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Pragmatic Deficits and Social Impairment in Children with ADHD

Ekaterina Staikova, M.A.^{1,4}, Hilary Gomes, Ph.D.^{1,2}, Vivien Tartter, Ph.D.^{1,2}, Allyssa McCabe, Ph.D.³, and Jeffrey M. Halperin, Ph.D.^{1,4}

¹ The Graduate Center, City University of New York, New York, NY, USA

² City College, City University of New York, New York, NY, USA

³ University of Massachusetts at Lowell, Lowell, MA, USA

⁴ Queens College, City University of New York, New York, N, USA Y

Abstract

Background—Impaired social functioning has been well-documented in individuals with ADHD. Existing treatments for ADHD are effective for managing core symptoms, but have limited effectiveness at improving social skills, suggesting that social deficits in ADHD may not be directly related to core symptoms of the disorder. Language problems are also common in ADHD, with accumulating evidence of pragmatic language difficulties. Pragmatic deficits are associated with social impairment in several neurodevelopmental disorders. This study systematically examined pragmatic language functioning in children with ADHD and whether social impairment in ADHD is mediated by pragmatic deficits.

Method—63 children (28 ADHD; 35 typically-developing), ages 7-11 years, underwent a comprehensive assessment of pragmatic language, including parent ratings, standardized tests, and a narrative task. Parents also rated children's social skills on the Social Skills Improvement System.

Results—Children with ADHD had poorer pragmatic language skills relative to peers across all measures, even after controlling for general language abilities. Furthermore, pragmatic abilities as measured by parent ratings, mediated the relation between ADHD and social skills.

Conclusions—Pragmatic language skills are impaired in many children with ADHD and may partially account for high rates of social impairment. Implications for treatment and possible prevention of social problems in children with ADHD are discussed.

Keywords

attention-deficit/hyperactivity disorder; ADHD; pragmatic language; social skills

Correspondence: Jeffrey M. Halperin, Ph.D., Department of Psychology, Queens College, 65-30 Kissena Blvd., Flushing, NY 11367. Phone: (718) 997-3254; Fax: (718) 997-3218; Jeffrey.halperin@qc.cuny.edu.

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Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is a complex neuropsychiatric disorder characterized by developmentally inappropriate levels of inattention and hyperactivity/impulsivity (APA, 1994). ADHD rarely occurs in isolation, with most affected individuals experiencing associated problems, including aggression, academic failure, and/or interpersonal difficulties (Barkley, 1997). Despite extensive research on the disorder, the mechanisms by which individuals with ADHD develop social difficulties remain unclear.

Social problems have been reported in 52% to 82% of children with ADHD and are increasingly seen as an important associated feature of the disorder (Landau, Milich, & Diener, 1998; Barkley, DuPaul, & McMurray, 1990). Impairment in social functioning has been reported by parents, teachers and peers, and documented as early as the preschool years (DuPaul, McGoey, Eckert, & VanBrakle, 2001). Children with ADHD are rated lower on social preference, have fewer reciprocated friendships (Hoza et al., 2005b), and are more often disliked by their peers, as soon as the first day or even within 20 minutes of the social interaction (Bickett & Milich, 1990; Erhardt & Hinshaw, 1994). Peer rejection in turn has been associated with negative long-term outcomes including substance abuse, school dropout, delinquency, academic problems, and higher rates of psychopathology (Greene, Biederman, Faraone, Sienna, & Garcia-Jetton, 1997; Klein & Mannuzza, 1991). Further, rejection limits a child's opportunity to practice social skills and as such exacerbates social problems (Hoza, 2007). Importantly, social difficulties are not limited to childhood and account for frequent job loss and increased divorce rates in adults with ADHD (Friedman et al., 2003).

Social problems in ADHD have primarily been attributed to impulsivity (e.g., interrupting, difficulty waiting turn) and inattention (e.g., not listening) (Barkley, 1997; Landau, Milich, & Diener, M., 1998), as well as to specific comorbid problems (e.g., oppositional behavior or anxiety) (Hodgens, Cole, & Boldizar, 2000; Mikami, Ransone, & Calhoun, 2011). In addition, social impairment has been related to lack of social knowledge (Grenell, Glass, & Katz, 1987), neuropsychological (Barkley, 1997; Huang-Pollock, Mikami, Piffner, & McBurnett, 2009), and social information processing deficits (Crick & Dodge, 1994).

Findings in support for these explanations have been inconsistent. Thus, existing treatments for ADHD, although helpful in treating core symptoms, have limited effectiveness at improving social skills (Hoza et al., 2005a), suggesting that social deficits are not fully explained by the disorder. While some studies show effectiveness of social skills training programs in children with ADHD, generalization beyond the treatment setting is limited (Piffner & McBurnett, 1997; de Boo & Prins, 2007; Beelman, Pffingsten, & Lösel, 1994), suggesting that lack of social knowledge does not fully account for the social impairment.

