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Spontaneous Language Use by Parents and Their Preschool Children at Risk for Adhd with or Without Li

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Abstract: This study examined the spontaneous language use between parents and their preschool children who are at high-risk for ADHD with a co-occurring language impairment (LI) and those without a co-occurring LI. Semantic and syntactic differences in language use were examined. Participants consisted of 20 children ages three to five years old and their parents. For each parent-child dyad, a 15-minute video-recorded interaction was orthographically transcribed and analyzed using the Systematic Analysis of Language Transcripts (SALT) software program. Children with co-occuring LI showed significantly lower Mean Length of Utterance (MLU), and Type-Token Ratios (TTR). Both groups showed very limited use of complex sentences and no specific difficulties with grammatical morphemes. Parents in both groups did not seem to adapt their language level whether or not their children had a LI.

Keywords: ADHD, Language Impairment, Parent-Child Interaction, Preschool

1. Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is the most common neurobehavioral disorder of childhood. Affecting over 11% of school-age children in the United States, ADHD diagnosis in childhood has been increasing by approximately 5% per year [1]. ADHD is characterized by the presence of developmentally inappropriate levels of inattention, over activity, and/or impulsivity which interfere with appropriate social, academic, or occupational functioning [2] Though ADHD is generally not diagnosed until children reach school age, research has documented the validity of an ADHD diagnosis in preschool age children [3], [4], [5], [6]. These studies indicate that two-thirds of preschoolers with significant behavior problems (e.g. disruptive behaviors in school, at home and in social settings) have been found to go on to receive a mental health diagnosis of ADHD or another disruptive disorder by the age of nine [3], thereby highlighting the importance of studying ADHD within a preschool population.

When compared to typically developing children, those with ADHD are at an increased risk for several markers of language impairment including: delayed onset of first words and word combinations, poor performance on standardized tests (vocabulary, syntax, reading fluency and short term memory), discourse limitations producing cohesive narratives, and pragmatic difficulties associated with inappropriate conversational participation [7], [8]. ADHD frequently co-occurs with a variety of neurodevelopmental and socioemotional behavioral disorders making differential diagnosis and identification of comorbidity essential to effective management of the disorder [9], [10].

Language impairments (LI) delay the mastery of receptive, expressive or pragmatic language skills in children [11]. When the LI neither co-occurs with any other impairment, nor is a consequence of a primary disability, it is called a Specific Language Impairment (SLI). Children with SLI do not have any hearing loss or developmental disorders such as intellectual disability, sensory disorder, neurological damage, emotional problems, or environmental deprivation. SLI is one of the most common childhood learning disabilities in the United States, affecting approximately 7 to 8 percent of

children in kindergarten with a higher prevalence in boys [12]. SLI may be manifested in significant difficulties with listening comprehension, following directions, oral/ gestural expression, social interactions, reading, writing or spelling, which adversely affects functioning and/or typical development [13]. In most cases of SLI, there is a substantial discrepancy between nonverbal performance and language skills with markedly lower skills in language. It is generally agreed that a z-score of at least -1.20 in a norm-referenced language test is necessary to diagnose it [14]. Most difficulties in SLI are noted in the syntax, morphology and phonology of the verbal output by the child [11], [15].

Preschoolers at risk for ADHD who also show language impairments do not fit the description of SLI because language is not their only deficient area. However, it is important to determine whether children at risk for ADHD who also show language impairments present with the same language difficulties as children with SLI. The high level of comorbidity between LI and ADHD has been well-established in the literature [16], [7], [17] and although the literature provides important findings, the implications of the co-occurrence of ADHD and LI are still controversial and remain poorly understood [18].

