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Pragmatic Assessment in Autism Spectrum Disorders:

A Comparison of a Standard Measure With Parent Report

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Abstract

The purpose of this study was to investigate the concurrent validity of subtests on the *Comprehensive Assessment of Spoken Language* (CASL) by comparing them with the assessment of communication and social skills on the *Vineland Adaptive Behavior Scales* (*Vineland*). The participants were 35 children and adolescents with higher functioning autism spectrum disorders (ASD) who had received both the CASL and the *Vineland*. Results of the study suggest that the Pragmatic Judgment and Inferences subtests of the CASL appeared to document the difficulties that individuals with ASD had in adaptive use of language for communication.

Keywords

assessment; autism; Asperger syndrome; pervasive developmental disorder; language; social skills

Pervasive developmental disorders (PDD) is a group of severe neuropsychiatric conditions characterized by disturbances in social, cognitive, and communicative function that are not fully explained by developmental level. Although cognitive and language functioning are depressed in 60% to 70% of individuals with autism spectrum disorders (ASD), approximately 20% of individuals with ASD function within the normal range on IQ testing (American Psychiatric Association, 1994; Fombonne, 2003; Klin & Volkmar, 1997). High-functioning autism (HFA) and Asperger syndrome (AS) are the predominant diagnoses in this group. Individuals with HFA and AS often demonstrate large spoken vocabularies and relatively intact formal language skills but have deficits in the areas of pragmatics (i.e., the use of language in real-life, culture-specific contexts) and social communication (Landa, 2000; Tager-Flusberg, 1995; Tager-Flusberg, Paul, & Lord, 2005). Individuals with HFA have histories of (a) delayed language development and symbolic play evidenced before 3 years of age, (b) qualitative impairments in social interactions, (c) qualitative abnormalities in communication after early childhood despite adequate formal language skills, and (d) restricted, repetitive, or stereotypic interests and behavioral patterns (American Psychiatric Association, 1994). Individuals with AS do not have a history of delayed language development. However, these individuals show the qualitative impairments in social interaction, play, and communication usually associated with autism, as well as intense circumscribed interests or obsessions, repetitive and stereotypic

behavior patterns, and some motor delay and clumsiness (American Psychiatric Association, 1994; Klin, Volkmar, & Sparrow, 2000). In addition, some higher functioning individuals with ASD (e.g., HFA and AS) fail to meet criteria for either of these disorders and are classified as having pervasive developmental disorders, not otherwise specified (PDD-NOS).

Because many individuals with higher functioning ASD often perform in the normal to superior range on standardized assessments of language, it is often difficult to establish the need for speech/language services for individuals with higher functioning ASD. These individuals often demonstrate significant and severe deficits in their ability to communicate and interact with others, which can limit their participation in mainstream academic settings and community activities (Klin et al., 2000). However, the ability to document deficits in these areas is limited. Very few standard measures are available that tap into these skills in higher functioning individuals with ASD; valid norms for pragmatic development and objective criteria for pragmatic performance are limited (Young, Diehl, Morris, Hyman, & Bennetto, 2005). As a result, many clinicians rely on parent report, clinical judgment, and nonstandard observational measures to evaluate pragmatic abilities. Although these measures often provide good information about a child's present level of performance, these criteria are not always sufficient for establishing eligibility for services. Because pragmatics may be the only area of deficit in these individuals, documenting the need and eligibility for communication intervention for these individuals can be problematic.

Recently, Young et al. (2005) demonstrated one approach to this problem when they showed that the *Test of Pragmatic Language* (TOPL; Phelps-Terasake & Phelps-Gunn, 1992) was useful in documenting the pragmatic deficits of 17 speakers with ASD relative to typical peers. Although this study demonstrated a standard measure that could be used to document pragmatic deficits of individuals with ASD, there was some overlap in scores on the TOPL for individuals with ASD and individuals with typical development. Thus, Young and colleagues concluded that the TOPL should not be used in isolation to demonstrate or identify pragmatic language difficulties in individuals with ASD.

