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Research Article

Observed and Parent-Report Measures of Social Communication in Toddlers With and Without Autism Spectrum Disorder Across Race/Ethnicity

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Purpose: This study investigated whether measures of early social communication vary among young children of diverse racial/ethnic status with and without autism spectrum disorder (ASD).
Method: Participants were 364 toddlers between ages 18 and 36 months with a diagnosis of ASD confirmed (*n* = 195) or ruled out (*n* = 169), from 3 racial/ethnic categories: non-Hispanic White (*n* = 226), non-Hispanic Black (*n* = 74), and Hispanic (*n* = 64). Group differences in social communication were examined using an observational measure—the Communication and Symbolic Behavior Scales Behavior Sample (CSBS-BS; Wetherby & Prizant, 2002)—and a parent-report measure, the Early Screening for Autism and Communication Disorders (Wetherby, Woods, & Lord, 2007).
Results: Controlling for maternal education, children with ASD scored significantly lower on the CSBS-BS than children without, indicating poorer social communication skills, and higher on the Early Screening for Autism and Communication Disorders, indicating more ASD features. Racial/ethnic groups did not differ on 6 CSBS-BS clusters, but Non-Hispanic White toddlers scored significantly higher than both other groups on the Understanding cluster. There were no significant Diagnosis × Race/Ethnicity interactions.
Conclusion: These findings indicate good agreement between observed and parent-report measures in this sample. Results suggest that the CSBS-BS and Early Screening for Autism and Communication Disorders could be viable tools in the detection process for toddlers with ASD in these racial/ethnic groups.

Research shows that signs of autism spectrum disorder (ASD) can be observed as early as the second year of life (Chawarska, Klin, Paul, & Volkmar, 2007; Lord et al., 2006; Shumway & Wetherby, 2009; Wolff et al., 2014; Zwaigenbaum et al., 2005), and stable diagnoses of ASD can be made by age 24 months (Guthrie, Swineford, Nottke, & Wetherby, 2013; Lord et al., 2006). However, through a chart review of children who are eligible for Medicaid (i.e., low socioeconomic status [SES]), Mandell and colleagues (Mandell et al., 2009; Mandell, Listerud, Levy, & Pinto-Martin, 2002) found that Black children were not diagnosed until age 7.9 years on average, 1.6 years later than the average age of diagnosis for White children. Studies have demonstrated that non-Hispanic White students with ASD are approximately 2 times more likely to be diagnosed with ASD than their Black or Hispanic peers (Kogan et al., 2009; Travers, Tincani, & Krezmien, 2013), and children from non-White minority groups are less likely than White children to have a diagnosis of ASD in their records (Mandell et al., 2009). Children born outside of the United States or to immigrant mothers are also diagnosed with ASD later than their peers (Valicenti-McDermott, Hottinger, Seijo, & Shulman, 2012). A recent study of diagnoses across race and ethnicity found a lower prevalence of ASD in non-Hispanic Black and Hispanic groups compared with non-Hispanic White children, suggesting that mild–moderate cases of ASD may be underdiagnosed in these groups (Jo et al., 2015). Despite these findings, very few studies to date have explored potential differences in early symptom presentation among minority and nonminority toddlers with ASD (Herlihy et al., 2014; Tek & Landa, 2012). In order to best serve the entire range of young children with ASD and other communication disorders, there

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is a pressing need to conduct research that represents diversity across race, ethnicity, and cultures.

Socioeconomic Status and Racial/Ethnic Impact on Social Communication

Cultural learning theory proposes that children develop cognitive, social, and communication skills not only through biological and experiential learning but also through the symbols, social interactions, and culture of their unique social world (Tomasello, 2000). The social, emotional, and cultural resources available to families of toddlers can affect preverbal communication abilities through language input and parenting behaviors. The World Health Organization (2001) integrates these environmental factors into the International Classification of Functioning, Disability, and Health (ICF). Their biopsychosocial model of functioning combines traditional medical models that limit the definition of disability to symptoms caused by a health condition with social models that focus on disability as a social problem resolved by participation in society (Bölte et al., 2014). The ICF model proposes that level of functioning is the outcome of the interaction between a condition (e.g., ASD), body structures and functions, execution of tasks or activities, participation in life situations, environmental factors, and personal factors intrinsic to the individual (e.g., age, motivation; World Health Organization, 2001). ICF Core Sets are currently being developed for ASD as a means of assessing functional impairments in ASD (Bölte et al., 2014). Given this movement toward the inclusion of environmental factors in disability models, it is imperative to consider the child's profile of strengths and limitations as well as factors outside the child.

SES and race serve as proxies for many key environmental experiences and have been found to relate to early communication development. Many studies have found a strong relationship between SES and language development over time (Dollaghan et al., 1999; Hart & Risley, 1995; Hoff, 2003; Qi, Kaiser, Marley, & Milan, 2012; Rowe & Goldin-Meadow, 2009), observable in children as early as age 18 months (Fernald, Marchman, & Weisleder, 2013), and potentially growing over time (Hart & Risley, 1995, 2003; Hoff, 2013). Of the variables used to measure SES, maternal education has been shown to have the strongest relationship with developmental outcomes (Noble, Norman, & Farah, 2005). It is also easy to obtain, potentially less biased than other measures of SES (Hurtado, Marchman, & Fernald, 2007), and can be measured on a continuous scale. In a prospective study of 94 African American children and 70 European American children observed between ages 12 and 36 months, Dotterer, Iruka, and Pungello (2012) found that race moderated the relationship between SES and academic readiness at age 36 months such that sensitive parenting significantly mediated this relationship for European American but not African American children. Their results suggest that findings from studies of White families cannot necessarily be applied to non-White children. Other studies have begun to explore the interaction between ethnicity, SES, and communication skills. For example, Hurtado et al. (2007) examined comprehension abilities in Spanish-speaking, U.S.-born children ages 15 to 37 months and found that those whose mothers had fewer years of education were slower and less accurate on a word-recognition task. This study did not compare these children to a sample of English-speaking children with similar SES characteristics, so conclusions cannot be made regarding the impact of ethnicity versus SES. Using a parent questionnaire, Hammer, Farkas, and Maczuga (2010) found ethnicity-linked differences in the amount of literacy-related experiences in the home, with Hispanic parents reporting fewer literacy activities than non-Hispanic parents. Jarrett, Hamilton, and Coba-Rodriguez (2015) conducted qualitative interviews with African American parents that revealed the reported use of a variety of literacy practices and inclusion of extended kin in literacy opportunities, suggesting methods of promoting literacy that may not have been recognized in previous quantitative studies. Potential differences in frequency and type of early literacy activities could affect performance during standardized assessments of communication, but further research is needed to understand the interactions between ethnicity and language outcomes.

Social-Communication Profiles of Children With ASD

An abundance of research has indicated that preverbal communication abilities in toddlers with ASD are significantly lower than in children with typical development (TD) or developmental delays (DD) without ASD. Several studies have shown significantly lower rates of communication in toddlers with ASD compared with children with DD or TD (Shumway & Wetherby, 2009; Wetherby, Watt, Morgan, & Shumway, 2007). Charman et al. (2005) found that the rate of communicative acts at age 2 years better predicted outcomes at age 7 years than formal measures of language or nonverbal IQ. Other studies have observed lower proportions of vocalizations with speech sounds in children with ASD than in children with TD (Plumb & Wetherby, 2013), lower rates of complex babbling (Werner & Dawson, 2005), and less-frequent gestures for joint attention (Shumway & Wetherby, 2009; Watson, Crais, Baranek, Dykstra, & Wilson, 2013).

Social Communication and Autism Features Across Race/Ethnicity

Data from the National Survey of Children's Health revealed that most of the research emerging on social communication in toddlers has used relatively homogenous samples of primarily non-Hispanic White children (Liptak et al., 2008). Harris, Barton, and Albert (2014) reviewed research on currently used diagnostic measures to see if the researchers included diverse samples and considered cultural differences. Although some of the measures mentioned cultural considerations, none of the assessments included specific information on culturally diverse norms, indicating that research is needed to determine whether current diagnostic and screening tools work across cultures or to develop new tools that are culturally universal.

