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Merely Misunderstood? Receptive, Expressive, and Pragmatic Language in Young Children With Disruptive Behavior Disorders

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Abstract

Children with disruptive behavior disorders (DBDs) often seem to have poorer language skills compared to same-age peers; however, language as an early risk factor for DBD has received little empirical attention. The present study provides an empirical examination of associations between normal language variation and DBD by investigating receptive, expressive, and pragmatic language skills and preschool DBD symptoms. The sample consisted of 109 preschoolers ages 3 to 6 ($M = 4.77$ years, $SD = 1.10$, 59% boys; 73% with DBD, including oppositional defiant disorder [ODD] and attention-deficit/hyperactivity disorder [ADHD]) along with their primary caregivers, who completed a clinician-administered interview, symptom questionnaires, and a questionnaire measure of pragmatic language, and teacher and/or daycare providers completed symptom questionnaires. Children completed objective tests of receptive and expressive vocabulary. Preschoolers with DBD showed poorer receptive, expressive, and pragmatic skills compared to preschoolers without DBD. Preschoolers with ADHD-only or ADHD+ODD exhibited poorer language skills, compared to ODD and non-DBD groups. Specificity analyses suggested that parent-rated hyperactivity-impulsivity were particularly associated with poorer language skills. Thus, preschoolers with DBD exhibited poorer language skills compared to preschoolers without DBD, and preschoolers with increased hyperactivity-impulsivity exhibited particular problems with language skills. This work suggests the need for early assessment of language in preschoolers, particularly those with ADHD, as well as the possible utility of tailored interventions focused on improving language skills, particularly for those with high hyperactivity-impulsivity.

More than 50% of well-child visits to pediatricians during preschool involve concerns related to disruptive behavior problems (Arndorfer, Allen, & Aliazireh, 1999), and approximately 10% of preschool-aged children are diagnosed with disruptive behavior disorders (DBDs; Egger & Angold, 2006; Wakschlag et al., 2007). Per the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev. [DSM-IV-TR]; American Psychiatric Association [APA], 2000), DBD is an overarching diagnostic category that includes oppositional defiant disorder (ODD) and attention-deficit/hyperactivity disorder (ADHD), with approximately 50% of children diagnosed with one disorder also diagnosed with the other (Egger & Angold, 2006). ODD is a common childhood behavioral disorder characterized by angry and irritable mood, headstrong behavior, and vindictiveness

(Stringaris & Goodman, 2009) with a prevalence rate of approximately 10% in preschool-aged children (Egger & Angold, 2006). ADHD is a childhood behavioral disorder characterized by symptoms of inattention, hyperactivity, and impulsivity (APA, 2000) with a prevalence rate of approximately 8% in preschool-aged children (Froehlich et al., 2007). DBDs exhibit a chronic course from preschool throughout childhood and into adolescence and young adulthood (Faraone & Biederman, 2005). Further, DBDs are impairing and have a negative impact on children's later academic and social development (APA, 2000; Hamilton & Armando, 2008; Speltz, McClellan, DeKlyen, & Jones, 1999). Thus, elucidation of early potential risk factors of DBD is important to allow for early identification of DBD and targeted early intervention for children with DBD. Language skills are one such early-developing potential risk factor that is thought to be involved in developmental pathways to DBD (Keenan & Shaw, 2003).

Poor language skills are theorized to be a shared risk factor for DBDs, including ODD and ADHD (Keenan & Shaw, 2003). Poor language skills are associated with social withdrawal, academic underachievement, deficits in impulse regulation and attention, and increased risk of comorbid psychopathology such as DBD (van Daal, Verhoeven, & van Balkom, 2007). Further, language problems are common; approximately 7% of kindergartners (Tomblin et al., 1997) show deficits in one or more language domains, including problems with receptive (i.e., comprehension of language), expressive (i.e., spoken language), and/or pragmatic language (i.e., language use within the communicative context; Owens, 1988). Yet the extent to which poor language skills are associated with DBDs is difficult to determine. For instance, language impairment (i.e., difficulty learning language in the absence of frank neurological damage and mental retardation; Leonard et al., 2007) is commonly associated with both ODD and ADHD (Cohen et al., 1998), co-occurring in approximately 39% of cases (Redmond, 2004). Yet the association between DBDs and language delays has been reported in some studies (Gurevitz, Geva, Varon, & Leitner, 2012) but not in others (Rescorla, Ross, & McClure, 2007; Whitehouse, Robinson, & Zubrick, 2011). Further, normal variation in language skills and its association with DBD is understudied.

By age 3, clinicians can begin to reliably and validly identify young children with impaired language development through the use of standardized performance measures (Paul, 1996). Further, by this age or slightly later, DBD can be reliably diagnosed and exhibits substantial temporal stability (Keenan & Wakschlag, 2002; Lahey et al., 1994). Theory suggests that poor language skills may increase risk for DBD (Keenan & Shaw, 2003). Language abilities are theorized to facilitate the development of cognitive processes, particularly in regard to shaping attention and holding information in short-term memory (Marchman & Fernald, 2008). Notably, as children's language abilities increase so does their ability to maintain focused attention and exercise control over their environment, such that children with poorly developed receptive and expressive language skills may look, behaviorally, as if they have difficulty paying attention or as if they are oppositional (e.g., a child who does not understand what is being asked of him may seem to ignore the speaker or may respond in a frustrated, seemingly oppositional/defiant manner). Children with initial language problems are at risk for developing attention problems and deficits in voluntary control, both of which are key deficits associated with DBD (Gartstein, Crawford, & Robertson, 2008; Ruf, Schmidt, Lemery-Chalfant, & Goldsmith, 2008). However, the relationship among language

skills, cognition, and DBD-related symptoms is likely bidirectional, such that behaviors associated with DBDs are also likely to negatively affect the development of language and cognitive control.

