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# Adaptive Behaviors in Toddlers Under Two With Autism Spectrum Disorders

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ORIGINAL PAPER

# Adaptive Behavior in Toddlers Under Two with Autism Spectrum Disorders

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**Abstract** The Vineland Adaptive Behavior Scale was administered to 54 children diagnosed with autism spectrum disorder (ASD) before age 2, and a matching group of 18 toddlers with developmental delay (DD). The group with ASD was more impaired on all scales of the Vineland than DD peers. When 18 ASD/DD pairs very closely matched on age, verbal and nonverbal development were selected, differences were found only on Vineland Receptive Communication and Daily Living. Correlation analyses to explore connection of these areas of difference with cognition and autistic symptoms suggested that Vineland Daily Living scores were significantly correlated with nonverbal ability and with ADOS total algorithm scores. Vineland Receptive Communication scores correlated significantly only with ADOS total algorithms. The clinical implications of these findings are discussed.

**Keywords** Autism spectrum disorder · Adaptive behavior · Toddlers

## Introduction

Although a range of factors affect outcome in autism spectrum disorders (Howlin 2005), adaptive skills are one aspect of development that contributes strongly to prognosis (Gillham et al. 2000; Klin et al. 2007). Adaptive skills are those involved with using whatever capacities the individual possesses to function within the everyday environment. These skills are particularly important in individuals with autism spectrum disorders (ASD) because they contribute so strongly to the ability to function successfully and independently in the world (Liss et al. 2001; Mazefsky et al. 2008; Saulnier and Klin 2007).

Several studies have confirmed that the Vineland Adaptive Behavior Scales (Sparrow et al. 1984, 2005), a well-standardized semi-structured caregiver report instrument for assessing adaptive behavior, can be used to document delays in adaptive development in individuals with autism spectrum disorders (Carter et al. 1998; Griffith et al. 2010; Jacobson and Ackerman 1990; Liss et al. 2001; Loveland and Kelley 1991; Rodrigue et al. 1991; Schatz and Hamdan-Allen 1995) and is useful in differentiating school-aged (Gillham et al. 2000) and preschool (Perry et al. 2009) children with ASD from those with non-autistic developmental disorder (DD).

Literature attesting to the adaptive deficits in ASD dates back at least to Volkmar et al. (1987). Greater delays in adaptive than in cognitive functioning have been frequently reported (e.g., Freeman et al. 1988; Joseph et al. 2002; Kenworthy et al. 2010; Klin et al. 1992; Saulnier and Klin 2007; Volkmar et al. 1987). Perry et al. (2009), for example, showed that preschool children (average age 4) with ASD had significantly different profiles of adaptive behavior from those of peers with DD, with Socialization and Communication lower in the ASD group. Their regression analyses indicated that autism severity accounted for a modest amount of variance in Socialization and Daily Living Skills.

However, literature on clinical presentation and adaptive functioning in toddlers (18–36 months of age) with ASD is more limited than is literature on children over the age of 3. Sutera et al. (2007) reported data on children with ASD at age 2 who retained the diagnosis to age 4, comparing these data to those of peers with DD. The data reveal significant differences between groups on all scales of the Vineland at

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both 2 and 4 years of age; however, it is important to note that overall IQs for the children with ASD were significantly lower than those with DD at both ages. Stone et al. (1999) reported on groups of 2-year old children with ASD and with DD matched on chronological age (CA) as well as on mental age (MA). Relative to children with DD, the group with ASD demonstrated weaker socialization and communication skills and greater discrepancies between adaptive behavior and MA.

Very few data, however, exist for children under the age of two, even though recent research suggests that clinical diagnosis of autism can be reliably assigned in the second year of life, and is stable when conferred by a multidisciplinary team of experienced clinicians (Chawarska et al. 2007, 2009; Lord 1995).

We were interested in testing the hypotheses that:

(1) toddlers under the age of 2 showing ASD would, like their older counterparts, demonstrate deficits in adaptive behavior that were greater than those of peers with non-autistic DD matched for developmental level, for whom we would predict closer convergence between developmental and adaptive levels.
(2) Correlations with adaptive skills would be seen in measures of cognitive ability and overall autistic symptomatology, as Perry et al. (2009) had shown for preschoolers with ASD.

