Fall 12-17-2011

Merely Misunderstood: Expressive, Receptive, and Pragmatic Language in Children with Disruptive Behavior Disorders

Monica L. Gremillion
University of New Orleans, mgremil2@uno.edu

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

A Thesis

Submitted to the Graduate Faculty of the
University of New Orleans
in partial fulfillment of the
requirements of the degree of

Master of Science
in
Psychology

By

Monica L. Gremillion
B.A. Northwestern State University, 2005

December, 2011

Contents

List of Tables and Figures

Abstract

Children with Disruptive Behavior Disorders (DBD), including Attention-Deficit/Hyperactivity Disorder (ADHD) and Oppositional Defiant Disorder (ODD) have poorer language skills compared to typically developing children; however, language as a potential risk factor for DBD has received little empirical attention or evaluation. Receptive, expressive, and pragmatic language skills in preschoolers with DBD were examined. Participants were 82 preschool-age children and their primary caregivers. Primary caregivers completed a semi-structured interview and symptom and language questionnaires. Preschoolers completed measures of receptive and expressive language. Results indicated that preschoolers with DBD were more impaired on receptive, expressive, and pragmatic language compared to non-DBD children. Pragmatic language appears particularly impaired in children with DBD, and language problems appear most linked with increased hyperactivity-impulsivity (vs. inattention or oppositional-defiance). This work suggests the need for early assessment of language in preschoolers with DBD, as well as the possibly utility of tailored interventions focusing on improving pragmatic language.
Keywords: Attention-Deficit/Hyperactivity Disorder; Oppositional Defiant Disorder; language impairment; preschool

Over 50% of well-child visits to pediatricians during preschool involve concerns related to disruptive behavior problems (Arndorfer, Allen, & Aliazireh, 1999). Approximately 10% of preschool-aged children are diagnosed with Disruptive Behavior Disorders (DBDs) with boys being affected more frequently than girls (Egger & Angold, 2006; Wakschlag et al., 2007). DBD is an overarching diagnostic category that includes Oppositional Defiant Disorder (ODD) and Attention-Deficit/Hyperactivity Disorder (ADHD). 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 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 school-age 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 risk factors and mechanisms of DBD are important to allow for early identification of DBD and targeted early intervention for children with DBD. Language impairment is one such early-developing risk factor that is thought to be involved in developmental pathways to DBD (Keenan & Shaw, 2003), but which is seldom empirically examined, the goal of the present investigation.

Language is theorized to be a shared risk factor for DBDs, including ODD and ADHD (Keenan & Shaw, 2003). Yet, language is understudied in relation to DBD, despite knowledge that Language Impairment (LI) is commonly associated with both ODD and ADHD (Cohen et al., 1998). LI, a general term referring to difficulty learning language in the absence of frank

neurobiological damage and mental retardation (Leonard et al., 2007), affects approximately 7% of kindergartners (Tomblin et al., 1997). Children with LI have impairment 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). LI is associated with social withdrawal, academic underachievement, increased risk of comorbid psychopathology, and deficits in impulse regulation and attention associated with DBD (van Daal, Verhoeven, & van Balkom, 2007).

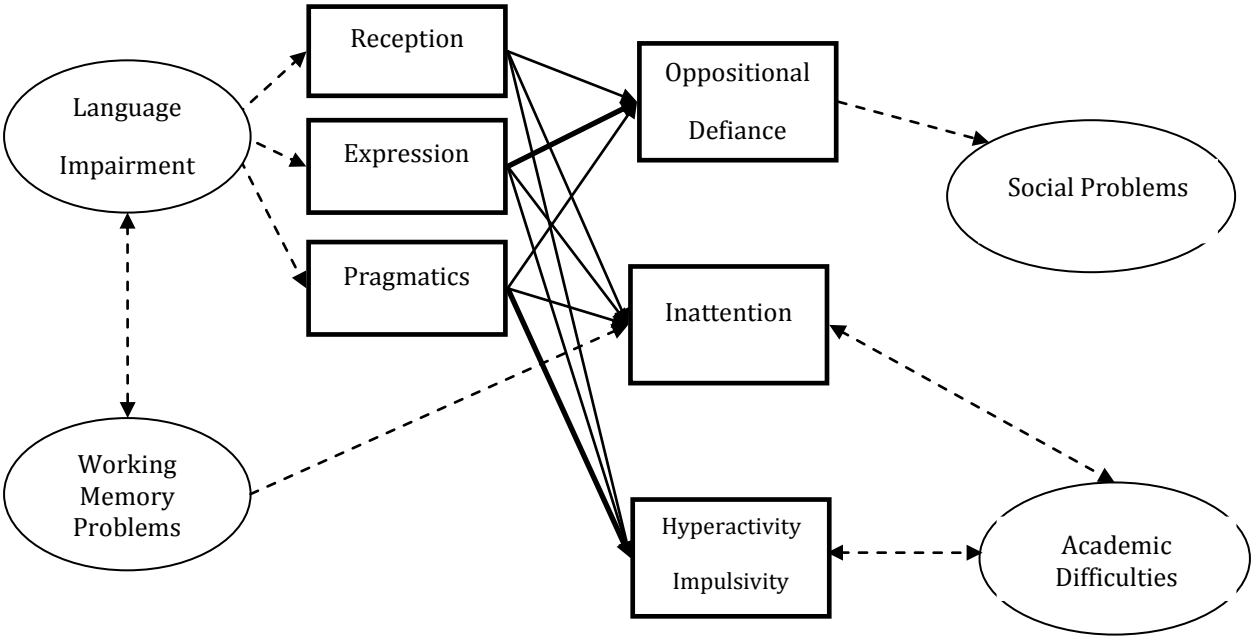
Of course, to understand how LI might increase risk for DBDs, an understanding of the process of typical language development and how this typical development can go awry is critical (e.g., Cicchetti & Curtis, 2006). By six months of age, typically developing infants begin to hold representations of objects or sounds in their mind over delays with increasing efficiency, indicating the development of working memory (Garon, Bryson, & Smith, 2008). This rudimentary form of working memory helps the infant to make associations between words and people/objects and thus aids in initial speech production. To this end, infants begin to say their first words and language can be recognized by the end of the first year of life (Bates, Dale, & Thal, 1995). By the end of the second year of life, toddler's language abilities have increased exponentially. They increasingly use referential words and have an average vocabulary of 300 words (Paul, 1996). The third year of life demarcates what may be the earliest point when clinicians can begin to reliably and validly identify preschoolers with impaired language development through the use of standardized performance measures (Paul, 1996).

Notably, as children's language ability increases so does their ability to maintain focused attention. Language is believed to play a role in the development of cognitive processes particularly in regard to shaping attention and holding information in short-term memory

(Marchman & Fernald, 2008). Thus, children with initial language problems are thought to be 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). Of course, the relationship between language impairment and DBD is likely bidirectional. That is, the behaviors associated with DBDs are also likely to negatively impact language development.

In line with this posited developmental trajectory (shown in Figure 1), empirical work suggests that children with LI exhibit significantly impaired working memory (Cohen et al., 2000). In fact, children with LI appear to exhibit more severe working memory problems than children with ADHD (Cohen et al., 2000), a somewhat surprising finding given the well-publicized nature of working memory deficits associated with ADHD (e.g., Martinussen, Hayden, Hogg-Johnson, & Tannock, 2005). Thus, it is striking, based on this preliminary work, that associations between LI and DBDs like ADHD have received little empirical attention despite the fact that there is some support for the idea that early working memory deficits may impair both language development and attention.

Figure 1: Hypothesized Developmental Framework for Language Associations with Disruptive Behavior Problems



NOTE: Dashed lines=not tested in the current project. Solid lines=tested in the current project. Bolded boxes and lines=emphasized hypothesized relations.

