The Role of Inattention and Social Perception and Performance in Two Subtypes of ADHD

Margaret Semrud-Clikeman1,2,*

1Department of Psychology, Michigan State University, East Lansing, MI, USA
2Department of Psychiatry, Michigan State University, East Lansing, MI, USA

*Corresponding author at: 321 A West Fee Hall, Michigan State University, East Lansing, MI 48824, USA. Tel.: +1-517-432-4212; fax: +1-517-432-2662.
E-mail address: semrudcl@msu.edu (M. Semrud-Clikeman).

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Abstract

This study evaluated the social perception and social functioning of children with Attention Deficit Hyperactivity Disorder-Combined (ADHD-C), ADHD-predominately inattentive (ADHD-PI), and controls. Two-hundred and seventy children with ADHD-C, ADHD-PI, or controls were evaluated using direct and indirect measures of social functioning. The ADHD-C and ADHD-PI groups showed significant differences in interpretation of emotional and nonverbal cues on a direct measure of social perception compared with controls. The number of inattentive symptoms was significantly related to poor performance for interpretation of both emotional and nonverbal cues, whereas hyperactivity and impulsivity symptoms showed a less robust relation. Children with ADHD-C were rated by parents and teachers as showing significant problems with social performance and problem behaviors compared with those with ADHD-PI or with controls. These findings show a link between inattention and social perception that is separate from impulsivity difficulties. These findings have important implications for treatment.

Keywords: ADHD; subtypes; social perception; children

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most frequently diagnosed psychiatric disorders in childhood (Barkley, 2006). It has been found to be highly comorbid with other disorders such as Oppositional Defiant Disorder (ODD), anxiety, depression, and learning disabilities (Biederman, Faraone, & Lapey, 1992; McBurnett, Piffiner, & Frick, 2001; Semrud-Clikeman et al., 1996). There are currently three subtypes identified in ADHD: ADHD-Combined type (ADHD-C), ADHD-Predominately Inattentive type (ADHD-PI), and ADHD-Hyperactive Impulsive type (ADHD-HI). Of these subtypes, the most common is ADHD-C followed by ADHD-PI. ADHD-HI is infrequently seen in children past the age of 6 (American Psychiatric Association, 2000).

Although all of these subtypes are under the rubric of ADHD, there is debate in the literature as to whether ADHD-C and ADHD-PI should be classified under the same category. Some researchers and clinicians argue that they are distinct and unrelated disorders (Baeyens, Roeyers, & Walle, 2006; Barkley, 1997; Booth et al., 2005; Diamond, 2005; Milich, Ballentine, & Lynam, 2001). Children with ADHD-C have been found to show more impulsive responding, poorer social problem-solving skills, and more conduct problems than children with ADHD-PI (Barkley, 2006). In contrast, ADHD-PI children are more likely to be socially isolated, experience more academic problems, and respond slower to stimulation (Diamond, 2005; Gaub & Carlson, 1997). Moreover, children with ADHD-PI have been found to be highly inhibited, show slower reaction times compared with those with ADHD-C that do not appear to be related to motivational style, and show a sluggish cognitive tempo that is not responsive to rewards (Derefinko et al., 2008).
Social Functioning in ADHD

Social functioning can be divided into three components: understanding social interactions (social perception), understanding what is correct for a particular situation (social knowledge), and performing the appropriate social action in response to a stimulus (social performance; Dodge, 1986). Social perception requires processing of nonverbal cues such as facial expressions and body gestures. It is possible to understand a social interaction and to know what the correct behavior is but to not utilize such perception and knowledge. On the other hand, incorrect perception of nonverbal cues will generally lead to inappropriate behaviors. Moreover, children with aggressive/impulsive tendencies exposed to ambiguous situations tend to act more aggressively than when social situations are clear cut (Dodge, 1980). When ambiguous situations are present coupled with inattention and impulsivity, then responses may be more impacted. For this reason, difficulties with impulsive responding, poor social skill problem-solving ability, and social isolation likely contribute to significant problems in social functioning in children with both subtypes of ADHD.