These hypotheses were investigated by comparing a large (n = 55) group of 13–27 month olds with diagnoses of ASD to a well-matched but smaller (n = 18) group of toddlers with non-autistic DD, as well as by a comparison of 18 individually matched pairs including all DD participants and 18 participants with ASD selected to provide close individual matches on age and cognitive level.

## Method

### Participants

Seventy-three toddlers were evaluated by a multidisciplinary team consisting of a clinical child psychologist, speech-language pathologist, and social worker. Children included in this sample were referred by parents or professionals between 2008 and 2011. Age at assessment ranged from 13 to 27 months (M = 21.5, SD = 4.9). Consecutive referrals that met the inclusionary and exclusionary criteria described below were considered for participation. Individuals were included in the ASD group if their age fell within the above range, and they received a clinical diagnosis of ASD conferred by two experienced clinicians following extensive characterization procedures, including administration of the Autism Diagnostic Observation Schedule (ADOS; Lord et al. 2000). The diagnosis of ASD was based not only on ADOS score, however, but on clinical best estimate diagnosis based on DSM-IV (1994) criteria, the review of developmental and medical history, and the results of direct assessment and parent interview. The DSM-IV criteria were modified for children under the age of 3 (see Chawarska and Volkmar 2005 for review) with emphasis on the absence of early emerging dyadic and triadic interaction skills, limited nonverbal communication skills, and lesser emphasis on the presence of restricted and repetitive behaviors (RRB). Studies suggest that experienced clinicians' judgment of children at the age of 2 is a better predictor of later diagnosis than are scores on standardized assessment instruments (Chawarska et al. 2007; Lord et al. 2006).

Toddlers with non-autistic DD were included if they met age criteria above, did not meet the exclusionary criteria below, did not meet clinical criteria for ASD, and scored 2 SDs below the mean on one scale of the *Mullen Scales of Early Learning* (Mullen 1995), or more than 1.5 SDs below the mean on two Mullen scales, in accordance with State of Connecticut eligibility requirements for early intervention. Exclusionary criteria for both groups consisted of gestational age below 32 weeks, documented hearing or visual impairment, history of head trauma with loss of consciousness, non-febrile seizure disorders, diagnosed neurological abnormality, and known genetic syndrome. Demographic information on the cohort appears in Table 1.

### *Provisional Diagnoses*

Using the methods outlined above, 54 participants received a diagnosis of ASD. Diagnosis of non-autistic DD was conferred for 18 participants. One-way analysis of variance (ANOVA), displayed in Table 2, shows there were no significant differences between the two groups on age or on any of the scales of the Mullen, except for a difference favoring the DD group on Expressive Language.

**Table 1** Demographic information on ASD and DD participants

| | ASD n = 54 | DD n = 18 |
|---|---|---|
| % Racial composition | | |
| African–American | 5.5 | 5.5 |
| Hispanic | 5.5 | 11.1 |
| Asian | 3.6 | – |
| Caucasian | 76.3 | 83.4 |
| Mixed/unknown/other | 9.1 | – |
| Mean maternal age at child's birth | 34.0 | 32.9 |
| % Mothers who completed college or higher | 96.9 | 94.4 |

**Table 2** Mean (standard deviation) T-scores on *Mullen Scales of Early Learning* in ASD Group versus DD group; and matched pairs of ASD and DD participants

| Measure | All participants | | | Matched pairs only (DD group unchanged) | |
|---|---|---|---|---|---|
| | ASD (n = 54) | DD (n = 18) | Significant difference? | ASD (n = 18) | Significant difference from original DD (n = 18)? |
| Age (month) | 21.7 (3.1) | 20.4 (4.3) | NS | 20.0 (3.5) | NS |
| Mullen visual reception | 35.4 (12.6) | 39.5 (13.8) | NS | 37.8 (11.7) | NS |
| Mullen fine motor | 35.8 (11.8) | 36.0 (12.1) | NS | 33.9 (9.2) | NS |
| Mullen gross motor | 35.6 (9.1) | 34.6 (10.8) | NS | 33.2 (9.3) | NS |
| Mullen expressive language* | 24.7 (7.8) | 29.4 (9.6) | F (1,71) = 4.5, $p < .04$ Cohen's d = .54 (medium) | 26.4 (8.7) | NS |
| Mullen receptive language | 26.5 (11.8) | 31.5 (12.6) | NS | 27.4 (11.7) | NS |