Only a few studies have examined potential racial/ethnic differences in the presentation of ASD, and most have focused on older children (Chaidez, Hansen, & Hertz-Picciotto, 2012; Cuccaro et al., 2007; Sell, Giarelli, Blum, Hanlon, & Levy, 2012). Tek and Landa (2012) examined 65 White toddlers and 19 non-White toddlers (African American, Asian, or Hispanic) between ages 16 and 38 months. The results indicated that non-White toddlers with ASD scored significantly lower than White toddlers on the Communication and Symbolic Behavior Scales Caregiver Questionnaire (Wetherby & Prizant, 2002) measures of words and understanding of words and on the Mullen Scales of Early Learning (Mullen, 1995) Receptive Language and Gross Motor scales. This study did not include children with parents who had less than a high school education, and the majority of the sample consisted of upper-middle-class families. Also, the individual races/ethnicities of the non-White children were not considered separately, and there were no comparison groups of children without ASD. The authors hypothesized that their results could indicate a phenotypic difference between groups but might also be explained by cultural differences in views of typical versus atypical development.

Scarpa et al. (2013) examined the relationship between race/ethnicity and parent report of autism features on the basis of the Modified Checklist for Autism in Toddlers (M-CHAT; Robins, Fein, Barton, & Green, 2001). Participants were 447 children from a rural, low-SES community whose caregivers completed an M-CHAT when the children were age 18 or 24 months. The researchers observed that children whose mothers had less than 12 years of education had the most reported signs of ASD according to the M-CHAT items. In contrast, no significant group difference for minority status (i.e., Black, Hispanic, Asian, Native American, or multiracial) on total M-CHAT scores was observed. Thus, in this study, differences in SES were more indicative of the number of failed M-CHAT items than race/ethnicity. Follow-up testing was not completed, so information regarding the diagnostic classification of participants is not available, and thus conclusions regarding the utility of the M-CHAT as an ASD screener for this sample could not be drawn. Another study using the M-CHAT found higher rates of initial positive screens that would indicate the need for further testing for toddlers from non-White and low-SES families that were negated by the M-CHAT Follow-Up interview (Khowaja, Hazzard, & Robins, 2015). This finding is particularly concerning given that non-White and low-SES families in this study were also significantly less likely to participate in the M-CHAT Follow-Up interview (which was completed over the phone at a later date) than White, high-SES families, illustrating a critical limitation in a two-step screening measure for diverse populations.

Herlihy et al. (2014) explored results of the M-CHAT or M-CHAT-Revised Follow-Up interview, as well as diagnostic assessment measures, in a diverse sample of toddlers ages 16 to 30 months. Group differences between non-minority White toddlers (n = 187) and a categorically collapsed minority group (i.e., African American, Latino/Hispanic, Asian American, or other/biracial; n =156) were analyzed. When maternal education and family income were controlled for, children with ASD in the non-White group were older at the time of evaluation and received lower Receptive Language scores on the Mullen Scales of Early Learning than White children with ASD. No other significant between-group differences were observed independent of SES. As in Tek and Landa's study (2012), results were not analyzed for individual racial/ethnic categories or compared to results for a group of children without ASD.

The purpose of the current study was to examine social-communication profiles of toddlers with ASD compared to toddlers with TD or DD in which ASD has been ruled out (non-ASD) from three racial/ethnic groups within the United States—non-Hispanic White, non-Hispanic Black, and Hispanic—across a wide range of maternal education levels. Consistent with the ICF framework of social communication as body functions, activity, and participation-level behaviors, we examined measures of communication (e.g., eye gaze, facial expressions, gestures, vocalizations, and words) for the purposes of behavior regulation, joint attention, and social interaction. Social communication was measured by both observed social-communication skills and a distributed profile of social communication on the basis of parent report of behaviors used across partners and time. This study aimed to answer the following specific research questions about this sample of toddlers: How do measures of early social-communication behavior vary across racial/ethnic status, if at all? Are these social-communication outcomes different depending on whether or not the children have an ASD diagnosis? And what is the role of factors such as maternal education and child age on these measures of early social-communication behavior?

On the basis of previous findings, we hypothesized that there would be few differences across race and ethnicity, if any, but that ASD and non-ASD groups would differ regardless of race/ethnicity. The one area that we hypothesized would show differences by race/ethnicity was receptive language, such that non-Hispanic White children would score higher in this area than children from the other racial/ethnic groups given previous study findings (Herlihy et al., 2014; Tek & Landa, 2012), regardless of diagnosis. We also predicted that lower levels of maternal education would be associated with lower social-communication abilities, given previous research indicating a link between environmental factors such as family SES and child communication outcomes. And last, we predicted a relationship between the personal factor of child age and social-communication skills because of developmental changes that occur with advancing age, such that older children would have a higher level of communication functioning.

Method

Participants

Participants were 364 toddlers between ages 18 and 36 months from three racial/ethnic groups: non-Hispanic White (henceforth referred to as White), non-Hispanic Black (henceforth referred to as Black), and Hispanic. Racial/ethnic group membership was determined on the basis of parent report using multiple-choice interview items for race and ethnicity similar to U.S. Census categories. Children of multiple racial backgrounds (e.g., Black father and White mother) were excluded. In addition, participants with no maternal education reported were excluded in this study; only three participants were excluded for not meeting this criterion.

Children and their families were recruited as part of the FIRST WORDS® Project, a prospective longitudinal study of children recruited through a general-population screening in northern Florida. All children who were evaluated and met age and racial/ethnic criteria were included in this study. Additional Hispanic families were recruited as part of a study examining early signs of ASD from diverse cultures (see Grinker et al., 2012). This study identified 30 Spanish-speaking toddlers in southwestern Florida, recruited through referrals to Florida's early-intervention program, as well as from community recruitment through health care providers, child care centers, and word of mouth. This sample was recruited from Collier County, Florida—a county in which nearly half of the population was born in Latin America (including Mexico) or Haiti and three fourths does not speak English. Purposeful sampling of participants referred for ASD assessments in southwestern Florida resulted in a higher SES in the ASD group compared with the non-ASD group for these children. In our sample, 80% of the Hispanic children from southwestern Florida were exposed to a language other than English in the home, compared with 70% of the Hispanic children from northern Florida. The process for recruiting children in southwestern Florida is further described by Grinker et al. (2012).

Specific to the present study, each racial/ethnic group was divided further into groups of children with and without ASD, for a total of six groups: White ASD (n = 120), White non-ASD (n = 106), Black ASD (n = 35), Black non-ASD (n = 39), Hispanic ASD (n = 40), and Hispanic non-ASD (n = 24). Participant demographic and developmental characteristics are summarized in Table 1. Children in each of the ASD groups received a best-estimate diagnosis of ASD that incorporated information from a direct observation of ASD features (Autism Diagnostic Observation Schedule [ADOS]; Gotham et al., 2007; Lord, Rutter, DiLavore, & Risi, 2002), parent-reported concerns or ASD red flags (including information gathered from the Early Screening for Autism and Communication Disorders [ESAC]; Wetherby, Woods, & Lord, 2007), and the presence of ASD characteristics across contexts (home observation). Diagnoses of ASD were made using criteria outlined in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association, 2013), which defines ASD as a neurodevelopmental disorder characterized by impairments in social communication and the presence of repetitive or restricted behaviors, interests, and activities. Additional children were sampled from each race/ethnicity to serve as a non-ASD comparison group. Because the ASD group contained a range of developmental levels, the non-ASD groups included children with TD as well as children with global developmental delay or language delay in which ASD had been ruled out. There was a larger proportion of children with global developmental delay in the ASD group than the non-ASD group. Children assigned to the non-ASD group received a best-estimate clinical diagnosis of non-ASD in addition to a classification of "nonspectrum" on the ADOS.