Most studies on social performance in children with ADHD have been conducted with the combined subtype. Children and adolescents with ADHD-C have been found to be rejected by their peers fairly quickly after the initial meeting resulting in fewer friends (Bagwell, Molina, Pelham, & Hoza, 2001) and have been found to be more disliked than aggressive children (Milich et al., 2001). Some clinicians and researchers have suggested that these social difficulties are important enough to be included in the diagnostic criteria and may be a defining characteristic of the disorder (Landau, Milich, & Diener, 1998).

While impulsive responding has been found to relate to social performance difficulty, it is not clear what role attentional difficulties may play in social perception and performance for these children (Bagwell et al., 2001). If social decisions are made quickly and ignore important environmental cues (i.e., facial expression, body language, voice), then inattention to these details may result in inappropriate behavior which serves to isolate the child even further (Guli, Wilkinson, & Semrud-Clikeman, 2008; Schafer & Semrud-Clikeman, 2008). Dodge’s (1986) social information processing model hypothesizes that the ability to encode information is an important part of social perception and requires attention to detail. Children who are aggressive, hyperactive, and inattentive have been found to show poorer attention to social cues (Milich & Dodge, 1984).

To further test whether children with ADHD have poor social performance, Maegden and Carlson (2000) compared the teacher ratings of children with ADHD-C or ADHD-PI on a measure of social functioning. They found that, in contrast to controls, children with ADHD-C showed higher levels of aggression and emotional dysregulation and were less popular. In contrast, children with ADHD-PI showed more passivity, anxiety, shyness, and poorer social skills compared with children with ADHD-C (Maegden & Carlson, 2000; Milich et al., 2001). This study evaluated social performance but not social perception. It is not clear whether differences in social perception are present between the two subtypes. If social perception difficulties are due to inattention, both subtypes should show difficulties while if aggression and impulsivity are paramount then children with ADHD-C will show more problems on a social perception measure.

Attention and Social Competence

Emerging studies using neuroimaging as well as behavioral measures suggest a link between ADHD and social perception impairments involving interpretation of emotional cues and perception of voice tone (Uekermann et al., in press). It has also been suggested that social perception deficits may be related to inattention, whereas hyperactivity and impulsivity are related to response inhibition (Uekermann et al., in press). Problems with attention may impact the child’s ability to function well socially or to process social information. Deficits in attending to important nuances in social exchanges (emotion and nonverbal cues) may underlie the social perception and social performance problems seen with children with ADHD (Barkley, 2005; Fine, Semrud-Clikeman, Butcher, & Walkowiak, 2008; Nijmeijer et al., 2008).

It is likely that problems with emotional regulation contribute to problems with social performance. For example, studies have found that children with ADHD-C are often experienced by their peers as negative, aggressive, hostile, controlling, and verbally and physically aggressive (Mikami & Hinshaw, 2003; Mrug, Hoza, Pelham, Gnagy, & Greiner, 2007). These difficulties may be more present in children with ADHD-C rather than those with ADHD-PI and are more likely to be reflected in behavioral ratings and reports rather than on direct measures of social perception.

A review of studies comparing ADHD-C and ADHD-PI on social performance found that both groups show social impairment (Milich et al., 2001). Children with ADHD-C were found to have more social problems that are aggressively based (Hodgens, Cole, & Baldizar, 2000), whereas those with ADHD-PI were more withdrawn and passive (Maegden & Carlson, 2000). Almost all of the studies comparing children with ADHD-C and ADHD-PI on social performance utilized parent or teacher ratings. The exception was the study by Maegden and Carlson (2000) that utilized a measure of social performance.
In this study, the ADHD-C group used more aggressive solutions to social problems whereas the ADHD-PI group was more passive in their solutions.

A review of the research literature found no studies that compare children with ADHD-PI and those with ADHD-C on a measure of social perception. One of the purposes of this study was to evaluate possible differences in social perception as well as in behavior ratings in children with ADHD-PI or ADHD-C compared with controls. It was expected that there would be no difference between the ADHD groups on the direct measures of social perception. It was also hypothesized that inattention would be related to poorer functioning on a direct measure of social perception. Children with ADHD-C were hypothesized to be rated more poorly by primary caretakers on a behavioral rating scale than those with ADHD-PI particularly in the areas of problem behaviors and social functioning. It was also expected that the measure of social perception and the behavioral rating of social functioning would correlate significantly.