ADHD is a globally recognized disorder supported by substantial clinical research, whereas the terms LI and SLI are mostly unrecognized outside the research literature [19]. Mueller and Tomblin [20] state that the majority of research on the comorbidity of these two disorders has been conducted within clinical sample sets, meaning that the subjects are defined by the presence of the first disorder, and many of these studies have not included control samples; however, ADHD has been one of the most frequently reported co-occurring neurodevelopmental disorders in study samples of children with LI [21], [22], [23], [17]. Data on the prevalence of ADHD and SLI indicate that the degree of overlap between the two disorders is greater than would be expected by chance [24]. In a cross-sectional and prospective longitudinal study of 600 children with SLI, the rate of ADHD increased by 21% in a five-year span depending on the language deficit [16]. Mueller and Tomblin [20] state that based on an analysis of their data, children with SLI are two to three times more likely than children with typical developing language abilities to have ADHD, and the same effect is seen if SLI is conditioned on ADHD. Analyses of the impact that co-occurring ADHD had on children's core LI, demonstrate that overall the ADHD status has little noticeable impact [18]. The available group studies of children with ADHD and SLI provide little support for a connection between nonlinguistic deficits found in ADHD and children's language abilities [19]. However, ADHD provides a useful validity test for the development of clinical markers of SLI and vice versa. Children with ADHD and LI might benefit from access to speech-language services available to children with SLI [19].

Another relevant area of research concerns parent-child interactions in the presence of disabilities. Research in this area has shown that mothers of typically developing preschool age children systematically adapt and modify their language input to the developmental level, language and cognitive abilities of the children, resulting in balanced and coordinated patterns of verbal exchanges This flexibility seems to support and aid the child in the developmental process [25], [26], [27]. However, literature on developmental and family systems is currently emphasizing the contributions and influences of both the parents and the child independently [28]. All parents develop expectations about their child's education and development based on their own experience and information provided by the media, family, relatives, and informal networks of friends [29]. Children with developmental delays, language difficulties or externalizing maladaptive behaviors contribute to the parent-child interaction in unique ways that may not meet the parent's expectations. Such unrealistic expectations may lead to anxiety and discouragement when a child cannot live up to the parents' goals, and the parent-child interaction becomes less conducive to further development [30].

As with many other impairments, studies have identified specific components of the parent-child interactions of children with LI that negatively affect the relationship with their parents [31]. When compared to parents of typically developing children, parents of children with LI are less responsive to their child's non-verbal communication (e.g., gestures and externalizing behaviors), focusing heavily on their spoken language [32]. They have idealistic communicative expectations, and tend to be less positive and accepting of their child's utterances. Siller and Sigman [33] found that as compared to parents of typically developing children, parents of children with language difficulties are more directive, and less likely to provide contingent feedback and semantically related utterances to topics that are child-initiated [31]. Other studies have identified that a child's LI has negative effects on the parent's language output, including quality, complexity, frequency of use and conversational style (when interacting with their child), in comparison to the parents of children who do not have LI [34], [35]. Knowing the significance and value of the parent-child interaction, it is important to further analyze how these interactions are affected when a child not only presents with LI but is also at a high risk for ADHD.

Parents of children with ADHD, as those of children with LI, report higher levels of parenting stress compared to parents of children without ADHD and LI [36], [37], [38], [39]. They use more negative verbal control strategies, engage in poorer quality conversations, and have significantly lower family functioning in marital and sibling relationships [40]. In a study conducted by Modesto-Lowe and colleagues [41] on preschool children, results indicated that parents who have a child with ADHD tend to be more controlling and less responsive; they tend to use more verbal direction, reprimands, and corrections than parents of children without ADHD.

There is no specific study of parent-child interactions in children who present with LI and are concurrently at risk for ADHD. The current study examined the spontaneous

language use between parents and their children at risk for ADHD. These children were enrolled in an intensive summer program for children at risk for ADHD. Half of the children were also identified as having a LI. Language samples from parents interacting with their children before the program started were recorded and analysed for measures of syntax and semantics. It was hypothesized that children at risk for ADHD and concurrent LI would have limited spontaneous language skills as compared to children at risk for ADHD without a concurrent LI, and that parents of children at risk for ADHD with concurrent LI would be less likely to adapt their language input to their children's language abilities.

