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Language and Aggressive Behaviors in Male and Female Youth with Autism Spectrum Disorder

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Abstract

Aggressive behaviors are common among youth with autism spectrum disorder (ASD) and correlate with pervasive social-emotional difficulties. Communication skill is an important correlate of disruptive behavior in typical development, and clarification of links between communication and aggression in ASD may inform intervention methods. We investigate child/family factors and communication in relation to aggression among 145 individuals with ASD (65 female; ages 8–17 years). Overall, more severe aggression was associated with younger age, lower family income, and difficulties with communication skills. However, this pattern of results was driven by males, and aggression was unrelated to child or family characteristics for females. Future work should incorporate these predictors in conjunction with broader contextual factors to understand aggressive behavior in females with ASD.

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Conflict of Interest

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Keywords

language; communication; aggression; externalizing behaviors; autism; ASD; sex differences; gender

Although not part of formal diagnostic criteria for autism spectrum disorder (ASD; American Psychiatric Association, 2013), externalizing behaviors are often a primary concern in home and school settings, occur with high prevalence, and are associated with a range of long-term negative consequences for individuals with ASD. Externalizing often takes the form of aggressive behavior during early childhood, with nearly a quarter (22%) of young children (ages 1.5–5.8 years) with ASD demonstrating clinically significant aggression (Hartley, Sikora, & McCoy, 2008). Estimates of prevalence increase with age. By conservative estimates, nearly a third of school-age children with ASD display aggressive behavior (32.8%; Dominick, Davis, Lainhart, Tager-Flusberg, & Folstein, 2007), with some estimates as high as 53–68% (Kanne & Mazurek, 2011; Mazurek, Kanne, & Wodka, 2013; McTiernan, Leader, Healy, & Mannion, 2011). Accordingly, 26% of parents and 31% of teachers identify externalizing behaviors as their *primary* behavioral concern among elementary school-aged children with ASD (Azad & Mandell, 2016).

Aggressive behavior can take a number of forms, including verbal aggression (e.g., threats, insults, name-calling, profanity; Farmer & Aman, 2009), as well as physical aggression (e.g., attempts to injure others, damage to belongings; Achenbach & Rescorla, 2001; Farmer & Aman, 2009). While both subtypes are problematic, physical aggression may be selectively elevated among youth with ASD as compared to peers with other developmental and intellectual disabilities (Farmer & Aman, 2011). In addition, physical aggression may worsen in intensity over the course of childhood and adolescence for youth with ASD, progressing from pinching, biting, and scratching in late childhood and adolescence to more serious aggression, altercations, and property destruction in adulthood (Farmer & Aman, 2011; Matson & Rivet, 2008). This stands in contrast to the literature among children and adolescents without ASD, for whom physically aggressive behaviors generally decrease over the course of development (e.g., Brame, Nagin, & Tremblay, 2001; Farmer & Aman, 2009; Underwood, Beron, & Rosen, 2009). Over time, aggressive behaviors constitute risk factors for physical and psychological harm to others, as well as social isolation, exhaustion, and concerns for safety among family members (Hodgetts, Nicholas, & Zwaigenbaum, 2013). Indeed, one large study (Mandell, 2008) found that the presence of significant aggressive behavior among youth with ASD increased their likelihood of psychiatric hospitalization by nearly fivefold, a striking increase relative to peers. Out of all the problem behaviors that led to hospitalization in that sample, aggression (79%) and attention problems (56%) were the most common symptoms observed in hospitalized youth with ASD based on parent report.

Influences on aggressive behavior

Given both the frequency and detrimental impact of physical aggression for youth with ASD, understanding child and family factors associated with its emergence and development is essential. Among children and adolescents without ASD, higher levels of aggressive behavior are associated with a variety of family demographic factors, such as lower

household income, lower maternal educational attainment, and younger maternal age at child birth (Nagin & Tremblay, 2001; Tremblay et al., 2004). Some of these same risk factors extend to youth with ASD, but findings have been inconsistent. For instance, some studies support lower household income, less parental education, and/or younger child age as risk factors for heightened aggression (e.g., Mazurek, Kanne, & Wodka, 2013; Neuhaus, Bernier, Tham, & Webb, 2018), but results from other samples have found opposite or nonsignificant relations among these variables (e.g., Kanne & Mazurek, 2011; Hill et al., 2014). Research among youth without ASD also highlights the role of sex differences related to physical aggression, as correlates and longitudinal trajectories may be moderated by sex (Campbell et al., 2010; Underwood et al., 2009).