**Method**

**Participants**

Participants were children referred by parents, teachers, psychologists, psychiatrists, and pediatricians in a large southwestern city for a research study. The parent was referred to the study coordinator by the referring agency and received information about the requirements for the study. A phone screening was conducted to determine eligibility for the study followed by a scheduled appointment for individual testing. This study met the conditions and approval of the Institutional Review Board of the relevant university and informed consent was obtained from all parents as well as assent from all participants.

The final sample included 270 children (176 males and 94 females) with 152 meeting DSM-IV TR (American Psychiatric Association, 2000) symptom criteria for ADHD and 113 controls. Seventy-four children met criteria for ADHD-C and 78 for ADHD-PI. The mean age was 10.4 with a standard deviation of 2.1 (age range: 7–16). Table 1 provides the demographics for this study. Twenty-two percent of the sample self-identified as a minority (Asian, Hispanic, and African American). The percentage of females in each group is as follows: 20% of the ADHD-PI group, 10% of the ADHD-C group, and 25% of the control group. Children were recruited from neighborhood schools as well as organizations for children with ADHD. Controls were recruited from the community.

Doctoral level clinical graduate students trained in administering the screening battery individually assessed the participants under the supervision of a licensed psychologist. No child was on medication during the testing and a 48-h washout period prior to coming to the study was required. Diagnoses were determined by consensus of two independent sources: licensed neuropsychologists within the community or university and the author. Participants for whom a diagnosis was not unanimous were subject to a file review. If the diagnosis could not be reconciled, the participant was not included in the study. Two subjects were not included in the study (2 ADHD-PI). Exclusionary criteria included a history of a seizure disorder, a reading disability, progressive neurological problems, traumatic brain injury, or any other serious medical condition. Those with comorbid psychopathology were also excluded from the sample except for ODD. For this sample, there were 38 children with ADHD-C who met criteria for ODD and 5 children with ADHD-PI. Children on medication for depression or anxiety or who met criteria for conduct disorders were not included in the study. These disorders were defined through a semi-structured interview using DSM-IV TR criteria (American Psychiatric Association, 2000). Only children with a Full-Scale Intelligence Quotient (FSIQ) >80 as estimated by the Wechsler Abbreviated Scale of Intelligence (WASI) were included in the sample.

Each child with ADHD-C was also required to obtain a T-score of 65 or higher on the Behavior Assessment System for Children-2 (BASC-2; Reynolds & Kamphaus, 2004) inattention and hyperactivity scale as well as meeting criteria for a DSM-IV diagnosis of ADHD-C using the parent semi-structured interview (SIDAC). Children in the ADHD-PI group required a T-score of 65 or higher on the BASC-2 on the inattention scale but <60 on the hyperactivity scale. Children in the control group had no history of learning, behavioral, or attentional difficulties both by parent and teacher report and an interview completed prior to participation.

**Instruments**

**Screening instruments.** SIDAC (Puig-Antich & Chambers, 1978): The SIDAC is a semi-structured interview based on DSM-IV diagnoses, modified and updated from the Kiddie-Schedule of Affective Disorders and Schizophrenia developed by Puig-Antich and Chambers (1978). The ADHD, ODD, and conduct disorder portions of the SIDAC interview were used in this study. Symptoms related to inattention, hyperactivity, and impulsivity were included. This measure was also used as partial confirmation of parent-reported diagnosis of ADHD, as noted above.
WASI (Psychological Corporation, 1999): The WASI is an abbreviated scale of intelligence with measures of similarities, vocabulary, block design, and matrix reasoning. It provides an estimated Verbal IQ, Performance IQ, and FSIQ. For this study, the FSIQ was used as it is the most robust psychometrically.

Woodcock–Johnson Achievement Battery-III (WJ-Ach III) (Woodcock, McGrew, & Mather, 2001): The letter-word subtest from the WJ-ACH III was administered to rule out a learning disability in reading. Each child needed to score within 16 standard score points compared with the estimated WASI FSIQ to be eligible for this study (Sattler, 2001).

BASC-2 (Reynolds & Kamphaus, 2004): The attention problems and hyperactivity subscales from the BASC-2 parent and teacher rating scale were used to confirm a diagnosis of ADHD. The BASC-2 is an omnibus behavioral rating scale that provides normative data for specific behaviors. The scales of anxiety and depression were also evaluated to further rule out these disorders.