* Significant difference at $p < .05$

*Matched Pairs*

Eighteen matched pairs of toddlers with ASD diagnoses and DD diagnoses were created from the sample described above. One participant with ASD was manually matched to each participant with DD based on chronological age and Mullen Visual Reception (VR) standard score, in order to provide matching on non-verbal cognitive ability, since children with ASD are known to be disproportionally impaired in language skills (Paul et al. 2008a; Wetherby et al. 2007). All pairs were matched within one month on chronological age, except for 2; the largest difference was 4 months. In terms of nonverbal cognitive age-equivalent (Mullen VR) all pairs were less than 2 months apart, except for 3; the largest difference was 5 months. The average age for all participants in the paired sample was 20.22 months (ASD = 20.04, SD = 3.53; DD = 20.41, SD = 4.32); the average Mullen VR score was 38.64 (ASD = 37.78, SD = 11.66; DD = 39.50, SD = 13.82). The sample was comprised of 26 males (ASD = 14; DD = 12) and 10 females (ASD = 4; DD = 6). Table 2 reports result of a one-way analysis of variance (ANOVA) comparing the matched groups, in the two right-most columns. No significant differences were found on age or on any scales of the Mullen (1995), suggesting that the matched groups are more closely similar, particularly with regard to Expressive Language, than are the large group of toddlers with ASD and the group with DD.

Procedures

Participants received intensive behavioral characterization, in addition to diagnostic assessment, including the following measures:

*Adaptive Skills*

The Vineland Adaptive Behavior Scales-II Survey form (Sparrow et al. 2005), a nationally standardized semi-structured caretaker interview instrument that assesses day-to-day adaptive functioning was administered to primary caregivers by research assistants extensively trained in Vineland interview and scoring procedures. The Vineland consists of four domains: Communication, Daily Living, Socialization and Motor. The Communication Domain also contains subdomains measuring Expressive and Receptive Language separately.

*Developmental Levels*

Developmental level was assessed with the *Mullen Scales of Early Learning* (Mullen 1995), a measure of early development in five domains: Gross Motor (GM), Fine Motor (FM), Visual Reception (VR), Receptive Language (RL), and Expressive Language (EL). The Mullen reports T-scores with a mean of 50 and standard deviation of 10. For the purpose of the present study, Mullen VR was used as an index of nonverbal developmental level.

*Autistic Severity*

Range and severity of symptoms was assessed directly with the ADOS-Module 1 (Lord et al. 2000). All examiners had previously established reliability with the ADOS training center and with each other. In order to examine Vineland performance in relation to autism symptomatology, the total ADOS algorithm score was used as an index of autism severity.

## Results

All Participants

As Table 2 shows, the ASD and DD groups were matched for age, Non-verbal, Motor, and Receptive Language ability on the Mullen, suggesting they were roughly

**Table 3** Mean (standard deviation) scaled scores on Vineland adaptive behavior scales (Sparrow et al. 2005) in ASD group versus DD group; and matched pairs of ASD and DD participants

| VABS-II scale | All participants | | | Matched pairs only (DD group unchanged) | |
|---|---|---|---|---|---|
| | ASD (n = 54) | DD (n = 18) | Significant difference? | ASD (n = 18) | Significant difference from original DD (n = 18)? |
| Communication Standard score | 73.7 (13.0) | 83.6 (13.2) | F (1,71) = 7.8; $p < .008$ Cohen's d = .76 (medium) | 74.1 (15.6) | NS |
| Receptive* communication V score | 10.5 (3.1) | 12.7 (3.0) | F (1,71) = 6.7; $p < .02$ Cohen's d = .72 (medium) | 10.5 (3.5) | F (1, 34) = 4.1; $p = .05$ Cohen's d = .67 (medium) |
| Expressive* communication V score | 10.4 (2.4) | 11.9 (2.1) | F (1,71) = 5.5; $p < .03$ Cohen's d = .76 (medium) | 10.7 (2.9) | NS |
| Daily living standard score | 77.7 (10.5) | 85.1 (9.9) | F (1,71) = 7.1; $p < .02$ Cohen's d = .73 (medium) | 77.9 (9.1) | F (1,34) = 5.2; $p < .03$ Cohen's d = .76 (medium) |
| Socialization standard score | 77.6 (7.0) | 83.3 (6.1) | F (1,71) = 9.3; $p < .004$ Cohen's d = .87 (large) | 79.7 (7.5) | NS |
| Motor standard score | 83.9 (10.3) | 85.1 (12.9) | NS | 81.8 (9.2) | NS |

* Subdomain scores are reported as "V scores" on the VABS-II, with a mean of 15 and standard deviation of 3

comparable in most aspects of development. There was a difference in favor of the DD group on Expressive Language.