Language problems are also common, reportedly occurring in nearly half of children with ADHD (Tirosh & Cohen, 1998; Cohen et al., 2000). Children with ADHD have a later onset of talking (Hartsough & Lambert, 1985) and are less mature in their self-speech (Berk & Potts, 1991). Reports on the nature of language deficits in ADHD have been inconsistent, with several studies suggesting that language difficulties in ADHD may be primarily

characterized by impairment in pragmatics (Camarata & Gibson, 1999; Kim & Kaiser, 2000; Baird, Stevenson, & Williams, 2000). Pragmatics is defined as the social use of language (Prutting & Kirchner, 1987). It is the domain of language that manages how other aspects of language (phonology, semantic, morphology, and syntax) are used in conversational contexts (Russell, 2007). Pragmatics is a heterogeneous construct that includes both verbal (language) and non-verbal (gestures) skills. It can be divided into separate domains including discourse management (skills to initiate, maintain, and end a conversation), presupposition (assumptions about the conversational partner and the specific social context, theory of mind), and narrative discourse (ability to generate a successful narrative) (Landa, 2005; Adams, 2002). Although general language ability is typically correlated with pragmatic skills (Astington & Jenkins, 1999), pragmatic deficits can occur independent of general language problems. Impairment in pragmatic language has been shown to contribute to problems in school functioning/performance, peer relationships and overall psychiatric adjustment, and is associated with many psychiatric disorders (Landa, 2005).

Given that communication requires the ability to initiate, respond, and maintain attention, it is not surprising that several symptoms of ADHD are associated with pragmatic deficits (Bruce, Thernlund, & Nettelbladt, 2006). Camarata and Gibson (1999) reviewed ADHD symptoms in relation to pragmatic skills and showed that both inattention and hyperactivity/impulsivity can interfere with verbal and non-verbal aspects of communication, including staying on topic and maintaining proper physical proximity. Pragmatic deficits in children with ADHD have been reported by parents and teachers (Humphries, Koltun, Malone, & Roberts, 1994; Bishop & Baird, 2001; Bignell & Cain, 2007). Bishop and Baird (2001) found that not only were children with ADHD rated as having more pragmatic deficits and social difficulties compared to typically developing children, but ratings of their pragmatic skills were only marginally different from children with Autism Spectrum Disorder (ASD). Similar to ASD, children with ADHD were rated as having relatively more difficulties with pragmatics than with structural language (Geurts et al., 2004; Geurts & Embrechts, 2008).

While pragmatic deficits have been linked to social impairment in other clinical populations, to date only one study examined a similar association in ADHD. Leonard, Milich, and Lorch (2011) assessed pragmatic language in a community sample of children with varying levels of hyperactivity and inattention and examined whether pragmatic deficits mediate the relation between hyperactivity/inattention and social skills. They found that pragmatic language fully mediated the relation between hyperactivity and social skills, and partially mediated the relation between inattention and social skills. While an important start, these findings were limited by the use of only parent ratings to assess both pragmatic language and social skills.

This study extends the question to a sample of children who meet diagnostic criteria for ADHD. The aim was to systematically evaluate pragmatic language abilities using an array of measures to more fully characterize the nature of pragmatic deficits and to examine the degree to which pragmatic deficits affect social skills in children with ADHD. Specifically we hypothesized that a) as compared to their typically-developing peers, children with ADHD will show pragmatic deficits that will be evident over and above receptive and expressive language problems; and b) pragmatic deficits will account for a significant

portion of the variance in social impairment in children with ADHD, such that the relation between ADHD and social impairment will be reduced when controlled for pragmatic deficits (partial mediator effect).

Method

Participants

Participants were recruited from an ongoing longitudinal study of children with ADHD. The original sample included preschoolers with elevated (at-risk group) and low (typically-developing group) parent and teacher-rated symptoms of ADHD. Exclusion criteria were: ASD, neurological disorder, severe receptive and/or expressive language delays based on developmental history and a WISC-IV VCI less than 80 at age 6, a chronic illness requiring systemic medication other than psychostimulants for ADHD (two participants taking stimulants withheld medication the day of evaluation), or a Full Scale IQ less than 80. Children had to be proficient in English and attending school. Parents of children eligible for the study were contacted via letters inviting them to participate in a study of pragmatic language and ADHD. Families that expressed interest were invited to come to the laboratory for an evaluation. The study procedures were explained to participants and written parental consent was obtained. All research procedures were approved by the university's Institutional Review Board.

The sample consisted of 63 children ages 7 – 11 years (mean (SD) = 8.88 (1.49)). Children in the ADHD group (N = 28) met DSM-IV-TR criteria for ADHD at the time of their last annual evaluation from the longitudinal study (mean (SD) time interval = 21 (17) weeks), based on parent and teacher ratings and a semi-structured interview with the parent(s); 8 children met criteria for Predominantly Inattentive type, 1 for Predominantly Hyperactive-Impulsive type, and 19 for Combined type. Children in the typically-developing group (TD, N = 35) never met criteria for ADHD. Among the sample, 38 children were Caucasian, 7 were African-American, 8 were Asian, and 10 were of mixed descent; 18 children were Hispanic. Mean socioeconomic status was 63.56 as measured by the Nakao and Treas (1990) scale, representing, on average, a middle class sample. Demographic characteristics are presented in Table 1.