Limited work to date has investigated children's language abilities in relation to DBD. Studies most frequently focus on ADHD and language in school-age children, or children between ages 6 and 12, and focus on complex measures of language that tap multiple facets of language development. For instance, studies focusing on oral evaluations of language may be complicated by non-language-related deficits. Cognitive processing or working memory deficits impact production and comprehension of oral narratives (Moonsamy, Jordaan, & Greenop, 2009; Papaeliou, Maniadaki, & Kakouros, 2012). Thus, investigating language fundamentals, such as receptive or expressive vocabulary, may provide a better picture of actual language skills of children with ADHD that rely more heavily on language than cognitive processing (Wise, Sevcik, Morris, Lovett, & Wolf, 2007).

Some research suggests that receptive language appears to be relatively intact in school-age with ADHD (Cohen et al., 2000) with no noticeable problems with overarching comprehension skills (Luo & Timler, 2008; Redmond, Thompson, & Goldstein, 2011); however, other studies suggests that children with ADHD have problems with comprehension (Bruce, Thernlund, & Nettelbladt, 2006). Most work on language and ADHD focuses on expressive language skills (O. H. Kim & Kaiser, 2000; Purvis & Tannock, 1997). These studies find that school-age children with ADHD have significantly lower scores on expressive language tests than same-aged peers (K. Kim & Lee, 2009; Purvis & Tannock, 1997; Re, Pedron, & Cornoldi, 2007), particularly in the domains of vocabulary, sentence structure, and phonology (i.e., speech sounds; O. H. Kim & Kaiser, 2000; Oram, Fine, Okamoto, & Tannock, 1999; van Daal et al., 2007). Pragmatic deficits have also been found in school-age children with ADHD (O. H. Kim & Kaiser, 2000). This is not surprising given the degree of conceptual overlap between pragmatic language deficits and ADHD, especially hyperactivity-impulsivity. For example, the ADHD hyperactivity-impulsivity symptoms of "often blurts out answers before questions have been completed," "often interrupts or intrudes on others," and "often talks excessively" all seem to represent instances in which the child is exhibiting problems using pragmatic language appropriately (APA, 2000).

Much less is known about the relationship between ODD and language because no work to date has directly examined that topic. However, a few studies have examined the association between language skills and physical and relational aggression, related disruptive behavior problems, findings indicated that both boys and girls with poorer receptive language skills were more likely to be physically aggressive and that girls with poorer expressive language skills were more likely to show higher levels of relational aggression (Carson, Klee, Perry, Muskina, & Donaghy, 1998; Estrem, 2005). However, an important limitation of this prior work is that it examines language abilities in school-age populations, or in children between ages 6 through 12, even though language develops most dramatically during toddlerhood and preschool (Owens, 2006), the focus on the present study. Thus, prior work may underestimate language problems in children with DBD.

The present study advances the field by providing an investigation of normal variation in receptive and expressive vocabulary and pragmatic language skills in preschoolers between ages 3 and 6 with two common DBDs: ODD and/or ADHD. Examination of normal variation in language abilities in preschoolers with DBD is critically important so as to inform targeted assessment and intervention efforts in this age range. The association between variation in specific language subdomains (i.e., receptive, expressive, and pragmatic) and DBD symptom subdomains will be systematically examined, particularly using a community-recruited sample of preschoolers aged 3 to 6 at risk for DBD and commonly used objective or questionnaire measures of simple language skills. It is hypothesized that the majority of preschoolers with DBD will exhibit lower language skills in receptive and expressive vocabulary and pragmatic language subdomains compared to typically developing preschoolers. Further, specificity of associations between DBD symptom domains and language skills is explored; based on limited prior work, it is predicted that poorer language skills will be most specifically associated with ADHD symptoms (vs. ODD symptoms).

METHODS

Participants

Overview—Participants included 109 preschoolers between the ages of 3 and 6 ($M = 4.77$ years, $SD = 1.10$; Table 1) and their primary caregivers (hereafter termed *parents* for simplicity; 69% mothers with the remaining 31% fathers + mothers, fathers only, foster parents, or grandmothers with guardianship). Fifty-nine percent of the sample was male, and 33% of the sample was ethnic minority (26% African American and 7% other including Latinos and mixed-race children). Parental education level ranged from not completing high school to completing a professional degree. Parental occupational status ranged from unemployed to highly skilled professionals, with incomes ranging from below \$20,000 to above \$100,000 annually. Based on multistage and comprehensive diagnostic screening procedures (detailed next), preschoolers were recruited into two groups: children with DBD ($n = 79$; subdivided into ADHD only [$n = 18$], ODD only [$n = 18$], and ADHD+ODD [$n = 43$]); and children without DBD ($n = 30$). Of preschoolers diagnosed with ADHD, 6 met criteria for primarily inattentive (33% with comorbid ODD), 26 for primarily hyperactive/impulsive (69% with comorbid ODD), and 29 for combined type (76% with comorbid ODD). The non-DBD group included preschoolers with subthreshold symptoms (i.e., fewer than six ADHD symptoms or four ODD symptoms) to provide a more continuous measure of ADHD and ODD symptoms, consistent with research suggesting that ADHD and ODD may be better captured by continuous measures than categorical diagnosis (e.g., Haslam et al., 2006). Further, analyses focus on symptom counts in order to be sensitive to the young age of the sample. No siblings were included.

