



# A Smartphone-Based Assessment of Parent-Child Interactions and ADHD



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## Background

- Negative parenting behaviors strongly predict childhood attention-deficit/hyperactivity disorder (ADHD).
- However, parental behavior is also contingent upon the characteristics of the child (i.e., "child effects;" Jaffee et al, 2004).
- Child behavioral variability is understudied, despite evidence that intra-individual variability is a plausible endophenotype for ADHD (Castellanos et al., 2005).
- Intra-individual variability in disruptive and prosocial behaviors may reflect an underlying deficit in recruiting the neural regions that regulate attention, impulse control and executive functions.
- No studies have example the impact of child behavioral variability on parental behavior, and how these associations influence the development of ADHD in young children.

## Aims

- Question 1: Are negative and positive parenting behaviors influenced by child behavioral variability?
- Question 2: Is the association between parenting behavior and child ADHD moderated by child behavioral variability?

## Methods

### Participants

- 143 children with and without ADHD from the community (large urban city)
- Child mean age = 5.54 (S.D. = .51), 53.8% male and 76.7% Caucasian
- 21.7% met clinical criteria for ADHD according to fully structured clinical interview (CDISC-IV)
  - 6.2% inattentive type
  - 10.4% hyperactive/impulsive type
  - 5.1% combined type
- 86.9% of parents who participated were mothers
- 84% parents had at least bachelor's degree
- Median household income = \$92,000

### Measures

- ADHD symptoms: *Vanderbilt Assessment Scale – Parent Version* (NICHQ, 2002)
- Global parenting behavior: *Alabama Parenting Questionnaire* (APQ; Frick, 1991)
- Observed parent-child behavior: A structured parent-child play task, coded from the *Dyadic Parent-Child Coding System* (DPICS; Eyberg et al., 2013)
- Daily parent-child dynamics: *Mobile Survey of Parent-Child Dynamics* (MSPCD; Li & Lansford, under review)
  - Ecological momentary assessments of child's positive and negative behaviors and parental response to those behaviors
  - Administered through push notification at 8pm each day, for 1 week

Figure 1. Example items from the Mobile Survey of Parent-Child Dynamics

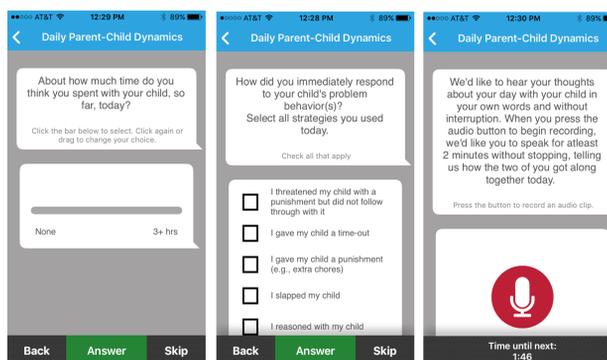
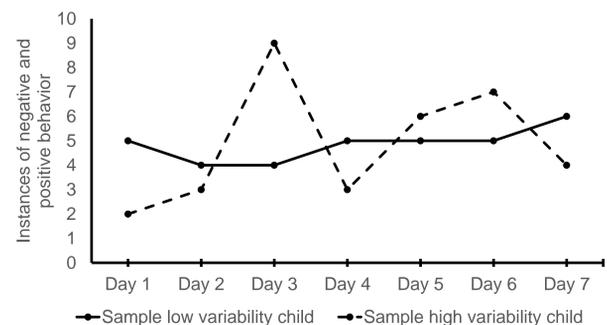


Figure 2. Intra-individual variability in child behavior over 1 week



### Data Analysis

- Confirmatory factor analysis* used to model latent factor scores for positive and negative dimensions of parenting from the APQ, DPICS, and MSPCD
- Hierarchical Poisson regression* used to predict ADHD from latent factor scores of parenting, child behavioral variability, and their interactions.
  - Covariates: child sex, gross household income, parenting stress and support, and parental depression

