Brief Report: Poor Self-regulation as a Predictor of Individual Differences in Adaptive
Functioning in Young Children with Autism Spectrum Disorder

Mirko Uljarević^{1,2}

Darren Hedley^{2,3}

Rose Nevill^{4,5}

David W Evans⁶

Ru Ying Cai²

Eric Butter^{3,4}

James A. Mulick⁴

¹Stanford Autism Center, Department of Psychiatry and Behavioral Sciences, School of
Medicine, Stanford University, Stanford, CA, USA

²Olga Tennison Autism Research Centre, La Trobe University, Melbourne, VIC, Australia

³Nationwide Children's Hospital, Columbus, OH, USA

⁴The Ohio State University, Columbus, OH, USA

⁵Kennedy Krieger Institute and John Hopkins School of Medicine, Baltimore, MD, USA

⁶Bucknell University, Lewisburg, PA, USA

Correspondence concerning this article should be addressed to:

Darren Hedley, PhD

Olga Tennison Autism Research Centre, School of Psychology and Public Health

La Trobe University, Melbourne, Victoria 3086, Australia

Phone: +61 03 9479 3704, Email: D.Hedley@latrobe.edu.au

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Conflict of Interest Statement

The authors declare no conflicts of interest.

Abstract

The present study examined the link between poor self-regulation (measured by the Child Behavior Checklist Dysregulated Profile [DP]) and core autism symptoms, as well as with developmental level, in a sample of 107 children with Autism Spectrum Disorder (ASD) aged 19 to 46 months. We further examined the utility of DP in predicting individual differences in adaptive functioning, relative to the influence of ASD severity, chronological age (CA) and developmental level. Poor self-regulation was unrelated to CA, developmental level, and severity of ADOS-2 restricted and repetitive behaviors, but was associated with lower ADOS-2 social affect severity. Hierarchical regression identified poor self-regulation as a unique independent predictor of adaptive behavior, with more severe dysregulation predicting poorer adaptive functioning. Results highlight the importance of early identification of deficits in self-regulation, and more specifically, of the utility of DP, when designing individually tailored treatments for young children with ASD.

Lay Summary: This study explored the relationship between poor self-regulation and age, verbal and non-verbal developmental level, severity of autism symptoms and adaptive functioning in 107 children with autism under 4 years of age. Poor self-regulation was unrelated to age, developmental level and severity of restricted and repetitive behaviors, but was associated with lower social affect severity. Importantly, more severe self-regulation deficits predicted poorer adaptive functioning.

Keywords: Autism spectrum disorder; Adaptive behavior; Dysregulated profile; Self-regulation; Individual variability/heterogeneity

Notable heterogeneity is apparent across every facet of Autism Spectrum Disorder (ASD) (Bryson et al., 2007; Prior et al., 1998; Vivanti, Prior, Williams, & Dissanayake, 2014). Although individuals with milder core symptoms, and higher cognitive and verbal skills are likely to have better outcomes (Magiati, Tay, & Howlin, 2014), specific factors accounting for the noted heterogeneity remain poorly understood. It thus remains difficult to predict prognosis on the basis of early and concurrent core symptom presentation.

Identifying mechanisms underlying the clinical heterogeneity of ASD is crucial for developing individually tailored treatments (Interagency Autism Coordinating Committee, 2011). Domains that cut across typical development and categorical diagnosis may be useful predictors of outcomes, over and above core symptom presentation and level of cognitive functioning (Insel et al., 2010; Mundy, Henderson, Inge, & Coman, 2007). Here we examine individual differences in self-regulation, a domain related to a range of psychological, social, and medical outcomes, throughout the life span, across both normative and atypical populations (Althoff, Verhulst, Rettew, Hudziak, & van der Ende, 2010; Eisenberg, Spinrad, & Eggum, 2010; Moffitt et al., 2011), as a possible marker accounting for the heterogeneity of ASD.