Recruitment and identification—Participants were recruited primarily through direct mailings to families with children between the ages of 3 and 6 from the Greater New Orleans area, including urban New Orleans, suburbs of the city, and surrounding rural areas. Addresses of families with children between the ages of 3 and 6 were obtained through the U.S. Postal Service based on U.S. Census information. Advertisements in newspapers and

on craigslist.com and flyers posted at doctors' offices, at community centers, at day-cares, and on campus bulletin boards were also used to recruit from the community. Two sets of advertisements were utilized; one set of advertisements targeted children between ages 3 and 6 with disruptive behavior problems and/or attention problems, and a second set of advertisements targeted children between ages 3 and 6 without these types of problems. After recruitment, families passed through a multigated screening process. An initial telephone screening was conducted to rule out children prescribed long-acting psychotropic medication (e.g., antidepressants) or children with parent-reported neurological impairments, mental retardation, autism spectrum disorders, seizure history, head injury with loss of consciousness, or other major medical conditions. Only 10 families were screened out at this phase, usually due to a prior child diagnosis of autism spectrum disorder, mental retardation, or neurological impairment; no children were prescribed long-acting psychotropic medication. One additional child was screened out during the laboratory visit because the child exhibited autistic symptoms. All families screened into the study at this point completed written and verbal informed consent procedures consistent with the university Institutional Review Board, the National Institute of Mental Health, and APA guidelines.

During the second stage, parents and children attended a campus laboratory visit after which participating caregivers received \$30 apiece and children received a small \$5 prize as incentives for participation. Parents of children taking psycho-stimulant medication ($n = 1$ in the current study) were asked to consult with a physician about discontinuing children's medication for 24 to 48 hr prior to the visit depending on their dosage and type of medication in order to allow for assessment of child cognitive control when not taking medication (Chhabildas, Pennington, & Willcutt, 2001; Nigg, Blaskey, Huang-Pollock, & Rappley, 2002). Before and during the laboratory visit, diagnostic information was collected via parent and teacher ratings. Parents completed the Kiddie Disruptive Behavior Disorders Schedule (K-DBDS; Leblanc et al., 2008), a semistructured diagnostic interview modeled after the Schedule for Affective Disorders and Schizophrenia for School-Age Children (Orvaschel & Puig-Antich, 1995) administered by a trained graduate student clinician. Questions about endorsed DBD symptoms were followed by questions that determine symptom severity, duration, onset, and cross-situational pervasiveness. The K-DBDS demonstrates high test-retest reliability and high interrater reliability (LeBlanc et al., 2008). Fidelity to interview procedure was determined via stringent check-out procedures before interview administration. Reliability of interviewer ratings was determined by blind ratings of interviews of each interviewer on 10% of families with acceptable interrater clinician agreement for DBD symptoms (intraclass correlation coefficient = .97).

Families were mailed teacher/caregiver questionnaires 1 week prior to the laboratory visit and instructed to provide the questionnaires to children's teacher and/or daycare provider who then mailed the completed questionnaires back to the university. When available (i.e., available on 45% of participating families), teacher= caregiver report on DBD symptoms was obtained via report on the Disruptive Behavior Rating Scale (DBRS; Barkley & Murphy, 2006). In the current study, approximately 67% of completed teacher/caregiver report was available from teachers, with most of the remaining questionnaires completed by

daycare providers or babysitters. Response rate did not differ based on child DBD diagnostic group, $\chi^2(3) = .59, p = .9$. Ultimately, clinical diagnoses were determined by the Principal Investigator, a licensed clinical psychologist, after a review of parent ratings on the K-DBDS and (when available) teacher/care-giver ratings on the DBRS, consistent with current best practice guidelines for current diagnosis (Pelham, Fabian, & Massetti, 2005). That is, when both parent and teacher/ caregiver ratings were available, both raters had to agree that there were clinically significant symptoms of ADHD present (i.e., six or more symptoms of inattention, hyper-activity-impulsivity, or both) for the child to receive a diagnosis of ADHD (if only parent report was available, the same rule was followed using only parent report). For ODD diagnosis, only the parent OR the teacher had to endorse four or more symptoms. All diagnoses were checked by a second clinician blind to previous diagnosis with 100% agreement.

Measures

Symptom counts—Parental and teacher/caregiver reports on symptoms were available via the DBRS (Barkley & Murphy, 2006), which assesses symptoms of ODD and ADHD using a 0-to-3 scale for a more continuous dimension. The DBRS has high internal consistency ranging from .78 to .96 in the preschool age range (Pelletier, Collett, Gimple, & Cowley, 2006). All scales for parent and teacher/caregiver report on the DBRS had high internal reliability (all α s > .92) in the current sample. Primary analyses were conducted using parent report on the DBRS with secondary checks conducted on teacher report from the DBRS.

Receptive vocabulary—The Peabody Picture Vocabulary Test–Fourth Edition (PPVT–4; Dunn & Dunn, 2007), a commonly used, objective test measuring receptive vocabulary, asks the child to point to one of four pictures that matches a specific prompt (Gray, Plante, Vance, & Henrichsen, 1999). The PPVT–4 has high internal consistency (between .95 and .97) and high test–retest reliability (from .92 to .96), even in the preschool range (Dunn & Dunn, 2007). Further, the PPVT–4 demonstrates acceptable construct and content validity (Dunn & Dunn, 2007). Raw scores were calculated by subtracting the number of errors made from the highest numbered item completed; standard scores ranged from 66 to 138 for the sample. Higher scores indicate better receptive vocabulary ability.