Study Measures

The Child and Adolescent Social Perception Measure (CASP) (Magill-Evans, Koning, Cameron-Sadava, & Manyk, 1996). CASP was developed as a clinical tool for evaluating social perception in children and adolescents using 10 videos. The videos show social interactions between two or more child actors or a child and an adult, with each video vignette lasting approximately 1 min. The intonation of the voices is audible, whereas the language is disguised by a filter that does not allow understanding of the individual words. The child describes each vignette and then is asked to explain how the characters are feeling (CASP emotional cues score, CASPem) and then to explain how they know what the characters felt (“mouth turned up in a smile,” “eyebrows were raised,” or “voice went up”; CASP nonverbal cues score; CASPnv). The range of emotions portrayed in the vignettes is from basic emotions of happy or sad to more complex ones depicting embarrassment or frustration. More points are awarded for the awareness of the complex emotions. Raw scores are calculated in number of emotions and nonverbal cues given by the child and are then compared with a normative sample. Training for scoring of the CASP was utilized and agreement among scorers was required to be at the 95 percentile prior to administering the test independently.

Validation of the CASP has found good internal consistency (Cronbach’s α ranging from 0.88 to the CASPem to 0.92 for CASPnv with test–retest reliability reported to range from 0.83 to 0.87; Magill-Evans, Koning, Cameron-Sadava, & Manyk, 1996).

Table 1. Demographics and screening measures for three groups

<table>
<thead>
<tr>
<th>Measure</th>
<th>ADHD-C Mean (SD)</th>
<th>ADHD-PI Mean (SD)</th>
<th>Controls Mean (SD)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>10.1 (2.3)</td>
<td>10.8 (2.2)</td>
<td>10.4 (2.2)</td>
<td>NS</td>
</tr>
<tr>
<td>Wechsler Abbreviated Scale of Intelligence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated FSIQ</td>
<td>110.4 (14.6)</td>
<td>106.8 (14.5)</td>
<td>112.9 (14.1)</td>
<td>ADHD-PI &lt; C</td>
</tr>
<tr>
<td>Estimated VIQ</td>
<td>109.0 (17.2)</td>
<td>104.9 (12.9)</td>
<td>111.9 (14.3)</td>
<td>ADHD-PI &lt; C</td>
</tr>
<tr>
<td>Estimated PIQ</td>
<td>109.2 (12.9)</td>
<td>107.1 (17.1)</td>
<td>110.1 (17.9)</td>
<td>NS</td>
</tr>
<tr>
<td>Woodcock-Johnson Achievement Battery-III</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Letter-Word Identification</td>
<td>106.3 (12.9)</td>
<td>102.3 (11.3)</td>
<td>106.7 (12.3)</td>
<td>NS</td>
</tr>
<tr>
<td>Diagnostic Interview</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total ADHD symptoms</td>
<td>14.3 (2.4)</td>
<td>10.9 (5.2)</td>
<td>2.7 (3.0)</td>
<td>ADHD-C &gt; ADHD-PI, C ADHD-PI &lt; C</td>
</tr>
<tr>
<td>Inattention symptoms</td>
<td>7.5 (1.4)</td>
<td>7.6 (1.2)</td>
<td>1.5 (1.9)</td>
<td>ADHD-C, ADHD-PI &gt; C</td>
</tr>
<tr>
<td>Hyperactivity symptoms</td>
<td>4.4 (1.3)</td>
<td>1.7 (1.4)</td>
<td>0.7 (1.0)</td>
<td>ADHD-C &gt; ADHD-PI, C; ADHD-PI &gt; C</td>
</tr>
<tr>
<td>Impulsivity symptoms</td>
<td>2.5 (0.8)</td>
<td>1.0 (0.9)</td>
<td>0.5 (0.8)</td>
<td>ADHD-C &gt; ADHD-PI, C; ADHD-PI &gt; C</td>
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<tr>
<td>Behavior Assessment System for Children-Parent Version-subscales</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Hyperactivity</td>
<td>72.1 (11.9)</td>
<td>56.0 (11.4)</td>
<td>46.9 (11.1)</td>
<td>ADHD-C &gt; ADHD-PI, C; ADHD-PI &gt; C</td>
</tr>
<tr>
<td>Inattention</td>
<td>67.9 (8.3)</td>
<td>67.9 (7.7)</td>
<td>49.7 (9.3)</td>
<td>ADHD-C, ADHD-PI &gt; C</td>
</tr>
<tr>
<td>Anxiety</td>
<td>53.0 (12.5)</td>
<td>51.7 (12.1)</td>
<td>50.7 (10.9)</td>
<td>NS</td>
</tr>
<tr>
<td>Depression</td>
<td>64.1 (15.1)</td>
<td>55.5 (10.5)</td>
<td>48.5 (11.2)</td>
<td>ADHD-C &gt; ADHD-PI &gt; C</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>55.4 (13.4)</td>
<td>56.0 (14.1)</td>
<td>49.2 (9.9)</td>
<td>ADHD-C, ADHD-PI &gt; C</td>
</tr>
<tr>
<td>Behavior Assessment System for Children-Teacher Version-subscales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyperactivity</td>
<td>64.7 (12.5)</td>
<td>51.8 (11.6)</td>
<td>48.4 (8.8)</td>
<td>ADHD-C &gt; ADHD-PI, C</td>
</tr>
<tr>
<td>Inattention</td>
<td>60.9 (9.9)</td>
<td>58.4 (10.6)</td>
<td>47.6 (9.2)</td>
<td>ADHD-C, ADHD-PI &gt; C</td>
</tr>
<tr>
<td>Anxiety</td>
<td>54.2 (12.0)</td>
<td>54.4 (11.1)</td>
<td>47.9 (9.9)</td>
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</tr>
</tbody>
</table>