One of the most common approaches to measuring poor self-regulation is the Dysregulated Profile (DP). DP is conceptualized as a broad dysregulation domain encompassing impairments in affective, cognitive, and behavioral aspects of self-regulation (Mick et al., 2011) that is derived from the anxious/depressed, attention problems and aggressive behavior scales of the Child Behavior Checklist (CBCL) (Althoff, 2010; Althoff, Rettew, Faraone, Boomsma, & Hudziak, 2006; Bellani, Negri, & Brambilla, 2012; Masi, Muratori, Manfredi, Pisano, & Milone, 2015; Mick et al., 2011). Impairments in self-regulation are estimated to affect between 1% and 5% of the general population (Althoff et al., 2006; Hudziak, Derks, Althoff, Rettew, & Boomsma, 2005; Volk & Todd, 2007) and are

highly prevalent across a range of neurodevelopmental and neuropsychiatric disorders, demonstrating medium to high long-term stability (Boomsma et al., 2006; Halperin, Rucklidge, Powers, Miller, & Newcorn, 2011).

Several recent longitudinal studies using the DP have examined long-term outcomes. In children whose parents had mood disorders, childhood DP was associated with the risk of developing bipolar disorder, ADHD, anxiety, depression and suicidal thoughts and behaviors, and impairments in adaptive functioning in adulthood (Meyer et al., 2009). Similar results have been reported in other longitudinal studies of both at risk (Biederman et al., 2009; Holtmann et al., 2011) and community samples (Althoff et al., 2010; Kim et al., 2012) of children and adolescents

As noted, self-regulation is a broad construct encompassing cognitive and emotion aspects of self-regulation (Mick et al., 2011) and a large body of research in ASD indicates significant impairment across all aspects of self-regulation including executive functioning (Hill, 2004), effortful control (Adamek, Nichols, Tetenbaum, Ponzio, & Carr, 2011; De Pauw, Mervielde, Van Leeuwen, & De Clercq, 2011; Faja & Dawson, 2015) and emotion regulation (Berkovits, Eisenhower, & Blacher, 2017; Cai, Richdale, Foley, Trollor, & Uljarević, 2018; Cai, Richdale, Dissanayake, & Uljarević, 2017; Konstantareas & Stewart, 2006; Mazefsky et al., 2013; Mazefsky, 2015; Nuske et al., 2017; Pitskel, Bolling, Kaiser, Pelphrey, & Crowley, 2014; Richey et al., 2015; Samson et al., 2014; for comprehensive overviews, please see Cai et al., under review and Mazefsky & White, 2014). Importantly, impairments in cognitive aspects of self-regulation have been found that are associated with a range of negative outcomes in ASD, in terms of both core and associated ASD symptomatology (Hollocks et al., 2014; Leekam, Prior, & Uljarević, 2011; Macari, Koller, Campbell, & Chawarska, 2017; Uljarević, Richdale, Evans, Cai, & Leekam., 2017; Wallace et al., 2016). For example, Uljarević et al. (2017) explored the contribution made by

impaired cognitive control to the insistence on sameness (IS)—anxiety relationship in a sample of $N = 71$ individuals with ASD ($M_{\text{age}} = 18.71$ years, $SD = 2.51$). Cognitive control was associated with both IS and anxiety. Furthermore, in the mediation model lower level of cognitive control was related to higher level of IS which was in turn related to higher anxiety. In addition, impairments in emotion regulation have been associated with more severe internalizing and externalizing problems (Berkovits et al., 2017; Cai et al., 2017; 2018; Rieffe, De Bruine, De Rooij, & Stockmann, 2014; Samson, Hardan, Lee, Phillips, & Gross, 2015), repetitive behaviors and sensory problems (Samson et al., 2014), social skills, and social and communication impairments (Berkovits et al., 2017; Nader-Grosbois & Mazzone, 2014; Samson et al., 2014). For example, using the Emotion Dysregulation Index (EDI) in a sample of children and adolescents with ASD (age range: 6–16 years), Samson et al. (2014) found that more severe dysregulation was associated with higher levels of repetitive behaviors (measured via the Repetitive Behavior Scale-Revised) and sensory problems (measured via the Short Sensory Profile). The EDI used by Samson and colleagues was conceptually derived from the CBCL items, and is conceptually more narrow than CBCL-DP that assesses impairments in self-regulation more broadly. A study by Berkovits et al. (2017) adapted the EDI for younger children with ASD (age range: 4–7) and found that it was associated with higher Social Responsiveness Scale total scores. Furthermore, a recent study by Cai et al. (2017) found that greater use of emotion suppression (maladaptive strategy) relative to emotion reappraisal (adaptive strategy) was associated with higher levels of anxiety and depression in a sample of 61 individuals aged 14–24 years.