Expressive vocabulary—The Expressive Vocabulary Test–Second Edition (EVT-2; Williams, 2007) is a commonly used objective test of expressive vocabulary administered to children. As suggested by Williams (2007), the EVT-2 was administered after the PPVT–4. During the EVT-2, the examiner asks the child to provide a one-word response to a prompt about a given picture. The EVT-2 is co-normed with the PPVT–4 and has similarly high reliability ratings, with internal consistency ranging from .88 to .97 and test–retest reliability ranging from .94 to .97. Further, the EVT-2 demonstrates content validity, convergent validity, and discriminant validity (Williams, 2007). Raw scores were calculated by subtracting the number of errors made from the highest number item answered; standard scores ranged from 71 to 140 for the sample. Higher scores indicate better expressive vocabulary ability.

Pragmatic language—Parental report on children’s use of pragmatic language was available via the Descriptive Pragmatics Profile for the Clinical Evaluation of Language Fundamentals Preschool-Second Edition (CELF Preschool-2; Wiig, Secord, & Semel, 2004). The questionnaire assesses the child’s ability to appropriately communicate in social situations (i.e., “communicates [verbally and nonverbally] when playing with other children” or “introduces new conversation topics”; Wiig et al., 2004). The questionnaire assesses nonverbal communication skills; conversational routines and skills; and ability to ask for, give, and respond to information. It should be noted that the CELF Preschool-2 was only available on 59% of the sample by design because it was added in the 2nd year of data collection. The Descriptive Pragmatics Profile has high internal consistency and test–retest reliability (both above .86; Wiig et al., 2004). Further, the Descriptive Pragmatic Profile exhibits content validity, convergent validity, and diagnostic accuracy (Wiig et al., 2004). In the current sample, items on the Descriptive Pragmatic Profile had high internal reliability ($\alpha = .94$). Raw scores were calculated by summing responses to individual questions. Higher scores denote better pragmatic language ability.

Item Overlap Between DBD Symptoms and Pragmatic Language

Item overlap between DBD symptoms and pragmatic language was notable. Five overlapping items were identified by two independent raters with 100% agreement (i.e., four items were similar to hyperactive-impulsive ADHD symptoms [e.g., “demonstrates turn-taking rules during play and/or in the classroom”] and one item was similar to an inattentive ADHD symptom [e.g., “maintains attention while another person speaks”]). These five items from the Descriptive Pragmatics Profile were removed, and a new pragmatics variable was then calculated by summing the remaining items on the Descriptive Pragmatics Profile. Scale reliability was not affected by item elimination ($\alpha = .93$). Primary analyses were conducted using the original raw scores from the Descriptive Pragmatics Profile to preserve the integrity of the pragmatics construct. Secondary analyses were conducted using the new pragmatics variable to examine criterion-predictor artifact.

Data Analysis

Missingness was minimal in the current study, with the exception of teacher report of symptoms (examined in secondary analyses) and the pragmatic language variable from the CELF Preschool-2. Despite this missing data, power was still adequate (.80) to detect a medium size effect ($r = .3$). The missingness and nonnormality of data (i.e., symptom counts) were addressed using robust full information maximum likelihood estimation (i.e., direct fitting) in Mplus, a method of directly fitting models to raw data without imputing data that is also robust to violations of normality (McCartney, Burchinal, & Bub, 2006).

Data analysis proceeded in a stepwise fashion. Preliminary statistics were conducted in SPSS. That is, independent samples t tests and chi-square tests were conducted to examine mean differences between the DBD and non-DBD groups on demographic variables, and a multivariate analysis of variance (MANOVA) was conducted to assess language impairment across groups. Evaluation of normality and linearity revealed no substantial threat to the interpretation of the MANOVA. Main analyses were conducted in Mplus (Muthén & Muthén, 1998–2007). Bivariate and partial correlations were conducted to examine initial

patterns of associations between language and DBD symptoms, and a series of multiple linear regressions used to examine specificity of associations between language and DBD symptom domains via covariance of collinearity (Tabachnick & Fidell, 2007).

RESULTS

As expected by design, DBD symptoms differed significantly in the expected direction between children with and without DBD (all $p < .001$; see Table 2 for mean differences). Preliminary evaluation of group differences on demographic variables indicated that there were no significant differences between the DBD (i.e., ADHD, ODD, ADHD + ODD) and non-DBD groups in percentage of boys/girls, $\chi^2(1) = 2.48, p = .115$ (Table 1); ethnicity minority status, $\chi^2(1) = 1.76, p = .185$; or family income, $\chi^2(5) = 10.49, p = .065$. However, preschoolers with DBD were older than non-DBD comparison children, $t(107) = -3.01, p = .003$ (Table 1). To control for this group difference in age, child age was covaried in all subsequent analyses involving DBD diagnosis or symptoms. Partial correlations covarying age were also conducted to examine associations between parent and teacher reported child DBD symptoms. As expected, the partial correlations between parent and teacher ratings of DBD symptom domains were all significant and at least in the moderate range (r range from .54 to .67, all $p < .001$; shown in Table 3).

Do Preschoolers with DBD Exhibit Poorer Language Ability Compared to Preschoolers Without DBD?

To test whether the DBD (i.e., including ADHD, ODD, and ADHD + ODD) and non-DBD groups significantly differed on receptive, expressive, or pragmatic language ability, a between-subjects MANOVA was performed. The overall MANOVA was significant, $F(3, 59) = 4.43, p = .007$; power = .85, $\eta^2 = .18$, indicating that the two groups significantly differed in language ability. Follow-up univariate analyses of variance were conducted to further examine group differences in specific language subdomains. Results indicated that the DBD group was significantly more impaired than the non-DBD group in each language subdomain with small to large effect sizes, $F(1, 61) = 6.23, p = .015$, power = .69, $\eta^2 = .09$ for receptive vocabulary; $F(1, 61) = 5.13, p = .027$, power = .61, $\eta^2 = .08$ for expressive vocabulary; $F(1, 61) = 11.78, p = .001$, power = .92, $\eta^2 = .16$ for pragmatic language (not shown in table).