In addition to these child and family factors, research among typically developing children suggests that individual differences in communication skills play a role in the development of physically aggressive behavior (e.g., Dionne, Tremblay, Boivin, Laplante, & Perusse, 2003; Fagan & Iglesias, 2000; Stevenson, Richman, & Graham, 1985). Although findings vary according to children's age, the aspect of language assessed, and the method of assessment, heightened aggression generally coincides with lower communication skills. As early as 18 months of age, weaker expressive vocabulary skills are associated with more physical aggression (Dionne et al., 2003). Similarly, stronger language skills among preschoolers predict fewer externalizing behaviors six months later (Fagan & Iglesias, 2000), and weaker structural language skills at age 3 years predict higher levels of externalizing behaviors at 8 years of age (Stevenson et al., 1985). Links between language skill and aggressive behavior are likely attributable to a number of reasons that vary across individuals and instances, but functional accounts suggest that aggressive behaviors may serve a communicative function at times, such as communicating requests or protests, gaining attention, or expressing an emotion such as frustration or discomfort (Hutchins & Prelock, 2014). Consequently, although difficulties with communication may also be expressed in other ways (see Tiger, Hanley, & Bruzek, 2008), it is plausible that aggressive behaviors may emerge more frequently during developmental phases or among individuals with insufficient communication skills to meet those needs through verbal means.

Although ASD is characterized by deficits in communication skills, the relation between language and aggression is not straightforward among youth with ASD. Whereas some research indicates that higher levels of externalizing and aggressive behaviors are associated with weaker expressive language skills (Hartley, Sikora, & McCoy, 2008), adaptive communication skills (Mazurek et al., 2013), and pragmatic communication skills (Boonen et al., 2014; Rodas, Eisenhower, & Blacher, 2017), effects are not uniformly observed and are not always robust when other predictors are included in statistical models (e.g., Fok & Bal, 2019; Kanne & Mazurek, 2011; Mazurek et al., 2013). Thus, the reliability of associations between aggression and communication skills among children and adolescents is unclear.

Aims of the current study

The objective of the current study was to explore language and communication skills in relation to aggressive behaviors in school-aged verbally fluent children and adolescents with

ASD, while also considering broader child and family characteristics. Unique to this sample were (1) a focus on verbally fluent individuals with ASD, and (2) the oversampling of females with ASD. Based on previous findings on the relationship between child/family factors and externalizing behaviors in populations with and without ASD, we predicted that aggressive behavior would be associated with younger age, lower family income, and lower levels of parent education. Moreover, we anticipated that weaker communication skills would associate with increased aggressive behavior over and above the effects of child and family factors. Because of inconsistency in published findings relating language with aggression in ASD, we did not have a priori hypotheses regarding specific aspects of communication. Finally, given the unique nature of our sample, and evidence that associations between communication and behavioral difficulties may vary by sex (e.g., Ketelaars, Cuperus, Jansonius, & Verhoeven, 2010), we tested our hypotheses with regard to possible sex differences.

Method

Participants

Participants aged 8 through 17 years of age were enrolled at four sites (Boston Children's Hospital, Seattle Children's Research Institute, University of California Los Angeles, and Yale University) as part of the ACE Network GENDAAR study (NIMH R01 MH10028). Under procedures approved by the appropriate institutional review boards, participants were recruited from clinics, schools, and community centers. Consent was obtained from a custodial caregiver, and children provided assent. Participants enrolled in the study did not have any known genetic or neurological conditions, significant pregnancy or perinatal complications, or sensory or motor impairments that would impede testing. All spoke English as a primary language.

A total of 145 youth with ASD (65 female / 45%) provided sufficient data for the current analyses. The majority of participants had existing diagnoses of ASD prior to joining the study. All participants met research diagnostic criteria for autism spectrum disorder based on research-reliable administration of the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Lord et al., 2012); Autism Diagnostic Interview–Revised (ADI-R; Rutter, Le Couteur, & Lord, 2003); as well as expert clinical judgement of DSM-IV diagnosis of ASD (Autistic Disorder, Asperger's Disorder, or PDD-NOS) by study lead clinicians (senior licensed psychologists). All participants had fluent language and verbal standard scores ≥70 on the Differential Ability Scales, 2nd Edition (DAS-II; Elliott, 2007), and provided data from measures addressing communication and externalizing behaviors. Participants' age, race/ethnicity, parental education, and family median income are presented in Table 1. For analyses, race was coded into two categories: white/non-Hispanic ($n = 97$) or non-white (other racial identification and/or Hispanic ethnicity; $n = 54$). Family income was coded based on total household income and adjusted based on site-specific median household income: ≤100% of area median income,101–170% of area median income, and >170% of the area median income. Parental education was coded as 3 categories: less than or some college, completion of bachelor's degree, or more than bachelor's level education.