Scaled scores from each of the VABS-II domains for each diagnostic group appear in Table 3. There it can be seen that the large group with ASD scored significantly lower than the group with DD on the two scales of the VABS-II (Communication and Socialization) on which differences have also been reported for older children. Additional deficits were seen in Daily Living skills for the ASD group, which have not been reported in older toddlers. Moreover, there were deficits in the adaptive use of both Expressive and Receptive Language in the group with ASD, even though they had scored comparably on standard developmental testing of Receptive language. Effect sizes were medium in most areas and large for Socialization.

### Matched Pairs

As Table 3 shows, matched pairs of ASD and DD participants were not significantly different in terms of age or on any scale of the Mullen. Thus, the matched pairs appeared to function more similarly with respect to expressive communication than was the case for the larger ASD group when compared to the DD participants.

Table 3 also shows that, unlike comparison with the large group with ASD, the matched ASD/DD pairs were not significantly different on the overall Vineland Communication Scale. However, when scores on the Receptive and Expressive subscales of this domain were examined separately, Receptive scores were significantly different, while Expressive scores were not. Thus in terms of adaptive use of communication, this analysis reveals that when pairs are very closely matched, including on expressive language skills, it is receptive language that primarily distinguishes the two groups. Additional differences were seen in the Daily Living domain between the matched pairs.

### Correlational Analyses

To test the hypothesis that adaptive skill was associated with measures of cognitive ability and overall autistic severity, as previous research has shown for older children, correlation analyses were performed (SPSS 18.0 PASW) with data from the 54 participants with ASD. Mullen VR and total ADOS Algorithm scores were correlated with Vineland Receptive Communication and Daily Living scores, since these areas differentiated toddlers with DD from closely-matched peers with ASD.

Vineland Daily Living scores were significantly correlated with Mullen VR (r = .45; $p < .001$) and with ADOS total algorithm (r = −.33; $p < .0001$). Vineland Receptive Communication scores correlated significantly only with ADOS total algorithm (r = .51; $p < .0001$), not with Mullen VR.

## Discussion

This report extends the picture of adaptive skills, as measured by the Vineland Adaptive Behavior Scales (Sparrow et al. 2005), in toddlers with ASD to those under the age of 2. Like their older counterparts, these children show deficits in adaptive behavior relative to age-mates with DD closely matched for cognitive level. However, there were some unexpected findings. First, although our group of 54 toddlers

with ASD, when matched to a smaller group with DD, differed on all scales of the Vineland, when pairs of ASD/DD participants were very closely matched so that initial differences on expressive language were removed, differences in the Socialization domain were no longer significant, even though this is one of the most frequently reported differences in older children. This finding could be due simply to a reduction in power present in the smaller sample size. Indeed, the effect size of the difference between the matched pairs on Vineland Socialization scores was medium (Cohen's d = .53) and comparable to the significant differences seen. More research with larger samples of toddlers with DD will be needed to resolve this question.

Second, although there were differences from DD peers in performance on a standard developmental measure for Expressive Language and differences in adaptive use of both Expressive and Receptive communication based on comparisons to the larger ASD group, for the most closely matched pairs, which did not differ on Expressive Communication, significant differences were seen in adaptive use of Receptive Communication only. Again, this could be simply explained by a loss of power; however, for this comparison, the effect size in terms of Expressive Communication was small (Cohen's d = .47), while the effect size for Receptive Communication remained medium for comparisons for both the whole group and the matched pairs.

