

Motor skills associate with restricted and repetitive behaviors but not social affect in autism

Sara P. Silber, Leah A.L. Wang, Adam J. Naples, Cara M. Keifer, Nicole G. Herman, Lindsey H. Rosenthal & James C. McPartland

Background

- Motor skills are related to core autism features, including social communication abilities and restricted and/or repetitive behaviors (RRBs).^{1, 4-8}
- Autistic children who have motor coordination difficulties are likely to miss opportunities for social interaction, particularly those based in physical activity.¹
- Motor skills are also associated with adaptive functioning in autistic children.⁶
- The extent to which this association is driven by variation in overall intellectual ability remains unclear.

Aim

- Investigate the relationship between motor ability and domains of autism features (social communication and RRBs) in autistic children with varying cognitive abilities.
- We predicted that more RRBs and greater challenges with social communication would be associated with lower motor ability, even after accounting for variation in cognitive functioning.

Methods

Participants

- Analysis was conducted on an existing clinical dataset collected from children referred for an autism evaluation at the Yale Child Study Center Developmental Disabilities Clinic. Evaluations were conducted between the years 2000-2012.
- All participants included in analysis were diagnosed with ASD.

N	Sex	Age range (years) (mean, SD)	FSIQ range (mean, SD)
117	17 female, 92 male (8 not reported)	3-15 (7.74, 2.83)	45-139 (92.63, 21.71)

Data Collection

- All participants completed the Autism Diagnostic Observation Schedule 1st edition (ADOS), Vineland Adaptive Behavior Scales (VABS-I/II), and a standardized IQ Measure (KABC, WASI, WISC, WPPSI, DAS I/II).
- ADOS Restrictive and Repetitive Behaviors (RRB) and Social Affect (SA) raw total scores were computed from ADOS item-level scores using updated algorithms.²⁻³
- VABS Motor Composite scores and full-scale IQ or equivalent scores were also extracted for analysis.

Analysis

- Linear regression models for RRB and SA were run with VABS motor standard scores and IQ scores as predictors.
- Exploratory Spearman correlations were run between 28 item-level ADOS scores and VABS motor standard scores, using Bonferroni-Holm corrections for multiple comparisons.

Results

- More RRBs were associated with lower motor ability ($\beta = -0.02$, $p = 0.01$) when controlling for IQ ($\beta = -0.02$, $p = 0.007$).

