May 2nd, 11:00 AM - 1:00 PM

Predicting ADHD Symptoms in Adolescents Using Error-Related Brain Potentials

Amber Schwartz  
Portland State University

Jessica Tipsord

Brittany Alperin

Sarah Karalunas

Let us know how access to this document benefits you.

Follow this and additional works at: https://pdxscholar.library.pdx.edu/studentsymposium

Part of the Social and Behavioral Sciences Commons

https://pdxscholar.library.pdx.edu/studentsymposium/2018/Poster/24

This Event is brought to you for free and open access. It has been accepted for inclusion in Student Research Symposium by an authorized administrator of PDXScholar. For more information, please contact pdxscholar@pdx.edu.
Introduction

- Attention Deficit Hyperactivity Disorder (ADHD) is one of the most prevalent childhood disorders affecting 5-6% of children and adolescents (Michelini et al., 2016).
- The clinical course of the disorder varies widely, and it is currently unknown why some individuals experience remission of their ADHD symptoms across development, while others have their symptoms persist into adulthood.
- Performance monitoring is one aspect of cognitive control important for self-regulation. It involves the ability to recognize errors and make behavioral adjustments.
- Performance monitoring can be measured using event-related potentials (ERPs), which capture brain activity in response to errors. Error-related ERPs include the earlier error-related negativity (ERN, unconscious error processing) and later error-related positivity (Pe, conscious awareness of errors).
- Performance monitoring may be impaired in some children with ADHD (Meel et al., 2007), and may contribute to symptom change (Geburek et al., 2013).

Research Question & Hypothesis

Research Questions:
- Are early or late stages of performance monitoring impaired in ADHD?
- Does performance monitoring predict ADHD symptom improvement?

Hypothesis:
- Later stages of performance monitoring will be impaired in ADHD participants. Greater awareness of errors, measured by higher Pe amplitudes, will be associated with greater symptom improvement.

Method

Study Design:
- Data was examined as part of a larger longitudinal study. 75 participants 7-11 years old at start of study (control=35, ADHD= 40).
- Year 1:
  - Parents and teachers completed behavioral rating forms (ADHD-rs).
  - Parents also completed a semi-structured clinical interview (KSAD). ADHD symptoms combined using “Or” algorithm.
- Annual follow-up visits (3-5 years later):
  - ADHD assessment repeated.
  - Children completed a computerized emotional go/no-go task while 32-channel electroencephalogram was recorded.
  - Response-locked ERN calculated as mean area amplitude from -100-100 ms and Pe calculated as mean area amplitude from 200-400ms at Cz and Fz.

Method (cont.)

Figure 1. The computerized go/no-go task:

3 Conditions:
- Fear, Happy, Neutral

![Figure 1](image)

Table 1. Descriptive information and task performance data.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control</th>
<th>ADHD</th>
<th>Stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>14.9 (1.1)</td>
<td>13.7 (1.5)</td>
<td>p = .332 (ns)</td>
</tr>
<tr>
<td>Sex (male/female)</td>
<td>23.12</td>
<td>35.40</td>
<td>p = .025</td>
</tr>
<tr>
<td>IQ</td>
<td>116.3 (12.1)</td>
<td>106.9 (13.9)</td>
<td>p = .003</td>
</tr>
<tr>
<td>Happy No-go Acc</td>
<td>.86 (.12)</td>
<td>.79 (.17)</td>
<td>p = .006</td>
</tr>
<tr>
<td>Neutral No-go Acc</td>
<td>.85 (.13)</td>
<td>.73 (.19)</td>
<td>p = .000</td>
</tr>
<tr>
<td>Fear No-go Acc</td>
<td>.84 (.15)</td>
<td>.74 (.20)</td>
<td>p = .002</td>
</tr>
<tr>
<td>Happy Go RT</td>
<td>503.12 (111.34)</td>
<td>529.01 (117.96)</td>
<td>p = .21 (ns)</td>
</tr>
<tr>
<td>Sadness Go RT</td>
<td>524.66 (106.16)</td>
<td>559.02 (153.73)</td>
<td>p = .14 (ns)</td>
</tr>
<tr>
<td>Fear Go RT</td>
<td>570.83 (161.07)</td>
<td>586.80 (162.22)</td>
<td>p = .58 (ns)</td>
</tr>
</tbody>
</table>

Results

- ERN amplitudes did not differ between groups at Cz, but were significantly larger in ADHD at Fz (p < .05).
- During positive emotion conditions, controls had higher Pe amplitudes (Cz: M=9.34, SD=6.49) than ADHD participants (Cz: M=5.57, SD=5.82), F(1,71)= 5.64, p <.02.

Figure 2. Average response locked event-related potentials of the error-related positivity (Pe, top left) and error-related negativity (ERN, top right) for ADHD and control group on no-go incorrect trials. Topographic maps included.

Results (cont.)

- Among the ADHD group, higher Pe amplitude in positive emotion conditions predicted a greater decrease in ADHD symptoms after controlling for baseline symptom severity, b = -.40, p=.005.

Conclusions

- Performance monitoring is a potential cognitive skill associated with the remission of ADHD symptoms.
- Insight into the progression of ADHD symptoms in individuals is essential for improving clinical outcomes through intervention.
- Understanding the clinical course adds to the research currently being conducted on its' heterogeneity.

References


Acknowledgements

Funding for this research was provided by K23 MH108656 (PI: Karalunas) and R37 MH059105 (PI: Nigg). Work reported in this paper was also supported by the National Institutes of Health Common Fund and Office of Scientific Workforce Diversity under three awards U54DA038864, R25DA018803, and T34DA018865, administered by the National Institute of General Medical Sciences. The work is solely the responsibility of the authors and does not necessarily represent the official view of the National Institutes of Health.