. One such promising target is Hostile Interpretation Bias (HIB).
- HIB is a tendency to interpret ambiguous social information as representing a threat, and is associated with irritability.
- In early training programs targeting HIB, we found that pathologically irritable youth are resistant to training against their HIB.
- It is unclear why irritable youth maintain HIB even when they receive feedback that ambiguous social information is benign.1
- Prior work suggests two hypothetical cognitive processes for resistance to training against HIB:
  - Irritability is associated with impairment in detecting subtle social cues. Thus, more irritable youth are more likely to miss cues they need to learn.
  - Irritability is associated with a slower rate of learning to replace prior hostile associations with new, benign information.
- In this study, we simultaneously tested the association between irritability and these proposed processes in youth with affective disorders.

Methods
Subjects:
- 48 youth (ages 8-21, M=14.05, SD=2.98; %F=41.67) who presented for research on affective disorders at the NIMH Emotion and Development Branch.
- 8 youth were excluded for performance (accuracy <75%)

Clinical Diagnosis: N (%)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>N</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMDD</td>
<td>6</td>
<td>12.5</td>
</tr>
<tr>
<td>ADHD</td>
<td>15</td>
<td>31.3</td>
</tr>
<tr>
<td>Anxiety</td>
<td>5</td>
<td>10.4</td>
</tr>
<tr>
<td>Relatives of BD</td>
<td>6</td>
<td>12.5</td>
</tr>
<tr>
<td>BD</td>
<td>2</td>
<td>4.2</td>
</tr>
<tr>
<td>HV</td>
<td>14</td>
<td>12.2</td>
</tr>
</tbody>
</table>

Clinical Variables: M (SD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>IQ</td>
<td>115.3</td>
<td>(11.4)</td>
</tr>
<tr>
<td>ARI</td>
<td>1.4</td>
<td>(1.8)</td>
</tr>
<tr>
<td>SCARED</td>
<td>12.7</td>
<td>(11.3)</td>
</tr>
<tr>
<td>CDI</td>
<td>15.1</td>
<td>(10.0)</td>
</tr>
<tr>
<td>CONNERS</td>
<td>64.4</td>
<td>(19.0)</td>
</tr>
</tbody>
</table>

Methods
- Interpretation Bias Task (IBT): 
  - Stimuli consisted of 15 face ‘morphs’ on a continuum from happy to angry
  - Figure 2: Trial Structure

Training Session Procedure:
- All participants completed a single training session beginning with an assessment, followed by 6 training blocks, and ending with another assessment; each face presented 3 times per block, in random order
- Assessment Blocks: Participant’s balance point is measured as the point on the morph continuum at which judgment changes from happy to angry
- Training Blocks: Post-response feedback provided to shift the balance point toward happy judgements of ambiguous faces

Computational Learning Model:
- Neural net variant of Rescorla-Wagner model (using MatLab) with several parameters:
  - Parameter Measures What it Means
    - σ Generalization Higher values indicate more generalization. Also, a difficulty distinguishing between faces.
    - Θ Reliability Lower values indicate poor intrasubject reliability.
    - ε Learning Rate Higher values indicate quicker adaptation to feedback.
- Further analysis of data accomplished using R Statistical Package

Results
- Generalization (σ):
  - We found no significant associations between σ and any of the clinical variables (p-values>0.08)
- Reliability (Θ):
  - We found no significant associations between Θ and any of the clinical variables (p-values>0.22)
- Learning Rate (ε):
  - Significant interaction of ARI by SCARED across ε, β(ε)=0.01(0.005), (27)=2.11, p=0.04
  - All other associations with ε were non-significant (p-values>0.18)

Discussion
- The significant interaction of ARI by SCARED for learning rate was the opposite our expectations.
- Further post hoc analysis showed that irritable, anxious youth were:
  - Quicker to reinforce angry associations
- Findings suggest that HIB persists in irritable, anxious youth because they are quick to learn hostile judgements, not because they are impaired at learning benign judgements

Limitations
- This particular population had sub-clinical level irritability
- A more irritable sample may likely yield expected associations
- Depression and ADHD symptoms may be confounds
- CONNERS and CDI effects did not account for this finding

Future Directions
- These findings suggest that both irritability and anxiety should be considered to assess viable candidates for this treatment
- Training should be altered to focus more on the prevention of rapid acquisition of hostile judgements through reinforcement

Funding
- NIMH Intramural Research Program
- Department of Psychiatry, School of Medicine, University of Colorado

Acknowledgement
- 2017 Summer Research Program for Undergraduate Students at the Pediatric Mental Health Institute

References