Cognitive & Communication Ability

To evaluate communication in a comprehensive manner, we used three measures to quantify skill across related but distinct areas, as shown in Table 2. First, we used the DAS-II Verbal composite standard score to assess core language knowledge and verbal reasoning ability. This composite of the DAS-II includes the Word Definitions and Verbal Similarities subtests. For reference, scores on the DAS-II General Conceptual Ability, Nonverbal Reasoning, and Spatial composites are provided in Table SM1 of supplemental materials.

Second, we used the Core Language Score (CLS) from the Clinical Evaluation of Language Fundamentals, 4th Edition (CELF-4; Semel, Wiig, & Secord, 2003), a standardized language assessment for children and adolescents of ages 5–21 years. The CLS measures overall language performance. Of note, the CLS includes different subscales by age. Subscale performance and number of participants who received each subscale are included in the supplemental materials, Table SM2.

Third, we used the Communication standard score from the Vineland Adaptive Behavior Scales, 2nd Edition (Vineland-II; Sparrow, Cicchetti, & Balla, 2005) as a measure of adaptive or applied communication. The Vineland-II is a standardized parent-report interview that assesses receptive, expressive, and written forms of communication for individuals from birth through adulthood. See supplemental materials (Table SM3) for correlations between communication measures.

Aggressive Behaviors

Aggression was assessed using the Aggressive Behavior T-score from the Child Behavior Checklist (CBCL/6–18; Achenbach & Rescorla, 2001), a parent-report questionnaire that assesses a broad spectrum of social-emotional concerns. The Aggressive Behavior subscale includes items pertaining to physical aggression toward others, destruction of items, and noncompliance, as well as elements of verbal aggression (e.g., teasing, threatening). Higher scores on the CBCL represent greater clinical concerns. See Table 2. For additional descriptive information on related externalizing subscales, see supplemental Table SM4. Note that CBCL scores are normed by participants' parent-reported sex, rather than by participants' identified gender.

Analyses

In order to explore associations between a variety of factors and participants' aggressive outcomes, we created a 3-level multiple regression model with aggressive behavior as the dependent variable in SPSS Statistics Version 19. At Level 1 of the model, child demographic variables of age and race (white, non-white) were entered. At Level 2, family characteristics of annual household income, mother's education, and father's education were entered. At Level 3, child communication variables (DAS-II Verbal score, CELF-4 Core Language Score, Vineland-II Communication standard score) were entered. Entering sets of related variables in this manner allowed us to examine the significance of the model following the addition of each level, as well as to consider contributions to aggressive behavior from each individual variable within the full (i.e., three-level) model. Because of the significant correlations between our three measures of communication skills (Table

SM3), the individual contributions of each communication measure should be interpreted cautiously. Throughout analysis, dummy coding was used for categorical variables, and continuous variables were entered as continuous.

We first tested the resulting models in our full sample of children and adolescents with ASD, and then separately for males and females to explore potential sex-based differences in effects.

Results

Parent report of aggression as assessed with CBCL Aggressive Behavior T-scores indicated substantial difficulties for both males ($M = 58.50$, $SD = 8.52$) and females ($M = 60.03$, $SD = 9.86$), with 21.3% and 27.7%, respectively, falling within the Clinical or Borderline Clinical score ranges. There were no significant sex differences in mean scores for aggression, $F(1,143) = 1.01$, $p = .32$, nor in the percentage of participants falling into the Borderline Clinical or Clinical score ranges, $\chi^2 = 0.81$, $p = .37$.