Procedure

Children and their parents visited the laboratory for a two-hour evaluation during which children were administered several measures to assess pragmatic, expressive, and receptive language functioning. Parents completed rating scales of children's pragmatic and social skills. Following the evaluation, the examiner completed the Child Autism Rating Scale (Schopler, Reichler, & Renner, 1988). All measures are described below:

Diagnostic measures

Attention-Deficit/Hyperactivity Disorder Rating Scale, Fourth Edition (ADHD-RS-IV; DuPaul, Power, Anastopolous, & Reid, 1998)—The ADHD-RS-IV, which was completed by parents and teachers, consists of the 18 DSM-IV ADHD symptoms. Data

from these scales were integrated with parent reports on the semi-structured interview to formulate diagnoses.

Child Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 1988)—The CARS was completed by the evaluator following the testing session to rule out ASD. A cutoff of 10 out of 15 was considered exclusionary; no participant received a score higher than five.

Kiddie-Schedule for Affective Disorders and Schizophrenia, Present and Lifetime Version (K-SADS-PL; Kaufman et al., 1997)—The KSADS-PL is a reliable, commonly-used, semi-structured child psychiatric interview that was administered to parents. Along with information provided during the interview, parent and teacher ratings on the ADHD-RS, as well as behavioral observations of the child during testing were used to arrive at a diagnosis. Diagnostic data from the most recent interview for the longitudinal study were used. For one child in the ADHD group who did not complete his concurrent annual evaluation, the diagnosis was derived based on the parent-rated ADHD-RS completed at the time of this study and history from multiple previous evaluations as part of the longitudinal project.

Pragmatic language

The assessment of pragmatic language poses several challenges. First, pragmatics is a heterogeneous construct that includes an array of verbal and non-verbal skills, making it difficult to assess with a single measure (Russell, 2007; Landa, 2005). Further, because by definition pragmatics is tied to social context, assessment of pragmatic skills via standardized testing may not reflect one's true abilities to use language in a natural setting. As such, a combination of formal tests, parent questionnaires and discourse analysis was used.

Children's Communicative Checklist, Second Edition (CCC-2; Bishop, 2003)—The CCC-2 is a 70-item questionnaire designed to assess children's skills in various areas of language, including pragmatics. The CCC-2 provides standard scores for 10 scales, four of which (Coherence, Initiation, Scripted Language, and Context) focus on verbal and non-verbal pragmatic skills. Similar to Leonard et al. (2011) and Bignell and Cain (2007), we calculated the pragmatic language composite by using the sum of pragmatic language subscales.

Comprehensive Assessment of Spoken Language (CASL; Carrow-Woodfolk, 1999)—The Nonliteral Language, Inferences, and Pragmatic Judgment subtests from the CASL, a standardized language battery, were used to assess children's pragmatic abilities. The Nonliteral Language subtest requires children to interpret the meaning of sentences that contain words used in their nonliteral, figurative meaning (e.g., "At 8pm Dad said to his daughter, "I think your doll is yawning". What did Dad really mean?"). For the Inferences subtest, children were read brief stories in which some information was omitted. Children have to answer questions by inferring information from the context (e.g., "Mary wanted a glass of milk, but after looking in the refrigerator, she drank orange juice instead. Why?").

For the Pragmatic Judgment subtest, children were read brief passages describing a situation requiring communication and were asked to provide an appropriate response (e.g., “Cassie spills her milk at the table. What does she say to her mother?”). Each subtest yielded an age-normed standard score.

Test of Pragmatic Language, Second Edition (TOPL-2; Phelps-Terasaki & Phelps-Gunn, 2007)—TOPL-2 elicits functional communicative interactions by using scenarios from common settings. Participants were shown pictures and read brief stories describing a social interaction and then asked questions that involved making inferences about the story and the characters. Responses were scored based on several criteria such as making reference to the context, appreciation of the facial expressions, emotional state of the characters, etc. A Pragmatic Language Usage (PLU) index expressed as a standard score was generated.

Narrative Assessment Profile: Discourse Analysis (NAP; Bliss, McCabe, & Melinda, 1998)—Children were presented with a wordless picture book “The Snowman” (Briggs, 1978) and asked to produce a narrative describing the story depicted in the book and to tell as exciting a story as they can. *The Snowman* was chosen based on its child-friendly content with high pragmatic load (e.g., interactions between the child and the snowman, the child feeling sorry for the snowman). Children were instructed to look through all of the pages before telling the story and were allowed to look at the pictures while telling the story. Children's narratives were recorded and transcribed verbatim. Transcriptions were coded using the NAP blind to the child's group status.