The purpose of this study was to examine additional standardized measures of pragmatic ability, the Pragmatic Judgment and Nonliteral Language subtests of the *Comprehensive Assessment of Spoken Language* (CASL; Carrow-Woolfolk, 1999). We investigated the concurrent validity of these measures by comparing them with the assessment of communication and social skills on the *Vineland Adaptive Behavior Scales* (*Vineland*; Sparrow, Balla, & Cicchetti, 1984). The *Vineland* is a well-standardized semistructured caregiver report instrument for assessing adaptive behavior and has been frequently used to document delays in adaptive development in individuals with autistic disorder (Carter et al., 1998; Jacobson & Ackerman, 1990; Liss et al., 2001; Loveland & Kelley, 1991; Rodrigue, Morgan, & Gefken, 1991; Schatz & Hamdan-Allen, 1995). When the *Vineland* has been used to assess individuals with ASD, research has shown that those individuals typically presented adaptive functioning levels much lower than intellectual levels (Volkmar, Carter, Sparrow, & Cicchetti, 1993; Volkmar et al., 1987). Furthermore, Gillham, Carter, Volkmar, and Sparrow (2000) reported that autism could be differentiated from both PDD-NOS and nonautistic developmental disorder (DD) by means of scores on the Socialization and Daily Living scales of the *Vineland*. Paul et al. (in press) demonstrated that *Vineland* Communication scores were related to measures of communication in spontaneous speech in speakers with ASD. Because the *Vineland* measures the actual use of everyday language through caregiver report, rather than the performance of an individual on contrived test items, it can be considered a measure with greater ecological validity for pragmatic ability than many standardized language assessments (Gilotty, Kenworthy, Sirian, Black, & Wagner, 2002). Our aim in this study was to determine if the Nonliteral Language and Pragmatic Judgment subtests of the CASL could

also function as valid measures of the use of everyday language in individuals with higher functioning ASD.

Method

Participants

A data set of 35 individuals between the ages of 3 and 15 years (M = 8.73, SD = 2.82) who had a diagnosis of HFA (n = 13; 37.14%), AS (n = 11; 31.43%), or PDD-NOS (n = 11; 31.43%) was obtained from children and adolescents seen in the Developmental Disabilities Section of the Yale Child Study Center. There was not a significant difference between the number of individuals in each diagnostic category, $\chi^2(df = 2) = .229$, *ns*. There were 28 boys (80%) and 7 girls (20%) in this sample, which is consistent with studies that have shown the prevalence ratio of boys to girls to be around 4:1 (Fombonne, 2003). These individuals received intensive multidisciplinary evaluations that included standardized assessments of cognitive, language, and social-adaptive functioning (see Klin, Saulnier, Tsatsanis, & Volkmar, 2005, for a description of the multidisciplinary evaluation). Diagnostic assignment followed the criteria for autism, AS, and PDD-NOS from the *Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition* (*DSM-IV*; American Psychiatric Association, 1994). In accordance with these criteria, none of the individuals assigned the diagnosis of AS had speech and language delays or marked deviance in the first 3 years of life (Klin & Volkmar, 1997; Volkmar et al., 1994). Clinical diagnoses were confirmed independently by two experienced clinicians (AK and FV) with demonstrated inter-rater reliability (Klin, Lang, Cicchetti, & Volkmar, 2000). Participants in this study were selected on the basis of their having received both the CASL (Carrow-Woolfolk, 1999) and the *Vineland* (Sparrow et al., 1984) during their evaluation. Selection criteria also included a standard score of at least 70 on developmentally appropriate measures of nonverbal IQ (NVIQ), such as the *Wechsler Intelligence Scale for Children–Third Edition* (WISC-III; Wechsler, 1992), Kaufman Assessment Battery for Children (K-ABC; Kaufman & Kaufman, 1983), and Wechsler Adult Intelligence Scale–Third Edition (WAIS-III; Wechsler, 1997).