Vineland Motor Standard Score and Residuals of ADOS RRB Score regressed on IQ

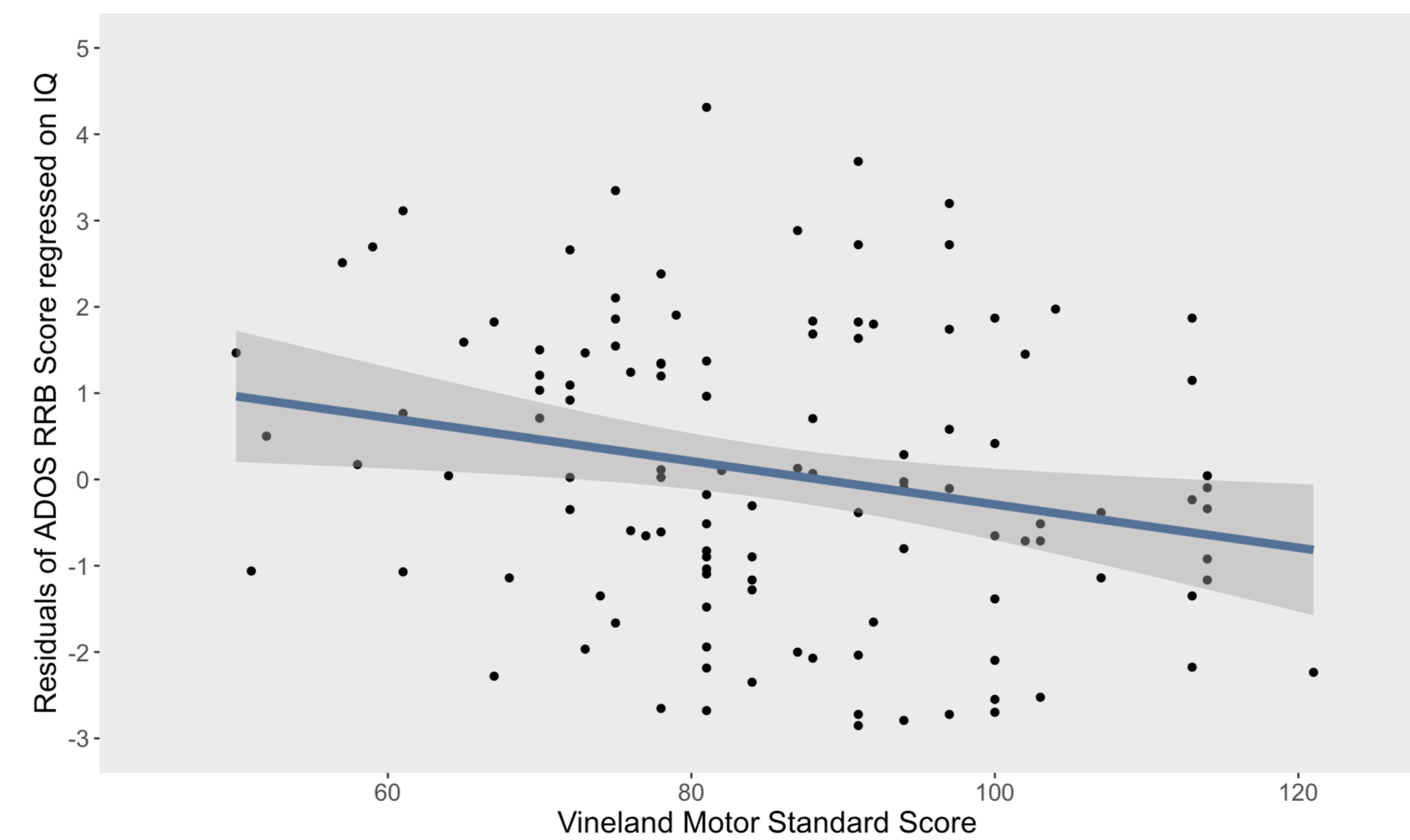


Figure 1. ADOS RRB scores in relation to Vineland motor standard scores in autistic children.

- SA was not associated with motor skills ($\beta = -0.07$, $p = 0.58$), when controlling for IQ ($\beta = 0.007$, $p < 0.001$).