Measures

Communication and Symbolic Behavior Scales Behavior Sample

The Communication and Symbolic Behavior Scales Behavior Sample (CSBS-BS; Wetherby & Prizant, 2002) is a clinical evaluation of social communication that is based on systematic naturalistic observation in which children interact with a clinician and a caregiver. The CSBS-BS was standardized for children between ages 12 and 24 months and was administered in approximately 20–30 min. A standard set of systematic procedures was used to encourage spontaneous social and communicative behaviors. Children were seated at a table between their caregiver and a clinician, and the clinician presented a series of communication opportunities (e.g., a wind-up toy, balloon, and books). The CSBS-BS was video-recorded and scored using standard procedures by trained examiners unaware of child diagnosis, resulting in seven cluster scores (Emotion and Eye Gaze, Communication, Gestures, Sounds, Words, Understanding, and Object Use), three composite scores (Social, Speech, and Symbolic), and a total score. Interobserver agreement for the CSBS-BS clusters and composites was calculated using intraclass correlation coefficients; each rater reached and maintained a minimum of .80 using randomly selected samples for at least 10% of the FIRST WORDS Project archival data of samples administered in English. The standardization of this measure demonstrated good internal consistency and test–retest stability on the basis of norming of a national sample (Wetherby & Prizant, 2002), and the CSBS-BS has been demonstrated to have good predictive validity with language outcomes at ages 2 and 3 years (Wetherby, Allen, Cleary, Kublin, & Goldstein, 2002). Because the CSBS-BS scores were only standardized up to age 24 months, raw scores were used for this study. Higher scores on the CSBS-BS indicate the use of better social-communication skills.

The CSBS-BS was administered in a clinic setting for the participants in northern Florida and in a home or library setting in southwestern Florida. Trained clinicians administered this assessment in Mainstream American English or in Spanish. For the southwestern-Florida site, the clinician was a native Spanish speaker and administered

Table 1. Summary and group comparison of participant demographics.

Demographic	White	Black	Hispanic	*F* value
ASD (*n* = 195)				
n	120	35	40	
Mean (*SD*) age at CSBS-BS (months)	21.07 (1.99)	20.69 (1.64)	24.88 (5.81)	24.83**
Number (%) male	100 (83.33)	31 (88.57)	34 (85.00)	
Number (%) female	20 (16.67)	4 (11.43)	6 (15.00)	
Number (%) firstborn	57 (47.50)	14 (40.00)	17 (42.50)	
Number (%) with global developmental delay	68 (56.70)	20 (57.10)	23 (57.50)	
Number (%) with language delay	32 (26.70)	9 (25.70)	16 (40.00)	
Age at ESAC (months)				
n	109	29	39	
M (*SD*)	21.81 (4.51)	21.16 (5.58)	25.06 (6.26)	6.82**
Parent's education (years)				
Mother				
n	120	35	40	
M (*SD*)	15.03 (2.59)	14.57 (2.13)	13.45 (3.93)	4.68*
Father				
n	118	30	37	
M (*SD*)	14.58 (2.91)	14.60 (2.50)	12.73 (4.30)	5.06*
Parent's age at child's birth (years)				
Mother				
n	119	35	40	
M (*SD*)	31.04 (5.99)	29.94 (6.55)	29.50 (5.46)	1.19
Father				
n	118	31	40	
M (*SD*)	34.22 (6.66)	32.38 (6.64)	31.75 (4.97)	2.74
Non-ASD (*n* = 169)				
n	106	39	24	
Mean (*SD*) age at CSBS-BS (months)	20.23 (1.77)	21.00 (3.10)	23.75 (4.04)	18.89**
Number (%) male	68 (64.15)	25 (64.10)	15 (62.50)	
Number (%) female	38 (35.85)	14 (35.90)	9 (37.50)	
Number (%) firstborn	37 (34.91)	17 (43.59)	9 (37.50)	
Number (%) with global developmental delay	15 (14.20)	6 (15.40)	6 (25.00)	
Number (%) with language delay	29 (27.40)	16 (41.00)	9 (37.50)	
Age at ESAC (months)				
n	101	28	21	
M (*SD*)	21.89 (4.86)	22.93 (5.41)	23.72 (4.97)	1.42
Parent's education (years)				
Mother				
n	106	39	24	
M (*SD*)	15.55 (2.80)	14.05 (2.10)	10.54 (5.76)	23.66**
Father				
n	105	36	21	
M (*SD*)	15.43 (2.90)	13.36 (2.86)	10.10 (5.84)	23.19**
Parent's age at child's birth (years)				
Mother				
n	106	39	24	
M (*SD*)	31.61 (5.00)	28.95 (6.96)	28.75 (5.44)	4.76*
Father				
n	104	37	22	
M (*SD*)	33.65 (5.91)	31.45 (8.56)	30.52 (7.78)	2.72

Note. ASD = autism spectrum disorder; CSBS-BS = Communication and Symbolic Behavior Scales Behavior Sample; ESAC = Early Screening for Autism and Communication Disorders.

*$p < .05$. **$p < .01$.

assessments in Spanish or English depending on family preference. For families in northern Florida who indicated that Spanish was their primary language, efforts were made to find accommodations by offering a Spanish-speaking clinician if available, or an interpreter, or having the family bring a family member or other professional who worked with them (e.g., social worker) to provide translation into Spanish. The verbal instructions to the CSBS-BS are minimal because the opportunities are set up nonverbally, with the exception of the probes for comprehension. For assessments conducted in English for children from bilingual homes, parents were invited to probe for comprehension of body parts and common objects in both English and their native language.

ESAC

The ESAC is a parent-report screening tool developed to detect the absence of or delay in typical skills and presence of unusual behaviors associated with ASD using the *DSM-5* framework. It has been designed for use with children ages 12 to 36 months and has been translated into Spanish. The translation process for this tool included focus groups of clinicians and parents who reviewed the translation and cultural appropriateness of the ESAC items (see Grinker et al., 2012). Preliminary field-testing indicated sensitivity from .84 to .86 and specificity from .83 to .85 for a total of 47 items (Wetherby et al., 2009). Follow-up analyses narrowed the number of items from 47 down to the best 30 items for differentiating children with and without ASD, on the basis of receiver-operating-curve analyses (Wetherby, Guthrie, et al., 2015; Wetherby, Lord, et al., 2015). The top 30 items were selected on the basis of their psychometric properties as well as clinical utility. For the top 30 items, good sensitivity (.87–.88), good specificity (.82–.85), and excellent area under the curve (.92–.93) were found using a cutoff score of 18 for children ages 18 to 36 months. A higher score on the ESAC indicates the presence of more red flags for ASD, thus a higher risk of having ASD. For this study, the ESAC was completed by parents in their homes prior to testing or at the time of the CSBS-BS.

ADOS

The ADOS is a standardized assessment of the features of ASD, including social communication and play or use of materials. Participants received Module 1, 2, 3, or the Toddler Module (Luyster et al., 2009) on the basis of age and expressive language level. Diagnostic classifications of "nonspectrum" or "ASD" were based upon the overall total score. Trained clinicians administered and scored the ADOS for participants in northern Florida in a clinical setting. Interpreters or Spanish-speaking clinicians were offered to families. For the participants from southwestern Florida, the ADOS was administered by trained bilingual clinicians in a clinical or community setting (e.g., library or child care center) in English or Spanish on the basis of family preferences and scored by the first author, who has achieved research reliability on the ADOS (which is defined as three consecutive administrations scored at or above 80% agreement at the item and protocol levels). ADOS scores were used to assist in making a best-estimate diagnosis of ASD or nonspectrum and were not included as a dependent variable for this study.