In ASD, impairments in adaptive functioning have been identified across the life span, regardless of intellectual functioning (Gillham, Carter, Volkmar, & Sparrow, 2000; Perry, Flanagan, Dunn Geier, & Freeman, 2009; Pugliese et al., 2015), and has been strongly linked to prognosis (Gillham et al., 2000; Klin et al., 2007). Although variability in adaptive

functioning has been attributed to ASD symptom severity, chronological age, language (Paul, Loomis, & Chawarska, 2014), and socio-cultural variables (Tasse et al., 2012), reliable predictors of adaptive outcomes are currently not well understood. Since it has been demonstrated that in both general population and non-ASD clinical groups, early individual differences in self-regulation are strong predictors of later adaptive functioning (Althoff et al., 2012; Meyer et al., 2009; Rettew, 2008), it seems highly plausible that difficulties with self-regulation may be an important predictor of adaptive functioning in ASD. However, despite findings linking different aspects of self-regulation impairments to negative outcomes, surprisingly, the relationship between self-regulation and adaptive functioning in ASD remains unexplored.

Individual differences in self-regulation emerge early in development and predict negative outcomes in adolescents and adults that require a high level of psychiatric care (Althoff et al., 2010; Boomsma et al., 2006; Hudziak et al., 2005). Marked plasticity in self-regulation during the first four years of life (Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013; Eisenberg et al., 2010; Zelazo et al., 2003; Zhou, Chen, & Main, 2012) offer a window of opportunity for treatment and prevention of negative outcomes (Althoff et al., 2010). It is therefore of paramount importance to explore impairments in self-regulation in ASD early in development. However, to date, studies on self-regulation in ASD have focused either on older children, adolescents, or adults, often across a wide age range (Bruggink, Huisman, Vuijk, Kraaij, & Garnefski, 2016; Mazefsky, Borue, Day, & Minshew, 2014; Rieffe et al., 2014; Rieffe et al., 2011; Samson et al., 2015; Samson et al., 2014), with few studies focusing on children younger than 7 years (Berkovits et al., 2017; Jahromi, Bryce, & Swanson, 2013; Nuske et al., 2017).

The present study examined the link between poor self-regulation (measured by the CBCL-DP) with core ASD symptoms as well as with developmental level in children under 4

years of age who had been diagnosed with ASD against *DSM-5* diagnostic criteria. We further examined the utility of CBCL-DP in predicting individual differences in adaptive functioning, relative to the influence of ASD severity, chronological age (CA) and developmental level.

Method

Participants

Participants were 107 children (89 males) aged 19 to 46 months who had received a multidisciplinary diagnosis of ASD (see Table 1 for demographic information). Inclusion criteria included available ADOS-2 (Toddler Module: $n = 50$; Module 1: $n = 51$; Module 2: $n = 6$), CBCL, Mullen, and Vineland-II measures.

[Insert Table 1 about here]

Measures

Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) (Lord, Luyster, Gotham, & Guthrie, 2012; Lord, Rutter, et al., 2012) is a play-based assessment of ASD. We report total and subdomain (Social Affect, SA; Restricted and Repetitive Behavior, RRB) Comparison Scores (CS; a standardized 10-point scale anchored to ADOS-2 classifications used to compare symptom severity across modules) (Esler et al., 2015; Hedley, Nevill, Uljarević, Butter, & Mulick, 2016; Hus, Gotham, & Lord, 2014; Lord, Rutter, et al., 2012) and the aggression and disruptive behavior item score (Toddler Module: Item E3; Modules 1 and 2: Item E2).