Notes: ADHD = Attention Deficit Hyperactivity Disorder; ADHD-C = ADHD-Combined; ADHD-PI = ADHD-predominately inattentive; C = control; FSIQ = Full-Scale Intelligence Quotient; VIQ = Verbal Intelligence Quotient; PIQ = Performance Intelligence Quotient.
Validity for the CASP has been demonstrated in its ability to discriminate children with the Asperger syndrome from controls (Koning & Magill-Evans, 2001). In addition, it has been found to correlate with the Social Skills Rating System (SSRS) at a low but significant level perhaps indicating that different areas of social functioning are being evaluated (Koning & Magill-Evans, 2001).

SSRS-Parent Form (Gresham & Elliott, 1990). The SSRS is a behavioral rating scale completed by the child’s main caretaker and teacher. It measures total social skills through a Likert scale of three options (never, sometimes, very often). Reliability and validity are reported in the manual to be adequate.

Results

Preliminary Measures

Preliminary measures were administered determining group selection as outlined above. There were no significant differences among groups for age ($p = .19$). There were significant differences on the WASI for all indices. A 3 (group) × 1 (FSIQ) ANOVA found a significant group difference—$F(2, 264) = 4.17, p = .02, \eta^2 = .03$. Post hoc comparisons found that the ADHD-PI group scored significantly worse on the FSIQ score compared with the control group ($p = .004$; see Table 1 for these scores). Subsequently, the FSIQ was used as a covariate for the analysis of the academic performance and social competence measures.

Reading ability using the letter-word subtest from the WJ-Ach III was evaluated across the groups using an ANCOVA. Because the groups were selected to have no reading difficulties, it was not expected that a group difference would be present. This expectation was confirmed as no group differences were found in reading ability—$F(2, 257) = 1.24, p = .29, \eta^2 = .1$. Table 1 provides the results for these measures.

The BASC-2 parent and teacher ratings from the hyperactivity, attention, anxiety, and depression scales were also evaluated using separate MANOVAs. As expected, there was a group effect and both ADHD groups were rated significantly more poorly compared with the control group on the attention scale ($p < .0001$) and hyperactivity ($p < .0001$). There was a significant difference between the ADHD-C and the ADHD-PI groups on hyperactivity ($p < .0001$) but not on attention ($p = .99$; Table 1). In addition, although there was a significant group effect for depression and withdrawal for the ADHD-C group, the scores were in the high average range but not clinically significant (Table 1). Although the teacher rating of children with ADHD-PI also did not meet the cutoff for clinical significance, it is important to note that many of these children were on medication during the school day perhaps suggesting the medication was effective.

