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A Preliminary Investigation: Social Problems and Executive Functioning in an
ADHD Pediatric Sample

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Abstract

Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder that is linked to a number of cognitive deficits including executive function (EF) impairments (Barkley, 2012). EFs refer to a number of separate (but related) processes that guide everyday behavior. While existing research has focused largely on the relation between ADHD-related social problems and EFs in general, the present study is unique in that we examined the relations among ADHD symptoms, social problems, and eight specific EF domains: working memory, shifting, inhibiting, controlling emotions, planning and organizing, organizing material, monitoring, and initiating. Parents of children aged 7-12 completed ratings of social problems, ADHD symptoms, and Executive Functions (N=36). First, we examined the relation between social problems and EFs. Next, we examined the relation between social problems and EFs after controlling for ADHD symptoms. Social problems were correlated positively with at least five EF domains: inhibition, shifting, emotional control, initiate and monitoring (all $p < .05$). After controlling for ADHD symptoms, however, only shifting was significantly correlated with social problems ($p < .05$). Preliminary findings highlight the extent to which EF-related social problems are better accounted for by ADHD symptoms. To inform current models of ADHD, clinical and research implications will be discussed further in the study and future research will be mentioned.

Keywords: ADHD, Executive Functions, Social Problems

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Introduction

According to the 2016 National Survey of Children's Health, 6.1 million children have received a diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD), with 5.4 million children having a current diagnosis of ADHD (Children and Adults, 2018). ADHD is a neurodevelopmental disorder characterized by inattention, excessive activity level, and impulsivity concerns (Faraone & Biederman, 1998). ADHD not only directly affects the child but also affects the family, friends, and society surrounding the individual. ADHD is associated with many impairments including impaired interactions with peers and adults. Even those with subthreshold ADHD symptoms experience significant social concerns.

An Overview of ADHD-Related Social Problems

ADHD-related social problems are particularly concerning, as impaired social functioning can be detrimental to an individual's well-being (Hong et al., 2014). ADHD-related social problems include problems establishing friendships and being accepted by same-age peers. A disruptive entry for ADHD boys into group play is linked to diminished likeability ratings from age-related and same gender peers (Ronk, Hund, & Landau, 2011). This disruptive entry for boys with ADHD is characterized by attention-getting behavior and self-centered patterns in discussions. Similarly, conflict and relational aggression affects developing relationships in girls with ADHD (Blachman & Hinshaw, 2002). Attention problems are associated with responses to social cues that are necessary in social interactions (Humphreys, Galán, Tottenham, & Lee, 2016). Researchers posit that ADHD symptoms influence social cognition directly and are

associated with poorer solutions to social problems (Barkley, 2015). Solutions to social problems include ineffective ideas, aggression, and had fewer adaptive responses.

ADHD and Executive Functions

Recently, researchers have started to examine the relation between ADHD-related social problems and cognitive impairments, namely impairments in working memory and planning executive functions (EFs). Executive Functioning is an umbrella like term that includes a number of related higher-order cognitive processes (Jurado & Rosselli, 2007) such as working memory, shifting, inhibiting, initiating, monitoring, organization of materials, controlling emotions, and planning/organizing. Working Memory is the ability to complete a task by retaining information (Gioia, Isquith, Guy, & Kenworthy, 2000). Shifting is the ability to move from one situation to the next, to flexibly solve problems (Gioia, Isquith, Guy, & Kenworthy, 2000). Inhibiting, however, refers to someone being able to stop their behavior at the right time (Gioia, Isquith, Guy, & Kenworthy, 2000). While Initiating is how well an individual starts an activity or task, monitoring is the ability to check your actions and performance while organization of materials refers to keeping your items in an orderly manner (Gioia, Isquith, Guy, & Kenworthy, 2000). Self-regulation of emotions is the way an individual composes their self emotionally and react in an emotionally appropriate way (Gioia, Isquith, Guy, & Kenworthy, 2000). Planning/organizing is the ability to appropriately carry out future events and carry out associated actions (Gioia, Isquith, Guy, & Kenworthy, 2000).