To further explore receptive, expressive, and pragmatic language ability in preschoolers with specific DBDs (i.e., ADHD only, ODD only, ADHD+ODD) versus preschoolers without DBD, a between-subjects MANOVA was conducted with DBD diagnostic group (i.e., ADHD only, ODD only, ADHD+ODD, and non-DBD) as the between-subjects factor. The overall MANOVA was significant, $F(9, 177) = 2.71, p = .006$, power = .95, $\eta^2 = .12$ (Table 2), indicating significant differences in language ability between the groups. Follow-up univariate analyses of variance indicated that expressive and pragmatic language significantly differed across the four diagnostic groups with moderate to large effect sizes, $F(3, 59) = 2.74, p = .05$, power = .63, $\eta^2 = .12$ for expressive vocabulary; $F(3, 59) = 8.08, p < .001$, power = .99, $\eta^2 = .29$ for pragmatic language, but receptive vocabulary did not significantly differ across groups, $F(3, 59) = 2.45, p = .076$, power = .59, $\eta^2 = .11$. Based on

the LSD post hoc tests, the ADHD-only and ADHD+ODD groups exhibited significantly more impaired expressive and pragmatic language compared to the non-DBD group, and the ADHD+ODD group exhibited significantly more impaired pragmatic language than the ODD-only group.

Are DBD Symptoms Associated with Language Problems?

Partial correlations covarying age were conducted to examine descriptive associations between receptive, expressive, and pragmatic language ability and parent- and teacher-rated continuous child DBD symptoms, including total DBD symptoms, ODD symptoms, total ADHD symptoms, inattentive ADHD symptoms, and hyperactive-impulsive ADHD symptoms (shown in Table 3). Lower receptive vocabulary was significantly associated with increased DBD symptoms in all domains except teacher-rated hyperactivity-impulsivity (r range from $-.42$ to $-.67$, all $ps < .05$). Lower expressive vocabulary was significantly associated with increased total DBD symptoms, increased total ADHD symptoms, and increased hyperactive-impulsive ADHD symptoms (r range from $-.47$ to $-.54$, all $ps < .05$), based on parent report but not teacher report. Lower pragmatic language ability was significantly associated with increased DBD symptoms in all subdomains, based on parent and teacher report (r range from $-.42$ to $-.61$, all $ps < .05$), with the exception of teacher-rated inattention. Although expressive vocabulary problems were associated with parent-rated DBD symptoms, they were not associated with teacher-rated DBD symptoms. However, receptive and pragmatic language problems were associated with parent and teacher-rated DBD symptoms.

Are DBD Symptoms Differentially Associated with Specific Kinds of Language Problems?

A series of multiple regressions was conducted to examine the specificity of associations between parent-rated DBD symptom domains and each individual language domain. Each individual language subdomain was regressed on DBD symptoms (i.e., inattention, hyperactivity-impulsivity, and ODD), entered simultaneously to partial out the shared covariance between DBD symptom domains (Table 4). When receptive vocabulary was regressed on DBD symptoms, the overall model was significant ($R^2 = .45$, $p < .001$). More hyperactive-impulsive symptoms were significantly associated with more impaired receptive vocabulary (estimate = $.30$, $p = .044$). Inattentive and oppositional-defiant symptoms were not significantly associated with receptive vocabulary deficits ($p > .05$).

When expressive vocabulary was regressed on DBD symptoms, the overall model was significant ($R^2 = .51$, $p < .001$). Hyperactive-impulsive symptoms were significantly associated with expressive vocabulary difficulty (estimate = $-.39$, $p = .004$). Inattentive and oppositional-defiant symptoms were not significantly associated with expressive vocabulary deficits ($p > .05$).

When pragmatic language was regressed on DBD symptoms, the overall model was significant ($R^2 = .32$, $p = .001$). More hyperactive-impulsive symptoms were significantly associated with poorer pragmatic language (estimate = $-.43$, $p = .05$); however, inattentive and oppositional-defiant symptom domains were not significantly associated with pragmatic language ability ($p > .05$).

Secondary Checks

Secondary checks were conducted to test the generalizability of specificity analyses to teacher-reported DBD symptoms. When all teacher-rated DBD symptom domains were entered simultaneously in regression analyses, nothing was significant ($p > .05$). However, it should be noted that teacher-rated inattention was marginally associated with both receptive ($\beta = -.33$, $p = .079$) and expressive vocabulary ($\beta = -.34$, $p = .058$).

Item overlap between DBD symptoms and pragmatic language was examined to minimize the criterion-predictor artifact of identical or nearly identical items while emphasizing the preservation of scale reliability. All primary regression analyses were conducted a second time using the new pragmatics variable. Results from these analyses did not change their pattern of significance (i.e., previously significant findings remained significant, whereas nonsignificant findings remained nonsignificant).

Because the stimulant medication washout could potentially confound results due to the attentional demands of language tasks, primary analyses were conducted removing participants ($n = 1$) prescribed stimulant medication. Results of prior analyses were unchanged based on this check.