NAP is a discourse analysis approach that assesses several domains of oral discourse, including (1) topic maintenance, (2) event sequencing, (3) informativeness (4) referencing, (5) conjunctive cohesion, and (6) fluency (for detailed description of each dimension see Bliss, McCabe, and Miranda, 1998). The narratives were coded on the six dimensions using a quantitative scoring metric adapted for this study. Topic maintenance, event sequencing, informativeness, and conjunctive cohesion were rated on a 3-point scale. Referencing was rated on a 4-point scale. To assess fluency, each instance of dysfluency, such as word repetition or false start, was counted and added to calculate the total fluency score. To assess inter-rater reliability, nine randomly selected narratives (15% of total) were also coded by an author of NAP (AM). Correlation coefficients for the six dimensions ranged from .5 to 1; the reliability for the total score was .98 ($p < .001$). Cases where discrepancy was found were discussed to reach consensus.

Deriving Pragmatic Language Constructs

The pragmatic language battery was used to generate separate measures of Discourse Management, Presupposition and Narrative Discourse. The pragmatic language composite from the CCC-2 was used to assess Discourse Management. A principal component analysis of the subtests from the CASL and the TOPL-2 was used to create a test-based composite measure of pragmatic language. The analysis generated a unitary factor which accounted for 70% of the variance with good internal consistency ($\alpha = 0.84$). Individual factor scores were saved and used to measure Presupposition. To measure of Narrative Discourse, the six

story dimensions from the NAP were examined for face and convergent validity. Based on the descriptions of each dimension, topic maintenance, event sequencing, and referencing were selected to comprise the Narrative Discourse composite. This composite score was significantly correlated with parent ratings of pragmatic language (Discourse Management; $r = .291$, $p = .025$) and test-based factor score (Presupposition; $r = .465$, $p < .001$), while the three dimensions that were not included in the composite (informativeness, fluency, and conjunctive cohesion) were not correlated with the other two measures of pragmatic language, indicating good convergent and divergent validity of the composite. These three measures of pragmatic language were used in subsequent analyses.

General Language

Clinical Evaluation of Language Fundamentals, Fourth Edition (CELF-4; Semel, Wiig, & Secord, 2003)—CELF-4 is a widely used measure of language skills. The Concepts and Following Directions, and Formulated Sentences subtests were administered to assess receptive and expressive language abilities, respectively. For the former, children had to point to visually presented stimuli in the same order as instructed by the examiner. For the latter, children were presented with pictures and asked to produce a sentence with a target word based on the picture. Age-based scaled scores were generated for both subtests. The sum of the two was used in the analyses as a composite measure of general language.

Social skills

Social Skills Improvement System (SSIS; Gresham & Elliott, 2008)—The SSIS is a rating scale that measures social behavior of children (e.g., cooperation, empathy, self-control), as well as problematic behaviors and academic competence. The social skills composite was used in the analyses. Participants' social skills ratings and performance on language measures are depicted in Table 2a.

Data Analyses

The hypothesis that children with ADHD will show pragmatic language deficits was tested using multivariate analysis of covariance (MANCOVA) comparing the ADHD and TD groups on the three pragmatic language constructs. Receptive/expressive language abilities were used as a covariate.

The hypothesis that social skills deficits in children with ADHD are largely accounted for by pragmatic language deficits (partial mediation model) was tested in two steps. First, bivariate correlations were calculated among independent (ADHD status), dependent (social skills), and potential mediator (pragmatic language) variables to satisfy the requirement of mediation (Baron & Kenny, 1986). Next, following procedures established by MacKinnon, Krull, and Lockwood (2000), a series of multiple linear regressions were computed to calculate the effects of the independent variable on the dependent variable with the proposed mediators in the model. More specifically, social skills were regressed on pragmatic skills; next, social skills were regressed on ADHD (group), and finally social skills were regressed on both pragmatic skills and ADHD status. A reduction of the effect after including both factors in the model would suggest the mediating effect of pragmatic skills. Separate

analyses were conducted with three pragmatic language constructs. Receptive but not expressive language abilities were correlated with social skills and as such were used as a covariate (Table 3b).

Results

The MANCOVA indicated significant group differences on measures of pragmatic language ($F = 44.120$, $p < .001$, Wilk's $\lambda = .286$, $\eta_p^2 = .714$). As indicated in Table 2b, follow-up univariate ANCOVAs indicated that after controlling for general language scores children with ADHD had significantly poorer pragmatic language skills as measured by Discourse Management ($F = 36.509$, $p < .001$, $\eta_p^2 = .570$), Presupposition ($F = 16.643$, $p < .001$, $\eta_p^2 = .377$) and Narrative Discourse ($F = 7.062$, $p = .002$, $\eta_p^2 = .204$).

As shown in Table 3a, there were significant correlations among all study variables with the exception of that between Narrative Discourse and social skills. However, after controlling for general language abilities (Table 3b), only Discourse Management was significantly correlated with both ADHD and the measure of social skills. As it is critical to control for general language in order to specifically assess the impact of pragmatic language, mediation analysis could only be conducted using the Discourse Management measure of pragmatics.