Child Behavior Checklist, Ages 1½ -5 (CBCL) (Achenbach & Rescorla, 2000) is a parent report instrument designed to assess behavior and emotional problems in preschool children. A CBCL Dysregulated Profile (CBCL-DP) was calculated by summing the

Anxious/Depressed, Attention Problems, and Aggressive Behavior syndrome scale T-scores (Althoff et al., 2012). The CBCL has been found to be valid and reliable in children with ASD with Cronbach's α ranging from .49 for the Somatic Complaints scale to .93 for the Total Problems score, and importantly, with α values of .63, .68 and .89 for Anxious/Depressed, Attention Problems, and Aggressive Behavior scales, respectively (Pandolfi, Magyar, & Dill, 2009).

Mullen Scales of Early Learning (Mullen, 1995) is a developmental assessment that provides standardized and age-equivalent overall Early Learning Composite and four subscale (Visual Reception, Fine Motor, Receptive and Expressive Language) scores. Standardized developmental quotient ($DQ = [\text{age equivalent}/\text{chronological age}] * 100$) were calculated for nonverbal (mean Fine Motor and Visual Reception) and verbal (mean Receptive and Expressive Language) domains (Lord et al., 2006; Messinger et al., 2013). Cronbach's $\alpha = .75-.83$.

Vineland Adaptive Behavior Scales, Second Edition (Vineland-II) (Sparrow, Cicchetti, & Balla, 2005) measures adaptive functioning in individuals with developmental disorders. Cronbach's $\alpha = .77-.96$.

Procedure

Nationwide Children's Hospital Institutional Review Board approved all procedures associated with this study. Data were collected through retrospective medical record review as part of a larger study. The present report represents secondary data analysis from this study. Children were assessed at the hospital's Child Development Center between May 2013 and February 2015. Children were assessed following the Autism Treatment Network (ATN) national protocol for the evaluation and management of ASD by a multidisciplinary team using the ADOS-2 and against *DSM-5* (American Psychiatric Association, 2013)

diagnostic criteria; more detailed assessment and study procedures are reported elsewhere (Hedley et al., 2015; 2016).

Analyses

Data were first reviewed for extreme outliers in SPSS. Extreme outlier is operationalized as a value that is either higher than three times the interquartile range (IQR) above the third quartile (Q3) (e.g., $> Q3 + 3 * IQR$) or lower than three times the IQR below the first quartile (Q1) (e.g., $< Q1 - 3 * IQR$). One verbal DQ score was identified as an extreme outlier; however a review of the mean (34.86, 95% CI [30.92, 38.79]) and 5% trimmed mean (e.g., mean after removing 5% of the largest and smallest values; 33.17) indicated that exclusion of this data point did not significantly impact the overall score. Several scales were non-normally distributed (refer to Table 2). Pearson r correlations were used to explore the associations between CBCL-DP, chronological age (CA), nonverbal DQ, verbal DQ, ADOS-2 SA and RRB CS, and Vineland-II scores. To address the second aim of the study, variables associated with the Vineland-II ABC were entered into a hierarchical regression model. Both Pearson r correlations and regression models were conducted using the bias-corrected bootstrapping (2000 resamples) to account for the non-normal distribution of variables (Efron & Tibshirani, 1993; Tabachnick & Fidell, 2007).

Results

Demographics and correlations

Descriptive data, including scale scores and assessment of normality, and correlations are provided in Table 2. The sample was characterized by an overall developmental delay, with significantly stronger nonverbal than verbal skills, $t(106) = 18.08, p < .001$, 95% BCa CI [24.82, 30.66]. Age was negatively associated with nonverbal DQ and adaptive behavior, but was otherwise unrelated to study variables. Mullen DQ was positively correlated with adaptive behavior, and nonverbal and verbal DQ were negatively associated with ADOS-2

RRB CS and SA CS, respectively. The CBCL-DP was negatively correlated with the ADOS-2 SA CS and Total CS, and positively associated with the ADOS-2 Aggressive–Disruptive item.