Measures

All measures used in this article were conducted as part of a comprehensive evaluation at a university-based Developmental Disabilities clinic (see Table 1 for assessment results for each participant). The comprehensive evaluation included a family and developmental history, psychological testing, language assessment, including the CASL, and an evaluation of adaptive behavior (*Vineland*). Clinical evaluations were typically conducted over 2 days to maximize the attending and focus of the individual being evaluated. Trained clinicians who were experienced in the evaluation of individuals with autism conducted all assessments, which were observed by a clinical psychologist or a psychiatrist (AK and FV). At the conclusion of the evaluation, the families of each individual met with the clinical staff to discuss the results of the evaluation, possible diagnoses, and intervention suggestions.

CASL—The CASL is a norm-referenced assessment used to measure oral language skills. It assesses oral language in four areas: (a) lexical/semantic, (b) syntactic, (c) supralinguistic, and (d) pragmatic. The CASL was standardized using a nationally representative sample of 1,700 individuals between the ages of 3 and 21 years with and without disabilities. Internal reliability for the CASL subtests was reported within a range of .64 to .94, with higher reliability being reported for the Core Composites (.85 to .96). To establish validity, the CASL was compared with four other tests of language; correlations between the measures were good, ranging from .39 to .85. The psychometric properties of the CASL for children with autism have not been established yet, and very little research has been published using the CASL as an outcome measure for children with autism.

Subtests in the CASL can be administered and scored individually or can be given together to obtain a core score. This study examined six specific CASL subtests: Nonliteral Language, Pragmatic Judgment, Antonyms, Syntax Construction, Paragraph Comprehension, and Inference. These six subtests were chosen because there were at least 10 participants who received all six subtests in each group, which has been suggested as a minimum number of participants when doing regression analyses (Bentler, 1985). The Nonliteral Language test evaluates an individual's ability to understand figurative speech, indirect requests, and idioms. The Pragmatic Judgment test evaluates the effectiveness and understanding of the use of language in real-life situations. The Antonym test is a measure of semantic functions and evaluates an individual's ability to identify and express words opposite in meanings. The Syntax Construction test measures grammatical ability and evaluates an individual's ability to generate sentences that adhere to morphosyntactic rules. The Paragraph Comprehension subtest assesses the ability to answer factual questions about paragraph-length stories read to the participant. The Inference test evaluates an individual's ability to derive meaning from previously acquired knowledge.

Vineland Adaptive Behavior Scale–expanded edition—The *Vineland* assesses an individual's adaptive behavior in five areas: communication, social, daily living, motor, and maladaptive behavior. Adaptive behavior is the performance of daily activities necessary to sustain independence. The evaluation is a semistructured interview administered to someone familiar with the individual being evaluated, typically the parents or primary care-giver. The *Vineland* was standardized using a nationally representative sample of more than 3,000 individuals between birth and age 18 years 11 months. Split-half reliabilities of the items in each domain were calculated and were good, with median reliabilities from .86 to .97. Test–retest and interrater reliabilities were also high, with coefficients in the .80s and .90s. Furthermore, the *Vineland* has been frequently used to examine the everyday capabilities of individuals with autism in clinical, educational, and research domains. Recently, supplemental norms for individuals with autism were developed (Carter et al., 1998).

This study examined two of the five domains on the *Vineland*: Communication and Socialization. The Communication domain evaluates an individual's ability to communicate in natural, everyday environments, with specific questions covering receptive, expressive, and written language. The Socialization domain evaluates an individual's ability to interact in social situations, express and regulate emotions, and participate in leisure activities or play.

Procedure

The data used in this study were collected previously and analyzed retrospectively; all of the comprehensive evaluations from which the data for this study were obtained were conducted between 2002 and 2005. The standardized formats specified in the manuals were used for all assessments.