Results

Preliminary analyses were completed to determine between-group differences on measures of participant demographics, including child age at the time of the CSBS-BS and ESAC, parent age at child's birth, and parent years of education, because the groups were not matched on these features. Descriptive statistics for these demographic measures and results of the between-group analyses are given in Table 1. Effect sizes were calculated using Hedges's *g,* with absolute values between 0.20 and 0.49 considered to indicate a small effect size, between 0.50 and 0.79 a medium effect, and ≥ 0.80 a large effect (Cohen, 1988). Within racial/ethnic categories, differences in maternal education were found between only the ASD and non-ASD groups for the Hispanic toddlers, $F(1, 62) = 5.75$, $p = .019$, $g = 0.61$, in that maternal education was higher in the ASD group than the non-ASD group. Across racial/ethnic categories, there were significant differences in the years of maternal education only for toddlers without ASD, $F(2, 166) = 23.66$, $p < .001$, with higher levels of education in the White group than both the Black ($g = 0.57$) and Hispanic ($g = 1.41$) groups and higher levels in the Black group than in the Hispanic group ($g = 0.89$). White children with ASD were observed to be significantly older at the time of the CSBS-BS than White children without ASD, $F(1, 224) = 11.13$, $p = .001$, $g = 0.44$. Differences in age at the time of the CSBS-BS were also observed across race/ethnicity for children with ASD, $F(2, 192) = 24.83$, $p < .001$, and for children without ASD, $F(2, 166) = 18.90$, $p < .001$; for both diagnostic classifications, Hispanic children were observed to be significantly older than children from the other racial/ethnic groups. Using Pearson partial correlations controlling for CSBS-BS age, ESAC age, and maternal education, we observed a large, negative significant correlation between ESAC scores and total CSBS-BS scores, $r = -.57$, $p < .001$, meaning that higher ESAC scores (i.e., more red flags) were correlated with lower CSBS-BS scores (i.e., poorer social-communication skills). This observed relationship provides preliminary support of the construct validity between an observational measure of social communication, a core deficit of ASD (CSBS-BS), and a parent-report measure of autism features (ESAC).

Social-Communication Variance Across Race/Ethnicity

The first research question examined whether and how measures of early social-communication behavior varied across racial/ethnic status. To answer this question, group differences were compared on the CSBS-BS and ESAC. Table 2 reports mean scores and effect sizes for CSBS-BS cluster scores and ESAC scores across both diagnostic classification and race/ethnicity.

CSBS-BS

To account for significant group differences in maternal education and child's age at the time of the CSBS-BS observed across race/ethnicity, a 2 × 3 between-subjects multivariate analysis of covariance controlling for child's age at the CSBS-BS and years of maternal education was used to analyze these data. The dependent variables (DVs) consisted of seven clusters of the CSBS-BS: Emotion and Eye Gaze, Communication, Gestures, Sounds, Words, Understanding, and Object Use. Independent variables were race/ethnicity and diagnostic classification.

Multivariate outliers were assessed using Mahalanobis distances. With seven DVs, a criterion $\alpha = .001$, and the critical $\chi^2 = 24.32$, five outliers were found at this level. Further investigation of these cases revealed high values on the Words cluster, which was leptokurtic (kurtosis = 4.12,

Table 2. Comparison of social-communication scores across diagnostic and racial/ethnic groups (N = 364).

Score	White	Black	Hispanic	Hedges's g[a]		
ASD						
n	120	35	40			
CSBS-BS cluster[b] (*n* = 195)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	W-B	W-H	B-H
Emotion and Eye Gaze	9.37 (4.49)	9.20 (4.01)	9.29 (4.19)	0.04	0.02	−0.02
Communication	12.43 (4.83)	11.45 (3.69)	13.57 (4.77)	0.21	−0.24	−0.49
Gestures	8.51 (4.72)	7.92 (3.59)	9.08 (4.66)	0.13	−0.12	−0.27
Sounds	6.88 (6.49)	6.86 (5.23)	7.23 (7.73)	0.01	−0.05	−0.05
Words	2.78 (5.16)	1.77 (2.19)	1.97 (4.12)	0.22	0.16	−0.06
Understanding	6.51 (7.71)	3.52 (4.51)	2.27 (5.13)	0.42	0.59	0.26
Object Use	11.91 (5.42)	12.09 (4.20)	11.99 (5.07)	−0.03	−0.01	0.02
ESAC (*n* = 176) *M* (*SD*)	28.37 (12.05)	29.58 (10.65)	31.07 (11.41)	−0.10	−0.23	−0.13
Non-ASD						
n	106	39	24			
CSBS-BS cluster[b] (*n* = 169)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	W-B	W-H	B-H
Emotion and Eye Gaze	14.37 (3.06)	12.71 (3.50)	14.06 (2.58)	0.52	0.10	−0.42
Communication	17.02 (3.08)	16.28 (3.47)	15.89 (4.23)	0.23	0.34	0.10
Gestures	13.72 (4.07)	12.56 (4.17)	13.08 (5.12)	0.28	0.15	−0.11
Sounds	11.63 (6.87)	11.08 (5.97)	10.64 (5.62)	0.08	0.15	0.07
Words	5.96 (7.02)	5.28 (6.10)	5.37 (4.75)	0.10	0.09	−0.02
Understanding	13.63 (7.65)	10.68 (8.25)	10.48 (7.61)	0.38	0.41	0.02
Object Use	15.60 (4.80)	16.20 (4.94)	14.93 (4.85)	−0.12	0.14	0.26
ESAC (*n* = 151) *M* (*SD*)	14.11 (9.95)	20.57 (8.27)	15.21 (13.73)	−0.67	−0.10	0.49

Note. CSBS-BS = Communication and Symbolic Behavior Scales Behavior Sample; ESAC = Early Screening for Autism and Communication Disorders.

[a]Effect size on the basis of Hedges's g: ≥ 0.20 is small, 0.50 is medium, 0.80 is large. [b]Using estimated means controlling for maternal education and behavior-sample age.

skewness =1.76). Analyses were run with and without these five outliers included, and the exclusion of the outlying cases did not have an effect on the interpretation of the analyses. Because of this lack of effect, and because the outliers accounted for only 0.01% of the sample, the outliers were kept in the sample for all subsequent analyses. Measures of normality were calculated for each of the CSBS-BS cluster scores and, with the exception of Words, skewness (−0.57 to 0.59) and kurtosis (−1.06 to −0.09) values fell within an acceptable range (−2 to 2). Pearson partial correlations controlling for maternal education and CSBS-BS age revealed significant correlations between all cluster scores, ranging from .43 to .77.

With the use of Wilk's criterion, the seven CSBS-BS cluster scores were first analyzed as a combined total to observe omnibus differences. These combined DVs were observed to significantly differ across the covariates of CSBS-BS age, $F(7, 350) = 6.57$, $p < .001$; maternal education, $F(7, 350) = 4.83$, $p < .001$; diagnostic classification, $F(7, 350) = 17.39$, $p < .001$; and race/ethnicity, $F(14, 700) = 2.08$, $p = .011$—but not the Diagnostic Classification × Race/Ethnicity, $F(14, 700) = 1.02$, $p = .436$. The results of this omnibus testing indicate that, as predicted, racial/ethnic groups were observed to significantly differ on the CSBS-BS as a whole. In order to establish how these racial/ethnic groups differed, the effects of race/ethnicity on the DVs after adjustment for covariates (CSBS-BS age and maternal education) were further investigated in univariate analyses. Table 3 gives the results of these analyses by race/ethnicity, with diagnostic groups combined. For the CSBS-BS, the only significant between-group difference was on the Understanding cluster score, with White children observed to score significantly higher than Black and Hispanic children, consistent with our hypothesis on the basis of previous findings (Herlihy et al., 2014; Tek & Landa, 2012). No significant cluster differences were observed between the Black and Hispanic groups.

ESAC

A 2 (diagnostic classification) × 3 (race/ethnicity) between-subjects analysis of covariance was conducted to detect group differences in parent report of autism features on the basis of the ESAC, controlling for maternal education and ESAC age. There were 37 children (16 White, 17 Black, four Hispanic) out of the total sample of 364 whose caregiver did not complete an ESAC; therefore, for this analysis, $n = 327$. Skewness (0.37) and kurtosis (−0.67) values for the ESAC indicate a normal distribution. No outliers were detected at $\alpha = .001$. In addition, there was a marginally significant main effect observed for race/ethnicity, $F(2, 319) = 2.95$, $p = .054$. No significant group differences were observed for the Diagnostic Classification × Race/Ethnicity interaction, $F(2, 319) = 1.68$, $p = .189$. Although the omnibus test was observed to be only marginally significant, there are medium effect sizes for the differences between scores on the ESAC in the non-ASD group for White children compared with Black children, $g = -0.67$, and for Black children compared with Hispanic children, $g = 0.49$. The ESAC scores of the non-ASD Black participants were significantly higher than the scores of

Table 3. Comparison of social-communication scores across race/ethnicity (N = 364).