While current research has focused largely on the relation between working memory and social problems (Kofler et al., 2011), the associations among social problems and other EF domains (i.e., inhibition, planning/organization, shifting, initiating, monitoring, organization of materials, and self-regulation of emotions) are unknown. Haung-Pollock and colleagues found

that while an ADHD diagnosis alone predicts social skills, peer rejection, and verbal social performance on a chat room task (Haung-Pollock, Mikami, Pfiffner, & McBurnett, 2009), this finding is not present after controlling for EFs. More recently, Tseng and Gau (2013) found that working memory and planning mediated the relation between ADHD symptoms and Social Problems. Research suggests that working memory is an important part of successful social interactions and maintaining peer relations (McQuade, Murray-Close, Shoulberg, & Hoza, 2013; Kofler et al., 2011). In one study, for example, central executive functioning is associated with reduced social competence and peer rejection (McQuade, Murray-Close, Shoulberg, & Hoza, 2013). Chiang and Gau (2014) found that both working memory and planning influence social abilities and relationships along with peer rejection at school. Kofler and colleagues (2011) found that the central executive working memory process negatively plays a role to social problems because of the inattentive and hyperactive ADHD symptoms it contributes to. Working memory in executive functioning is commonly connected with creating social problems and barriers for children with ADHD, but many of the times other domains of executive functioning are left out.

The aim of the present study is to provide a comprehensive review of the associations among ADHD symptoms, social problems and eight EF domains: working memory, shifting, initiating, monitoring, organizing of materials, inhibiting, controlling emotions, and planning/organizing. A comprehensive review of social problems and the eight EF domains may inform the development of impairment-specific interventions for children. For example, perhaps social interventions for children diagnosed with ADHD should target specific EF domains. Based on existing research (Sparrow & Erhardt, 2014) we expect to document positive relations between ADHD and parent-reported social problems. If a relation between social problems and

EFs is documented in the present study, we will examine this relationship after controlling for ADHD symptomatology.

Method

Participants

The sample for this study is part of a larger study examining cognitive and behavioral processes unique to ADHD. Participants were between the ages of 7 and 12 years of age (N=36). This sample was obtained by the Behavior and Learning Lab through community and campus resources. Children with below average intelligence, motor impairment, and a history of seizures were excluded from the present study. The research team obtained IRB approval before starting the study and informed consent and assent were obtained from the parents and the children, respectively.

Measures

Child Behavior Checklist (CBCL):

The Childhood Behavior Checklist (CBCL) measures emotional and behavioral problems in children aged 8-18 years old. The CBCL is completed by the child's guardian/ parent or anyone that interacts with the child in family-like contexts. Parents/guardians were asked to rate the items on a three point Likert scale anchorings of 2: Very true or often true of the child, 1: Somewhat or sometimes true, or 0: Not true of the child. In the present study, *T*-scores were used in the data analysis in order to get a more accurate score controlling for age differences in the sample. The Social Problems *T*-score on the CBCL was used to assess social difficulties the children experienced as reported by the child's parent/guardian. The ADHD Problems *T*-Score on the CBCL was used to assess ADHD symptomatology. Higher *T*-scores on the CBCL denote greater social problems and ADHD problems, respectively. Reliability for the CBCL ranged

from .72 to .91 and the validity was established through significant associations with DSM criteria (Achenbach & Rescoria, 2001).

Behavior Rating Inventory of Executive Function (BRIEF):

The Behavior Rating Inventory of Executive Function (BRIEF) is a questionnaire that examines EF-related behaviors manifested in the home environments. The children's parent/guardian complete the rating scales to understand the child's executive function abilities at home. The BRIEF includes 8 domains: inhibition, shifting, emotional control, initiative, working memory, planning/organizing, organization of materials, and monitoring. In the present study, *T*-scores were used in the data analysis in order to get a more accurate score controlling for age differences in the sample. Higher *T*-scores denote greater EF impairment. BRIEF subscale scores will be utilized to examine specific executive facets that may be associated with the relation between social problems and ADHD symptoms. Reliability and validity for the BRIEF was established via the stability of scores over 2-3 weeks and its indexes being correlated with other behavioral functioning and attentional scales (Gioia, Isquith, Guy, & Kenworthy, 2000).

Childhood Questionnaire

The childhood questionnaire is a clinical assessment given to the child's parent. This measure reviews the child's medical history, developmental history, academic history, and social history. The childhood questionnaire assesses psychosocial factors that may affect the emotional/behavioral profile. The questionnaire is used in the present study to understand situational factors affecting the child.

Procedures:

Study announcements were posted on community bulletin boards and the research lab's website. Parents were invited to contact the lab to complete a brief telephone screen. The

telephone screen assessed ADHD and Oppositional Defiant Disorder symptoms. Parents were mailed two packets. One packet contained the childhood questionnaire and a number of rating scales (e.g., CBCL and BRIEF-Parent). Parent(s) and classroom teachers were invited to mail the completed packet to the clinical research laboratory. After the parent and teachers packets were received by the research team, the measures were scored by clinical research assistants and the first research appointment was scheduled. All preliminary data correlations were examined with SPSS Statistical Software.