After controlling for receptive language difficulties, ADHD was a significant predictor of social skills contributing to 40% of the variance in social skills ($B = -22.835$, $\beta = -.626$, $p < .001$). However, when Discourse Management was added into the model, there was a significant reduction in B (Sobel SE = -5.22 , $p < .001$) and the association between ADHD and social skills was no longer significant ($B = -8.814$, $\beta = -.241$, $p = .097$), indicating that Discourse Management fully mediated the relation between ADHD and social skills (see Figure 1).

Discussion

This is the first study to demonstrate that children with ADHD have a wide array of pragmatic language problems, which are evident over and above general language functioning, irrespective of measurement approach. More specifically, relative to their typically-developing peers, children with ADHD have difficulties with discourse management, presupposition, and narrative discourse. Although certain discourse management skills overlap with ADHD symptoms (e.g., turn-taking, interrupting), skills related to presupposition and narrative discourse cannot be directly accounted for by ADHD symptoms. These findings are consistent with literature suggesting that pragmatic deficits can occur independent of general language difficulties (Bishop et al., 2000) and provide evidence of this dissociation in ADHD.

Further, we found that pragmatic language skills, as measured by parent ratings of discourse management, fully mediated the relation between ADHD and social skills, whereby after including discourse management in the model, ADHD was no longer a significant predictor of social impairment. Pragmatic language as measured by presupposition and narrative discourse did not mediate this relation.

Thus, our findings revealed different relations between pragmatics and social skills depending on the measure of pragmatic language used. Several possible explanations can be offered for such discrepancy. First, the three pragmatic language areas refer to distinct abilities, which may have development-specific implications for social functioning. For example, interrupting others in conversation may have a more direct adverse effect on popularity among childhood peers than difficulty understanding irony and sarcasm, which may have a greater impact on social functioning later in life. Another possible explanation for the discrepancy across areas of pragmatic language is that pragmatics is a complex and heterogeneous construct that is difficult to measure (Adams, 2002). As discussed above, pragmatic language includes a wide range of verbal and non-verbal abilities, all of which are important in social interactions. Since pragmatic language by definition refers to the social use of language, it is particularly difficult to measure through laboratory testing, and the ecological validity of pragmatic language tests may be limited; as such, ratings scales may be a better approach to measuring pragmatic language skills in a natural setting. In addition, discourse management skills may be easier to observe and rate compared to other aspects of pragmatic language. The issue of test ecological validity has been widely discussed in the field of neuropsychological testing where similar discrepancy has been described between performance-based and rating scale measures of executive functions (Sbordone, 1996; Sbordone & Guilmette, 1999). Notably, ratings of discourse management and social skills were completed by parents, possibly creating a method bias. However, close examination of items on both scales indicated that only 4 items on both scales were similar; thus, although the scales were completed by the same rater, the correlation is unlikely to be due to item overlap.

This study differed from previous attempts to evaluate pragmatic language in ADHD in several important ways. First, it used a comprehensive battery to assess pragmatic language skills, which included parent ratings, standardized tests, and a narrative task, while previous studies primarily employed ratings only (Geurts et al., 2004; Leonard et al., 2011). Second, whereas previous studies examined children with elevated levels of parent-rated inattention and hyperactivity (Leonard et al, 2011; Bignell & Cain, 2007), our sample was carefully diagnosed with ADHD based on a comprehensive evaluation. Finally, our sample was ethnically diverse, which increases external validity of the study.

Whereas our data regarding the diversity of pragmatic language deficits in children with ADHD are compelling, the mediating role of discourse management in the relation between ADHD and social skills requires further confirmation due to the potential for method bias discussed above. It will be critical for future studies to collect ratings from a separate informant. Alternatively, observation of children engaging in a social interaction with peers could provide another source of information for both pragmatic and social skills. In addition, children with severe language problems were excluded from this study. In light of the high comorbidity between ADHD, language disorders, and social problems, it would be important to evaluate pragmatic language skills of children with ADHD and comorbid language difficulties in order to assess specific impairment patterns.

In summary, we found that children with ADHD have less developed skills compared to their typically developing peers across multiple aspects of pragmatic language, which was

evident after controlling for general language abilities. Further, our results indicated that pragmatic language deficits as measured by parent ratings of discourse management mediated the social impairment seen in ADHD. These findings have important clinical implications and suggest that for many children with ADHD it might be advantageous for social skills interventions to address pragmatic deficits in addition to social skills. Importantly, given the wide range of pragmatic skills and possible deficit profiles, as well as distinct implications of specific skills on social functioning, such interventions would be most useful when tailored to the child. This could potentially provide a new framework for developing treatment approaches, which is important in light of limited effectiveness of existing treatments.