2. Methodology

This study was part of a larger study conducted at an urban university in the southeastern United States. Children and their caregivers were recruited from local preschools and mental health agencies via brochures, radio and newspaper ads, and open houses/parent workshops for participation in a summer treatment program for pre-kindergarteners (STP-PreK) [42]. To qualify for the study children were required to (a) have an externalizing problems composite t-score of 60 or above on the parent (M = 65.21, SD = 12.03) or teacher (M = 65.17, SD = 12.77) Behavior Assessment System for Children- 2 (BASC-2) [43]; (b) be enrolled in preschool during the previous year, (c) have an estimated IQ of 65 or higher (M = 91.63, SD = 14.67), (d) have no confirmed history of Autistic or Psychotic Disorder, and (e) be able to attend an 8-week summer program prior to the start of kindergarten. The current study utilized data collected prior to the start of the program on a subsample of 20 parents with their biological children ages three to five years old (76% male; M_{age}= 4.67).

As part of the pre-treatment assessment, consenting caregivers brought the children to the laboratory on two occasions. During the first visit children were individually administered the Wechsler Preschool and Primary Scale of Intelligence- 4th edition (WPPSI-IV) [44] while consenting caregivers completed a structured diagnostic interviews (C-DICS) [45]. During the initial visit, parents also completed several questionnaires about their child's behavior.

Most relevant to the current study, parents (mother or father) and their children participated in a video-recording of a standardized 15-minute play session. They were provided with age-appropriate toys including Legos and Mr./Mrs. Potato Heads. The videos were utilized to orthographically transcribe all spontaneous language used by parents and their children.

During the initial interview, parents were also offered an optional speech and language screener and follow-up speech and language assessment for those who failed the screener. Speech and language screenings were completed using the Preschool Language Scale-5 Screening Test (PLS-5-screener) [46]; those participants who failed the screening received a full speech-language evaluation using the Preschool Language Scales 5th Edition (PLS-5) [46]. Out of the 60 participants of the summer program, 31 of them were identified as having language impairments, and 10 of these were randomly selected for this study to participate in Group 1 (ADHD+LI). Ten of the remaining 29 children were randomly selected to be part of Group 2 (ADHD only). Eligibility for Group 1 included children whose expressive language score on the PLS-5 was at or below 82 standard score (*SS)* which is equivalent to a z-score of -1.20. Children in Group 1 (ADHD + LI) had total language (expressive + receptive) mean standard scores of 73.9 on the PLS-5 (Table 1). Demographics of participants in Group 2 (ADHD) are presented in table 2. Gender distribution was the same in both groups; a total of eight boys and two girls in each group. The mean age for Group 1 was 4 years and 11 months and for Group 2, 4 years and 8 months. A t-test revealed no significant difference in ages for the 2 groups (t-test =.52, p=.29).

Table 1. *Demographics of participants in group 1 (ADHD+LI).*

Subject	Age	Receptive Language SS	Expressive Language SS	PLS-5 Total Language SS	Gender
1	5y 9m	74	81	76	Male
2	4y 5m	94	82	87	Male
3	5y 9m	70	59	62	Male
4	5y 1m	82	73	76	Male
5	4y 2m	73	72	71	Male
6	3y 11m	78	76	77	Female
7	5y 1m	78	76	77	Female
8	4y 11m	82	80	80	Male
9	5y 0m	80	63	70	Male
10	5y 2m	66	79	71	Male

To asses children's behavioral functioning, parents and teachers were asked to complete the Behavior Assessment System for Children, 2nd Edition (BASC-2) [43]. Items on the BASC-2 are rated on a four-point scale ("never," "sometimes," "often," "almost always") and yield scores on broad internalizing, externalizing, adaptive and social functioning domains. For the purposes of this study, the externalizing behavior problems composite t-score reported by parents (M = 65.72, SD = 13.78) and preschool teachers (M = 67.72, SD = 13.28) were used as the primary screening measure.