For this study, the database for the university-based Developmental Disabilities clinic was searched to locate all individuals who had received both the CASL and the *Vineland*. The search revealed 46 individuals who had received both assessments. Eleven individuals were excluded from the final sample because they did not have an NVIQ above 70 ($n = 8$) or because their NVIQ data were missing ($n = 3$). The resulting cases ($n = 35$) were used to create a new database for this study, which was later used for statistical analysis.

Results

Characteristics of the participants in each of the three diagnostic groups (HFA, AS, PDD-NOS) were compared using analyses of variance (ANOVAs). The participants did not differ on mean age, NVIQ, or scores on the *Vineland* (Sparrow et al., 1984; see Table 2). However, the full-

scale IQ (FSIQ) and verbal IQ (VIQ) scores were significantly different, $F(2, 32) = 5.301$, $p = .01$, $F(2, 32) = 6.891$, $p = .003$, respectively. Least significant difference post hoc comparisons were calculated to examine the differences between diagnostic groups (Seaman, Levin, & Serlin, 1991). These analyses revealed that the individuals with AS had significantly higher FSIQ scores than individuals with HFA, $p = .010$, or PDD-NOS, $p = .006$.

The individuals with AS also had significantly higher VIQ scores than individuals with HFA, $p = .001$, or PDD-NOS, $p = .007$. These findings are consistent with the neuropsychological patterns typically seen within the autism spectrum (Tsatsanis, 2004). In this study, means were not compared across groups, thus, these differences did not affect the results.

Because the sample included a broad range of ages, data were examined to see if the participants could be divided into two groups: younger than 7 years old and older than 7 years old. This age split was examined based on the suggested Core Composite subtests in the CASL manual (Carrow-Woolfolk, 1999). When the participants were divided into these two groups, the younger group had a small total sample size ($n = 9$), and the Nonliteral Language CASL subtest only had a sample size of 2. Because of the small sample size of the younger group, we were not able to compare results between the groups. Therefore, it was decided to keep the sample as one large group to help ensure proper statistical power and reduce the likelihood of Type II errors. To further reduce the risk of Type II errors, a significance level of $p < .01$ was used.

Spearman's ρ was used to calculate the correlations between performance on the CASL subtests and performance on the *Vineland*. Spearman's ρ was used due to the relatively small sample size and the nonnormal distribution of scores in the sample. Correlations were calculated for all CASL subtests with a sample size greater than 10 because further analyses were desired and Bentler (1985) suggested entering only one predictor per 10 participants. The different sample sizes for the CASL subtests were due to clinical judgment and suggested age ranges given in the testing manual (Carrow-Woolfolk, 1999).

Significant correlations were found between the Pragmatic Judgment subtest of the CASL and the Communication domain of the *Vineland* and between the Inferences subtest of the CASL and the Socialization domain of the *Vineland* (see Table 3). The Nonliteral Language subtest of the CASL was not significantly correlated to either *Vineland* domain when using a significance level of $\alpha = .01$. Scatterplot graphs were visually analyzed for all significant correlations, which revealed that higher scores on the CASL subtests predicted higher scores on the *Vineland*. Stepwise regression analyses were computed to examine the percentage of variance on *Vineland* scores that could be attributed to the CASL subtests with significant correlations. The regression analyses revealed that the Pragmatic Judgment CASL subtest accounted for a significant portion of the variance in Communication domain scores on the *Vineland* when paired with the Inferences CASL subtest, $R^2 = .43$; $F(1, 14) = 10.35$, $p = .006$, and the Inferences CASL subtest accounted for a significant portion of the variance in Socialization domain scores on the *Vineland* when paired with the Pragmatic Judgment CASL subtest, $R^2 = .45$; $F(1, 14) = 11.38$, $p = .005$.