Vineland Motor Standard Score and Residuals of ADOS SA Score regressed on IQ

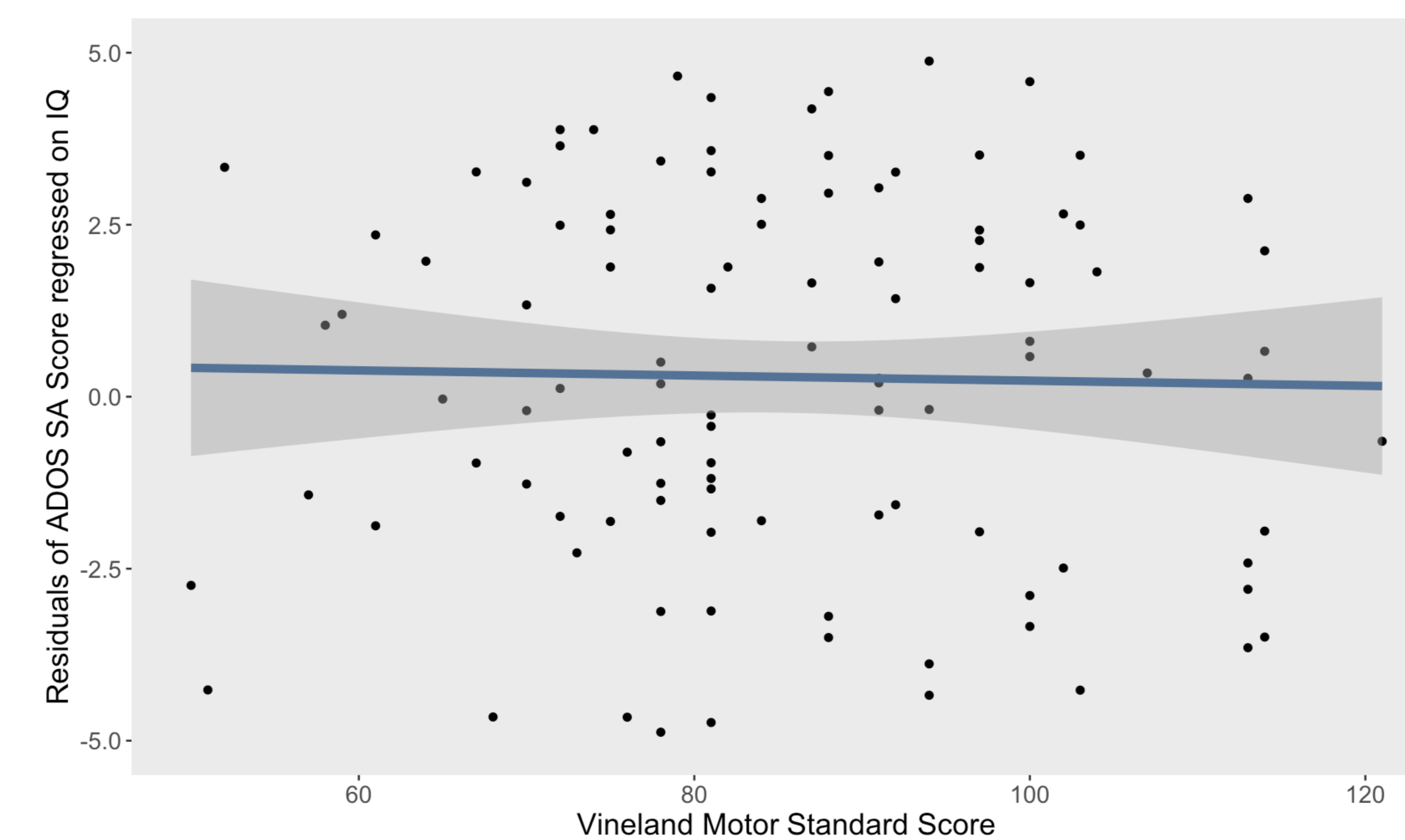


Figure 2. ADOS SA scores in relation to Vineland motor standard scores in autistic children.

Results

- The relationship between item D2 (complex mannerisms) and motor ability was significant, such that more motor mannerisms were associated with lower motor ability ($\rho = -0.31$, $p_{adj} = 0.01$).