Main Analyses

Direct social understanding measure. The first hypothesis of this study stated that there would be group differences on the direct measure of social perception with the children with ADHD scoring worse than the controls with more difficulty understanding emotional cues as well as nonverbal cues. It was expected both ADHD groups would score lower than the controls on both indices of the CASP with no differences between the ADHD groups. These hypotheses were confirmed by a 2 (CASPem, CASPnv) × 3 (group) MANCOVA. Findings indicated a significant group effect was present—$F(2, 257) = 14.75, p < .0001, \eta^2 = .12$ (Table 2). Follow-up analyses found a significant group effect for CASPem—$F(2, 222) = 6.27, p = .002, \eta^2 = .05$—and for CASPnv—$F(2, 222) = 8.18, p < .001, \eta^2 = .06$. Post hoc analysis found that both ADHD groups scored worse than the control group on the CASPem (ADHD-C, $p = .003$; ADHD-PI, $p = .004$) with no difference between the subtypes ($p = .95$). Similarly on the CASPnv, the ADHD groups both scored significantly worse compared with the control group ($p = .002$) with no difference between the ADHD groups ($p = .97$).

To test the hypothesis that the number of attentional symptoms but not hyperactivity symptoms was related to performance on the direct social measure, a regression of the CASP on these variables was performed. It had been hypothesized that while hyperactivity and impulsivity symptoms may influence performance on the CASP indices, the number of attention symptoms would explain more of the variance. The first regression predicting performance on the CASP from the total number of ADHD symptoms resulted in a significant finding for the CASPem ($t = -3.57, p < .001, \beta = - .228$) and CASPnv ($t = -3.71, p < .001, \beta = - .23$) scales. Inattention symptoms contributed significantly to the variance in CASPem such that one fewer symptom raised the CASPem score by about 0.08 z-score points ($b = -.086, \beta = -.23, p = .006$). Along with estimated IQ, inattention symptoms had the strongest influence on the CASPem score in the presence of all symptoms types with a significant and moderate effect size found—$\Delta R^2 = .121, F(4, 220) = .755, p < .0001$. Hyperactivity and impulsivity were not significant predictors for the CASPem score (Table 3).
Similar results were obtained for the CASPnv score. Inattention symptoms also contributed significantly to the variance in CASPnv such that one fewer symptom raised the CASPnv score by about 0.1 z-score points ($b = -2.097, b = -2.279, p = .001$). Along with estimated IQ, inattention symptoms had the strongest influence on the CASPnv score in the presence of all symptom types, with a significant and moderate effect size found—$R^2 = .198, F(4, 220) = 13.6, p < .0001$. Taken together, less severe symptoms of inattention are related to better emotional and nonverbal cue recognition for this sample. Similar to the CASPem findings, hyperactivity and impulsivity symptoms were not significant predictors for the CASPnv score.

Social Skills Rating Scale

It was also hypothesized that children with ADHD would be rated as having more difficulty socially by their parents and teachers. It was hypothesized that children with ADHD-C would be rated worse than those with ADHD-PI and that both groups would be rated more poorly compared with the control groups on social skills. This hypothesis was confirmed on the SSRS. A 3 (group) by 2 (social skills, problem behaviors) MANOVA resulted in a significant group effect—$F(2, 257) = 5.4, p = .006, \eta^2 = .1$. As seen in Table 2, there are several statistically significant group comparisons. Many of these comparisons have means that are in the average range for the child’s age and are not clinically significant. Of the ones that are clinically informative, the ADHD-C children were rated more poorly than the ADHD-PI ($p = .008$) and control ($p < .0001$) on social skills. For problem behaviors, the ADHD-C children were rated more poorly compared with the ADHD-PI ($p = .002$) and control ($p < .0001$). The ADHD-PI group was also rated more poorly than the control group ($p < .0001$).

There were fewer teachers who completed the SSRS as part of the study, although all teachers were asked. For the SSRS, there were a total of 142 teachers that completed the questionnaire (ADHD-C, 35; ADHD-PI, 40; controls, 67). A 3 (group) × 3
(social skills, problem behaviors, academics) MANOVA resulted in a significant group effect—\(F(6, 274) = 9.79, p < .0001; \eta^2 = .18\). Post hoc comparisons indicated that the ADHD-C group was rated more poorly than the control group on social skills \((p < .0004)\), problem behaviors \((p = .003)\), and academics \((p = .002)\). The ADHD-C group was rated more poorly than the ADHD-PI group on problem behaviors \((p = .003)\). All other comparisons, although significant, are not as meaningful because the scores are in the average range (Table 2).