Because the Pragmatic Judgment and Inferences CASL subtests were significantly correlated to the *Vineland*, these two measures may serve to represent a valid measure of pragmatic ability in students with ASD. However, Table 4 shows that scores on these measures, despite their relationship to *Vineland* scores, were within the normal range. To demonstrate that these normal-range scores nonetheless represent a significant impairment relative to other language skills, we compared them to a measure of more formal linguistic ability. The Antonyms subtest of the CASL, which is a subtest in the Lexical/Semantic category, was used as an index of formal language. Paired *t* tests were used to contrast performance on Antonyms with each of the subtests found to relate to the *Vineland* (i.e., Pragmatic Judgment and Inferences).

Compared to scores on the Antonyms subtest of the CASL, individuals with ASD scored significantly lower on the CASL subtests of Inferences ($M = 22.00$, $SD = 10.66$), $t(12) = 7.44$, $p < .001$, and Pragmatic Judgment ($M = 23.15$, $SD = 16.44$), $t(25) = 7.18$, $p < .001$.

Discussion

This study examined the validity of a standardized language assessment as a measure of the pragmatic language abilities (as measured by the *Vineland*) of children and adolescents with higher functioning ASD. The results of this study extend the literature on standard assessments that can be used as a measure of pragmatic skills in individuals with ASD and corroborate the findings of Young et al. (2005). The results of this study showed that the Pragmatic Judgment and Inferences sub-tests of the CASL were significantly correlated with the Communication and Social domains of the *Vineland*. The significant correlations and regression analyses concerning the Pragmatic Judgment and Inferences CASL subtests suggest that they might be acceptable measures of the everyday language skills of individuals with higher functioning ASD that can be used to document the difficulties these individuals have with social uses of language. This provides clinicians with an additional tool for establishing pragmatic deficits in students with ASD.

Individuals with higher functioning ASD often fail to qualify for speech–language services because they present strong verbal skills and large vocabularies and score well on formal language assessments. Nonetheless, social communication has often been considered an area of weakness for these individuals, which the results of this study confirm. Whereas participants in this sample performed at above-average levels on CASL subtests that measured formal aspects of language, their performance on the Pragmatic Judgment and Inferences CASL subtests were near the bottom of the normal range and were close to one standard deviation below scores on the Antonyms CASL test. Students' *t* tests revealed significant differences between Antonyms and each of the other two scores. (We are not suggesting that the Antonyms subtest will always be the best indicator of an individual's formal language functioning level. Clinical judgment should be used to select subtests that are indicative of the individual's formal language functioning level for comparison.) This significant deviation provides a form of documentation that can be used in conjunction with teacher and parent observations to display the need for communication services for high-functioning individuals with these syndromes.

Although a conservative *p* value was used, these results should still be interpreted with caution and are not without limitations. First, although the study had a total sample of 35 individuals, the sample was obtained at one site serving predominantly middle-and upper class clients; further research needs to determine if the results shown here are typical across socioeconomic levels.

Second, the sample included children and adolescents with HFA, AS, and PDD-NOS, and the results of group comparisons by diagnostic category demonstrated significant IQ differences (see Table 2). The heterogeneity of research samples can make it difficult to interpret the results and to generalize the results to specific individuals; thus, caution should be taken when applying these results in a clinical or practical situation. The small sample size of each diagnostic category also did not allow for a reliable examination of correlations between CASL test scores and *Vineland* scores by diagnostic category or age group. Further research is needed to determine if the findings of this study are consistent across all diagnostic categories and age groups, which, if favorable, would add confidence to the conclusions drawn from this study.

However, these findings do suggest that a within-test comparison of scores on the CASL, in particular a contrast between scores on a lexical/semantic measure such as the Antonyms subtest and subtests such as Pragmatic Judgment and Inferences, to adaptive use of

communication can be a useful component of a comprehensive assessment of individuals with higher functioning ASD. When working with students whose pragmatic skills appear to be significantly discrepant from other language skills, and for whom it would be difficult to justify language services on other grounds, these findings can provide a tool for documenting the serious social communicative deficits so commonly seen in this population.