To assess intelligence, children were administered the Wechsler Preschool and Primary Scale of Intelligence – Fourth Edition (WPPSI-IV) [44]. Core subtests (block design, information, matrix reasoning, bug search, similarities, and picture memory) were administered by trained graduate students and research assistants and used to calculate a full-scale IQ (M = 89.88, SD = 14.96).

Table 2. *Demographics of participants in group 2 (ADHD).*

Subject	Age	Gender
1	3y 8m	Male
2	5y 0m	Female
3	4y 7 m	Male
4	4y 5m	Male
5	4y 5m	Male
6	4y 9m	Male
7	4y 2m	Male
8	5y 2m	Female
9	5y 6m	Male
10	5y 6m	Male

The fifteen minutes of video recorded play interaction were orthographically transcribed for later analyses. Each transcript was then reviewed by a second transcriber (graduate students in speech-language pathology) who made notes on any disagreements between the first and second transcriber. A third transcriber reviewed disagreements and made a final judgement on which version was correct. The transcripts were then entered into the Systematic Analysis of Language Transcripts (SALT) software program [47], which is a widely used computer program for analysing language transcripts.

Language samples were analysed for children's and parents' Mean Length of Utterance (MLU), Type-Token Ration (TTR), which is a measure of vocabulary diversity that varies from 0 to 1 (proportion of number of different words divided by number of total words). The children's samples were also analysed for percentage of grammatical morpheme usage in obligatory contexts and use of complex sentences as well as percentage of mazes (false starts, repetitions, and fillers).

3. Results

Tables 3 and 4 show individual dyad's scores for each of the semantic and syntactic measures in each group (as well as standard deviations from the mean for child's MLU).

Table 3. *Summary analysis results for Group1 (ADHD + LI).*

Subject	Child MLU	Child MLU SD	Adult MLU	Child TTR	Adult TTR	Prop Child Complex Utterances	Number of Child Utterances	Number Adult Utterances
1	2.53	-3	3.74	0.4	0.25	0	58	138
2	2.84	-2.5	4.36	0.25	0.18	0.08	224	262
3	2.17	-3.1	3.53	0.31	0.25	0.06	120	258
4	3.67	-2.15	5.63	0.32	0.26	0.03	106	171
5	3.59	-2.25	4.57	0.39	0.25	0.05	102	185
6	2.29	-3	4.67	0.57	0.18	0.03	80	344
7	2.74	-2.89	4.12	0.67	0.3	0	80	303
8	2.3	-3.2	3.97	0.58	0.2	0.04	66	238
9	3.19	-2.38	4.26	0.37	0.19	0.06	94	247
10	3.46	-2.36	3.87	0.4	0.25	0.01	93	251
MEANS	2.878		4.27	0.426	0.231	0.03	102	239

Table 4. *Summary analysis results for Group 2 (ADHD only).*

Subject	Child MLU	Child MLU SD	Adult MLU	Child TTR	Adult TTR	Prop Child Complex Utterances	Number of Child Utterances	Number Adult Utterances
1	2.80	-2.50	4.16	0.28	0.17	0.032	184	297
2	3.87	-2.18	3.49	0.29	0.45	0.06	231	136
3	3.85	-2.00	3.66	0.27	0.38	0.07	185	175
4	3.89	-2.09	4.85	0.5	0.21	0.02	46	235
5	4.01	-2.00	4.94	0.37	0.2	0.10	108	267
6	2.71	-3.30	4.24	0.36	0.26	0.02	184	235
7	3.43	-2.40	4.59	0.4	0.33	0	132	208
8	3.57	-2.15	4.34	0.28	0.28	0.02	108	151
9	3.46	-1.95	5.23	0.32	0.19	0.12	124	301
10	4.86	-0.96	4.53	0.31	0.24	0.21	90	224
MEANS	3.65		4.403	0.338	0.271	0.06	139	222