Limited work to date suggests that children with DBD, particularly ADHD, have problems with expressive and pragmatic language, but not receptive language. That is, studies on the association between DBD and language indicate that school-age children with ADHD have relatively intact receptive language abilities compared to same-age peers (Kim & Kaiser, 2000; Purvis & Tannock, 1997). However, there is some evidence to support the idea that children with attention problems have problems with language expression. Overall, school-age children with ADHD have significantly lower scores on expressive language tests than same-aged peers (Kim & Lee, 2009; Purvis & Tannock, 1997; Re, Pedron, & Cornoldi, 2007). Children with attention

problems exhibit deficits in multiple domains of expressive language, including vocabulary, sentence structure, and phonology (i.e., speech sounds; Kim & Kaiser, 2000; Oram, Fine, Okamoto, & Tannock, 1999; van Daal et al., 2007). Van Daal and colleagues (2007) found that poor syntax (i.e., sentence structure), semantics (i.e., word meanings), and phonology are associated with attention problems, but that only poor phonology is associated with delinquency and aggression. It should be noted that this last study did not take into account ADHD or ODD diagnosis, but only examined continuous measures of problem behaviors. In addition, study participants were recruited from special schools for children with LI. Thus, the generalizability of results to a clinical sample of children with DBD or a population sample is to be questioned.

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 and both physical and relational aggression, related disruptive behavior problems (Carson, Klee, Perry, Muskina, & Donaghy, 1998; Estrem, 2005). Estrem (2005) found that girls with poor expressive language were more likely to show higher levels of relational aggression and that both boys and girls with poor receptive language were more likely to be physically aggressive.

Despite the fact that possible deficits in pragmatic language have been under-examined in relation to DBDs, pragmatic language would, at a superficial level, appear to be the language subdomain most likely to be impaired in children with DBDs. Many symptoms used to define DBDs in the DSM-IV (APA, 2000) appear related to deficits in pragmatic language. For example, "does not respond when spoken to directly" is an inattentive ADHD symptom that directly reflects instances in which the child is responding inappropriately to social interactions involving language. Based on diagnostic criteria alone though, hyperactive-impulsive ADHD

symptoms arguably appear to be more grounded in pragmatic deficits at a superficial level. For example, “often blurts out answers before questions have been completed,” “often interrupts or intrudes on others,” and “often talks excessively” all represent instances in which the child is not using language properly in relation to social context. Similarly, several ODD symptoms, including “defies adult requests,” reflect noncompliant and emotionally reactive responses to social situations involving language (APA, 2000). These kinds of pragmatic language problems could account for poor social development, including social withdrawal, inability to properly indentify social cues, and negative peer interactions, commonly seen in children with DBD (Estrem, 2005; Guralnick, Connor, Hammand, & Gottman, 1996). Further, pragmatic language deficits associated with DBD appear to go beyond those captured by the behavioral symptoms of DBD. For example, Kim and Kaiser (2000) found that children with ADHD committed more pragmatic errors in conversational speech compared to typically developing, same-age peers.

As noted, there has been a relative lack of empirical work on associations between language and DBD, despite the fact that theory has suggested that delayed language development may increase risk for later DBD (Keenan & Shaw, 2003). Desperately needed is a comprehensive descriptive analysis of language impairment association with DBDs with attention to subcomponents of language development and DBD symptom domains, particularly during the preschool period, a period when both language and DBD-related behaviors are actively developing. Pinpointing specific language deficits during preschool is important because LI can lead to a devastating cycle of behavior problems that further hinder language advancement. When children cannot comprehend or express language appropriately during social interactions, they may be more likely to exhibit symptoms of inattention, hyperactivity, impulsivity, and/or defiance. Further, children with DBD may be more at risk for language

problems due to inattentive, hyperactive-impulsive, and oppositional-defiant symptoms that might interfere with parent and peer interactions that scaffold language development. Thus, DBD and LI may interact in a vicious cycle, fueling one another longitudinally. Importantly, DBD and LI both lead to later problems with academic and social development and peer relations. Thus, language deficits coupled with DBD may have additive detrimental effects on social relationships and academic performance, and empirical evaluation of these associations during preschool would provide important information for advancement of early assessment and intervention for these difficulties.

The present study provides a comprehensive investigation of language in preschoolers with DBDs including ADHD and/or ODD. The association between specific language subdomains (i.e., receptive, expressive, and pragmatic) and DBD symptom subdomains was systematically examined, a task hitherto unattempted, particularly using a community-recruited clinical sample of preschool-age children and well-validated assessment instruments for language. Surprisingly, little empirical research to date has examined the possibility that language impairments might be a shared risk factor for DBD despite current theory and the fact that these children typically have poor language ability as compared to their peers (Cohen et al., 2000; Kim & Lee, 2009; Kim & Kaiser, 2000). The possibility that there are specific language deficits associated with ADHD or ODD was explored.

To this end, it was hypothesized that all preschoolers with DBD (i.e., ADHD, ODD, or ADHD+ODD) would exhibit LI. Specifically, it was predicted that preschoolers with DBD would be significantly more impaired in at least one language subdomain compared to typically-developing preschoolers. Further, it was predicted that expressive language and pragmatic language would be significantly more impaired in preschoolers with DBD, while receptive

language would remain relatively intact in preschoolers with DBD (compared to typically developing children). When DBD symptom domains were examined individually, it was predicted that expressive language would exhibit a curvilinear association with ODD symptoms such that preschoolers with ODD will exhibit either weak or strong expressive language abilities. In contrast, pragmatic language deficits were expected to be specifically and linearly associated with hyperactive-impulsive ADHD symptoms.

METHODS

Participants

Overview. Participants included 82 preschoolers between the ages of three and six (*M*=4.82 years, *SD*=1.10) and their primary caregivers (67% mothers with the remaining 33% fathers+mothers, fathers only, foster parents, or grandmothers with guardianship). Sixty 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; coded as 0 [majority/Caucasian] or 1 [minority, including African American/Latino/mixed]). Parental educational level ranged from unemployed to highly skilled professionals, with incomes ranging from below $20,000 to above $100,000 annually (coded categorically 0 through 5: 0=<$20,000 annually, 1=$20,000 through $40,000, 2=$40,000 through $60,000, 3=$60,000 through $80,000, 4=$80,000 through $100,000, and 5=>$100,000). Based on multistage and comprehensive diagnostic screening procedures (detailed below), preschoolers were recruited into two groups: DBD (*n*=64), subdivided into ADHD-only (*n*=13), ODD-only (*n*=16), and ADHD+ODD (*n*=35); and non-DBD children (*n*=18). The non-DBD group included preschoolers with subthreshold 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 (Haslam et al., 2006). No siblings were included.

Recruitment and Identification. Participants were recruited primarily through direct mailings to families with children between the ages of three and six from the Greater New Orleans area, as well as from the community through advertisements in newspapers and on craigslist.com and flyers posted at doctors' offices, community centers, daycares, and on campus bulletin boards. After recruitment, families passed through a multi-gated screening process. An initial telephone screening was conducted to rule out children prescribed psychotropic medication or children with neurological impairments, mental retardation, autism spectrum disorders, seizure history, head injury with loss of consciousness, or other major medical conditions. All families screened into the study at this point completed written and verbal informed consent procedures consistent with University of New Orleans Institutional Review Board, the National Institute of Mental Health, and APA guidelines.

During the second stage, parents and preschoolers attended a campus laboratory visit. Parents of children taking psycho-stimulant medication were asked to consult with a physician about discontinuing children's medication for 24 to 48 hours prior to the visit depending on their dosage and type of medication in order to ensure a more accurate measure of cognitive performance (less than 5% of children in the study are currently taking medication for attention problems). 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 semi-structured 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. For endorsed symptoms to count toward diagnosis, the symptom must be present in more than one setting (i.e., school, home, or public) and must occur frequently compared to same-aged peers. The K-DBDS demonstrates high test-retest reliability and high inter-rater reliability (LeBlanc et al., 2008). Fidelity to interview procedure was determined via stringent check-out procedures before interview administration. In addition, reliability of interviewer ratings was determined by blind ratings of interviews of each interviewer on 5% of families. Clinician agreement was adequate for ODD and ADHD symptoms (r=.99, p<.001, r=1.00, p<.001, respectively).

Families were mailed teacher/caregiver questionnaires one 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 50% 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.

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/caregiver ratings on the DBRS, consistent with current best practice guidelines for current diagnosis (Pelham, Fabian, & Massetti, 2005).