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Table 1

Assessment Results for Each Participant

Participant Characteristics				Intelligence			Vineland		CASL			
ID	Age	Sex	Dx	FSIQ	VIQ	NVIQ	COM	SOC	NONL	PRAG	INFR	ANT
1	4.2	M	1	99	104	90	84	73		103		
2	5.3	M	1	97	100	96	106	70		76		123
3	7.7	M	1	68	60	79	54	64	75	53		72
4	8.2	M	1	90	101	80	73	53	79	84	80	112
5	8.3	F	1	86	75	94	48	51	67	46	64	82
6	8.4	M	1	114	112	115	68	55	88	81	93	122
7	9	M	1	113	104	123	67	51	79	89	98	126
8	9.3	M	1	113	114	111	88	57		90		
9	9.5	F	1	82	72	96	52	59	82	75		83
10	10.6	F	1	113	111	113	66	56	97	79	87	128
11	12.3	M	1	83	88	80	77	52	90	72		91
12	13	M	1	93	104	82	83	59	99	86	90	104
13	15.4	F	1	99	105	94	87	51	87	65	87	
14	3.8	F	2	118	136	97	130	77		152		
15	4.5	M	2	102	103	106	79	62		120		
16	6	M	2	134	134	129	84	69	107	104	110	113
17	6.6	M	2	113	126	98	92	61	98	91	95	110
18	7.5	M	2	131	146	110	92	61	126	103	110	
19	8.6	M	2	124	125	119	69	50	118	95		127
20	8.8	M	2	114	128	96	103	72	115	117		143
21	9.6	M	2	124	126	117	81	73	108	94	108	142
22	11.3	M	2	87	89	89	84	49		73	83	
23	13.9	M	2	107	121	91	63	45	114	85	92	106
24	13.6	M	2	81	93	71	80	60	105	87	94	
25	5.3	M	3	77	78	78	70	63		93		88
26	5.3	M	3	102	106	103	76	62		108		104
27	6.5	F	3	93	91	96	80	66		92		90
28	7.3	M	3	108	117	98	80	58	109	104		113

Participant Characteristics				Intelligence			Vineland		CASL			
ID	Age	Sex	Dx	FSIQ	VIQ	NVIQ	COM	SOC	NONL	PRAG	INFR	ANT
29	8	F	3	102	121	82	100	65	120	96	95	115
30	8.1	M	3	106	104	107	103	95	79	56		109
31	8.4	M	3	83	91	77	86	61	70		72	98
32	9.5	M	3	104	122	83	112	77	115	102	104	116
33	10.4	M	3	84	79	93	62	67	69	62		92
34	10.5	M	3	96	102	90	59	52	99	89		98
35	11.1	M	3	83	85	82	69	61	74	51		73

Note: Dx = diagnosis (1 = Asperger syndrome, 2 = high-functioning autism, 3 = pervasive developmental disorder, not otherwise specified); FSIQ = full-scale intelligence quotient; VIQ = verbal intelligence quotient; NVIQ = nonverbal intelligence quotient; VABS = *Vineland Adaptive Behavior Scales* (Sparrow, Balla, & Cicchetti, 1984); COM = Communication domain; SOC = Socialization domain; CASL = *Comprehensive Assessment of Spoken Language* (Carrow-Woolfolk, 1999); NONL = Nonliteral Language; PRAG = Pragmatic Judgment; INFR = Inference; ANT = Antonyms. Intelligence was measured on developmentally appropriate measures, such as the *Wechsler Intelligence Scale for Children–Third Edition* (WISC-III; Wechsler, 1992), *Kaufman Assessment Battery for Children* (K-ABC; Kaufman & Kaufman, 1983), and *Wechsler Adult Intelligence Scale–Third Edition* (WAIS-III; Wechsler, 1997).