As can be seen in the tables, almost all children in both groups had MLUs at or below 2 standard deviations from what is expected for their ages (standard deviations are provided by the SALT program, which compares each child's MLU to a database of children of the same age + or – 2 months), except subject 10 in Group 2 (ADHD only), who had a standard deviation of -.95. Though children in both groups had MLUs significantly below what is expected for their ages, the MLUs for children with LI (mean 2.878) were still significantly below those of the children with ADHD only (mean 3.65) (t=-1.85, p=.04). Parents in both groups used MLUs that were significantly higher than their children's (t-test = 2.1, p=.05), but the MLUs of parents in both groups were nearly identical (Mean MLU for parents of ADHD + LI = 4.272; Mean MLU for parents of ADHD only = 4.403).

An analysis of the children's grammatical morphemes usage showed no specific difficulties with their use in

obligatory contexts by children in either group, therefore that analysis is not reported here (nearly 100% correct usage in obligatory context by all children). The proportion of complex utterance usage was very low for both groups (Mean for ADHD+LI =.03; Mean for ADHD only =.06) and there was no significant difference in proportion of complex utterances between the 2 groups (p=.19). Percentage of mazes (false starts, repetitions, and fillers) in both groups showed no significant difference either (Mean ADHD+LI= 6.5; Mean ADHD ONLY=4.5; p=.23). Type-Token Ratios (TTR) were significantly lower in the ADHD+LI children (Mean ADHD only=.34; Mean ADHD+LI =.42; t-test=1.81, p=.04). Parents' TTRs were essentially the same for both groups (Mean ADHD only =.27; Mean ADHD+LI =.23). Interestingly, children in both groups had significantly higher TTRs than their parents (t=2.15, p=.045).

A comparison of number of utterances used by parents and children showed that parents in both groups had very similar number of utterances during the 15-minute recordings (mean for parents of ADHD+LI = 239, mean for parents ADHD only = 229). Children with ADHD+LI used slightly fewer utterances (mean = 102) than those with ADHD only (mean =139), but that difference was not significant (t-test=-1.26, p=.125).

4. Discussion

As expected, children who were classified as having a language impairment by the PLS-5 showed significantly lower MLUs than those who were not identified. However, MLU alone could not differentiate between children with LI or not in this population of children at risk for ADHD, as children in both groups had MLUs that were significantly below the level expected for their ages. Perhaps all children with ADHD tend to use shorter utterances, but those with concurrent LI use even shorter utterances. Unlike what happens in children with SLI, the shorter utterances in children with ADHD do not seem related to a specific difficulty with grammatical morphemes. This finding is consistent with findings by Redmond, Thompson, and Goldstein [48], who found that tense marking seems to separate children with SLI from ADHD. However, in this study, tense marking did not separate children with ADHD who show language impairments from those who do not. Both groups of children also showed very low usage of complex sentences (3% for children with ADHD+LI and 6% for those with ADHD only), and those few complex sentences used were classified as "infinitives" (e.g., "I want to play"), which are the earliest type of complex sentences acquired by children with typical development. Though there is no established expected percentage of complex sentence usage in children, by age 5, it is generally expected that 20% of children's utterance would be complex, including a variety of types, such as relative clauses and verbal complements [11]. The use of mazes by the children did not differentiate between the 2 groups either. Again, we see that the language behaviours of children with ADHD+LI is essentially different from those of children with SLI, as a study by Redmond [8] comparing conversational profiles of children with ADHD, SLI and typically developing, demonstrated that subjects with ADHD produced significantly more and longer mazes than those with SLI or typically developing. However, it should be noted that the above study collected conversational samples during free-play with an examiner and not the child's parent. From our results, it seems clear that both groups of children had limited language ability, but those identified as having an LI were more limited in their sentence length and vocabulary diversity.