Findings from the BASC-2 parent and teacher ratings of social skills were similar to the SSRS with significant differences present for the ADHD groups. The ADHD groups were rated worse on social skills compared with the control group \((p < .0001)\) with the ADHD-C group rated worse on this scale than the ADHD-PI group \((p = .02)\). The teacher BASC-2 was completed by 49 teachers of children with ADHD-C; 55 with ADHD-PI, and 85 controls. Both ADHD groups were rated worse on social skills compared with the controls \((p < .0001)\) with no difference from each other \((p = .86)\).

To explore the relation of the CASPem and CASPnv to behavioral ratings of social skills by parents and teachers, a correlation matrix was conducted. Significant correlations were found between CASPem, SSRS parent social skills rating, BASC-2 parent and teacher social skills ratings. Likewise, significant correlations were found between these indices and CASPnv (Table 4). There was no significant relation found for teacher SSRS social skills rating. These findings suggest that the difficulties found on the CASP were also largely reflected on parent and teacher ratings.

**Discussion**

This study sought to evaluate social perception and performance in children with two subtypes of ADHD and typically developing controls. It was hypothesized that the children with ADHD would score more poorly on direct measures of social understanding as well as on social skills as observed by parents and teachers. It was also hypothesized that inattention would contribute significantly to these difficulties. These hypotheses were generally confirmed. On the direct measure of social perception, children with either subtype of ADHD performed significantly more poorly than controls on interpreting emotional and nonverbal cues. There were no differences between the subtypes on this measure. When the contribution of attention, hyperactivity, and impulsivity symptoms were separately evaluated, it was found that inattention was more significantly related to difficulty understanding emotional and nonverbal cues compared with hyperactivity or impulsivity symptomatology.

Consistent with previous research findings, parent and teacher ratings also were found to differ in social skills between the groups. Parents rated children with ADHD-C as experiencing significantly more social problems compared with those with ADHD-PI or controls. In addition, children with ADHD-C were rated as showing more problem behaviors compared with those with ADHD-PI who also were rated more poorly than controls. For the teacher ratings, children with ADHD-C were rated with poorer social skills and more problem behaviors compared with controls or with ADHD-PI.

When the direct measure of social processing was compared with social performance, significant correlations were found with the parent and teacher ratings. These strong correlations indicate that the ability to process social and nonverbal cues was related to performance. Of interest is the lack of significant correlations to the teacher SSRS whereas significant correlations were found to the BASC-2 social skills scale. A review of the items on the SSRS teacher form indicate that many of the questions relate to politeness rather than directly to social functioning (i.e., Says please and thank you). These findings suggest that the underlying difficulty with attention to social cues is reflected not only on the direct measure but also on parent and teacher ratings. The BASC-2 social skills teacher rating scale appeared to be more related to social perception than the SSRS teacher rating scale.

**Table 4. Correlation matrix of the CASP to behavior rating scales**

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**p < .0001**
Impulsivity or inattention?

Children with ADHD have been reported in the literature to experience significant problems with social interactions perhaps partly due to impulsive responding (Bagwell et al., 2001). It has been suggested that social deficits in ADHD are due to problems with behavioral inhibition (Barkley, 1997; Rapport, Friedman, Tzelepis, & Van Voorhis, 2002). In this theory, social skill deficits are due to deficits in executive functioning and emotional dysregulation. It is assumed in this conceptualization that self-regulation of behavior and emotion (or impulsivity and disinhibition) lie at the core of social deficits in ADHD while social perception is intact. The findings from the current study do not support this theory but suggest that social perception is related to inattention to cues and information that may then negatively impact social performance. They also suggest that it is important to take a more intensive view of the social adaptation of children with ADHD in order to more fully understand where the breakdown lies.

Social perception difficulties have been found in children with ADHD to accurately identify their own and peer’s affective expression compared with controls, children with ODD, or depression (Casey, 1996) or in recognition of affect from voice intonation and facial expression (Shapiro, Hughes, August, & Bloomquist, 1993). These studies have not evaluated whether inattention or impulsivity was a crucial component in these difficulties. In addition, there was little information provided as to the type of ADHD evaluated.