Among the full sample (male and female participants combined), the regression model predicting aggressive behavior was not significant when only child demographic factors were entered, adj. $R^2 = 0.00$, $F(2, 133) = 1.23$, $p = 0.29$, indicating that child age and race alone did not account for significant variance in aggressive behavior. However, the addition of family characteristics at the next level of the model increased the variance explained by the model such that it accounted for an adjusted 7.5% of variance in aggressive behavior, $F(8, 133) = 2.35$, $p = 0.02$. Inclusion of child communication variables further improved the model such that the full model accounted for an adjusted 14.4% of variance in aggressive behavior, $F(11, 133) = 3.03$, $p < 0.001$. Within the full model, effects were significant for child's age, family income, paternal education, and Vineland-II Communication skills. These effects were such that higher levels of aggressive behavior were associated with younger age, lower family income, higher paternal education, and lower communication skills. See Table 3 and supplemental Table SM5 for model results.

We next tested the model separately for male and female participants. For males with ASD, the model including only child demographic factors was not significant with respect to aggressive behavior, adj. $R^2 = 0.04$, $F(2, 72) = 2.58$, $p = 0.08$. Following the addition of family factors, the model accounted for an adjusted 10.4% of variance in aggressive behavior and was only marginally significant, $F(8, 72) = 2.05$, $p = 0.06$. However, the addition of child communication skills yielded a significant model accounting for an adjusted 25.5% of the variance in aggressive behavior, $F(11, 72) = 3.24$, $p = 0.002$. As shown in Table 3, within this model, effects were significant for child age and Vineland-II Communication skills. For males with ASD, higher levels of aggressive behavior were observed when participants were younger and when they had lower communication skills as assessed by the Vineland-II.

In contrast, for females with ASD, aggressive behavior was not explained by any of the models tested. The model containing only child demographic factors was not significant, adj. $R^2 = -0.03$, $F(2, 60) = 0.00$, $p = 0.99$, nor was the model yielded by the addition of

family factors, adj. $R^2 = 0.03$, $F(8, 60) = 1.20$, $p = 0.32$. The full model, in which child communication skills were added, was again not significant, adj. $R^2 = 0.03$, $F(11, 60) = 1.17$, $p = 0.33$. See Table 3. For females with ASD in our sample, aggressive behavior appeared to be unrelated to child age, race, family income, parental education, or child communication skills.

Discussion

Overall, rates of aggression were similar in verbal male and female youth with ASD in this sample, with approximately one quarter of the participants reported as having aggression that fell within the clinical or borderline clinical ranges of the CBCL. These rates are comparable to those reported in some samples of school-age children and adolescents with ASD (32.8%, Dominick, Davis, Lainhart, Tager-Flusberg, & Folstein, 2007), although lower than that of other reports (53–68%, Kanne & Mazurek, 2011; Mazurek, Kanne, & Wodka, 2013; McTiernan et al., 2011). Considering externalizing behaviors more broadly, over a third of our sample experienced heightened rates of behavioral concerns by parent report. Thus, although problem behaviors have often been inversely associated with cognitive skill (e.g., Dominick et al., 2007; Hartley et al., 2008), a substantial proportion of our sample – verbally-fluent youth with ASD without co-occurring intellectual disability – had marked parent-reported difficulties with externalizing behaviors.

Overall, results provide preliminary evidence that externalizing behaviors among children and adolescents with ASD may be linked with factors at multiple levels. Within the full model, child's age, family income, paternal education, and adaptive communication abilities explained 14.4% of variance in aggressive behavior. In this sample, higher levels of aggression were associated with younger age, in contrast to research discussed earlier documenting increasing prevalence of aggressive behavior over childhood. This difference may be due in part to the nature of our sample, for whom exclusion criteria included intellectual disability, neurological concerns, and genetic differences.

With regard to communication, among the three variables considered, it was the broader, applied communication skills as assessed by the Vineland-II that emerged as significant for understanding aggressive behavior, whereas core or foundational language skills (such as vocabulary) as assessed by the DAS-II and CELF-4 did not. This may be due in part to methodological differences, as the Vineland-II is a parent interview (and so completed by the same informant as the CBCL) whereas the DAS-II and CELF-4 are clinician-administered measures. While speculative, it could be that the Vineland-II's relatively stronger association with aggressive behavior reflects in part shared-method variance. Indeed, as shown in supplemental Table SM3, the DAS-II and CELF-4 were more strongly correlated with each other than with the Vineland-II. However, this pattern of findings is consistent with previous work in samples with ASD (e.g., Park, Yelland, Taffe, & Gray, 2012; Helland & Helland, 2017) and those without ASD (e.g., Ketelaars et al., 2010), in which behavioral problems were associated with pragmatic, but not structural, language impairments.