Measures

Symptom Counts. Parental report on ADHD and ODD symptoms were available via report on the K-DBDS which assesses symptoms using a dichotomous 0 or 1 response. Endorsed symptoms are summed within each diagnostic subdomain (i.e., ODD symptoms, inattentive ADHD symptoms, hyperactive-impulsive ADHD symptoms) to determine final symptom counts for total DBD symptoms (sum of ODD+ADHD symptoms), ODD symptoms, total ADHD symptoms (sum of inattentive and hyperactive-impulsive ADHD symptoms), inattentive ADHD symptoms, and hyperactive-impulsive ADHD symptoms. All scales within the K-DBDS had high internal reliability with alphas ranging from .72 (for ODD symptoms) to .91 (for total DBD symptoms).

Parental and teacher/caregiver reports on symptoms were also available via the Disruptive Behavior Rating Scale (DBRS: Barkley & Murphy, 2006), which assesses symptoms using a 0 to 3 scale for a more continuous dimension. The same symptom domains described above were available from this questionnaire. 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 alphas > .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 Language. The Peabody Picture Vocabulary Test-Fourth Edition (PPVT-4; Dunn & Dunn, 2007) is a clinical measure of receptive language administered to children. The PPVT-4 provides information about children's receptive vocabulary by asking the child to point to one of four pictures that matches a specific prompt. 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 demonstrated construct and content validity via significant associates with other language measures and clinical utility via its ability to discriminate among children with and without language disorders (Dunn & Dunn, 2007). Raw scores were calculated by subtracting the number of errors made from the highest numbered item completed. Higher scores indicate better receptive language ability.

Expressive Language. The Expressive Vocabulary Test-Second Edition (EVT-2; Williams, 2007) is a clinical measure of expressive vocabulary administered to children. As suggested by Williams (2007), the EVT-2 is 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 with other language tests, and discriminates between children with and without language disorders (Williams, 2007). Raw scores were calculated by subtracting the number of errors made from the highest number item answered. Higher scores indicate better expressive language 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 uses a 1 (never) to 4 (always) rating scale to assess 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 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 with other language measures, and diagnostic accuracy (Wiig et al., 2004). In the current sample, items on the Descriptive Pragmatic Profile have 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 was notable. Six overlapping items were identified by two independent raters with 100% agreement. In secondary analyses addressing item overlap between pragmatic language and DBD symptom domains, six items from the Descriptive Pragmatics Profile were removed (see Appendix 1): four that were similar to hyperactive-impulsive ADHD symptoms (e.g., "demonstrates turn-taking rules during play and/or in the classroom") and two that were similar to inattentive ADHD symptoms (e.g., "maintains attention while another person speaks"). 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 in order 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 the pragmatic language variable from the CELF Preschool-2. Pragmatic language was only available on 57% of the sample by design because the measure was added in the second year of data collection. The missingness and nonnormality of data was addressed using robust full information maximum likelihood estimation (FIML; i.e., direct fitting) in Mplus, a method of directly fitting models to raw data without imputing data (McCartney et al., 2006).

Data analysis proceeded in a step-wise fashion. Preliminary statistics were conducted in SPSS. Independent samples t-tests and chi-square tests were conducted to examine mean differences between the DBD and non-DBD groups on demographic variables, a multivariate analysis of variance (MANOVA) was conducted to assess language impairment across groups, and bivariate correlations were conducted in order to examine initial patterns of associations between language and DBD symptoms. Evaluation of normality and linearity revealed no substantial threat to the interpretation of the MANOVA. Next, main analyses were conducted in Mplus using 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

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 ($X^2[1]=.285$, $p=.594$; see Table 1), ethnicity minority status ($X^2[1]=.002$, $p=.967$), or family income ($X^2[5]=5.68$, $p=.339$). However, preschoolers with DBD were older than non-DBD comparison preschoolers ($t[80]=2.45$, $p=.016$; see Table 1). In order to control for this group difference in age, child age was covaried in all subsequent analyses involving DBD diagnosis or symptoms.

Table 1: Descriptive Statistics for the Sample

	ADHD *n=13*		ODD *n=16*		ADHD+ODD *n=35*		Non-DBD *n=18*	
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*M*	*(SD)*
Boys *n*(%)	8	(61.5)	10	(62.5)	22	(62.9)	10	(55.6)
Ethnic Minority *n*(%)	6	(46.2)	1	(6.3)	14	(40)	6	(33.3)
African-American	6	(46.2)	0	(0)	9	(25.7)	6	(33.3)
Hispanic	0	(0)	0	(0)	2	(5.7)	0	(0)
Other	0	(0)	1	(6.3)	3	(8.6)	0	(0)
Age*	5.62	(.88)	4.55	(1.19)	4.50	(1.35)	4.88	(1.00)
Income *mode*(%)	0, 2, 5[†]	(23)	0,1[†]	(25)	0	(20)	0	(44)
Parent Report on DBRS								
Total DBD Sx	10.54[1]	(4.68)	7.75[2,3]	(7.46)	14.71[3,4]	(8.26)	1.56[1,2,4]	(2.33)
ADHD Sx								
Total	9.23[1,2]	(4.28)	5.25[1,3,4]	(5.65)	11.43[3,5]	(6.12)	1.50[2,4,5]	(2.33)
Inattentive	4.08[1]	(2.87)	2.25[2]	(2.89)	5.11[2,3]	(3.15)	.72[1,3]	(1.32)
Hyperactive-Impulsive	5.15[1,2]	(2.37)	3.00[1,3,4]	(2.99)	6.31[3,5]	(2.99)	.78[2,4,5]	(1.11)
ODD Sx	1.31[1]	(1.31)	2.5[2]	(2.90)	3.29[1,3]	(2.74)	.06[2,3]	(.24)
Parent Interview								
Total DBD Sx	14.27[1,2]	(4.52)	14.15[3,4]	(6.59)	20.47[1,3,5]	(5.41)	4.47[2,4,5]	(3.89)
ADHD Sx								
Total	11.15[1,2]	(3.46)	7.63[1,3,4]	(5.74)	12.26[3,5]	(3.93)	2.56[2,4,5]	(2.48)
Inattentive	4.38[1]	(2.87)	3.25[2]	(3.09)	4.97[3]	(2.84)	.83[1,2,3]	(1.25)
Hyperactive Impulsive	6.77[1,2]	(1.83)	4.38[1,3,4]	(2.85)	7.29[3,5]	(2.02)	1.72[2,4,5]	(1.41)
ODD Sx	2.23[1,2]	(.83)	4.69[1,3,4]	(.95)	5.8[2,3,5]	(1.28)	1.39[4,5]	(1.20)
Teacher Report on DBRS								
Total DBD Sx	13.00[1,2]	(3.90)	1.33[1,3]	(1.94)	15.38[3,4]	(5.44)	3.00[2,4]	(3.93)
ADHD Sx								
Total	12.00[1,2]	(4.24)	.78[1,3]	(1.30)	11.63[3,4]	(3.18)	2.50[2,4]	(3.25)
Inattentive	7.17[1,2]	(2.79)	.56[1,3]	(.73)	5.69[3,4]	(2.57)	.88[2,4]	(1.46)
Hyperactive-Impulsive	4.83[1,2]	(2.99)	.22[1,3]	(.67)	5.94[3,4]	(1.95)	1.56[2,4]	(1.94)
ODD Sx	1.00[1]	(.89)	.50[2]	(.85)	3.75[1,2,3]	(3.15)	.44[3]	(1.33)
Language								
Receptive	76.15	(21.78)	83.87	(38.04)	74.85[1]	(27.68)	80.72[1]	(33.49)
Expressive	58.54[1]	(18.07)	65.31	(29.43)	55.88[2]	(20.28)	60.18[1,2]	(26.76)
Pragmatic	83.83	(7.89)	90.20[1]	(12.66)	75.28[1,2]	(15.42)	92.54[2]	(10.04)

NOTE: *=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 $100,000 annually). M=Mean, SD=Standard Deviation, Sx=Symptom, like subscripts indicate significant differences on LSD post hoc comparisons ($p<.05$).