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References

- Adams C. Practitioner Review: The assessment of language pragmatics. *Journal of Child Psychology and Psychiatry*. 2002; 43:973–987. [PubMed: 12455920]
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed.. Author; Washington, DC: 1994.
- Astington JW, Jenkins JM. A longitudinal study of the relation between language and theory-of-mind development. *Dev.Psychol*. 1999; 35:1311–1320. [PubMed: 10493656]
- Baird J, Stevenson JC, Williams DC. The evolution of ADHD: a disorder of communication? *Q.Rev.Biol*. 2000; 75:17–35. [PubMed: 10721532]
- Barkley RA. Behavioral inhibition, sustained attention, and executive functions: constructing a unifying theory of ADHD. *Psychol.Bull*. 1997; 121:65–94. [PubMed: 9000892]
- Barkley RA, DuPaul GJ, McMurray MB. Comprehensive evaluation of attention deficit disorder with and without hyperactivity as defined by research criteria. *J.Consult Clin.Psychol*. 1990; 58:775–789. [PubMed: 2292627]
- Beelman A, Pfungsten U, Lösel F. Effects of training social competence in children: A meta-analysis of recent evaluation studies. *Journal of Clinical Child Psychology*. 1994; 23(3):260–271.
- Berk LE, Potts MK. Development and functional significance of private speech among attention-deficit hyperactivity disordered and normal boys. *J.Abnorm.Child Psychol*. 1991; 19:357–377. [PubMed: 1865050]
- Bickett L, Milich R. First impressions formed of boys with learning disabilities and attention deficit disorder. *J.Learn.Disabil*. 1990; 23:253–259. [PubMed: 2324638]
- Bignell S, Cain K. Pragmatic aspects of communication and language and comprehension in groups of children differentiated by teacher ratings of inattention hyperactivity. *British Journal of Developmental Psychology*. 2007; 25:499–512.
- Bishop DV, Baird G. Parent and teacher report of pragmatic aspects of communication: use of the children's communication checklist in a clinical setting. *Dev.Med.Child Neurol*. 2001; 43:809–818. [PubMed: 11769267]
- Bishop DV. Development of the Children's Communication Checklist (CCC): a method for assessing qualitative aspects of communicative impairment in children. *J.Child Psychol.Psychiatry*. 1998; 39:879–891. [PubMed: 9758196]
- Bishop, DV. The Children's Communication Checklist version 2 (CCC-2). Psychological Corporation; London: 2003.
- Bliss LS, McCabe A, Miranda AE. Narrative Assessment Profile: discourse analysis for school-age children. *J.Commun.Disord*. 1998; 31:347–362. [PubMed: 9697044]

- Bruce B, Thernlund G, Nettelbladt U. ADHD and language impairment: A study of the parent questionnaire FTF (Five to Fifteen). *Eur.Child Adolesc.Psychiatry*. 2006; 15:52–60. [PubMed: 16514510]
- Camarata SM, Gibson T. Pragmatic Language Deficits in Attention-Deficit Hyperactivity Disorder (ADHD). *Ment.Retard.Dev.Disabil.Res.Rev*. 1999; 5:207–214.
- Carrow-Woolfolk, E. CASL comprehensive assessment of spoken language manual. Author; Circle Pines, MN: 1999.
- Cohen NJ, Vallance DD, Barwick M, Im N, Menna R, Horodezky NB, Isaacson L. The interface between ADHD and language impairment: an examination of language, achievement, and cognitive processing. *J.Child Psychol.Psychiatry*. 2000; 41:353–362. [PubMed: 10784082]
- Crick NR, Dodge KA. A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin*. 1994; 115:74–101.
- de Boo GM, Prins PJ. Social incompetence in children with ADHD: possible moderators and mediators in social-skills training. *Clin.Psychol.Rev*. 2007; 27:78–97. [PubMed: 16814435]
- DuPaul GJ, McGoey KE, Eckert TL, VanBrakle J. Preschool children with attention-deficit/hyperactivity disorder: impairments in behavioral, social, and school functioning. *J.Am.Acad.Child Adolesc.Psychiatry*. 2001; 40:508–515. [PubMed: 11349694]
- DuPaul, GJ.; Power, TJ.; Anastopoulos, AD.; Reid, R. ADHD Rating Scale–IV. Guilford; New York: 1998.
- Erhardt D, Hinshaw SP. Initial sociometric impressions of attention-deficit hyperactivity disorder and comparison boys: predictions from social behaviors and from nonbehavioral variables. *J.Consult Clin.Psychol*. 1994; 62:833–842. [PubMed: 7962888]
- Friedman SR, Rapport LJ, Lumley M, Tzelepis A, VanVoorhis A, Stettner L, Kakaati L. Aspects of social and emotional competence in adult attention-deficit/hyperactivity disorder. *Neuropsychology*. 2003; 17:50–58. [PubMed: 12597073]
- Geurts HM, Embrechts M. Language profiles in ASD, SLI, and ADHD. *J.Autism Dev.Disord*. 2008; 38:1931–1943. [PubMed: 18521730]
- Geurts HM, Verte S, Oosterlaan J, Roeyers H, Hartman CA, Mulder EJ, Berckelaer-Onnes IA, Sergeant JA. Can the Children's Communication Checklist differentiate between children with autism, children with ADHD, and normal controls? *J.Child Psychol.Psychiatry*. 2004; 45:1437–1453. [PubMed: 15482504]
- Greene RW, Biederman J, Faraone SV, Sienna M, Garcia-Jetton J. Adolescent outcome of boys with attention-deficit/hyperactivity disorder and social disability: results from a 4-year longitudinal follow-up study. *J.Consult Clin.Psychol*. 1997; 65:758–767. [PubMed: 9337495]
- Grenell MM, Glass CR, Katz KS. Hyperactive children and peer interaction: knowledge and performance of social skills. *J.Abnorm.Child Psychol*. 1987; 15:1–13. [PubMed: 3571733]
- Gresham, FM.; Elliott, SN. Social Skills Improvement System—Rating Scales. Pearson Assessments; Minneapolis: 2008.
- Hartsough CS, Lambert NM. Medical factors in hyperactive and normal children: prenatal, developmental, and health history findings. *Am.J.Orthopsychiatry*. 1985; 55:190–201. [PubMed: 4039534]
- Hodgens JB, Cole J, Boldizar J. Peer-based differences among boys with ADHD. *J.Clin.Child Psychol*. 2000; 29:443–452. [PubMed: 10969428]
- Hoza B. Peer functioning in children with ADHD. *J.Pediatr.Psychol*. 2007; 32:655–663. [PubMed: 17556400]
- Hoza B, Gerdes AC, Mrug S, Hinshaw SP, Bukowski WM, Gold JA, Arnold LE, Abikoff HB, Conners CK, Elliott GR, Greenhill LL, Hechtman L, Jensen PS, Kraemer HC, March JS, Newcorn JH, Severe JB, Swanson JM, Vitiello B, Wells KC, Wigal T. Peer-assessed outcomes in the multimodal treatment study of children with attention deficit hyperactivity disorder. *J.Clin.Child Adolesc.Psychol*. 2005; 34:74–86. [PubMed: 15677282]
- Hoza B, Mrug S, Gerdes AC, Hinshaw SP, Bukowski WM, Gold JA, Kraemer HC, Pelham WE Jr. Wigal T, Arnold LE. What aspects of peer relationships are impaired in children with attention-deficit/hyperactivity disorder? *J.Consult Clin.Psychol*. 2005; 73:411–423. [PubMed: 15982139]