Score	White to Black			White to Hispanic		Black to Hispanic	
	F value	p^a	g^b	p^a	g^b	p^a	g^b
CSBS-BS cluster[c]							
Emotion and Eye Gaze	1.58	.077	0.24	.760	0.05	.313	−0.20
Communication	1.36	.110	0.22	.984	−0.00	.255	−0.21
Gestures	1.25	.121	0.20	.299	0.01	.926	−0.19
Sounds	0.10	.705	0.04	.739	0.05	.982	0.01
Words	1.27	.146	0.15	.327	0.12	.855	−0.03
Understanding	7.69**	.002	0.40	.002	0.50	.582	0.11
Object Use	0.30	.559	−0.08	.461	0.06	.722	0.13
ESAC (n = 327)	2.95	.018*	−0.30	.293	−0.14	.362	0.16

Note. CSBS-BS = Communication and Symbolic Behavior Scales Behavior Sample; ESAC = Early Screening for Autism and Communication Disorders.

[a]On the basis of post hoc Bonferroni comparisons. [b]Effect size on the basis of Hedges's g: ≥ 0.20 is small, 0.50 is medium, 0.80 is large. [c]Using estimated means controlling for maternal education and behavior-sample age.

$^*p < .05$. $^{**}p < .01$.

the other two non-ASD groups, indicating more reported red flags, which suggests poorer social-communication skills.

Social-Communication Differences Across Diagnostic Classification

The second research question examined whether these social-communication outcomes differed depending on whether or not the children had an ASD diagnosis. As with the previous question, group differences on the CSBS-BS and ESAC were analyzed.

CSBS-BS

As seen in the omnibus testing reported in the previous section, there were significant group differences on the CSBS-BS across ASD and non-ASD groups, regardless of race/ethnicity, $F(7, 350) = 17.39$, $p < .001$. On the basis of follow-up analyses, significant differences continued to be observed for all CSBS-BS clusters between children with and without ASD, with children with ASD having lower social-communication scores.

Small to medium effects were observed for differences in race/ethnicity for comparisons of the Understanding cluster scores across each diagnostic classification, except for the difference between Black and Hispanic children without ASD (g = 0.02). Thus the racial/ethnic difference in scores on the Understanding cluster of the CSBS-BS was present whether or not the children had ASD. Figures 1 and 2 illustrate the results presented in Table 2. It can be noted through these visual representations of the data that the patterns of CSBS-BS cluster scores are similar across diagnostic classifications and lower overall for the ASD group.

ESAC

As expected, a significant group difference was observed on the total score of the ESAC for children with ASD (estimated marginal M = 29.67, SD = 11.76) compared with children without ASD (estimated marginal M = 16.63, SD = 10.77), $F(1, 319) = 79.16$, $p < .001$, with a large effect size (g = 1.15) on the basis of the 2 × 3 analysis of covariance reported previously.

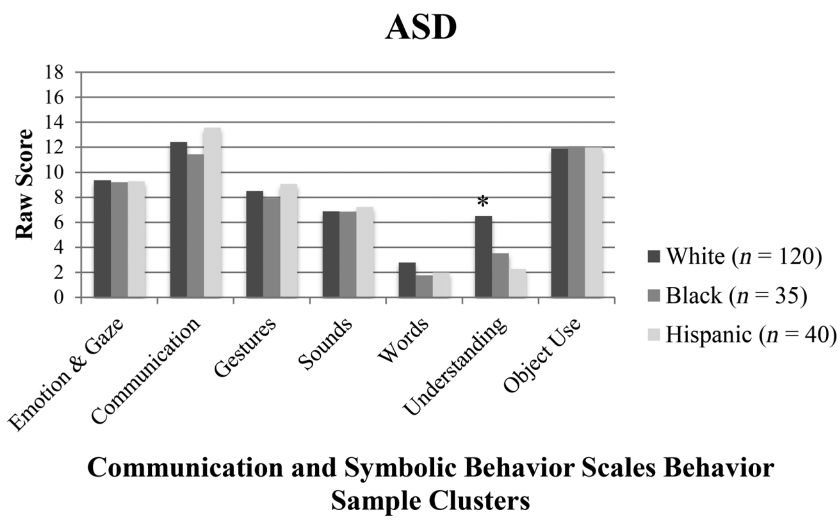
Relationships Among Maternal Education, Age, and Social Communication

To answer the third research question—regarding the relationships among maternal education, child age, and measures of early social-communication behavior—Pearson product–moment correlations were used to observe the relationships among age at the time of the CSBS-BS, cluster scores on the CSBS-BS, ESAC age, ESAC score, and maternal education level (see Table 4). Small, significant correlations were observed between CSBS-BS age and the clusters of Sound (r = .14, p = .009) and words (r = .20, $p < .001$), reflecting that older children tended to use more sounds and words. Small significant positive correlations were observed between maternal education and Gesture (r = .10, p = .05), Sounds (r = .14, p = .006), Words (r = .13, p = .011), and Understanding (r = .17, p = .001), with higher scores observed in children whose mothers had higher levels of education. A small significant negative correlation was observed between maternal education and ESAC scores (r = −.24, $p < .001$), with lower levels of maternal education corresponding to higher ESAC scores (thus more red flags of ASD). Additional Pearson product–moment correlations revealed small to medium negative correlations between maternal education and both ESAC age (r = −.22, $p < .001$) and CSBS-BS age (r = −.32, $p < .001$), such that children whose mothers reported fewer years of education were older at the time of assessment.

Discussion

This study examined the effects of race and ethnicity on early observed and reported measures of social

Figure 1. Mean Communication and Symbolic Behavior Scales Behavior Sample cluster raw scores for children with autism spectrum disorder using estimated means, controlling for maternal education and behavior-sample age. Asterisk indicates group is significantly different than other groups, $p < .05$.



communication in young toddlers with and without ASD. The first research question examined the potential impact of race/ethnicity on social communication. The results of this study suggest that the patterns of social-communication impairment seen in children with ASD are relatively consistent across race and ethnicity. No significant interaction effects for diagnostic classification and race/ethnicity were observed for the clusters of the CSBS-BS or for parent report of autism features using the ESAC.

Differences related to race/ethnicity were observed in only one cluster of the CSBS-BS—Understanding—which was consistent with our study hypothesis on the basis of previous differences observed in receptive language across race/ethnicity (Herlihy et al., 2014; Tek & Landa, 2012). This cluster measures a child's response to instructions to identify common objects (i.e., bowl, cup, spoon, bottle), familiar people, and body parts (e.g., nose, eyes, mouth). White children were observed to score significantly higher

Figure 2. Mean Communication and Symbolic Behavior Scales Behavior Sample cluster raw scores for children without autism spectrum disorder using estimated means, controlling for maternal education and behavior-sample age. Asterisk indicates group is significantly different than other groups, $p < .05$.

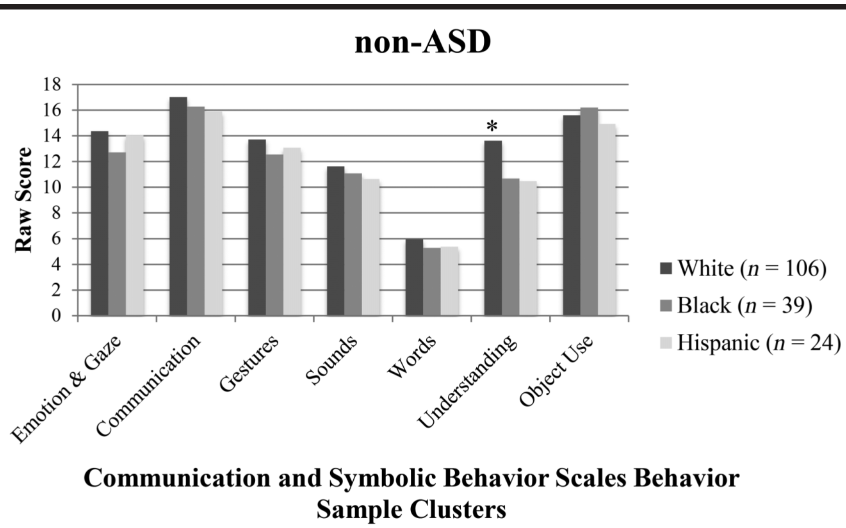


Table 4. Pearson product–moment correlations.