It has been more recently suggested that affect perception may require sustained attention in order to accurately interpret another’s feelings and intentions (Uekermann et al., in press). Facial expressions, voice intonation, and gestures have been linked to understanding the intentions of others with impairments in such understanding linked to poor social competence and social isolation in children with ADHD or those with Autistic Spectrum Disorders (Corbett & Glidden, 2000; Nijmeijer et al., 2008; Sinzig, Walter, & Dopfner, 2009). Previous studies have not controlled for subtype of ADHD or intelligence; variables that may have an effect on performance. A strength of the current study is that both of these variables were controlled. It was found that attentional difficulties present in both subtypes were significantly related to problems with social perception and interpretation.

Previous studies of social functioning using a single modality (faces or voices) in children with ADHD have hypothesized that the social difficulty seen for these children was due more to impulsivity than to inattention (Rapport et al., 2002), whereas others have suggested that inattention may be an equally important variable (Uekermann et al., in press). The current study utilized stimuli that are dynamic and require real-time processing on several levels which may stress the attentional system as it processes multiple sources of information rather than a single source. The relation of inattention to successful performance on these naturalistic tasks may reflect the problems encountered by children with ADHD. Two aspects of such interpretation require attention to the context as well as to emotional and nonverbal cues.

For the current study, inattention was linked to difficulties in reporting emotional and nonverbal cues; a finding consistent with Dodge’s model. Although impulsivity and hyperactivity did contribute to poorer performance on the CASP, inattention was more highly related to social perception. There was no difference between the subtypes in the current study suggesting that impulsivity was not a major component in the difficulties experienced with social perception. These findings build on Dodge’s (1986) social information processing model that requires accurate encoding and interpretation of social cues for successful social interactions. It is also of interest that while inattention was more strongly linked to social perception than impulsivity/hyperactivity, these difficulties were more indicative of behavioral problems as noted by the parent and teacher behavioral ratings. It may well be that inattention difficulty relates to problems with social perception, whereas behavioral difficulty (disinhibition, impulsivity) is more strongly related to social performance.

The findings of the current study are consistent with a study of social behavior in children with ADHD in a structured setting (Huang-Pollock, Mikami, Pfiffner, & McBurnett, 2009). Although the above study was mainly investigating the relation of executive functioning and subtypes of ADHD, no difference was found between the subtypes on social behavior. It was concluded that inattention rather than hyperactivity or impulsivity interfered with social performance. The strength of the current study is that it allowed for assessment of understanding of social cues (emotional and nonverbal) as well as assessing parent and teacher ratings of social behavior. Although Huang-Pollock et al. (2009) focused on social performance, the current study evaluated social perception and interpretation. These two studies are complimentary and both point to the relative importance of inattention to social functioning rather than impulsive and hyperactive behaviors.

It is possible that poorer social perception and inattention interact to result in poorer performance across subtypes. Differences between the subtypes in social perception were not found. The ADHD subtypes have been found to differ in how they cope with social perception deficits with the children with ADHD-C utilizing externalizing methods and those with ADHD-PI becoming more passive and withdrawn. For both subtypes, interventions that target social perception rather than the resulting behaviors (aggression or passivity) may be more successful than solely working on those behaviors.
Limitations

One of the limitations of this study is that the findings from this study are limited to children with ADHD with only a possible co-diagnosis of ODD. Since we did not include children with comorbid diagnoses other than ODD, these findings may not be generalizable to children with ADHD with other common co-diagnoses such as learning disabilities. We were also not able to recruit sufficient numbers of females, particularly in the ADHD-C group, to evaluate gender differences.

Clinical Implications

These findings have important clinical implications. The contribution of inattention to social functioning suggests that therapeutic programs need to address such attentional deficits directly when working with children with ADHD. One program has found success in working with children with ADHD by focusing attention on particular aspects and reinforcing correct responding (Yuill & Lyon, 2007). Children were directly instructed to look at all aspects of the problem before selecting an answer. The intent of this program was to work on impulsivity but it is likely such directions and support also improved attention. The increased number of depression symptoms, particularly in children with ADHD-C, is an important finding and suggestive of necessary psychological treatment. Providing a forum for these children to discuss their feelings about social functioning would be helpful and provide a needed support. Self-reports from the children with ADHD indicated either no awareness of the symptoms or an unwillingness to divulge. Further exploration of these issues is likely needed when working with a child/adolescent with ADHD.

Conflict of Interest

None declared.

References