- Huang-Pollock CL, Mikami AY, Piffner L, McBurnett K. Can executive functions explain the relationship between Attention Deficit Hyperactivity Disorder and social adjustment? *J.Abnorm.Child Psychol.* 2009; 37:679–691. [PubMed: 19184400]
- Humphries T, Koltun H, Malone M, Roberts W. Teacher-identified oral language difficulties among boys with attention problems. *J.Dev.Behav.Pediatr.* 1994; 15:92–98. [PubMed: 8034773]
- Kaufman J, Birmaher B, Brent D, Rao U, Flynn C, Moreci P, Williamson D, Ryan N. Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL): initial reliability and validity data. *J.Am.Acad.Child Adolesc.Psychiatry.* 1997; 36:980–988. [PubMed: 9204677]
- Kim OH, Kaiser AP. Language characteristics of children with attention deficit hyperactivity disorder. *Communication Disorders Quarterly.* 2000; 21:154–165.
- Klein RG, Mannuzza S. Long-term outcome of hyperactive children: a review. *J.Am.Acad.Child Adolesc.Psychiatry.* 1991; 30:383–387. [PubMed: 2055874]
- Landa RJ. Assessment of social communication skills in preschoolers. *Ment.Retard.Dev.Disabil.Res.Rev.* 2005; 11:247–252. [PubMed: 16161095]
- Landau S, Milich R, Diener M. Peer relations of children with attention-deficit hyperactivity disorder. *Reading and Writing Quarterly: Overcoming Learning Difficulties.* 1998; 14(1):83–105.
- Leonard MA, Milich R, Lorch EP. The role of pragmatic language use in mediating the relation between hyperactivity and inattention and social skills problems. *J.Speech Lang Hear.Res.* 2011; 54:567–579. [PubMed: 20719870]
- MacKinnon DP, Krull JL, Lockwood CM. Equivalence of the mediation, confounding, and suppression effect. *Prevention Science.* 2000; 1:173–181. [PubMed: 11523746]
- Mikami AY, Ransone ML, Calhoun CD. Influence of anxiety on the social functioning of children with and without ADHD. *J.Atten.Disord.* 2011; 15:473–484. [PubMed: 20574058]
- Nakao K, Treas J. Updating Occupational Prestige and Socioeconomic Scores - How the New Measures Measure Up. *Sociological Methodology.* 1994; 24:1–72.
- Piffner LJ, McBurnett K. Social skills training with parent generalization: treatment effects for children with attention deficit disorder. *J. Consult Clin.Psychol.* 1997; 65:749–757.
- Phelps-Terasaki, D.; Phelps-Gunn, T. TOPL-2 Test of Pragmatic Language: Examiner's Manual. 2 ed.. Pro-ed Inc; Shoal Creek Boulevard, Austin, Texas: 2007.
- Prutting CA, Kirchner DM. A clinical appraisal of the pragmatic aspects of language. *J.Speech Hear.Disord.* 1987; 52:105–119. [PubMed: 3573742]
- Russell RL. Social communication impairments: pragmatics. *Pediatr.Clin.North Am.* 2007; 54:483–506. [PubMed: 17543906]
- Sbordone, RJ.; Guilmette, TJ. Ecological validity: Prediction of everyday and vocational functioning from neuropsychological test data.. In: Sweet, J., editor. *Forensic neuropsychology: Fundamentals and practice. Studies on neuropsychology, development, and cognition.* Swets & Zeitlinger; Lisse, Netherlands: 1999. p. 185-226.
- Sbordone, RJ. Ecological validity: Some critical issues for the neuropsychologist.. In: Sbordone, CJLRJ., editor. *Ecological validity of neuropsychological testing.* Gr Press/St Lucie Press, Inc; Delray Beach, FL: 1996. p. 15-41.
- Schopler, E.; Reichler, RJ.; Renner, BR. *The Childhood Autism Rating Scale.* Western Psychological Services; Los Angeles: 1988.
- Semel, E.; Wiig, EH.; Secord, WA. *Clinical Evaluation of Language Fundamentals.* 4th ed.. Psychological Corporation; San Antonio, TX: 2003.
- Tirosh E, Cohen A. Language deficit with attention-deficit disorder: a prevalent comorbidity. *J.Child Neurol.* 1998; 13:493–497. [PubMed: 9796755]