Together, these findings suggest that challenges in applied or pragmatic communication skills may contribute to aggressive behavior by interfering with social interactions (Ketelaars et al., 2010), whereas difficulties with other aspects of language (e.g., articulation, grammar, vocabulary) may be more easily overcome or more readily detected and treated (Ketelaars et al., 2010). Similarly, aggressive behavior may result from challenges in applied communication skills, either as an expression of frustration, or as a tool used instrumentally as an alternative means of communicating a need. Indeed, improvements in functional communication skills correspond to reductions in aggressive behaviors for some individuals with ASD and other developmental differences (Kurtz, Boelter, Jarmolowicz, Chin, & Hagopian, 2011; Schieltz et al., 2011), bolstering these possibilities.

Sex Differences in Aggression in ASD

Our findings also suggest the possibility of differential effects of participant sex on the relations between these factors and aggressive behaviors, as findings among male participants did not hold constant for females with ASD. Whereas aggressive behavior was higher when males were younger and had lower communication skills, the same factors did not appear to be associated with aggression for females with ASD. These differences are unlikely to be methodological artifacts, given comparable sample sizes across sexes, and instead suggest the possibility of different mechanisms (e.g., temperamental traits, impulsivity) or functions (e.g., escape, protest) underlying aggression among females and males in verbal youth with ASD. Because these aspects of aggressive behavior were not evaluated in the current study, those possibilities will await further research.

Related, previous work from our group indicates that there appear to be sex-based implications of aggressive behavior. In a prior report with a large sample of children and adolescents with ASD (Neuhaus, Webb, & Bernier, 2019), we found that aggression moderated the relationship between social motivation and social skills. Overall, youth with stronger social motivation tended to have stronger social skills, but this effect was blunted for those who also had high emotion dysregulation (including aggression as measured by the CBCL), suggesting that emotional difficulties can interfere with children's ability to benefit from their social motivation. For female youth with ASD, higher rates of aggression had greater negative associations with social skills than aggression in males with ASD. Our findings in the current study – that correlates of aggression in boys with ASD do not hold constant for girls – highlight the need for research focusing on externalizing behaviors in females with ASD. Not only may females with ASD experience more detrimental social effects when they are aggressive (Neuhaus et al., 2019), but our field knows even less about the causes and predictors of that aggression. Consequently, better understanding of factors contributing to aggression and other challenging behaviors among females with ASD remains an important goal for future research.

Our findings must be interpreted in relation to the limitations of our data, which include a somewhat coarse measure of aggression (CBCL Aggressive Behavior subscale) that cannot distinguish between finer forms of aggression (e.g., verbal vs physical, reactive vs proactive) or elucidate more nuanced aggressive behaviors. Ideally, our data would also include additional factors relevant to aggression to allow a richer ecological perspective.

Moving forward, research directions that may prove fruitful could include consideration of peer conflicts and isolation, sibling constellation and relationships, symptoms of anxiety that might manifest as aggression, or learning-related difficulties that might trigger aggressive behavior in school settings.

Regardless of sex, exploration of contextual factors (e.g., parenting strategies, family size and interaction styles, peer relationships) and their contributions to aggressive behavior among youth with ASD will likely be valuable, as such variables have long been associated with the emergence and maintenance of challenging behaviors among children and adolescents in the general population (Hartas, 2011; Jambon, Madigan, Plamondon, & Jenkins, 2019; Patterson, 2002). By extending the literature on challenging behavior into the field of ASD research, we may more efficiently identify risk factors for aggressive behavior in ASD, and may also build on existing knowledge to develop or adapt treatment approaches for youth with ASD. For example, intervention programs (e.g., Bearss et al., 2015) that integrate traditional parent training approaches focused on disruptive behavior with strategies originating in the ASD literature (e.g., use of visual aids, focus on functional communication, consideration of triggering events common in ASD) effectively decrease behavioral problems in ASD and increase adaptive skills (Bearss et al., 2015; Scahill et al., 2016). Thus, consideration of broader contextual factors in concert with child characteristics such as communication skills may identify risk factors across levels of analysis, and capitalize on multiple points for prevention and intervention.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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At time of data collection for this project, Pelphrey and Jack were at Yale University; Van Horn was at University of Southern California. Bernier is now at Apple.