An examination of the parents' language use showed that parents in both groups did not demonstrate sensitivity to their children's language limitations, as the parents' MLUs were significantly higher than their children's in both groups showing that parents were not adjusting to the complexity of their children's language. This lack of adjustment was even more pronounced in the group of children with ADHD+LI when we consider that these children had much lower MLUs than those with ADHD only, and their parents had MLUs that were just as high as those of the parents of children with ADHD only. This lack of adjustment might be good from the point of view of not limiting the richness of language exposure these children are getting. On the other hand, it seems that children with LI learn better when the language used by their parents is only slightly more complex than their own, thus narrowing the distance between the two [11]. These parents would likely benefit from intervention that focuses on making their own language more accessible to their children.

In terms of semantics, there was a significant difference found between the vocabulary diversity of children in the two groups, as measured by the Type-Token Ratio (TTR). Children with ADHD+LI had lower scores than those with ADHD only, thus suggesting that these children also have limited vocabulary skills in spontaneous language use. It was interesting to note that the children's TTRs were higher than that of their parents for both groups, creating a significant difference between parents and children in both groups. This difference may have been due to parents using more reinstatements in their language to keep their children engaged. In reinstating their comments, parents likely used a higher number of total words (tokens) without using more different words (types). Though it did not reach significance, children with LI used fewer utterances than those without. This is possibly due to the limited language skills of children with LI coupled with the unadjusted verbal output noted from their parents.

5. Conclusions

As expected, the children with concurrent LI and ADHD showed more limited syntactic and semantic skills than those with ADHD only. Their utterances were shorter and their vocabulary less varied than those not identified with LI. However, children without LI still showed shorter utterances than what is expected for typically developing children of the

same age. In addition, both groups showed very limited use of complex sentences. At least for the population examined in this study, children with ADHD, whether or not they have a concurrent LI, show limited syntactic skills and would likely benefit from intervention in this area. Another important finding is that parents of children with or without LI did not seem to adapt to their children's language limitation, as they used much longer utterances than their children. These parents would likey benefit from information on how to optimize the language input their children receive.

6. Limitations, Future Research, and Clinical Implications

This study had significant limitations that should be addressed in future studies. The study sample was small and the age ranges were broad given the variables of interest. Larger groups would not only make results more generalizable to the population of children at risk for ADHD with and without LI, but would also provide more statistically significant results attributable to added statistical power.

Another important limitation of this study is that it did not include a group of typically developing children. Previous research studies [34], [35], [41], [40] have shown clear differences in interaction patterns of parents and their children with ADHD or LI as compared to parents of typically developing children, therefore it would be expected that such control group would show differences from both our ADHD groups. However, previous studies did not use exactly the same measures used here, so it would be important to include such control group in any future studies to get a clearer understanding of the results.

Perhaps the most important limitation of this study was the choice of assessment tool to diagnose LI in children with ADHD, the PLS-5 and its screener companion. This instrument was chosen because it is the most widely used in preschool populations, however one study by Smith [49] has found low diagnostic accuracy in the PLS-5 for preschool children in general. It is possible that some of the children in the ADHD only group also had LIs that went undiagnosed, thus diluting our results. A more accurate measure might be the Mean Length of Utterance (MLU) which showed significantly lower values in ADHD+LI children. However, the MLUs for children in ADHD only were also considered lower than expected for their age. It is possible that even though children with concurrent LI had more pronounced language difficulties, both groups had low language skills. The development of more accurate measures of language impairments in children with, or at risk for, ADHD should be a priority in future research for better understanding of the co-occurrence of these 2 disorders. More importantly, it is clinically imperative that parent-child interactions continue to be studied in pre-school children at high risk for ADHD and LI. Clinicians and teachers are to be educated on the importance of assisting parents to cope and deal with their child's disorder, in order to facilitate a team approach in the process of accurately diagnosing and selecting the most appropriate treatment plan. Children with ADHD need to be accurately diagnosed with LI if they are to receive all the treatment and support they need in order to achieve psycho-social and academic success.

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