DBD symptoms differed significantly in the expected direction between groups. For example, preschoolers in the DBD groups exhibited higher DBD symptoms compared to preschoolers without DBD based on parent-reported symptoms, and preschoolers in the ADHD and ADHD+ODD groups exhibited higher DBD symptoms compared to the ODD and non-DBD groups, based on teacher-reported symptoms (all $p<.001$; see Table 1 for mean differences). Bivariate correlations were also conducted to examine associations between parent and teacher reported child DBD symptoms. As expected, the bivariate correlations of parent and teacher ratings of total DBD and individual DBD symptom domains were all significant and at least in the moderate range (r range from .39 to .55, all $p<.05$; shown in Table 2).

Table 2: Bivariate 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	.91**											
3	DPP	.34*	.22										
4	P-ADHD	-.16	-.14	-.50**									
5	P-Inattn	-.19	-.16	-.48**	.96**								
6	P-HI	-.27*	-.29**	-.54**	.96**	.83**							
7	P-ODD	-.21	-.15	-.54**	.65**	.62**	.62**						
8	P-DBD	-.25*	-.23*	-.57**	.97**	.93**	.93*	.81**					
9	T-ADHD	-.37*	-.26	-.37	.55**	.57**	.49**	.90	.52**				
10	T-Inattn	-.28	-.17	-.22	.50**	.49**	.32*	.25	.40*	.92**			
11	T-HI	-.35*	.25	-.34	.52**	.47*	.40*	.30	.44**	.91**	.68**		
12	T-ODD	-.27	.14	-.42*	.41*	.20	.24	.39*	.29	.61**	.41**	.71**	
13	T-DBD	-.38*	-.26	-.43*	.56**	.50**	.44**	.44**	.46**	.97**	.84**	.93**	.79**

NOTE: *$p<.05$, **$p<.01$. 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.

Are DBD symptoms associated with language impairment?

Bivariate correlations were conducted to examine descriptive associations between receptive, expressive, and pragmatic language impairment and parent- and teacher-rated child DBD symptoms, including total DBD symptoms, ODD symptoms, total ADHD symptoms, inattentive ADHD symptoms, and hyperactive-impulsive ADHD symptoms. In line with hypotheses, lower receptive language was significantly associated with increased total DBD symptoms and increased hyperactive-impulsive ADHD symptoms for both parent- and teacher-reported child symptoms and increased total ADHD symptoms for teacher-reported child symptoms (r range from -.25 to -.38, all $p<.05$; Table 2). Lower expressive language ability was significantly associated with increased total DBD symptoms ($r=-.23$, $p<.05$) and increased hyperactive-impulsive ADHD symptoms ($r=-.29$, $p<.01$), based on parent-report only. Lower pragmatic language ability was significantly associated with increased total DBD symptoms, ODD symptoms, total ADHD symptoms, inattentive ADHD symptoms, and hyperactive-impulsive ADHD symptoms for parent-reported symptoms (r range from -.48 to -.57, all $p<.01$), as well as increased total DBD symptoms ($r=-.43$, $p<.05$) and ODD symptoms ($r=-.42$, $p<.05$), based on teacher-report.

Do preschoolers with DBD exhibit language impairment?

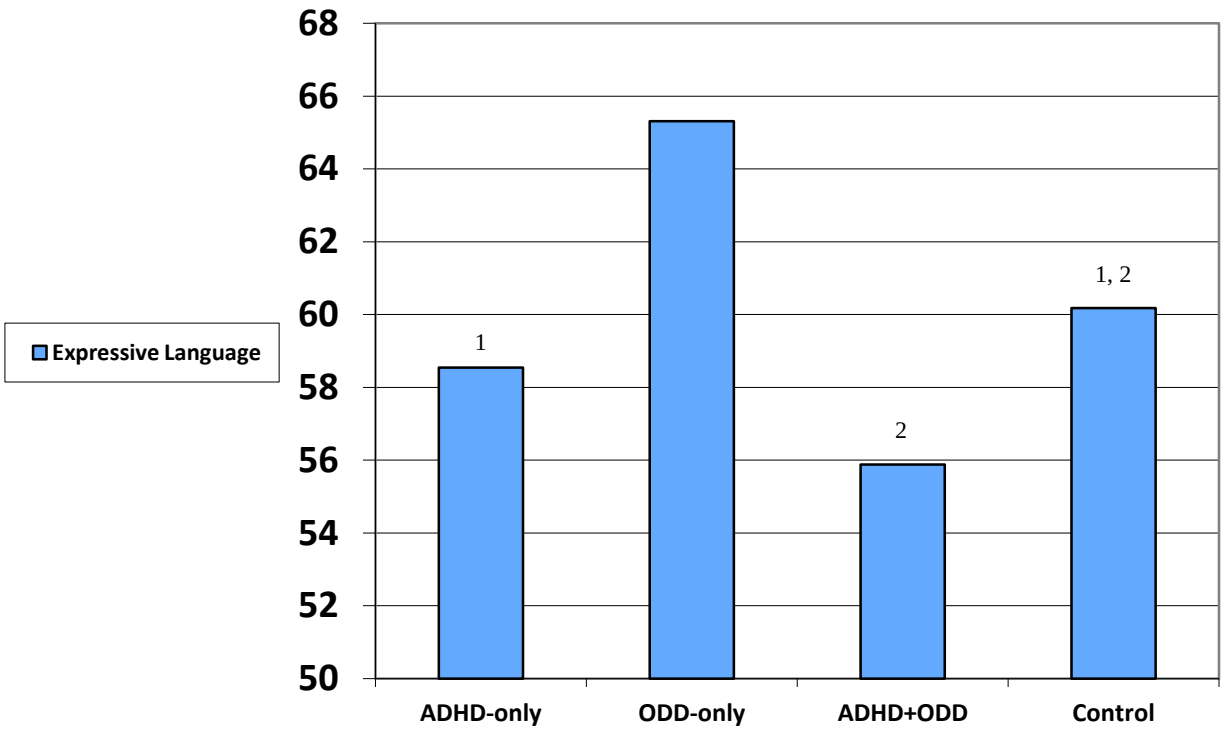
To test whether the DBD (i.e., ADHD, ODD, and ADHD+ODD examined altogether) and non-DBD group significantly differed on receptive, expressive, or pragmatic language impairment, a between-subjects MANOVA was performed. The overall MANOVA was significant ($F[3,42]=3.18$, $p=.034$; power=.69, $\eta^2=.19$), suggesting that the two groups

significantly differed in language impairment. Thus, follow-up univariate ANOVAs 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 moderate to large effect sizes (F[1,44]=5.79, p=.020, power=.65, η^2=.12 for receptive language; F[1,44]=6.76, p=.013, power=.72, η^2=.13 for expressive language; F[1,44]=6.10, p=.017, power=.68, η^2=.12 for pragmatic language).

To further explore receptive, expressive, and pragmatic language impairment in preschoolers with DBD compared to 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-subject factor. The overall MANOVA was significant (F[9, 97.5]=2.50, p=.013, power=.82, η^2=.16), suggesting significant differences in language impairment between the DBD diagnostic groups. Follow-up univariate ANOVAs were conducted to further examine subgroup differences in the specific language subdomains. Results indicated that expressive and pragmatic language significantly differed across the four diagnostic groups with large effect sizes (F[3,42]=3.73, p=.018, power=.77, η^2=.21 for expressive language; F[3,42]=5.33, p=.003, power=.91, η^2=.28 for pragmatic language), but receptive language did not (F[3,42]=2.24, p=.097, power=.53, η^2=.14). Because Levene's test of equality was not significant, equal variances could be assumed and Least Significant Difference (LSD) post hoc analyses were conducted to determine which diagnostic groups differed on expressive and pragmatic language ability (see Table 1 for mean scores and differences). Based on these post hoc tests, the ADHD-only and ADHD+ODD groups exhibited significantly more impaired expressive language compared to the non-DBD group (see Figure 2), and the ADHD+ODD