Ethical Oversight

Ethical oversight was provided by the Yale Institutional Board (Yale, SCRI), the UCLA Office of Human Research Protection Program (UCLA), Boston Children's Hospital Institutional Review Board (BCH), and USC Office for the Protection of Research Subjects. All procedures performed were in accordance with the ethical standards of the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all parents of children participating in the study; children provided written assent.

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Table 1:

Participant Demographic Characteristics

	Males ***N*** **= 80**	**Females** ***N*** **= 65**	**Main effect of sex**
Age (Years)	12.44 (2.99)	12.62 (2.81)	$F(1,143) = 0.14$
Race (*Ns*)			$\chi^2 = 5.70$
– American Indian or Alaska Native	1	0	
– Asian	1	0	
– African American or Black	3	2	
– Hawaiian or Pacific Islander	0	1	
– More than one race	16	8	
– White	59	53	
– Unknown	0	1	
Ethnicity (Hispanic) (*Ns*)	14	8	$\chi^2 = 0.69$
Education – Paternal | Maternal (*Ns*)			$\chi^2 = 1.03$ | $\chi^2 = 1.47$
– Less than or some college	32 | 32	26 | 20	
– Bachelor's degree	17 | 20	17 | 18	
– More than bachelor's degree	27 | 24	17 | 24	
Family Median Income			$\chi^2 = 1.50$
– ≤ 100%	13	14	
– 101–170%	25	15	
– > 170%	38	33	

Note.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Table 2:

Participant Phenotypic Characterization

	Males	Females	Main effect of sex
ADOS-2 CSS	7.31 (1.76) Range: 3–10	6.51 (1.80) Range: 4–10	$F(1,143) = 7.33^{**}$
DAS-II Verbal SS	102.09 (18.90) Range: 70–155	103.52 (17.97) Range: 72–155	$F(1,143) = 0.22$
CELF-4 Core Language SS	92.22 (19.42) Range: 50–132	98.94 (17.16) Range: 58–133	$F(1,139) = 4.64^{*}$
Vineland -II Communication SS	74.53 (9.76) Range: 57–104	78.11 (12.99) Range: 49–111	$F(1,140) = 3.52$
CBCL Aggressive Behavior T-Score	58.50 (8.52) Range: 50–81	60.03 (9.86) Range: 50–94	$F(1,143) = 1.01$

Note.

$^{*}p < 0.05$.

$^{**}p < 0.01$.

ADOS-2 = Autism Diagnostic Observation Schedule, 2nd edition (Lord et al., 2012). DAS-II = Differential Ability Scales, 2nd edition (Elliott, 2007). CELF-4 = Clinical Evaluation of Language Fundamentals, 4th edition (Semel et al., 2003). CBCL = Child Behavior Checklist (Achenbach & Rescorla, 2001).

Table 3:

Model Results for Aggressive Behavior

	Full sample		Males with ASD		Females with ASD	
	β	***t*-value**	***β***	***t*-value**	***β***	***t*-value**
Level 1: Child Demographic Factors						
Age	−0.24	−2.72**	−0.43	−3.74***	−0.09	−0.64
Race	−0.03	−0.39	−0.03	−0.26	−0.01	−0.10
Level 2: Family Factors						
Household Annual Income †						
- 100 to 170% of median	−0.06	−0.55	−0.14	−0.93	0.09	0.51
- Over 170% of median	−0.27	−2.27*	−0.19	−1.18	−0.31	−1.61
Maternal Education ††						
- Bachelor's degree	0.03	0.31	0.02	0.17	0.01	0.06
- More than bachelor's degree	−0.14	−1.38	−0.18	−1.34	−0.19	−1.12
Paternal Education ††						
- Bachelor's degree	0.08	0.78	0.07	0.53	0.10	0.55
- More than bachelor's degree	0.23	2.27*	0.23	1.75	0.25	1.42
Level 3: Child Communication Skills						
DAS-II Verbal	−0.14	−1.12	−0.22	−1.18	−0.03	−0.12
CELF-4 Core language	0.16	1.17	0.17	0.83	0.06	0.26
Vineland-II Communication	−0.34	−3.42**	−0.47	−3.78***	−0.29	−1.66

Note.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

† Relative to income below median.

†† Relative to less than college degree. DAS-II = Differential Ability Scales, 2nd edition (Elliott, 2007). CELF-4 = Clinical Evaluation of Language Fundamentals, 4th edition (Semel et al., 2003).