[Insert Table 2 about here]

Regressions

Chronological age and nonverbal and verbal DQ were entered in the first step of the hierarchical regression, followed by ADOS-2 SA CS in the second, and CBCL-DP in the third steps, with the Vineland-II ABC entered as the dependent variable. A summary of the full model is presented in Table 3. In the first step, CA, nonverbal and verbal DQ scores accounted for 42.8% of variance, $F = 25.71, p < .001$. In the second step, ADOS-2 SA CS accounted for 1.2% of variance with CBCL-DP accounting for an additional 11.1% of variance in the final step. The total model accounted for 55.1% of variance, $F = 24.79, p < .001$, with CA ($\beta = -.257, t = -3.46, p = .001$), nonverbal DQ ($\beta = .225, t = 2.25, p = .045$), verbal DQ ($\beta = .375, t = 4.04, p = .002$), and CBCL-DP ($\beta = -.343, t = -5.01, p = .001$) emerging as unique predictors.

[Insert Table 3 about here]

Individual Vineland-II domains

In order to provide more fine-grained understanding of how impairments in self-regulation impact different aspects of adaptive functioning, we explored the relationship between CBCL-DP and individual Vineland-II domains. We found that CBCL-DP was most strongly associated with the Socialization domain ($r = -.22$; CI: $-.42, -.03$) when compared to

other domains (Communication: $r = -.17$; CI: $-.34, -.01$; Motor Skills: $r = -.18$, CI: $-.37, .02$; Daily Living Skills: $r = -.16$, CI: $-.32, .006$).

Discussion

In this study, we first examined correlates of poor self-regulation, as indexed by the CBCL-DP, in a sample of children with ASD aged 19 to 46 months. The relationship between the emotional aspects of poor self-regulation and both core ASD symptoms as well as co-occurring internalizing and externalizing symptoms has been previously studied (Bruggink et al., 2016; Mazefsky et al., 2014; Rieffe et al., 2014; Rieffe et al., 2011; Samson et al., 2015; Samson et al., 2014). However, to our knowledge this is the first study to examine the role of poor self-regulation, as measured by CBCL-DP, in children with ASD at this early point in development.

Consistent with previous studies in ASD (Berkovits et al., 2017; Samson et al., 2014), other clinical (Peyre, Speranza, Cortese, Wohl, & Purper-Ouakil, 2015) and community samples (Graziano, Reavis, Keane, & Calkins, 2007), poor self-regulation was unrelated to nonverbal or verbal DQ scores. Although previous studies (Berkovits et al., 2017; Samson et al., 2014) primarily examined children without intellectual disability, the present study included children with a range of developmental levels. Our results suggest that lower developmental level is not a risk for poor self-regulation *per se* nor, conversely, does higher developmental level serve as a protective factor (Berkovits et al., 2017).

Our findings that poor self-regulation was not significantly associated with restricted and repetitive behaviors and associated with less severe ADOS-2 social affect severity scores, is inconsistent with previous studies reporting a positive association between impairments in the cognitive and emotional aspects of self-regulation and core ASD symptom severity (Berkovits et al., 2017; Hollocks et al., 2014; Samson et al., 2014; Uljarević et al., 2017).

However, it is important to note that our findings were based on the ADOS-2, which is a

clinician-administered observational assessment, whereas the aforementioned findings were derived from self- or parent-reports of ASD symptoms, which may have significant content overlap with measures of emotion dysregulation (South, Carr, Stephenson, Maisel, & Cox, 2017). In support of this interpretation Berkovits et al. (2017) found emotion dysregulation was positively associated with ASD symptoms on the parent report SRS-2 but (and consistent with our findings) was negatively associated with ASD severity derived from the ADOS-2.

Although observational methods are not influenced by reporting bias, they are nevertheless limited by temporal and contextual restrictedness. Children characterized by the CBCL-DP might readily, if impulsively, enter new situations and initially interact positively with experimenters during testing which may lead to less impaired ratings on social skills. Over time, however, children may become anxious and uncomfortable, leading to aggression, outbursts, and a range of other externalizing behaviors (Althoff et al., 2012; Deutz et al., 2017). Interestingly, and unlike the ASD severity score, the ADOS-2 Aggressive-Disruptive item was positively associated with DP.