Key Points

- Consistent with other reports, we showed that children with ADHD have less developed pragmatic language skills relative to their typically-developing peers.
- Pragmatic language difficulties were seen across multiple measures over and above receptive and expressive language problems.
- Parent-rated pragmatic language difficulties mediated social skills impairment in children with ADHD.
- Findings have implications for social skills interventions for children with ADHD.

Figure 1.
Mediation Model Using Ratings of Discourse Management.

Figure 2.
The Relation between Discourse Management and Social Skills.

Table 1

Sample Characteristics

Variable	ADHD (N = 28)	TD (N = 35)	t/ χ^2	p
Age (years) M (SD)	8.62 (1.86)	9.08 (1.08)	1.15	.258
Sex (% male)	82.1	68.6	1.51	.219
SES M (SD)	55.54 (14.06)	69.97 (16.23)	3.78	< .001
Race	57.1% W 5.7% AA 20% A 17.1% Mixed	64.3% W 17.9% AA 3.6% A 14.3% Mixed	5.58	.134
ADHD KSADS Mean Total Score (0 – 36)	27.46	5.69	-15.38	< .001

Table 2a

Group Differences on Measures of Language and Social Skills.

Measure	ADHD (28) Mean (SD)	TD (35) Mean (SD)	F	P
Concepts and Following Directions (CELF-4)	9.18 (2.09)	10.97 (2.07)	11.594	.001
Formulated Sentences (CELF-4; TD N = 34)	9.32 (2.45)	10.94 (2.28)	7.237	.009
Nonliteral Language (CASL)	103.78 (13.58)	113.06 (15.85)	5.904	.018
Inferences (CASL)	98.22 (10.95)	106.94 (10.19)	10.548	.002
Pragmatic Judgment (CASL)	97.82 (9.43)	109.63 (11.94)	18.240	<.001
Pragmatic Language Usage (TOPL-2)	82.57 (7.25)	87.20 (8.73)	5.071	.028
Social Skills (SSIS)	80.54 (16.20)	103.66 (12.51)	40.874	<.001

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Group Differences on Measures of Discourse Management, Presupposition, and Narrative Discourse after Controlling for General Language Abilities.

Table 2b

Pragmatic language Measure	ADHD (25) Mean (SD)	TD (33) Mean (SD)	F	P	Partial Eta ²
Discourse Management	32.00 (6.00)	45.67 (6.07)	36.509	<.001	.570
Presupposition (z-score)	-.46 (.81)	.35 (1.0)	16.643	<.001	.377
Narrative Discourse	4.08 (1.26)	5.18 (1.10)	7.062	.002	.204

Table 3a

Zero-order Correlations among ADHD, Pragmatic Language, and Social Skills.

	ADHD	Discourse Management	Presupposition	Narrative Discourse	CFD	FS
Discourse Management	-.740**					
Presupposition	-.434**	.357**				
Narrative Discourse	-.429**	.291*	.465**			
Concepts and Following Directions (CFD)	-.400**	.244	.415**	.257*		
Formulated Sentences (FS)	-.328**	.230	.502**	.268*	.351**	
Social Skills	-.633**	.693**	.290	.088	.270*	.093

Table 3b

Partial Correlations among ADHD, Pragmatic Language, and Social Skills after Controlling for Receptive Language.

	ADHD	Discourse Management	Presupposition	Narrative Discourse
Discourse Management	-.761 **			
Presupposition	-.315 *	.282 *		
Narrative Discourse	-.371 **	.263 *	.411 **	
Social Skills	-.625 **	.669 **	.190	.029

**
p < .01

*
p < .05