DISCUSSION

The present study provided a comprehensive and novel investigation of receptive, expressive, and pragmatic language skills in preschoolers with DBD, including ODD and/or ADHD. As hypothesized, preschoolers with DBD exhibited lower receptive, expressive, and pragmatic language skills as compared to preschoolers without DBD. More specifically, preschoolers with ADHD and comorbid ADHD+ODD exhibited specific problems in expressive vocabulary and pragmatic language as compared to preschoolers without DBD. Lower receptive vocabulary and pragmatic language skills were associated with parent- and teacher-rated DBD symptoms, and lower expressive vocabulary skills were associated with parent-rated DBD symptoms, but not with teacher-rated DBD symptoms. When the shared variance between DBD subdomains was partialled out to examine specificity of language subdomain associations with DBD symptoms, increased hyperactive-impulsive symptoms appeared to be driving associations between poor language skills and parent-rated DBD symptoms. In contrast, increased inattention appeared to be driving the association between poor receptive and expressive vocabulary and teacher-rated DBD symptoms.

Based on results of the present study, preschoolers between ages 3 and 6 with DBD exhibit poorer language skills as compared to same-aged peers without DBD, though it should be noted that the DBD group still performed within the low end of the average range. This is consistent with prior research suggesting that children with DBD, particularly children with ADHD, exhibit language problems (O. H. Kim & Kaiser, 2000; Purvis & Tannock, 1997). This study extends prior work conducted on school-aged children with ADHD by examining language development during early childhood, an important period when language is still developing. Results of the current study suggest that, during this early period, children with DBD are exhibiting worse receptive, expressive, and pragmatic language skills compared to

children without DBD but that these problems are most notable in expressive and pragmatic domains.

Further, the current study provided important information about language associations with general DBD, including ODD and ADHD, as well as comorbid profiles (i.e., ADHD+ODD). Preschoolers with ADHD only, ODD only, and ADHD+ODD differed in their expressive and pragmatic language ability. Preschoolers with ADHD with or without comorbid ODD exhibited significantly poorer expressive and pragmatic language compared to typically developing peers. Further, the comorbid ADHD+ODD group showed significantly poorer pragmatic language skills than the ODD-only group. Thus, children with ADHD, with or without comorbid ODD, appear to be at particular risk for language problems, compared to children without DBD and even other children with DBD. Because extensive prior work indicates that school-age children with ADHD are at increased risk for learning disorders and particularly reading disorder (Willcutt et al., 2007; Willcutt & Pennington, 2000; Willcutt et al., 2001), it is possible that worse language skills during this age range may predispose children with ADHD toward the development of academic problems, particularly in the reading domain. This idea deserves further attention and evaluation.

Worse receptive vocabulary and pragmatic language skills were associated with increased parent- and teacher-rated DBD symptoms; worse expressive vocabulary was associated with increased parent-rated DBD symptoms but not with teacher-rated DBD symptoms. Specificity analyses differed based on parent- or teacher-report of DBD symptoms. Although hyperactivity-impulsivity appeared to be driving associations between worse language skills and DBD, as rated by parents, inattention appeared to be driving associations between worse receptive and expressive vocabulary skills and DBD, when rated by teachers. These differences in results based on parent- and teacher-report of DBD symptoms might be due to the different situational demands on the child at home versus when in school (Mischel & Shoda, 1995). This work is in line with prior work on rater effects on DBD symptom ratings, which have suggested that different raters provide equally valid information on DBD symptoms, as they are differentially manifested in specific contexts (Bartels et al., 2004; Bird, Gould, & Staghezza, 1992; Piacentini, Cohen, & Cohen, 1992). However, the different associations between parent and teacher ratings of symptoms and language could also be due to limited power to detect effects based on teacher report due to substantial missing data. This cannot be ruled out and is a study limitation.

Poor language skills appeared to be associated with parent-rated hyperactive-impulsive ADHD symptoms and teacher-rated inattentive ADHD symptoms. This finding may be consistent with multiple pathway models of DBD, suggesting at least partially dissociable pathways to childhood disorders and even to specific ADHD symptom domains (Frick, 2004; Sonuga-Barke, 2005; Sonuga-Barke, Bitsakou, & Thompson, 2010). Also in line with developmental models, delayed language development may hinder the development of higher order cognitive functions such as sustained attention and voluntary control (Gartstein et al., 2008; Ruf et al., 2008). These deficits in attention and control, in turn, can further hinder subsequent language development, in a bidirectional manner, such that preschoolers with DBD may develop receptive, expressive, and pragmatic language at a slower pace compared to typically developing peers. However, because receptive language develops

earlier and is likely less complex to master than expressive or pragmatic language, deficits in receptive language might not be as notable in preschool-age children with DBD, compared to problems with expressive and pragmatic language, which come online developmentally later and are more difficult to master due to the importance of social context (Owens, 2006; Sharp & Hillenbrand, 2008). It should be noted that preschoolers with ADHD may exhibit particularly prominent language problems in line with the idea that ADHD is a neurodevelopmental disorder, as it will be considered in *DSM-5* (Frick & Nigg, 2012).

This work has important practical implication for assessment and early intervention. Results suggest the need for early language assessment in preschoolers showing early signs of DBD, particularly ADHD. Further, early intervention for language is likely to be important in preschoolers with ADHD. Current results suggest the possible utility of personalized interventions that could be pursued based on a child's symptom profile. For example, children with increased ADHD symptoms, and particularly for those with high parent-rated hyper-activity-impulsivity or teacher-rated inattention, might most benefit from interventions targeting language. Such interventions might focus on developing language expression, improving the identification of social cues, and promoting positive peer interactions. This kind of intervention might have beneficial secondary effects on academic achievement, particularly reading.