Score	Age	Maternal education
CSBS-BS cluster		
Emotion and Eye Gaze	−.01	−.04
Communication	.01	.06
Gestures	−.04	.10*
Sounds	.14**	.14**
Words	.20**	.13*
Understanding	−.03	.17**
Object Use	.00	.06
ESAC	.09	−.24**

Note. CSBS-BS = Communication and Symbolic Behavior Scales Behavior Sample; ESAC = Early Screening for Autism and Communication Disorders.

*$p < .05$. **$p < .01$.

on this cluster than Black and Hispanic children. This pattern of performance on the CSBS-BS was the same for both children with and without ASD, even when we controlled for differences in age and maternal education. The difference in understanding could reflect group differences in cognitive functioning, given previous findings that observed a strong correlation between the Understanding cluster of the CSBS-BS and nonverbal developmental level (Wetherby, Watt, et al., 2007). In the alternative, this difference could reflect a cultural influence in responding to requests to point to or show objects or body parts, potentially related to limited experience with the nature of the task (Anderson, 1996; Hurtado et al., 2007; Peña, Quinn, & Iglesias, 1992). Last, the finding that both Black and Hispanic children performed lower on this Understanding cluster could be indicative of a language or dialect difference. For example, children who speak African American English may score lower on standardized tests due to dialect differences that do not equate to a delay (Stockman, 2010).

The second research question addressed differences across diagnostic classifications. As hypothesized, there were significant group differences between toddlers with and without ASD on both the observed and parent-reported measures of social communication. To be specific, compared with children without ASD, children with ASD scored significantly lower on all seven cluster scores of the CSBS-BS, and parents of children with ASD reported significantly higher levels of autism features on the ESAC. Although ESAC scores for children with ASD were comparable across race/ethnicity, parents of Black children without ASD reported significantly more red flags on the ESAC than parents from both other racial/ethnic groups, with a mean score of 20.57 red flags—above the ESAC cutoff of 18. This unexpected finding could reflect a difference in the interpretation of the ESAC questions or potential communication differences.

The final research question explored the relationships among social communication and environmental and personal factors. As predicted, a small, significant negative correlation was observed between maternal education and ESAC scores, and a medium, significant negative correlation was observed between maternal education and ESAC age. These results suggest that children whose mothers had fewer years of education reported more autism features, which may reflect a situation in which these children do not get referred until the features are more obvious and may contribute to later referral and diagnosis. This difference may stem from a difference in comprehension of the ESAC questions or it may reflect a true difference in social communication. This latter hypothesis may be supported by the observed relationship between maternal education and performance on the CSBS-BS Sounds and Words clusters. Child age was correlated with only two CSBS-BS clusters, Sounds and Words, with older children having higher scores in these areas. Although more correlations were predicted, this finding is consistent with patterns of development in which children expand their sound inventory and gain words across the toddler years.

In addition to our main findings, significant differences in maternal education level were observed across race/ethnicity for children without ASD. For the non-ASD groups, White mothers had significantly more years of education than mothers in both other groups, and Black mothers had significantly more years of education than Hispanic mothers. This observed difference represents a bias in our sample of children without ASD yet reflects the racial/ethnic educational disparity in the United States. According to Ryan and Bauman (2016), 32.8% of White adults have graduated from college, compared with only 22.5% of Black and 15.5% of Hispanic adults. In contrast, no significant differences in maternal education were observed for toddlers with ASD, which could indicate an underrepresentation of Black and Hispanic participants with less education in this ASD sample. For both the ASD and non-ASD groups, Hispanic children were significantly older at the time of their CSBS-BS than children from both other groups, which was likely primarily due to differences in recruitment procedures in southwestern Florida. A large, negative correlation was observed between the CSBS-BS and the ESAC. In other words, children with lower social-communication scores on the basis of observation during the CSBS-BS had higher parent report of autism features, and vice versa. These findings indicate good agreement between the observed and parent-report measures. Taken together, the results of this study suggest that the use of the CSBS-BS and ESAC to measure social communication could be instrumental in finding young toddlers with ASD across race/ethnicity.

Strengths of the Current Study

Strengths of this study include a relatively large sample of young toddlers from three racial/ethnic groups with ASD confirmed or ruled out. The sample size was sufficient to allow for separation into six groups, with analysis of group differences on the basis of diagnostic classification, racial/ethnic categories, and level of maternal education. The sample for this study included children from multiple counties in both northern and southern regions of the state of Florida and was more diverse than most studies comparing toddlers with and without ASD.

An additional strength of the current study was the measures used. Rather than looking only at developmental level and language abilities, the CSBS-BS allowed us to examine potential differences across six domains of social communication, one of the two core domains of ASD in the *DSM-5* criteria. The CSBS-BS is also an interactive measure that incorporates social communication among the child and both an examiner and parent, and provides naturalistic communication temptations rather than direct questioning. These naturalistic social situations allow for the assessment of social-communication limitations or restrictions at the activity and participation levels of the ICF model rather than only impairment in physical or cognitive functioning (World Health Organization, 2001). These are characteristics of assessments that have been found to be beneficial for Spanish-speaking children (Anderson, 1996; Peña et al., 1992) and may also benefit children from other cultural groups who may have limited experience with testing situations. The ESAC included questions that covered both core domains in the *DSM-5* criteria for ASD.

Last, features for ASD were detected at a very young age in this study: All of the toddlers in this study were screened between ages 18 and 36 months, with an overall average age of screening of 22.2 months. According to the Centers for Disease Control and Prevention, the average age that 8-year-old children identified with ASD in 2010 had been first evaluated for ASD was 44 months (Autism and Developmental Disabilities Monitoring Network Surveillance Year 2010 Principal Investigators, 2014), double the age of participants in our sample. In their 2002 study, Mandell et al. found that the average age of diagnosis for Black children receiving Medicaid was 7.9 years, whereas our Black participants (recruited from a wide range of SES levels) were first identified as having red flags of ASD at an average age of 20.7 months. Despite the Hispanic children being identified at a significantly older age than White (M = 21.1 months) and Black participants, their mean age of identification was only 24.9 months.

Limitations of the Current Study

This study has several limitations. First of all, although the measures have been translated into Spanish, they have not been field-tested separately for a Hispanic population. Second, the ESAC, which relies on parent report of autism features, was the only measure of autism features analyzed. In addition, the CSBS-BS is normed only up to age 24 months, so raw scores rather than standard scores were used for all analyses. Although racial/ethnic groups were comparable for the proportion of children with ASD and global developmental delay, the overall proportion of children with developmental delays was higher for children with ASD than for children in the non-ASD group, which included both children with TD and children with DD. This difference could have affected the results such that group differences in developmental level could have contributed to social-communication differences between ASD and non-ASD groups. However, previous research has shown that when matched on developmental level, children with ASD scored lower than children with DD on many CSBS-BS items, including rate of communication, inventory of gestures, and eye gaze (Wetherby, Watt, Morgan, & Shumway, 2007). Future research controlling for developmental level is needed to fully explore the influence of developmental level on these group differences.

Furthermore, in the northern-Florida assessments, although bilingual clinicians or interpreters were available for Spanish-speaking families if requested, families may have been reluctant to ask for or indicate the need for an interpreter. For bilingual families, test administration performed by a bilingual clinician is ideal, with trained interpreters being an acceptable alternative (American Speech-Language-Hearing Association, n.d.). The inconsistency of assessments performed across languages is a limitation of the current study, and potential dialect differences, measurement biases, or cultural mismatch between the child and examiners could have possibly contributed to observed group differences (Peña, 2007; Stockman, 2010).

Another important limitation of this study is the division of groups by reported race and ethnicity. Although separating groups by race and ethnicity mirrors U.S. Census categories and other classification systems, racial or ethnic membership does not equate with culture (Betancourt & López, 1993). In this study, information regarding specific ethnicity (e.g., Mexican American, Cuban American, etc.), dialect use, detailed information about home language, or immigrant status was not gathered. To fully examine the effects of a family's culture on a child's social-communication development, further information is needed regarding the family's level of acculturation with the mainstream culture, language or dialect use at home, and the family's self-identified beliefs and values. In addition, parental variables beyond educational level and other markers of SES should be further explored as mediators of children's communication.