Our second aim was to explore the role of poor self-regulation in predicting adaptive functioning. Individuals with ASD exhibit pronounced impairments in adaptive functioning, regardless of their IQ or developmental level (Perry et al., 2009; Pugliese et al., 2015). In both the general population (Sparrow et al., 2005), and across neurodevelopmental disorders, including ASD (Gillham et al., 2000; Klin et al., 2007), adaptive skills define one's ability to function independently. Therefore, understanding early predictors of adaptive skills in ASD is a key to delivering targeted, person-centred interventions for improving developmental outcomes. However, sources of individual differences in adaptive profiles among children with ASD are currently not well-understood (Green & Carter, 2014). Our findings replicate previous studies (e.g., Paul et al., 2014) by demonstrating that younger CA and lower nonverbal and verbal DQ scores predicted lower scores on the Vineland-II ABC. By

demonstrating that more severe poor self-regulation provided a unique independent contribution in predicting Vineland-II ABC scores, our study provides a significant contribution to the literature on adaptive behaviors in ASD. Although early self-regulation is a strong predictor of subsequent adaptive functioning in general populations (Althoff et al., 2012; Meyer et al., 2009; Rettew, 2008), this is the first paper to demonstrate this in toddlers and young children with ASD.

There are a number of limitations to this study that require replication and expansion of our findings. CBCL-DP has been demonstrated as a robust measure of poor self-regulation across general and clinical populations, and to be a strong predictor of outcomes. However, DP is a broad measure of self-regulation impairment and does not provide a fine-grained distinction between different aspects of cognitive or emotion regulation. Therefore, it will be important for future research to explore the role of DP relative to measures designed to sample more specific aspects of emotion dysregulation (Gross & John, 2003; Samson et al., 2015) and cognitive control. Gender differences in self-regulation have been noted in the general population (Althoff et al., 2010; John & Gross, 2004; Silk, Steinberg, & Morris, 2003; Tamres, Janicki, & Helgeson, 2002). However, our sample included relatively few females precluding valid assessment of gender effects. Finally, our study was cross-sectional. Cross-sectional designs do not capture the dynamic processes as they unfold over time. A carefully designed longitudinal study, with larger, well-characterized samples, utilizing multimodal and multi-informant measures capturing different aspects of self-regulation, is necessary.

Despite the aforementioned limitations, our findings have important clinical implications. Our findings reveal that poor self-regulation, assessed with a widely used parent-report measure, had significant predictive value in explaining variability in adaptive functioning in young children with ASD, independent of the effects of CA and developmental

level. This highlights the importance of early identification of regulatory deficits, and dysregulation profile more generally, when considering individually tailored treatments for young children with ASD, and where appropriate, incorporating interventions targeting emotion dysregulation.

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Table 1. Gender, ethnicity, additional diagnoses, and maternal education (*n* = 107)

Label		Frequency	%
Gender	Male	89	83.2
	Female	18	16.8
Child ethnicity	White	76	71.0
	Black	14	13.1
	Hispanic Latino	5	4.7
	Asian, Asian American, Pacific Islander	1	.9
	More than one	7	6.5
	Not selected or missing	4	3.7
Additional diagnoses ¹	Language or Communication Disorders	76	71.0
	Developmental Coordination Disorder	15	14.0
	Global Developmental Delay	25	23.4
	None	19	17.8
Mother's highest education level	Some high school	4	3.7
	Completed high school	16	15.0
	Post-high school training (not college)	6	5.6
	Some college or university	28	26.2
	Completed college or university	19	17.8
	Post-graduate	7	6.5
	Missing	27	25.2

Note: ¹Cumulative and % totals more than 107 and 100% due to records indicating more than one additional diagnosis.