Results

The sample consisted of 36 children. While approximately 24% of the study's sample is female, 76% of the sample is male. The average age of participants is ten years old ($SD=1.58$). The sample's average grade is fourth grade with the lowest grade reported being first and the highest grade reported being seventh. The mode for grade level was third grade and the mode age was nine. The range for grade was second to seventh grade.

First, bivariate correlations were examined to understand the relation among ADHD symptoms, social problems, and EFs. As expected, we documented a significant positive correlation between the social problems and ADHD symptoms ($r=.556, p<.001$).

Similarly, we documented significant positive correlations between social problems and the following EF subscales: inhibit ($r=.421^*;p=.013$), shift ($r=.595^{**};p<.001$), emotional control ($r=.375^*;p=.029$), initiate ($r=.348^*;p=.044$), and monitor ($r=.422^*;p=.013$). In the present study, social problems were not related significantly to working memory ($r=.290;p=.096$), planning/organization ($r=.332;p=.055$), and organization of materials ($r=.323;p=.062$).

Finally, partial correlations were utilized to examine the associations between social problems and specific EF domains after controlling for ADHD symptoms. After ADHD symptoms were controlled for in the present study, only one EF domain was associated with social problems. We

documented a significant positive correlations between social problems and Shift ($r=.364^*;p=.037$). When controlling for the CBCL scale of ADHD, social problems were not related significantly to inhibit ($r=.118;p=.513$), emotional control ($r=.177;p=.325$), initiate ($r=-.082;p=.651$), working memory ($r=-.176;p=.326$), planning/organization ($r=-.086;p=.632$), organization of materials ($r=.072;p=.691$), and monitoring ($r=-.012;p=.947$).

Discussion

The present study aimed to examine the extent to which EFs are related to both ADHD symptoms and social problems. While previous research has examined both (a) the relation between EFs defined broadly and (b) the relation between social problems and working memory, the present study is unique in that we attempt to examine the relations among ADHD symptoms, social problems, and eight EF domains: initiate, inhibit, working memory, shifting, emotional control, planning/organizing, organization of materials, and monitoring. Our goal is to inform current interventions for ADHD and develop impairment-specific interventions for individuals diagnosed with ADHD.

In the present study, we document a relation between social problems and ADHD symptoms. This means that children with ADHD symptoms may show high levels of social problems due to the difficulties they face with hyperactivity and other ADHD behaviors. This supports previous research in social problems and ADHD problems being interconnected and influencing one another. It is important to note that while the present study relied on subjective ratings of social problems and EFs our findings are consistent with studies utilizing objective measures of both social problems and EFs (Haung-Pollock, Mikami, Pfiffner, & McBurnett, 2009;Kofler et al., 2011). Research suggests that ADHD symptoms are linked to peer-rejection and difficulties maintain relationships. While we utilized ratings of social problems, future research should examine the role of social competence and ADHD symptoms. Social

competence is defined as an individual's process to integrate skills in a sequence for a given social task (Guralnick, 1990). Social competence interventions include social environment modifications, education programs for peers, and social skill trainings (Whalon, Conroy, Martinez, & Werch, 2015). Understanding the relation between ADHD and social competence can help modify existing interventions by targeting EF-related processes and decreasing social problems. Certain types of interventions, like play-based interventions, for children with ADHD have been shown to improve peer-to-peer interactions (Wilkes-Gillan, Bundy, Cordier, Lincoln, & Chen, 2016). More research on specific social interventions are needed to see how they can increase social competence with children diagnosed with ADHD and can help lower social problems in children with ADHD.

In the present study, we document a positive relation between social problems and five of eight EF domains: inhibiting, shifting, controlling emotions, initiating, and monitoring. Inhibiting refers to the ability to control impulses, children with ADHD may not be able stop their behavior in social contexts. Initiating and monitoring could influence the ability for children to begin an activity and check how it went after. This makes it difficult for children with ADHD to gage in social interactions and notice how successful social interactions went. Difficulties with ADHD diagnosed children controlling emotions can influence appropriate emotional responses in social settings. Shifting can be related to ADHD symptoms and can hinder a child's ability to efficiently move between subjects in conversations with others. Since five EF domains are related to social problems, it is important for future possible interventions to include the ability to stimulate several domains. Multiple-domain specific interventions could decrease social problems in children with ADHD and could decrease their risk for peer rejection and poor relationship development.