Clinical Implications and Future Directions

Because the diversity of the U.S. population is increasing, the need is also increasing for communication assessments that are culturally sensitive and account for potential cultural, racial, or ethnic differences. Reducing health disparities across SES and racial/ethnic categories is a national priority. The U.S. Department of Health and Human Services (2011) has created an action plan to reduce the effects of racial and ethnic disparities in health care, with early childhood development included as one of its priorities. It is crucial for clinicians to be able to differentiate cultural differences from communication disorders, including ASD. Our results support the use of the CSBS-BS across racial/ethnic groups, given the similarities in performance across six of the seven cluster scores. The strong relationship between the CSBS-BS and the ESAC supports the clinical utility of both of these measures with diverse families.

Further research is needed to improve early detection of communication disorders including ASD across an increasingly diverse population of young children. Because ASD is detected at younger ages and research continues to improve diagnostic accuracy, we need to ensure that all toddlers have equal access to early diagnosis and intervention. Future research directions should include examining the barriers to detection of ASD across culture/race/ethnicity and investigating strategies to improve screening in diverse populations. Although this study revealed only marginal differences in autism features across race/ethnicity on the basis of a parent-report measure, further investigation of potential differences in autism presentation and how these combinations of features are interpreted by families across race/ethnicity is needed, including research on observed characteristics in addition to parent-report measures. In addition, early-intervention research is needed to determine culturally appropriate strategies for maximizing outcomes in children from diverse cultures.

Given the growing diversity in the United States, racial/ethnic disparities in the provision of services for young toddlers with ASD will be an increasing public-health challenge that will directly affect the clinical services provided by speech-language pathologists. This improved knowledge about the social-communication profile of children with ASD and early autism features will aid in improved early detection and access to earlier intervention for children with ASD, which may help to reduce health and educational disparities in early speech-language and other intervention services.

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References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

American Speech-Language-Hearing Association. (n.d.). *Bilingual service delivery* [Practice portal]. Retrieved from www.asha.org/Practice-Portal/Professional-Issues/Bilingual-Service-Delivery

Anderson, R. T. (1996). Assessing the grammar of Spanish-speaking children: A comparison of two procedures. *Language, Speech, and Hearing Services in Schools, 27,* 333–344.

Autism and Developmental Disabilities Monitoring Network Surveillance Year 2010 Principal Investigators. (2014). Prevalence of autism spectrum disorder among children aged 8 years—Autism and Developmental Disabilities Monitoring Network, 11 sites, United States, 2010. *Morbidity and Mortality Weekly Report Surveillance Summaries, 63*(2), 1–21.

Betancourt, H., & López, S. R. (1993). The study of culture, ethnicity, and race in American psychology. *American Psychologist, 48,* 629–637.

Bölte, S., de Schipper, E., Robison, J. E., Wong, V. C. N., Selb, M., Singhal, N., . . . Zwaigenbaum, L. (2014). Classification of functioning and impairment: The development of ICF Core Sets for autism spectrum disorder. *Autism Research, 7,* 167–172.

Chaidez, V., Hansen, R. L., & Hertz-Picciotto, I. (2012). Autism spectrum disorders in Hispanics and non-Hispanics. *Autism, 16,* 381–397.

Charman, T., Taylor, E., Drew, A., Cockerill, H., Brown, J.-A., & Baird, G. (2005). Outcome at 7 years of children diagnosed with autism at age 2: Predictive validity of assessments conducted at 2 and 3 years of age and pattern of symptom change over time. *The Journal of Child Psychology and Psychiatry, 46,* 500–513.

Chawarska, K., Klin, A., Paul, R., & Volkmar, F. (2007). Autism spectrum disorder in the second year: Stability and change in syndrome expression. *The Journal of Child Psychology and Psychiatry, 48,* 128–138.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Mahwah, NJ: Erlbaum.

Cuccaro, M. L., Brinkley, J., Abramson, R. K., Hall, A., Wright, H. H., Hussman, J. P., . . . Pericak-Vance, M. A. (2007). Autism in African American families: Clinical-phenotypic findings. *American Journal of Medical Genetics, Part B: Neuropsychiatric Genetics, 144B,* 1022–1026.

Dollaghan, C. A., Campbell, T. F., Paradise, J. L., Feldman, H. M., Janosky, J. E., Pitcairn, D. N., & Kurs-Lasky, M. (1999). Maternal education and measures of early speech and language. *Journal of Speech, Language, and Hearing Research, 42,* 1432–1443.

Dotterer, A. M., Iruka, I. U., & Pungello, E. (2012). Parenting, race, and socioeconomic status: Links to school readiness. *Family Relations, 61,* 657–670.

Fernald, A., Marchman, V. A., & Weisleder, A. (2013). SES differences in language processing skill and vocabulary are evident at 18 months. *Developmental Science, 16,* 234–248.

Gotham, K., Risi, S., Pickles, A., & Lord, C. (2007). The Autism Diagnostic Observation Schedule: Revised algorithms for improved diagnostic validity. *Journal of Autism and Developmental Disorders, 37,* 613–627.

Grinker, R. R., Chambers, N., Njongwe, N., Lagman, A. E., Guthrie, W., Stronach, S., . . . Wetherby, A. M. (2012). "Communities" in community engagement: Lessons learned from autism research in South Korea and South Africa. *Autism Research, 5,* 201–210.

Guthrie, W., Swineford, L. B., Nottke, C., & Wetherby, A. M. (2013). Early diagnosis of autism spectrum disorder: Stability and change in clinical diagnosis and symptom presentation. *The Journal of Child Psychology and Psychiatry, 54,* 582–590.

Hammer, C. S., Farkas, G., & Maczuga, S. (2010). The language and literacy development of Head Start children: A study using the Family and Child Experiences Survey database. *Language, Speech, and Hearing Services in Schools, 41,* 70–83.

Harris, B., Barton, E. E., & Albert, C. (2014). Evaluating autism diagnostic and screening tools for cultural and linguistic responsiveness. *Journal of Autism and Developmental Disorders, 44,* 1275–1287. https://doi.org/10.1007/s10803-013-1991-8

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Brookes.

Hart, B., & Risley, T. R. (2003, Spring). The early catastrophe: The 30 million word gap by age 3. *American Educator, 27*(1), 4–9.

Herlihy, L. E., Brooks, B., Dumont-Mathieu, T., Barton, M. L., Fein, D., Chen, C.-M., & Robins, D. L. (2014). Standardized screening facilitates timely diagnosis of autism spectrum disorders in a diverse sample of low-risk toddlers. *Journal of Developmental & Behavioral Pediatrics, 35,* 85–92.

Hoff, E. (2003). The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child Development, 74,* 1368–1378.

Hoff, E. (2013). Interpreting the early language trajectories of children from low-SES and language minority homes: Implications for closing achievement gaps. *Developmental Psychology, 49,* 4–14.

Hurtado, N., Marchman, V. A., & Fernald, A. (2007). Spoken word recognition by Latino children learning Spanish as their first language. *Journal of Child Language, 34,* 227–249.

Jarrett, R. L., Hamilton, M.-B., & Coba-Rodriguez, S. (2015). "So we would all help pitch in": The family literacy practices of low-income African American mothers of preschoolers. *Journal of Communication Disorders, 57,* 81–93.

Jo, H., Schieve, L. A., Rice, C. E., Yeargin-Allsopp, M., Tian, L. H., Blumberg, S. J., . . . Boyle, C. A. (2015). Age at autism spectrum disorder (ASD) diagnosis by race, ethnicity, and primary household language among children with special health care needs, United States, 2009–2010. *Maternal and Child Health Journal, 19,* 1687–1697.

Khowaja, M. K., Hazzard, A. P., & Robins, D. L. (2015). Sociodemographic barriers to early detection of autism: Screening and evaluation using the M-CHAT, M-CHAT-R, and Follow-Up. *Journal of Autism and Developmental Disorders, 45,* 1797–1808.

Kogan, M. D., Blumberg, S. J., Schieve, L. A., Boyle, C. A., Perrin, J. M., Ghandour, R. M., . . . van Dyck, P. C. (2009). Prevalence of parent-reported diagnosis of autism spectrum disorder among children in the US, 2007. *Pediatrics, 124,* 1395–1403.