Table 2. Means, standard deviations, range, assessment of normality, and correlations ($n = 107$)

Variable	<i>M</i>	<i>SD</i>	<i>Range</i>	Skewness	Shapiro	1.	2.	3.	4.	5.	6.	7.	8.
				Kurtosis.	Wilk								
1. CBCL Dysregulation	184.49	27.81	150–265	1.04; .53	.905***	–							
2. Age	31.58	6.90	19.20–46.60	.51; -.45	.956***	.005	–						
3. Nonverbal DQ	62.60	18.01	18.16–126.71	-.001; .69	.981	.079	–.393***	–					
4. Verbal DQ	34.86	20.55	5.88–126.71	1.54; 3.46	.885***	.176	–.126	.668***	–				
5. Vineland-II ABC	71.38	10.07	50–102	.50; .39	.981	–.238*	–.414***	.584***	.518***	–			
6. ADOS-2 SA CS	8.20	1.85	2–10	-.97; .46	.865***	–.337***	–.093	–.070	–.212*	–.035	–		
7. ADOS-2 RRB CS	7.57	1.65	1–10	-.53; 1.00	.926***	–.143	.132	–.220*	–.133	–.240*	.226*	–	
8. ADOS-2 Total CS	8.15	1.80	3–10	-.71; -.25	.866***	–.344***	–.089	–.053	–.141	–.016	.877***	.551***	–
9. Aggressive- Disruptive ¹	.46	.719	0–3	1.34; 1.08	.669***	.211*	.151	–.053	–.030	–.049	–.074	–.069	–.035

Note. ¹Aggressive-disruptive data (ADOS-2 “E codes”) were available for ($n = 99$) participants. Participants excluded ($n = 8$) due to missing data did not differ from included participants on age ($t[105] = -1.37, p = .173$), Nonverbal DQ ($t[105] = .09, p = .929$), or Verbal DQ ($t[105] = 1.06, p = .291$). ADOS-2: Autism Diagnostic Observation Schedule, Second Edition; SA CS: Social Affect Comparison Score; RRB CS:

Restricted and Repetitive Behavior Comparison Score; Total CS: Total Comparison Score (Lord, Luyster, et al., 2012; Lord, Rutter et al., 2012). CBCL: Child Behavior Checklist (Achenbach & Rescorla, 2000). DQ: Mullen Scales of Early Learning Developmental Quotients (Lord et al., 2006; Messinger et al., 2013; Mullen, 1995). Vineland-II ABC: Vineland Adaptive Behavior Scales, Second Edition, Adaptive Behavior Composite (Sparrow et al., 2005).

p* < .05. *p* < .01. ****p* < .001.

Table 3. Hierarchical regression model with significantly associated variables entered as

	$R^2\Delta$	$R^2\Delta$ Change	B	SEB	β	BCa 95% CI
Step 1	.428**					
CA			-.390	.104	-.267**	-.594, -.203
Nonverbal DQ			.157	.059	.281**	.034, .277
Verbal DQ			.145	.061	.297*	.020, .267
Step 2	.440**	.012				
CA			-.382	.105	-.261**	-.596, -.171
Nonverbal DQ			.144	.061	.258*	.018, .260
Verbal DQ			.146	.061	.298*	.021, .280
ADOS-2 SA CS			-.669	.565	-.109	-1.781, .447
Step 3	.551**	.111**				
CA			-.375	.091	-.257**	-.553, -.198
Nonverbal DQ			.126	.061	.225*	.009, .230
Verbal DQ			.184	.057	.375**	.061, .311
ADOS-2 SA CS			-.954	.519	-.156	-1.918, .095
CBCL-DP			-.124	.027	-.343**	-.173, -.071

predictors of the Vineland-II Adaptive Behavior Composite (ABC)

Note. ADOS-2: Autism Diagnostic Observation Schedule, Second Edition; SA CS: Social Affect Comparison Score (Lord, Luyster, et al., 2012; Lord, Rutter et al., 2012). CBCL-DP: Child Behavior Checklist Dysregulated Profile (Achenbach & Rescorla, 2000; Althoff et al., 2012). DQ: Mullen Scales of Early Learning Developmental Quotients (Lord et al., 2006; Messinger et al., 2013; Mullen, 1995).

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

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Author/s:

Uljarevic, M;Hedley, D;Nevill, R;Evans, DW;Cai, RY;Butter, E;Mulick, JA

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