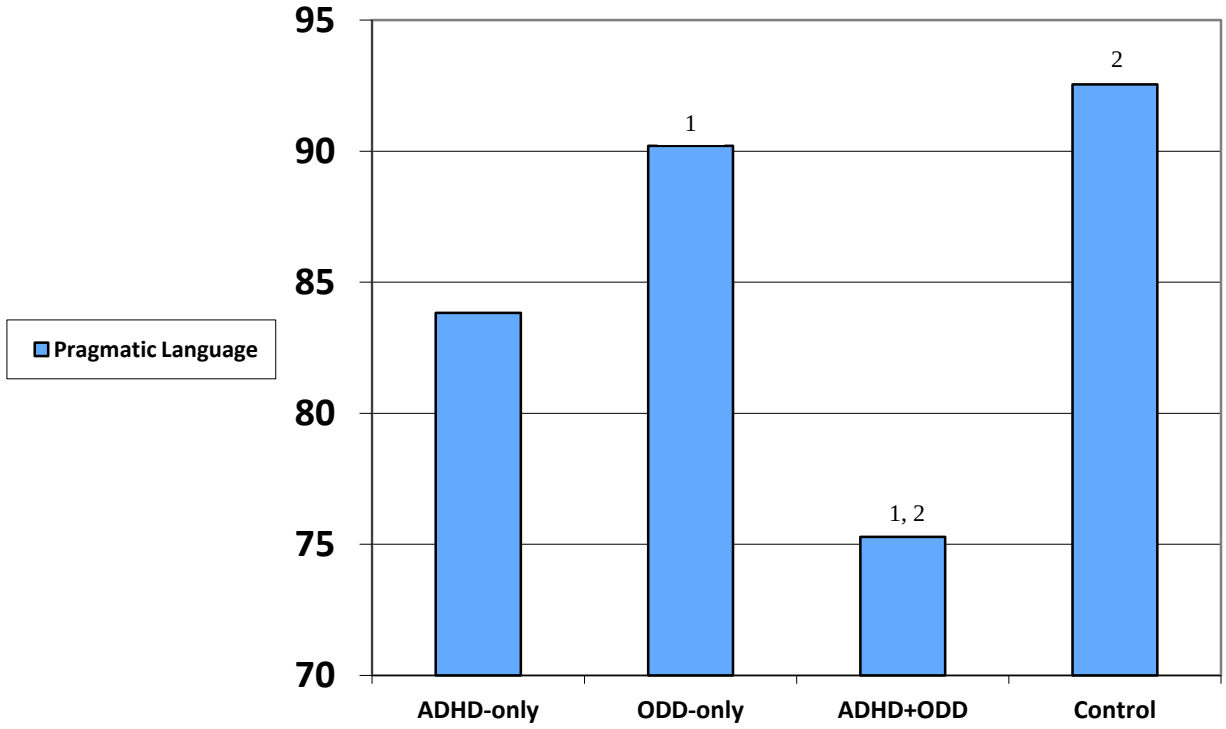
group exhibited significantly more impaired pragmatic language than the ODD-only and non-DBD groups (see Figure 3).

Figure 2: Group Differences for Expressive Language Ability



NOTE: Like numbers indicate significant group differences, $p<.05$.

Figure 3: Group Differences for Pragmatic Language Ability



NOTE: Like numbers indicate significant group differences, $p<.05$.

Are deficits in language subdomains differentially associated with individual DBD symptom domains?

A series of regression analyses was conducted to determine the specificity of associations between language subdomains and each individual DBD symptom domain. Each individual DBD symptom domain (i.e., inattention, hyperactivity-impulsivity, and oppositional-defiance) were regressed on all three language subdomains (i.e., receptive, expressive, or pragmatic), entered simultaneously in order to assess language subdomain associations with specific DBD symptom domains via covariance of collinearity between the language subdomains. Although there receptive and expressive language were highly correlated, multicollinearity did not appear

to negatively impact the validity of results (tolerance=.22, variance inflation factor=4.55 for receptive language; tolerance=.19, variance inflation factor=5.29 for expressive language; Kutner, Nachtsheim, Neter, & Li, 2004).

When ODD symptoms were regressed on the language subdomains, the overall model was significant (ΔR^2=.27, p=.014). Lower pragmatic language scores were significantly associated with more ODD symptoms (β=-.43, p=.002), but receptive and expressive language ability were not significantly associated with ODD symptoms (β=-.23, p=.363 and β=.08, p=.747, respectively; see Table 3). Squared semipartial correlations, which reflect the percentage of the unique variance attributed to an independent variable when the effects of other independent variables have been partialled out, indicate that pragmatic language accounted for 10% of the unique variance in ODD symptoms, suggesting a large effect size (R^2=.27).

When inattentive ADHD symptoms were regressed on language subdomains, the overall model was significant (ΔR^2=.26, p=.01). Again, lower pragmatic language was significantly associated with increased inattention (β=-.32, p=.028; see Table 3), but expressive and receptive language were not (β=-.13, p=.613 for receptive language; β=-.10, p=.691 for expressive language). When hyperactive-impulsive ADHD symptoms were regressed on the language subdomains, the overall model was significant (ΔR^2=.38, p=.001). As before, more impaired pragmatic language was significantly associated with more ADHD hyperactive-impulsive symptoms (β=-.42, p=.001; 10% of unique variance), but receptive and expressive language were not significantly associated with hyperactive-impulsive ADHD symptoms (β=-.04 p=.865 for receptive language; β=-.39, p=.092 for expressive language; see Table 3). Thus, pragmatic language impairment seems to be driving the association between DBD symptoms and overall language impairment.

Table 3: Specificity of Language Associations with Individual DBD Symptom Domains: Individual DBD Symptom Domain Regressed on Language Subdomains

Parent-Reported Symptoms

	β	*p*	Semipartial
ODD Sx			
Receptive	-.23	.363	-.18
Expressive	.08	.747	.01
Pragmatic	-.43	.002	-.32
Inattentive Sx			
Receptive	-.13	.613	-.06
Expressive	-.10	.691	-.13
Pragmatic	-.32	.028	-.25
Hyperactive-Impulsive Sx			
Receptive	.04	.865	-.03
Expressive	-.39	.092	-.24
Pragmatic	-.42	.001	-.32

Teacher-Reported Symptoms

	β	*p*	Semipartial
ODD Sx[1]			
Receptive	-.31	.498	-.15
Expressive	.23	.584	.08
Pragmatic	*-.37*	*.098*	*-.21*
Inattentive Sx			
Receptive	-.75	.068	-.18
Expressive	.03	.935	-.04
Pragmatic	*.08*	*.707*	*.02*
Hyperactive-Impulsive Sx[2]			
Receptive	-.52	.303	-.14
Expressive	.14	.742	.10
Pragmatic	*-.21*	*.439*	*-.18*

NOTE: Italicized indicate differences in significance patterns between parent- and teacher-reported symptoms on the DBRS

[1] ΔR^2=.19, p=.117

[2] ΔR^2=.22, p=.058

Are DBD symptoms differentially associated with specific kinds of language impairment?

A series of multiple regressions was conducted to examine the specificity of associations between 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 in order to partial out the shared covariance between DBD symptom domains. When receptive language was regressed on DBD symptoms, the overall model was significant (ΔR^2=.45, p=.000). More hyperactive-impulsive symptoms were significantly associated with more impaired receptive language (β=-.40, p=.019). Inattentive and oppositional-defiant symptoms were not significantly associated with receptive language impairment (β=.11, p=.522 for inattention; β=-.08, p=.472 for oppositional-defiance; see Table 4).

When expressive language was regressed on DBD symptoms, the overall model was significant (ΔR^2=.51, p=.000). Hyperactive-impulsive symptoms were significantly associated with expressive language impairment (β=-.49, p=.002). Inattentive and oppositional-defiant symptoms were not significantly associated with expressive language impairment (β=.16, p=.299 for inattention; β=-.02, p=.831 for oppositional-defiance; see Table 4).

When pragmatic language was regressed on DBD symptoms, the overall model was significant (ΔR^2=.34, p=.003). More hyperactive-impulsive symptoms were significantly associated with poorer pragmatic language (β=-.52, p=.032; see Table 4); however, inattentive and oppositional-defiant symptom domains were not significantly associated with pragmatic language ability (β=.21, p=.408 for inattention; β=-.30, p=.095 for oppositional-defiance).