ADOS Motor Mannerisms and Vineland Motor Standard Score

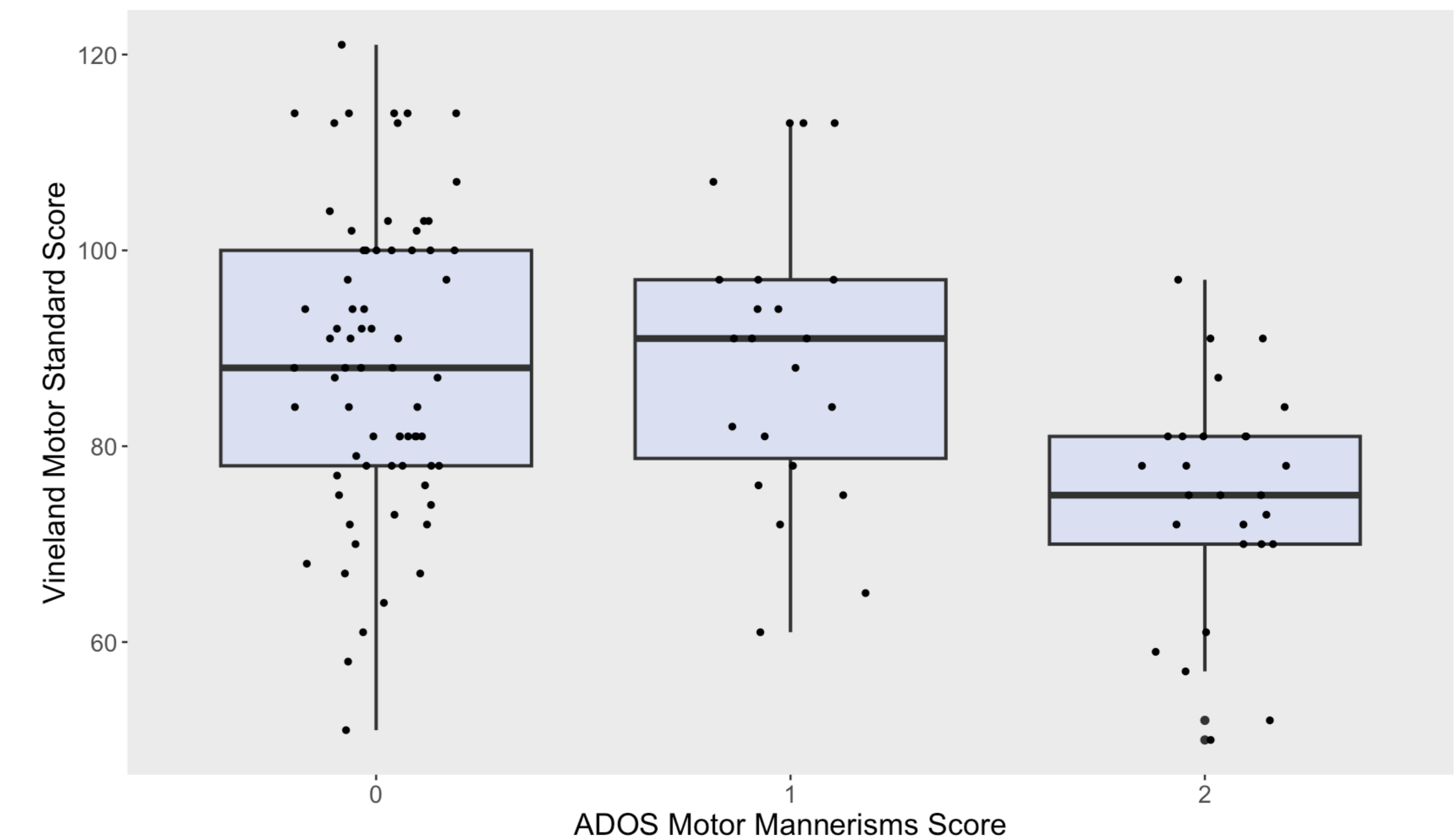


Figure 3. ADOS Motor Mannerisms score in relation to Vineland motor standard score in autistic children.

Conclusions

- Consistent with our hypothesis, higher levels of RRBs were associated with lower motor ability, even after statistically controlling for IQ.
- Lower motor ability was associated specifically with more complex mannerisms.
- In contrast to prior research, the relationship between autism features and motor ability was not found for SA.¹
- This dataset uniquely looks at adaptive motor skills, which may not be associated with clinically significant levels of social disability (as captured by the ADOS) and instead may show stronger relationships with measures of social ability.⁵
- Future studies may investigate measures of motor and social ability to further evaluate this relationship.

References

- 1 Craig, F., Crippa, A., Ruggiero, M., Rizzato, V., Russo, L., Fanizza, L., et al. (2021). Characterization of autism spectrum disorder (ASD) subtypes based on the relationship between motor skills and social communication abilities. *Human Movement Science*, 77, 102802. doi:10.1016/j.humov.2021.102802
- 2 Hus, V., Gotham, K., & Lord, C. (2014). Standardizing ADOS domain scores: Separating severity of social affect and restricted and repetitive behaviors. *Journal of Autism and Developmental Disorders*, 44(10), 2400–2412. https://doi.org/10.1007/s10803-012-1719-1
- 3 Hus, V., & Lord, C. (2014). The Autism Diagnostic Observation Schedule, Module 4: Revised algorithm and standardized severity scores. *Journal of Autism and Developmental Disorders*, 44(8), 1996–2012. https://doi.org/10.1007/s10803-014-2080-3
- 4 Jin, C., Gu, T., Shi, B., Wang, X., Jing, J., & Cao, M. (2022). The association between motor coordination impairment and restricted/repetitive behaviors in autistic children: The partial mediating effect of executive function. *Research in Autism Spectrum Disorders*, 99, 102053. doi:10.1016/j.rasd.2022.102053
- 5 Klin, A., Saulnier, C. A., Sparrow, S. S., Cicchetti, D. v., Volkmar, F. R., & Lord, C. (2007). Social and communication abilities and disabilities in higher functioning individuals with autism spectrum disorders: The Vineland and the ADOS. *Journal of Autism and Developmental Disorders*, 37(4), 748–759. https://doi.org/10.1007/s10803-006-0229-4
- 6 Macdonald, M., & Ulrich, D. (2013). The relationship of motor skills and adaptive behavior skills in young children with autism spectrum disorders HHS Public Access. *Res Autism Spectr Disord*, 7(11), 1383–1390. https://doi.org/10.1016/j.rasd.2013.07.020
- 7 Wang, L. A. L., Petrucci, V., Zampella, C. J., Waller, R., & Schultz, R. T. (2022). Gross Motor Impairment and Its Relation to Social Skills in Autism Spectrum Disorder: A Systematic Review and Two Meta-Analyses HHS Public Access. *Psychol Bull*, 148(4), 273–300. https://doi.org/10.1037/bul0000358.supp
- 8 Zampella, C. J., Wang, L. A. L., Haley, M., et al. Motor Skill Differences in Autism Spectrum Disorder: A Clinically Focused Review. *Curr Psychiatry Rep* 23, 64 (2021). https://doi.org/10.1007/s11920-021-01280-6

Funding Sources

This work was supported by: Alan B. Slifka Foundation, NIH U19 MH108206 (McPartland), NIMH R01 MH100173 (McPartland), Eagles Foundation, and Hillman Fisher Foundation

McPartland Lab
mcp-lab.org
mcp.lab@yale.edu