Liptak, G. S., Benzoni, L. B., Mruzek, D. W., Nolan, K. W., Thingvoll, M. A., Wade, C. M., & Fryer, G. E. (2008). Disparities in diagnosis and access to health services for children with autism: Data from the National Survey of Children's Health. *Journal of Developmental & Behavioral Pediatrics, 29,* 152–160.

Lord, C., Risi, S., DiLavore, P. S., Shulman, C., Thurm, A., & Pickles, A. (2006). Autism from 2 to 9 years of age. *Archives of General Psychiatry, 63,* 694–701.

Lord, C., Rutter, M., DiLavore, P.C., & Risi, S. (2002). *Autism Diagnostic Observation Schedule*. Los Angeles, CA: Western Psychological Services.

Luyster, R., Gotham, K., Guthrie, W., Coffing, M., Petrak, R., Pierce, K., . . . Lord, C. (2009). The Autism Diagnostic Observation Schedule–Toddler Module: A new module of a standardized diagnostic measure for autism spectrum disorders. *Journal of Autism and Developmental Disorders, 39,* 1305–1320.

Mandell, D. S., Listerud, J., Levy, S. E., & Pinto-Martin, J. A. (2002). Race differences in the age at diagnosis among Medicaid-eligible children with autism. *Journal of the American Academy of Child & Adolescent Psychiatry, 41,* 1447–1453.

Mandell, D. S., Wiggins, L. D., Carpenter, L. A., Daniels, J., DiGuiseppi, C., Durkin, M. S., . . . Kirby, R. S. (2009). Racial/ethnic disparities in the identification of children with autism spectrum disorders. *American Journal of Public Health, 99,* 493–498.

Mullen, E. M. (1995). *Mullen Scales of Early Learning: AGS edition.* Circle Pines, MN: AGS.

Noble, K. G., Norman, M. F., & Farah, M. J. (2005). Neurocognitive correlates of socioeconomic status in kindergarten children. *Developmental Science, 8,* 74–87.

Peña, E. D. (2007). Lost in translation: Methodological considerations in cross-cultural research. *Child Development, 78,* 1255–1264.

Peña, E., Quinn, R., & Iglesias, A. (1992). The application of dynamic methods to language assessment: A nonbiased procedure. *The Journal of Special Education, 26,* 269–280.

Plumb, A. M., & Wetherby, A. M. (2013). Vocalization development in toddlers with autism spectrum disorder. *Journal of Speech, Language, and Hearing Research, 56,* 721–734.

Qi, C. H., Kaiser, A. P., Marley, S. C., & Milan, S. (2012). Performance of African American preschool children from low-income families on expressive language measures. *Topics in Early Childhood Special Education, 32,* 175–184.

Robins, D. L., Fein, D., Barton, M. L., & Green, J. A. (2001). The Modified Checklist for Autism in Toddlers: An initial study investigating the early detection of autism and pervasive developmental disorders. *Journal of Autism and Developmental Disorders, 31,* 131–144.

Rowe, M. L., & Goldin-Meadow, S. (2009, February 13). Differences in early gesture explain SES disparities in child vocabulary size at school entry. *Science, 323*(5916), 951–953.

Ryan, C. L., & Bauman, K. (2016). Educational attainment in the United States: 2015. Washington, DC: United States Census Bureau.

Scarpa, A., Reyes, N. M., Patriquin, M. A., Lorenzi, J., Hassenfeldt, T. A., Desai, V. J., & Kerkering, K. W. (2013). The Modified Checklist for Autism in Toddlers: Reliability in a diverse rural American sample. *Journal of Autism and Developmental Disorders, 43,* 2269–2279.

Sell, N. K., Giarelli, E., Blum, N., Hanlon, A. L., & Levy, S. E. (2012). A comparison of autism spectrum disorder *DSM-IV* criteria and associated features among African American and white children in Philadelphia County. *Disability and Health Journal, 5,* 9–17.

Shumway, S., & Wetherby, A. M. (2009). Communicative acts of children with autism spectrum disorders in the second year of life. *Journal of Speech, Language, and Hearing Research, 52,* 1139–1156.

Stockman, I. J. (2010). A review of developmental and applied language research on African American children: From a deficit to difference perspective on dialect differences. *Language, Speech, and Hearing Services in Schools, 41,* 23–38.

Tek, S., & Landa, R. J. (2012). Differences in autism symptoms between minority and non- minority toddlers. *Journal of Autism and Developmental Disorders, 42,* 1967–1973.

Tomasello, M. (2000). Culture and cognitive development. *Current Directions in Psychological Science, 9,* 37–40.

Travers, J., Tincani, M., & Krezmien, M. P. (2013). A multiyear national profile of racial disparity in autism identification. *The Journal of Special Education, 47,* 41–49.

U.S. Department of Health and Human Services. (2011). *HHS action plan to reduce racial and ethnic health disparities: A nation free of disparities in health and health care*. Washington, DC: Author.

Valicenti-McDermott, M., Hottinger, K., Seijo, R., & Shulman, L. (2012). Age at diagnosis of autism spectrum disorders. *Journal of Pediatrics, 161,* 554–556.

Watson, L. R., Crais, E. R., Baranek, G. T., Dykstra, J. R., & Wilson, K. P. (2013). Communicative gesture use in infants with and without autism: A retrospective home video study. *American Journal of Speech-Language Pathology, 22,* 25–39.

Werner, E., & Dawson, G. (2005). Validation of the phenomenon of autistic regression using home videotapes. *Archives of General Psychiatry, 62,* 889–895.

Wetherby, A. M., Allen, L., Cleary, J., Kublin, K., & Goldstein, H. (2002). Validity and reliability of the Communication and Symbolic Behavior Scales Developmental Profile with very young children. *Journal of Speech, Language, and Hearing Research, 45,* 1202–1218.

Wetherby, A. M., Guthrie, W., Petkova, E., Woods, J., Lord, C., Voccola, D., . . . Rozenblit, L. (2015, May). *Broadband and autism-specific screening using the Early Screening for Autism and Communication Disorders (ESAC): Moving from paper to the Smart ESAC for children 12 to 36 months of age*. Presented at the International Meeting for Autism Research, Salt Lake City, UT.

Wetherby, A. M., Lord, C., Woods, J., Guthrie, W., Pierce, K., Shumway, S., . . . Ozonoff, S. (2009, May). *The Early Screening for Autism and Communication Disorders (ESAC): Preliminary field-testing of an autism-specific screening tool for children 12 to 36 months of age*. Presented at the International Meeting for Autism Research, Chicago, IL.

Wetherby, A., Lord, C., Woods, J., Guthrie, W., Pierce, K., Shumway, S., . . . Ozonoff, S. (2017). The Early Screening for Autism and Communication Disorders (ESAC): Preliminary field-testing of an autism-specific screening tool for children 12 to 36 months of age. Manuscript in preparation.

Wetherby, A. M., & Prizant, B. M. (2002). *Communication and Symbolic Behavior Scales Developmental Profile–First Normed Edition*. Baltimore, MD: Brookes.

Wetherby, A. M., Watt, N., Morgan, L., & Shumway, S. (2007). Social communication profiles of children with autism spectrum disorders late in the second year of life. *Journal of Autism and Developmental Disorders, 37,* 960–975.

Wetherby, A., Woods, J., & Lord, C. (2007). *ESAC: Early Screening for Autism and Communication Disorders*. Unpublished manual, Florida State University, Tallahassee, FL

Wolff, J. J., Botteron, K. N., Dager, S. R., Elison, J. T., Estes, A. M., Gu, H., . . . Piven, J. (2014). Longitudinal patterns of repetitive behavior in toddlers with autism. *The Journal of Child Psychology and Psychiatry, 55,* 945–953. https://doi.org/10.1111/jcpp.12207

World Health Organization. (2001). *International classification of functioning, disability and health: ICF*. Geneva, Switzerland: Author.

Zwaigenbaum, L., Bryson, S., Rogers, T., Roberts, W., Brian, J., & Szatmari, P. (2005). Behavioral manifestations of autism in the first year of life. *International Journal of Developmental Neuroscience, 23,* 143–152. https://doi.org/10.1016/j.ijdevneu.2004.05.001