Does expressive language exhibit a curvilinear association with ODD symptoms?

A univariate regression with curvilinear trends was conducted in order to examine possible curvilinear associations between expressive language and ODD symptoms. Expressive language did not exhibit a significant curvilinear association with ODD symptoms (Δr^2=.05, F[2,73]=1.98, p=.146).

Table 4: Specificity of DBD Symptom Associations with Individual Language Subdomains: Individual Language Subdomains Regressed on DBD Symptoms

Parent-Reported Symptoms

	β	*p*
Receptive Language		
Inattention	.11	.522
Hyperactivity-Impulsivity	-.40	.019
Oppositional-Defiance	-.08	.472
Expressive Language		
Inattention	.16	.299
Hyperactivity-Impulsivity	-.49	.002
Oppositional-Defiance	-.02	.831
Pragmatic Language		
Inattention	.21	.408
Hyperactivity-Impulsivity	-.52	.032
Oppositional-Defiance	-.30	.095

Teacher-Reported Symptoms

	β	*p*
Receptive Language		
Inattention	*-.44*	*.013*
Hyperactivity-Impulsivity	*-.01*	*.978*
Oppositional-Defiance	-.09	.608
Expressive Language		
Inattention	*-.44*	*.014*
Hyperactivity-Impulsivity	*-.06*	*.810*
Oppositional-Defiance	-.02	.904
Pragmatic Language[1]		
Inattention	-.03	.902
Hyperactivity-Impulsivity	-.03	.915
Oppositional-Defiance	-.42	.092

NOTE: Italicized indicate differences in significance patterns between parent- and teacher-reported symptoms on the DBRS

[1] ΔR^2=.23, p=.094

Secondary Checks

Several secondary checks on the data analyses were conducted. First, though tolerance and variance inflation factors did not indicate that multicollinearity negatively impacted the validity of results, primary regression analyses were checked via the use of a receptive and

expressive language composite score, generated by taking an average of the two individual scores. Results of these analyses were largely the same as results conducted using the two individual scores with one exception. When hyperactive-impulsive symptoms were regressed on language subdomains, both the composite score and individual pragmatic score were significantly associated with hyperactive-impulsive symptoms (β=-.56, p=.007 for composite; β=-.35, p=.014 for pragmatics), suggesting less specificity of associations than prior analyses.

Second, the generalizability of results to teacher-reported child DBD symptoms was evaluated. Most of the significant findings reported above became non-significant when examining teacher report of symptoms. However, there were a few significant differences in patterns of findings based on teacher report, most particularly in the domain of inattention. Namely, worse receptive language and expressive language were significantly associated with increased inattention (β=-.44, p=.013 for receptive language; β=-.44, p=.014 for expressive language). Also, when inattention was regressed on language domains, receptive language was marginally significantly associated with inattention (β=-.75, p=.068).

Next, effects of age were examined. All significant results reported above, using age as a covariate, remained significant when age was not covaried with a few exceptions. Namely, the overall models became non-significant for inattentive ADHD symptoms regressed on language subdomains and for receptive and expressive language regressed on DBD symptoms (Δr^2=.19, p=.076 for language-inattention; Δr^2=.09, p=.172 for DBD-receptive language; Δr^2=.09, p=.145 for DBD-expressive language), but the specific associations remained significant.

Finally, item overlap between DBD symptoms and pragmatic language was examined in order 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 remained significant with few exceptions. Namely, when inattentive symptoms were regressed on language subdomains, pragmatic language was only marginally significant (β=-.26, *p*=.095). Further, when pragmatic language was regressed on DBD symptom domains, the previously non-significant association between oppositional-defiant symptoms and poor pragmatic language became significant (β=-.41, *p*=.029) while the association between hyperactive-impulsive ADHD symptoms and pragmatic language became non-significant (β=-.32, *p*=.227).

DISCUSSION

The present study provided a comprehensive and novel investigation of receptive, expressive, and pragmatic language in preschoolers with DBD, including preschoolers with ADHD and/or ODD. As hypothesized, preschoolers with DBD exhibited impairment in receptive, expressive, and pragmatic language as compared to preschoolers without DBD. More specifically, preschoolers with ADHD and comorbid ADHD+ODD exhibited specific deficits in expressive and pragmatic language as compared to preschoolers without DBD. When the shared variance between language subdomains was partialled out to examine specificity of language subdomain association with DBD symptoms, deficits in pragmatic language appeared to be the primary language impairment in preschoolers with DBD. When the shared variance between DBD symptom domains was partialled out to examine specificity of DBD symptom domain association with language, hyperactivity-impulsivity appeared to be the DBD symptom domain most highly associated with LI, although this effect did not necessarily hold when controlling for item overlap between pragmatic language impairment and hyperactivity-impulsivity.

Based on results of the present study, preschoolers with DBD exhibit early language impairment as compared to same-aged peers without DBD. This is consistent with prior research

suggesting that preschoolers with DBD, particularly preschoolers with ADHD, exhibit language problems (Kim & Kaiser, 2000; Purvis & Tannock, 1997). This study extends prior work conducted on school-aged children with ADHD by examining language development during preschool, an important time period when language is still developing. Further, the current study provides important information of comorbidity profiles (i.e., ADHD, ODD, and ADHD+ODD) in a large sample of preschoolers.

DBD diagnostic groups (i.e., ADHD-only, ODD-only, ADHD+ODD) differed in expressive and pragmatic language ability. Preschoolers with ADHD or combined ADHD+ODD showed significant expressive language deficits compared to preschoolers without DBD, and preschoolers with ADHD+ODD exhibited poorer pragmatic language compared to preschoolers with ODD-only or typically developing peers. These results are consistent with prior research that suggests that school-aged children with ADHD have expressive language impairment (Kim & Kaiser, 2000). Children with ADHD in particular, 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. Since extensive prior work indicates that school-age children with ADHD are at increased risk for Learning Disorders and particularly Reading Disorder (Willcutt & Pennington, 2000; Willcutt et al., 2007; 2001), it is possible that early language problems during preschool may predispose children with ADHD toward the development of academic problems, particularly in the reading domain.

Of all the DBD symptom domains, hyperactive-impulsive ADHD symptoms appeared to be most specifically associated with LI in general and with pragmatic language impairment in particular. These findings are not surprising given the high degree of overlap between hyperactivity-impulsivity and pragmatic language impairment, namely in areas that involve

appropriate conversational routines and skills like maintaining attention and interrupting appropriately. When item overlap between hyperactivity-impulsivity and pragmatics was removed, effects largely disappeared, suggesting that pragmatic language problems are inextricably related to hyperactive-impulsive symptoms and may—in fact—be at least partially measuring the same construct. However, it should be noted that hyperactivity-impulsivity was also associated with objective measures of receptive and expressive language, suggesting that preschoolers with high levels of hyperactivity-impulsivity exhibit LI more generally. This finding is consistent with recent dual-pathway models of ADHD, suggesting at least partially dissociable pathways to inattention versus hyperactivity-impulsivity (Sonuga-Barke, 2005). Namely, children with ADHD characterized by high hyperactivity-impulsivity may exhibit prominent language problems that are not typical for children with just high inattention. In line with the originally posited model in the current paper (see Figure 1), hyperactivity-impulsivity may exhibit prominent associations with pragmatic language impairment, while inattention may be more associated with working memory deficits (Wahlstedt et al., 2009; Thorell, 2007).

Of all the language subdomains, pragmatic language impairment was most specifically associated with DBD symptoms. This suggests that although preschoolers with DBD exhibit LI globally, problems with pragmatic language are particularly prominent. To this end, pragmatic language appears to be driving the association between LI and DBD symptoms. Further, it should be noted that when item overlap between pragmatic language and DBD was investigated, the association between pragmatics and oppositional-defiance became significant, suggesting that deficits in pragmatic language are associated with ODD symptoms, over and above the similarities between the two constructs. These findings suggest that deficits in pragmatic language could partially explain the poor social development commonly seen in children with

DBD (DuPaul, McGoey, Eckert, & Van Brakle, 2001; Guralnick et al., 1996; Milich, Whitten, Landau, & Kilby, 1982). For example, children who have difficulty appropriately participating in social interactions involving language may be more likely to act out to garner parents' or peers' attention. This could—in turn—lead to the development of negative coercive cycles with parents and negative peer interactions, including rejection. These problems have important social consequences in that they could lead to the higher levels of unemployment and problems with social interactions and romantic relationships commonly seen in adults with DBD (Foster et al., 2005; Pelham, Foster, & Robb, 2007).