The present study provides a good starting point for investigating the association between normal variation in language skills and DBD symptoms in preschoolers; however, it is not without limitations. Although language was the focal point of this investigation, it is possible that an unknown variable may predispose children to both poor language development and make them susceptible to developing DBD. Possible factors contributing to both that would benefit from further investigation include early neurodevelopment, motor skills, inhibitory control, and working memory. Further, general cognitive ability was not assessed and may potentially confound results. Receptive and expressive vocabulary were measured with well-established objective measures, but these measures are limited and should be supplemented with other measures; examination of the Children's Communication Checklist (Bishop & McDonald, 2009) is an important direction for future work. Further, information on children's pragmatic language was only available via parent-report on a questionnaire assessing pragmatic language. Future work should address the development and use of a more objective measure of pragmatic language and should examine additional measures of language (e.g., other subtests on the CELF-P-2). Further, this study is cross-sectional and does not provide information about the longitudinal progression or trajectory of these problems, meaning that it is unclear whether poor language development precedes DBD, whether language difficulty is a consequence of DBD, or whether the relationship between language development and DBD is bidirectional, as originally suggested. Impaired language and DBD both exhibit chronic courses from preschool through childhood and into young adulthood so longitudinal study of the association between language problems and DBD is needed. Finally, this study utilized a community-recruited sample enriched for DBD; replication with general population samples and clinic-recruited samples would be beneficial.

This study makes an important contribution to existing literature by examining receptive, expressive, and pragmatic language skills in preschoolers with DBD, including ADHD, ODD, and ADHD+ODD. Preschoolers with DBD exhibited global language deficits compared to same-aged peers without DBD. Preschoolers with ADHD alone or comorbid with ODD were at particular risk for language problems. Of all DBD symptom domains, increased parent-rated hyper-activity-impulsivity and teacher-rated inattention were most prominently associated with poor language skills. This work suggests the need for early assessment of language problems in preschoolers with DBD, as well as the possible utility of tailored interventions that focus on improving language in children with DBD and particularly ADHD.

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TABLE 1

Descriptive Statistics for the Sample

	ADHD ^a		ODD ^b		ADHD+ODD ^c		Non-DBD ^d	
	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)	<i>n</i>	(%)
Boys	13	(72.2)	10	(55.6)	27	(62.8)	14	(46.7)
Ethnic Minority	10	(55.6)	2	(11.2)	17	(39.5)	7	(23.3)
African American	9	(50)	1	(5.6)	12	(27.9)	7	(23.3)
Hispanic	1	(5.6)	0	(0)	2	(4.7)	0	(0)
Other	0	(0)	1	(5.6)	3	(7)	0	(0)
Age <i>M</i> (<i>SD</i>) [*]	5.03	(.95)	5.07	(1.19)	4.89	(1.08)	4.28	(1.07)
Income <i>Mode</i> (%)	1	(38.9)	5	(33.3)	0	(20)	1,2,3 [†]	(20)

Note. ADHD = attention-deficit/hyperactivity disorder; ODD = oppositional defiant disorder; DBD = disruptive behavior disorder.

^a *n*=18.

^b *n*=18.

^c *n* = 43.

^d *n* = 30.

^{*} Significant differences between DBD and non-DBD groups, $p < .05$.

[†] Multiple modes (0 = annual income less than \$20,000, 1 = between \$20,000 and \$40,000, 2 = between \$40,000 and \$60,000, 3 = between \$60,000 and \$80,000, 4 = between \$80,000 and \$100,000, and 5 = over \$100,000 annually).

TABLE 2

Symptom Ratings and Language Scores of the Sample

	ADHD ^a		ODD ^b		ADHD+ODD ^c		Non-DBD ^d	
	M	(SD)	M	(SD)	M	(SD)	M	(SD)
Parent Report on DBRS								
Total DBD Sx	12.83 ^a	(5.29)	11.07 ^{b,c}	(7.62)	18.86 ^{c,d}	(9.30)	3.20 ^{b,d}	(3.83)
ADHD Sx								
Total	11.22 ^{a,b}	(4.80)	7.33 ^{a,c,d}	(6.13)	14.45 ^{c,e}	(6.55)	2.70 ^{c,d}	(3.11)
Inattentive	4.72 ^a	(3.06)	3.13 ^b	(3.18)	6.29 ^{b,c}	(3.72)	.93 ^c	(1.60)
Hyperactive-	6.50 ^{a,b}	(2.62)	4.20 ^{a,b,c}	(3.14)	8.17 ^{c,e}	(3.28)	1.77 ^{b,d,e}	(1.98)
Impulsive	1.61 ^a	(1.33)	3.73 ^b	(3.24)	4.49 ^{a,c}	(3.49)	.50 ^{b,c}	(1.33)
ODD Sx								
Parent Interview on K-DBDS								
Total DBD Sx	14.44 ^{a,b}	(3.96)	13.50 ^{c,d}	(6.71)	20.53 ^{a,c,e}	(5.28)	5.13 ^{b,d,e}	(3.39)
ADHD Sx								
Total	11.28 ^{a,b}	(3.16)	7.11 ^{a,c,d}	(5.60)	12.44 ^{c,e}	(3.71)	3.27 ^{b,d,e}	(2.56)
Inattentive	4.28 ^a	(2.59)	3.00 ^b	(3.01)	5.02 ^c	(2.69)	1.03 ^{a,b,c}	(1.35)
Hyperactive	7.00 ^{a,b}	(1.868)	4.11 ^{a,c,d}	(2.78)	7.42 ^{c,e}	(1.91)	2.23 ^{b,d,e}	(1.65)
Impulsive	2.28 ^{a,b}	(.83)	4.67 ^{a,c,d}	(.91)	5.49 ^{b,c,e}	(1.45)	1.50 ^{d,e}	(1.22)
ODD Sx								
Teacher Report on DBRS								
Total DBD Sx	13.80 ^{a,b}	(3.77)	1.33 ^{a,c}	(1.94)	16.05 ^{c,d}	(5.43)	2.92 ^{b,d}	(4.23)
ADHD Sx								
Total	13.00 ^{a,b}	(3.87)	.78 ^{a,c}	(1.30)	12.21 ^{c,d}	(3.33)	2.46 ^{b,d}	(3.50)
Inattentive	8.20 ^{a,b}	(1.30)	.56 ^{a,c}	(.73)	5.95 ^{c,d}	(2.53)	.85 ^{b,d}	(1.52)
Hyperactive-	4.83 ^{a,b}	(2.99)	.22 ^{a,c}	(.67)	6.26 ^{c,d}	(1.97)	1.57 ^{b,d}	(2.06)
Impulsive	1.00 ^a	(.89)	.50 ^b	(.85)	3.84 ^{a,b,c}	(2.97)	.43 ^c	(1.16)
ODD Sx								
Language								