After controlling for ADHD, only Shifting was related to social problems. Shifting is the ability to move from one activity/situation to another; to switch or alternate attention, and the ability to tolerate change. Shifting is related to cognitive flexibility which is the ability to appropriately and effectively adapt to a social situation (Curran, 2018). Curran (2018) suggests that this ability is important in social adjustment research. Although ADHD may increase shifting problems in individuals, those with general social problems may have issues with switching attention and adapting successfully to different social situations. Future research should examine what ADHD symptom domain (i.e., attention, hyperactivity/impulsivity) are associated with EF processes, as the present study included a broad measure of ADHD symptoms. The other findings could be non-significant due to the overlap between ADHD symptomatology and EFs. ADHD symptoms could be the explanation for the previously significant results and may explain why certain EFs are correlated with social problems.

Limitations

It is important to note a number of study limitations. First the study included a small sample of children aged 7-12 years old. A more diverse and larger sample size is needed to understand other outside influences such as socioeconomic status, racial differences, and environmental influences. Measures were completed by parents of the child limiting the accuracy of the assessments to an objective and selective view point. The age limitation of the sample may have also affected results with same-gender relationships being the main source of relationships at this time in their development. Future studies may want to look at older adolescents to see how development changes the type and depth of peer relationships they have. This study is also limited with the reliance of ratings of social problems and EFs between only one measure for each variable. Future research should include objective measures of both social problems and EFs. Finally, the present study relied on parent ratings of ADHD symptomatology. Future

research should utilize a clinical interview to diagnosis ADHD and understanding ADHD-related social impairments.

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Table 1

Means, standard deviations, and bivariate correlations among study variables

	1	2	3	4	5	6	7	8	9
1 Social Problems									
2 Inhibit	.421*								
3 Shift	.595**	.497**							
4 Emotional Control	.375*	.512**	.809**						
5 Initiate	.348*	.543**	.645**	.442**					
6 Working Memory	.290	.543**	.579**	.307	.839**				
7 Plan/Organize	.332	.484**	.603**	.299	.783**	.878**			
8 Organization of Materials	.323	.408*	.374*	.110	.529**	.664**	.587**		
9 Monitor	.422*	.575**	.648**	.473**	.711**	.808**	.798**	.473**	
Mean	59.14	59.17	59.08	57.22	60.56	66.03	63.58	60.19	59.47
SD	9.53	14.54	15.14	16.25	12.36	13.55	12.86	8.66	14.18

**p<.01 *p<.05

Note. 1. Childhood Behavior Checklist Social Problems; 2. Behavior Rating Inventory of Executive Function Inhibit; 3. Behavior Rating Inventory of Executive Function Shift; 4. Behavior Rating Inventory of Executive Function Emotional Control 5. Behavior Rating Inventory of Executive Function Initiate; 6. Behavior Rating Inventory of Executive Function Working Memory 7. Behavior Rating Inventory of Executive Function Planning/Organization; 8. Behavior Rating Inventory of Executive Function Organization of Materials; 9. Behavior Rating Inventory of Executive Function Monitoring

Table 2

Means, standard deviations, and bivariate correlations among study variables.

	1	2	3	4	5	6	7	8	9
1 Social Problems									
2 Inhibit	.118								
3 Shift	.364*	.372*							
4 Emotional Control	.177	.440*	.789**						
5 Initiate	-.082	.288	.463**	.293					
6 Working Memory	-.176	.343	.316	.098	.717**				
7 Plan/Organize	-.086	.219	.391*	.094	.611**	.778**			
8 Organization of Materials	.072	.213	.157	-.076	.328	.543**	.419**		
9 Monitor	-.012	.350*	.467**	.374	.440*	.609**	.607**	.217	
Mean	59.23	59.97	58.70	56.85	61.09	66.59	64.18	60.44	60.38
SD	9.71	14.51	15.03	16.64	12.38	13.13	12.69	8.8	13.51

**p<.01 *p<.05

Note. Controlling for ADHD. 1. Childhood Behavior Checklist Social Problems; 2. Behavior Rating Inventory of Executive Function Inhibit; 3. Behavior Rating Inventory of Executive Function Shift; 4. Behavior Rating Inventory of Executive Function Emotional Control 5. Behavior Rating Inventory of Executive Function Initiate; 6. Behavior Rating Inventory of Executive Function Working Memory 7. Behavior Rating Inventory of Executive Function Planning/Organization; 8. Behavior Rating Inventory of Executive Function Organization of Materials; 9. Behavior Rating Inventory of Executive Function Monitoring