In line with a developmental model (Figure 1), initial problems with sustained attention may delay language development, such that preschoolers with DBD may develop receptive, expressive, and pragmatic language at a slower pace compared to preschoolers without DBD. Results of the current study were in line with this idea. For example, deficits in receptive language did not appear to be as prominent as deficits in other language subdomains possibly because reception develops during the first year of life, and preschoolers have had more time to learn how to compensate for deficits in this language subdomain. In contrast, pragmatic language develops later than the other language subdomains, and children with DBD in the preschool age range may show more prominent deficits in pragmatic language (vs. other language subdomains) due to the fact that pragmatic language is just beginning to develop during this period.

Generalizability of results using teacher-rated DBD symptoms suggested additional associations between inattention and receptive and expressive language deficits. These findings suggest that the association between LI and inattention may be better captured in school settings where academic demands highlight deficits in attention that are not necessarily present in home

settings. Thus, even during preschool, teachers and other caregivers appear to be an important source of information about inattention (APA, 2000; Lahey et al., 1994).

This work has important practical implication for assessment and early intervention. Results suggest the need for early language assessment, particularly for those preschoolers with early signs of DBD. Study results suggest that pragmatic language may be a particularly important area of language to examine during clinical assessment of preschoolers at risk for DBD. Further, early intervention for language is likely to be important in preschoolers with DBD. Current results suggest the possible utility of personalized interventions that could be pursued based on a child's symptom profile. For example, children with high hyperactivity-impulsivity might most benefit from interventions targeting pragmatic language. Such interventions might focus on 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 language impairment and DBD symptoms in preschoolers; however, it is not without limitations. Though language was the focal point of this investigation, it is possible that an unknown third variable may predispose children to both poor language development and DBD. Possible factors contributing to both language impairment and DBD include early inhibitory control and neurodevelopment, and both of these possibilities deserve attention and further investigation. Receptive and expressive language were measured with well-established objective measures, but information on children's pragmatic language was only available via parent-report on a questionnaire assessing pragmatic language problems. Future work should address the development and use of a more objective measure of pragmatic language. 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 LI precedes DBD, is a consequence of DBD, or the relationship between LI and DBD is bidirectional, as originally hypothesized. LI and DBD both exhibit chronic courses from preschool through childhood and into young adulthood so longitudinal study of the association between LI 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 the receptive, expressive, and pragmatic language impairment in preschoolers with DBD, including ADHD, ODD, and ADHD+ODD. Preschoolers with DBD exhibited global language impairment compared to same-aged peers without DBD. Children with ADHD alone or comorbid with ODD were at particular risk for language problems. Of all the DBD symptom domains, hyperactivity-impulsivity appeared to be most specifically associated with language impairment, particularly deficits in pragmatic language. Of all the language subdomains, deficits in pragmatic language were most prominently associated with DBD symptoms. 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 pragmatic language in children with DBD.

REFERENCES

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders—Fourth ed., text revision*. Washington, D.C.: American Psychiatric Association.

Arndorfer, R.E., Allen, K.D., & Aliazireh, L. (1999). Behavioral health needs in pediatric medicine and the acceptability of behavioral solutions: Implications for behavioral psychologists. *Behavior Therapy, 30*(1), 137-148.

Barkley, R.A. & Murphy, K.R. (2006). Attention-Deficit Hyperactivity Disorder: A clinical workbook (3rd Ed.) New York: The Guilford Press.

Bates, E., Dale, P.S., & Thal, D. (1995). Individual differences and their implications for theories of language development. In P. Fletcher & B. MacWhinney (Eds.). *Handbook of Child Language*. Oxford: Basil Blackwell.

Carson, D.K., Klee, T., Perry, C.K., Muskina, G., & Donaghy, T. (1998). Comparisons of children with delayed and normal language at 24 months of age on measures of behavioral difficulties, social and cognitive development. *Infant Mental Health Journal, 19*(1), 59-75.

Cicchetti, D., & Curtis, W.J. (2006). The developing brain and neural plasticity: Implications for normality, psychopathology, and resilience. In D. Cicchetti & D.J. Cohen (Eds.). *Developmental Psychopathology, Vol. 2: Developmental Neuroscience* (2nd Ed.). (pp. 1-64). Hoboken, NJ: John Wiley & Sons, Inc.

Cohen, N.J., Menna, R., Vallance, D.D., Barwick, M.A., Im, N., & Horodezky, N.B. (1998). Language, social cognitive processing, and behavioral characteristics of psychiatrically

disturbed children with previously identified and unsuspected language impairments. *Journal of Child Psychology and Psychiatry, 39*(6), 853-864.

Cohen, N.J., Vallance, D.D., Barwick, M., Im, N., Menna, R., Horodezky, N.B., & Isaacson, L. (2000). The interface between ADHD and language impairment: An examination of language, achievement, and cognitive processing. *Journal of Child Psychology and Psychiatry, 41*(3), 353-362.

Dunn, L.M., & Dunn, D.M. (2007). *Peabody Picture Vocabulary Test, Fourth Edition, Manual*. Minneapolis, MN: NCS Pearson, Inc.

DuPaul, G.J., McGoey, K.E., Eckert, T.L., & Van Brakle, J. (2001). Preschool children with Attention-Deficit/Hyperactivity Disorder: Impairments in behavioral, social, and school functioning. *Journal of the American Academy of Child & Adolescent Psychiatry 40*(5), 508-515.

Egger, H.L., & Angold, A. (2006). Common emotional and behavioral disorders in preschool children: Presentation, nosology, and epidemiology. *Journal of Child Psychology & Psychiatry, 47*(3/4), 313-337.

Estrem, T.L. (2005). Relational and physical aggression among preschoolers: The effect of language skills and gender. *Early Education and Development, 16*(2), 207-231.

Faraone, S.V., & Biederman, J. (2005). What is the prevalence of adult ADHD? Results of a population screen of 966 adults. *Journal of Attention Disorders, 9*(2), 384-391.

Foster, E.M., Jones, D.E., & the Conduct Problems Prevention Research Group (2005). The high costs of aggression: Public expenditures resulting from Conduct Disorder. *American Journal of Public Health, 95*(10), 1767-1772.

Froehlich, T.E., Lanphear, B.P., Epstein, J.N., Barbaresi, W.J., Katusic, S.K., & Kahn, R.S. (2004). Prevalence, recognition, and treatment of attention-deficit/hyperactivity disorder in a national sample of US children. *Archives of Pediatrics & Adolescent Medicine, 161*(9), 857-864.

Garon, N., Bryson, S.E., & Smith, I.M. (2008). Executive function in preschoolers: A review using an integrative framework. *Psychological Bulletin, 134*(1), 31-60.

Gartstein, M.A., Crawford, J., & Robertson, C.D. (2008). Early markers of language and attention: Mutual contributions and the impact of parent-infant interactions. *Child Psychiatry and Human Development, 39*(1), 9-26.

Guralnick, M.J., Connor, R.T., Hammond, M.A., & Gottman, J.M. (1996). The peer relations of preschool children with communication disorders. *Child Development, 67*(2), 471-489.

Hamilton, S., & Armando, J. (2008). Oppositional defiant disorder. *American Family Physician, 78*(7), 861-866.

Haslam, N., Williams, B., Prior, M., Haslam, R., Graetz, B., & Sawyer, M. (2006). The latent structure of attention-deficit/hyperactivity disorder: A taxonomic analysis. *Australian and New Zealand Journal of Psychiatry, 40*(8), 639-647.