	ADHD ^a		ODD ^b		ADHD+ODD ^c		Non-DBD ^d	
	M	(SD)	M	(SD)	M	(SD)	M	(SD)
Receptive	97.17	(11.58)	107.00	(13.81)	98.27 ^a	(15.50)	109.23 ^a	(13.05)
Expressive	97.89 ^a	(9.76)	107.65	(13.56)	96.86 ^b	(14.11)	107.7 ^{a,b}	(11.64)
Pragmatic	82.78	(6.89)	89.58 ^a	(11.87)	76.18 ^{a,b}	(14.46)	92.76 ^b	(8.33)

Note. Like subscripts denote significant differences between groups ($p < .05$). Receptive language was measured using the PPVT-4, Expressive language was measured using the EVT-2. Standard scores for receptive and expressive language are reported. Pragmatic language was measured via parent-report on the CELF-P-2 Descriptive Pragmatics Profile. Raw scores for pragmatic language are reported. ADHD = attention-deficit/hyperactivity disorder; ODD = oppositional defiant disorder; DBD = disruptive behavior disorder; DBRS = Disruptive Behavior Rating Scale; K-DBDS = Kiddie Disruptive Behavior Disorder Schedule; Sx = Symptoms.

^a $n = 18$.
^b $n = 18$.
^c $n = 43$.
^d $n = 30$.

TABLE 3

Partial Correlation Matrix of Associations Between Language and Parent and Teacher-Rated DBD Symptoms

	1	2	3	4	5	6	7	8	9	10	11	12
1 PPVT												
2 EVT	.81											
3 DPP	.73	.49*										
4 P-ADHD	-.66	-.48*	-.59									
5 P-Inattn	-.58	-.36 ^{ns}	-.55	.95								
6 P-HI	-.67	-.55	-.58	.96	.83							
7 P-ODD	-.53	-.35 ^{ns}	-.50*	.67	.61	.67						
8 P-DBD	-.67	-.48*	-.61	.97	.92	.94	.83					
9 T-ADHD	-.42*	-.30 ^{ns}	-.42*	.65	.63	.62	.50*	.65				
10 T-Inattn	-.44*	-.38 ^{ns}	-.33 ^{ns}	.64	.64	.59	.47*	.63	.92			
11 T-HI	-.32 ^{ns}	-.16 ^{ns}	-.43*	.54	.50*	.54	.44*	.55	.90	.67		
12 T-ODD	-.47*	-.33 ^{ns}	-.49*	.54	.43*	.60	.59	.60	.79	.62	.84	
13 T-DBD	-.46*	-.33 ^{ns}	-.46*	.65	.59	.64	.55	.67	.98	.86	.93	.90

Note. All unflagged correlations are significant at $p < .01$. PPVT = Peabody Picture Vocabulary Test-Fourth Edition; measure of receptive language. EVT = Expressive Vocabulary Test-Second Edition, measure of expressive language; DPP = Descriptive Pragmatics Profile of CELF = Clinical Evaluation of Language Fundamentals Preschool-Second Edition, measure of pragmatic language; P-Inattn = parent-rated inattention on DBRS; P-HI = parent-rated hyperactivity-impulsivity on DBRS; P-ODD = parent-rated ODD symptoms on DBRS; P-DBD = total parent-rated DBD symptoms on DBRS; T-Inattn = teacher-rated inattention on DBRS; T-HI = teacher-rated hyperactivity-impulsivity on DBRS; T-ODD = teacher-rated ODD symptoms on DBRS; T-DBD = total teacher-rated DBD symptoms on DBRS.

* $p < .05$.

TABLE 4

Specificity of DBD Symptom Domains: Individual Language Subdomains Regressed on DBD Symptom Domains

<i>Parent-Reported Symptoms</i>	<i>β</i>	<i>p</i>
Receptive Language		
Inattentive Sx	-.02	.864
Hyperactive-Impulsive Sx	-.30	.044
ODD Sx	.01	.931
Expressive Language		
Inattentive Sx	.09	.498
Hyperactive-Impulsive Sx	-.39	.004
ODD Sx	.01	.896
Pragmatic Language		
Inattentive Sx	.001	.997
Hyperactive-Impulsive Sx	-.43	.05
ODD Sx	-.17	.273

Note. DBD = disruptive behavior disorder; ODD = oppositional defiant disorder; Sx = symptoms.