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Table 2

Analyses of Variance (ANOVAs) of Assessment Results by Diagnostic Category and Least Significant Difference (LSD) Post Hoc Comparisons

	ANOVA			LSD Post Hoc Comparison Level of Significance		
Variable	***df***	***F***	**Sig.**	**AS to HFA**	**AS to PDD-NOS**	**HFA to PDD-NOS**
Age tested	2, 32	0.46	.637	.528	.783	.361
FSIQ	2, 32	5.30	.010**	.010**	.006**	.763
VIQ	2, 32	6.89	.003**	.001**	.007**	.622
NVIQ	2, 32	2.06	.144	.330	.051	.270
VABS COM	2, 32	1.94	.161	.061	.463	.251
VABS SOC	2, 32	2.18	.130	.328	.301	.045

Note: AS = Asperger syndrome; HFA = high-functioning autism; PDD-NOS = pervasive developmental disorder, not otherwise specified; FSIQ = full-scale intelligence quotient; VIQ = verbal intelligence quotient; NVIQ = nonverbal intelligence quotient; VABS = *Vineland Adaptive Behavior Scales* (Sparrow, Balla, & Cicchetti, 1984); COM = Communication domain; VABS SOC = Socialization domain.

** $p < .01$.

Table 3

Correlations Between *Vineland Adaptive Behavior Scales* Domains and *Comprehensive Assessment of Spoken Language* Subtests in Individuals With Higher Functioning Autism Spectrum Disorders

Subtest	VABS COM	VABS SOC
VABS COM	—	
VABS SOC	$r = .532^{**}$	—
CASL		
Nonliteral Language	$r = .480$	$r = .108$
Pragmatic Judgment	$r = .449^{**}$	$r = .371$
Antonyms	$r = .452$	$r = 124$
Syntax Construction	$r = .367$	$r = .064$
Paragraph Comprehension	$r = .146$	$r = .131$
Inferences	$r = .401$	$r = .621^{**}$

Note: VABS = *Vineland Adaptive Behavior Scales* (Sparrow, Balla, & Cicchetti, 1984); CASL = *Comprehensive Assessment of Spoken Language* (Carrow-Woolfolk, 1999); COM = Communication domain standard score; SOC = Socialization domain standard score.

** $p < .01$.

Table 4

Assessment Results: Means, Standard Deviations, and Ranges

	n	*M*	*SD*	Range
Intelligence				
FSIQ	35	100.66	16.06	68–134
VIQ	35	104.94	19.83	60–140
NVIQ	35	96.14	14.52	71–129
Vineland				
Communication	35	80.20	17.67	48–130
Socialization	35	61.63	10.06	45–95
CASL				
Nonliteral Language test	26	94.96	17.81	67–126
Pragmatic Judgment test	34	87.44	21.50	46–152
Inferences test	17	91.88	12.67	64–110
Antonym test	27	106.67	18.96	72–143
Syntax Construction test	27	99.74	21.72	61–153
Paragraph Comprehension test	24	97.96	23.28	41–132

Note: All scores are reported as standard scores. Intelligence was measured on developmentally appropriate measures, such as the *Wechsler Intelligence Scale for Children–Third Edition* (WISC-III; Wechsler, 1992), *Kaufman Assessment Battery for Children* (K-ABC; Kaufman & Kaufman, 1983), and *Wechsler Adult Intelligence Scale–Third Edition* (WAIS-III; Wechsler, 1997). FSIQ = full-scale intelligence quotient; VIQ = verbal intelligence quotient; NVIQ = nonverbal intelligence quotient; *Vineland* = *Vineland Adaptive Behavior Scales* (Sparrow, Balla, & Cicchetti, 1984); CASL = *Comprehensive Assessment of Spoken Language* (Carrow-Woolfolk, 1999).