Keenan, K., & Shaw, D.S. (2003). Starting at the beginning: Exploring the etiology of antisocial behavior in the first years of life. In B.B. Lahey, T.E. Moffitt, & A. Caspi (Eds.), *Causes of Conduct Disorder and Juvenile Delinquency* (pp. 153-181). New York: Guilford Press.

Kim, K., & Lee, C.H. (2009). Distinctive linguistic styles in children with ADHD. *Psychological Reports, 105*(2), 365-371.

Kim, O.H., & Kaiser, A.P. (2000). Language characteristics of children with ADHD. *Communication Disorders Quarterly, 21*(3), 154-165.

Kutner, M., Nachtsheim, C., Neter, J., & Li, W. (2004). *Applied Linear Statistical Models (5th ed.)*. McGraw-Hill/Irwin.

Lahey, B.B., Applegate, B., McBurnett, K., Biederman, J., et al. (1994). DSM-IV field trials for attention deficit hyperactivity disorder in children and adolescents. *American Journal of Psychiatry, 151*(11), 1673-1685.

Leblanc, N., Boivin, M., Dionne, G., Brendgen, M., Vitaro, F., Tremblay, R.E., et al. (2008). The development of hyperactive-impulsive behaviors during the preschool years: The predictive validity of parental assessments. *Journal of Abnormal Child Psychology, 36*, 977-987.

Leonard, L.B., Weismer, S.E., Miller, C.A., Francis, D.J., Tomblin, J.B., & Kail, R.V. (2007). Speed of processing, working memory, and language impairments in children. *Journal of Speech, Language, and Hearing Research, 50*(2), 408-421.

Marchman, V.A., & Fernald, A. (2008). Speed of word recognition and vocabulary knowledge in infancy predict cognitive and language outcomes in later childhood. *Developmental Science, 11*(3), F9-F16.

Martinussen, R., Hayden, J., Hogg-Johnson, S., & Tannock, R. (2005). A meta-analysis of working memory impairments in children with attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 44*(4), 377-384.

McCartney, K., Burchinal, M.R., & Bub, K.L. (2006). Best practices in quantitative methods for developmentalists. In W.F. Overton & M. Berry (Eds.), *Monographs of the Society for Research in Child Development, 285*(71).

Milich, R., Whitten, P., Landau, S., & Kilby, G. (1982). Preschool peer perceptions of the behavior of hyperactive and aggressive children. *Journal of Abnormal Child Psychology 10*(4), 497-510.

Múthen, L.K., & Múthen, B.O. (1998-2007). *MPlus User's Guide, Fourth Edition.* Los Angeles, CA: Múthen & Múthen.

Oram, J., Fine, J., Okamoto, C., & Tannock, R. (1999). Assessing the language of children with attention deficit hyperactivity disorder. *American Journal of Speech Language Pathology, 8*(1), 72-80.

Owens, R.E. (1988). *Language Development: An Introduction*. Columbus, OH: Merril.

Orvaschel, H., & Puig-Antich, J. (1995). *Schedule for Affective Disorders and Schizophrenia for School-Age Children—Epidemiologic 5th Version*. Ft. Lauderdale, FL: Nova University.

Paul, R. (1996). Clinical implications of the natural history of slow expressive language development. *American Journal of Speech-Language Pathology, 5*(2) 5-21.

Pelham, W.E., Jr., Fabiano, G.A., & Massetti, G.M. (2005). Evidence based assessment of attention-deficit/hyperactivity disorder in children and adolescents. *Journal of Clinical Child and Adolescent Psychology, 34*(3), 449-476.

Pelham, W.E., Jr., Foster, M., & Robb, J.A. (2007). The economic impact of Attention-Deficit/Hyperactivity Disorder in children and adolescents. *Ambulatory Pediatrics, 7*(1S), 121-131.

Pelletier, J., Collett, B., Gimple, G., & Cowley, S. (2006). Assessment of disruptive behaviors in preschoolers: Psychometric properties of the Disruptive Behavior Disorders Rating Scale and School Situations Questionnaire. *Journal of Psychoeducational Assessment, 24*(1), 3-18.

Purvis, K.L., & Tannock. R. (1997). Language abilities in children with attention deficit hyperactivity disorder, reading disorders, and normal controls. *Journal of Abnormal Child Psychology, 25*(2), 133-144.

Re, A.M., Pedron, M., & Cornoldi, C. (2007). Expressive writing difficulties in children described as exhibiting ADHD symptoms. *Journal of Learning Disabilities, 40*(3), 244-255.

Ruf, H., Schmidt, N., Lemery-Chalfant, K., & Goldsmith, H.H. (2008). Components of childhood impulsivity and inattention: Child, family, and genetic correlates. *European Journal of Developmental Science, 2*(1-2), 52-76.

Sonuga-Barke, E.J. (2005). Causal models of attention-deficit/hyperactivity disorder: From common simple deficits to multiple developmental pathways. *Biological Psychiatry, 57*, 1231-1238.

Speltz, M.L., McClellan, J., DeKlyen, M., & Jones, K. (1999). Preschool boys with oppositional defiant disorder: Clinical presentation and diagnostic change. *Journal of the American Academy of Child & Adolescent Psychiatry, 38*(7), 838-845.

Stringaris, A., & Goodman, R. (2009). Three dimensions of oppositionality in youth. *Journal of Child Psychology and Psychiatry, 50*(3), 216-223.

Tabachnick, B.C., & Fidell, L.S. (2007). *Using Multivariate Statistics (5th Ed.*) Allyn & Bacon.

Thorell, L.B. (2007). Do delay aversion and executive function deficits make distinct contributions to the functional impact of ADHD symptoms? A study of early academic skill deficits. *Journal of Child Psychology and Psychiatry, 48*(11), 1061-1070.

Tomblin, J.B., Records, N.L., Buckwalter, P., Zhang, X., Smith, E., & O'Brien, M. (1997). Prevalence of specific language impairment in kindergarten children. *Journal of Speech, Language, & Hearing Research, 40*(6), 1245-1216.

Van Daal, J., Verhoeven, L, & van Balkom, H. (2007). Behavior problems in children with language impairment. *Journal of Child Psychology and Psychiatry, 48*(11), 1139-1147.

Wahlstedt, C., Thorell, L.B., & Bohlin, G. (2009). Heterogeneity in ADHD: Neuropsychological pathways, comorbidity, and symptom domains. *Journal of Abnormal Child Psychology, 37*(4), 551-564.

Wakschlag, L.S., Briggs-Gowan, M.J., Carter, A.S., Hill, C., Danis, B., Keenan, K., et al. (2007). A developmental framework for distinguishing disruptive behavior form normative misbehavior in preschool children. *Journal of Child Psychology and Psychiatry, 48*(10), 976-987.

Wiig, E.H., Secord, W.A., & Semel, E. (2004). *Clinical Evaluation of Language Fundamentals Preschool—Second Edition, Manual*. San Antonio, TX: Pearson.

Willcutt, E.G., Betjemann, R.S., Wadsworth, S.J., Samuelsson, S., Corley, R., DeFries, J.C., et al. (2007). Preschool twin study of the relation between attention-deficit/hyperactive disorder and prereading skills. *Reading and Writing, 20,* 103-125.

Willcutt, E.G. & Pennington, B.F. (2000). Comorbidity of reading disability and attention-deficit/hyperactivity disorder: Differences by gender and subtype. *Journal of Learning Disabilities, 33*(2), 179-191.

Willcutt, E.G., Pennington, B.F., Boada, R., Ogline, J.S., Tunick, R.A., Chhabildas, N.A., et al. (2001). A comparison of the cognitive deficits in reading disability and attention-deficit/hyperactivity disorder. *Journal of Abnormal Psychology, 110*(1), 157-172.

Williams, K.T. (2007). *Expressive Vocabulary Test—Second Edition, Manual*. AGS Publishing, Pearson Assessment.

VITA

The author was born in Lafayette, Louisiana. She obtained her Bachelor's degree in language and literature from Northwestern State University in Natchitoches, Louisiana in 2005. She joined the University of New Orleans Applied Psychology graduate program to pursue a Ph.D in Applied Biopsychology and become a member of Dr. Michelle Martel's research team in 2009.