Although more research with larger groups of participants with DD is necessary, these findings suggest that in very young children with ASD, an adaptive deficit in the ability to respond to language is one aspect of behavior that discriminates them from other toddlers with nonautistic but equivalent delays in expressive language development. The fact that there is no difference between matched pairs of toddlers with ASD and DD in their scores on standard tests of receptive language emphasizes the suggestion that this deficit in toddlers with ASD is not necessarily in knowledge or language competence, but in functional use; in the ability to focus on and respond to language directed to them in everyday situations. We (Paul et al. 2007b, 2008a, b) and others (Ellis Weismer et al. 2010; Wetherby et al. 2007) have reported a similar finding in older toddlers (25–36 months) with ASD, and we (Paul et al. 2007a) have reported that these older children show reduced preference for child-directed speech in an auditory preference paradigm. Here, however, we see a suggestion that this deficit is present even before the second birthday and that it impacts significantly the ability to engage in daily activities of communication, as well as on the future trajectory of both expressive and receptive language development. These findings emphasize the importance of providing interventions that address this deficit in response to language when programs for the earliest-identified children with ASD are being developed.

This study also identified robust differences between ASD and DD groups in Daily Living Skill area on the Vineland. The finding suggests that in children under two, early emergence of self-help and age-appropriate participation in home and community activities are more significantly impacted than previously thought. Young toddlers with ASD appear more impaired even than their counterparts with DD in their acquisition of self-help skills such as feeding, dressing, and bathing. While it may be social skills that distinguish these two groups diagnostically, in terms of activities of daily living, young toddlers with ASD are also significantly less able, even than peers with DD, to perform basic activities of self-care. These deficits, too, require intervention approaches that will foster higher levels of independence, not only for the sake of the development of affected children, but for the the well-being of their families.

The correlations found between both nonverbal ability (Mullen VR) and autistic severity in terms of Daily Living extend similar findings in preschoolers with ASD to this very young cohort. However, we did not find a relationship between nonverbal ability and Vineland Receptive Communication; rather Receptive Communication was related only to the severity of autistic symptoms. This could be taken to suggest that at this early age, general level of cognition is not the limiting factor in developing receptive skills, but the severity of symptomatology more strongly influences the child's ability by means of the impact of self-directed interests and actions on the ability to attend to others, both visually (to look at objects they refer to) and auditorily (to "tune in" to child-directed speech), resulting in diminished joint attention. Thus these very young children with ASD may have the capacity to increase their receptive performance, even in the presence of limited non-verbal skills, with focused intervention aimed at circumventing the autistic symptoms that limit their ability to acquire receptive skills through mediated joint attention activities.

Limitations of the current study include the relatively small number of participants with non-autistic DD, thus potentially limiting the power to find differences in the closely matched group comparisons. In addition, long-term outcome data demonstrating that diagnoses conferred before age 2 are retained in the sample during the preschool years would add to the strength of the current findings. We intend to follow this cohort to the age of 3–4, so that these data will be available in later reports.

## Clinical Implications

These findings highlight the continuity of reports on significant adaptive deficits, even relative to peers with non-autistic DD, in children with ASD, extending them down to the second year of life. They emphasize the need, when designing early intervention, to focus not only on the

elicitation of basic skills in ABA formats, such as naming, sorting and matching. Instead, they suggest the necessity to focus from the first on integrating newly learned skills into adaptive contexts, such as sorting and matching tools of daily living in functional contexts (e.g., choosing spoons from a set of utensils; choosing pairs of socks). Findings also suggest that even before children begin to speak, actively encouraging attention and response to language is indicated. Activities such as gently withholding objects of interest until a child responds first to name, and eventually to words for objects' names, as well as activities that integrate joint attention and simple language input, may enhance orientation to spoken language. Work on adaptive responses to others' language should continue even when the child's first communicative initiations emerge.

The central message to take from these data would appear to be that very young children with ASD are already showing marked deficits not only in basic skill acquisition of social, communicative, and daily living skills, but in functional integration even of skills they posses. Intervention aimed at optimizing their development will need to include not only the acquisition of these basic skills but their practice in a range of functional activities from the earliest stages of therapy, in order to minimize the adaptive impact of the autistic syndrome.

## Contribution of the Vineland Adaptive Behavior Scales

What is also clear is that the Vineland Adaptive Behavior Scales represent one of the enduring contributions of Sara Sparrow to the study of developmental disabilities. A measure so carefully and thoughtfully constructed to be valid from the first months of life through adulthood, so broad in scope as to be sufficient to contrast with cognitive measures across disabilities, and so flexible it can be used throughout the world, the Vineland has served the field of autism studies well, as it has developmental disabilities in general. For this, as for so much else, we are thankful to Sara Sparrow, and grateful to have had the privilege to work with and learn from her.

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