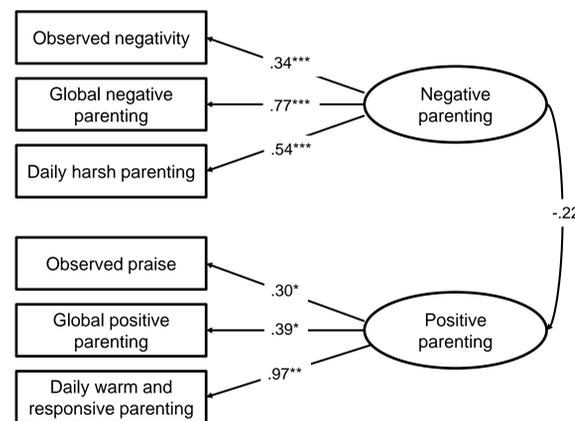
## Results

Table 1. Bivariate correlations between global, observed, and daily parenting variables

Variable	1	2	3	4	5	6	7	8
1 Child behavioral variability	1							
2 Daily parental warmth	.07	1						
3 Daily parental harshness	.25**	-.05	1					
4 Observed parental praise	-.04	.28**	-.05	1				
5 Observed parental negativity	.04	-.14	.17	.05	1			
6 Global positive parenting	-.01	.41**	-.18*	.13	-.01	1		
7 Global negative parenting	-.07	-.26**	.40**	-.07	.24*	-.25**	1	
8 Parent-reported ADHD symptoms	.01	-.10	.15	-.03	.09	-.05	.23**	1

\*p < .01, \*\*p < .05

Figure 3. Confirmatory factor model of positive and negative parenting

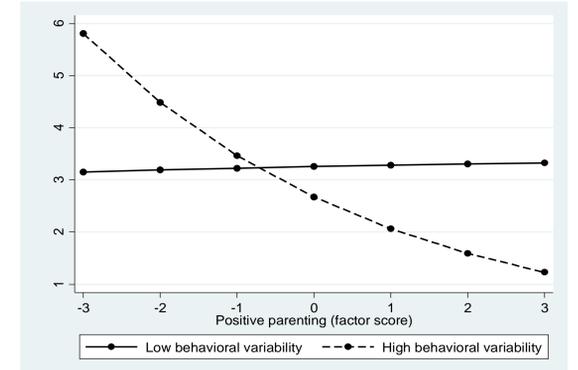


Model fit:  $\chi^2(df = 3) = 29.46$ , RMSEA = 0, CFI = 1, TLI = 1

Table 2. Hierarchical Poisson regressions predicting child ADHD symptoms from negative and positive parenting and child behavioral variability

Variable	b	s.e.	p	95% Lower	95% Upper
Step 1					
Child sex	.72	.26	.01	.21	1.23
Gross household income (dummy coded)					
55001 - 85000	-.35	.33	.28	-.99	.28
85001 - 112000	-.20	.34	.56	-.86	.47
112001 - 150000	-.16	.40	.69	-.94	.62
150001+	-.59	.35	.09	-1.29	.10
Parental depression	.10	.02	<.01	.07	.13
Daily parenting-related stress	.36	.17	.04	.02	.70
Daily parenting-related support	.04	.13	.79	-.22	.29
Positive parenting (factor scored)	-.05	.06	.44	-.17	.07
Negative parenting (factor scored)	-.01	.10	.90	-.21	.19
Behavioral variability	-.16	.25	.51	-.65	.32
Step 2					
Behavioral variability x Positive parenting	-.28	.10	.01	-.48	-.08
Behavioral variability x Negative parenting	.01	.20	.98	-.38	.39

Figure 4. Interaction positive parenting and child behavioral variability on ADHD total symptoms



## Conclusions

- Question 1:** Greater variability in child prosocial and disruptive behaviors did not predict individual differences in negative or positive parenting behavior.
  - Parental behavior is relatively stable, even when children's behavior varies from day-to-day.
  - Negative and positive parental styles also demonstrate cross-situational stability (Carrasco, Rodriguez, del Barrio, & Holgado, 2011; Dallaire & Weinraub, 2005; Forehand & Jones, 2002).
- Question 2:** Child behavioral variability moderated the association between positive parenting (but not negative parenting) and child ADHD symptoms.
  - Children who were more behaviorally variable benefited from positive parenting by having fewer ADHD total symptoms than children low on behavioral variability.
  - Intra-individual variability is linked to perturbations in the same neural circuitry that regulate motivation and reward responsivity (Sonuga-Barke & Castellanos, 2007).
  - Children exhibiting greater behavioral variability may respond better to warmth, involvement, and praise because the regions of the brain that regulate reward responsivity may be more highly recruited in the context of environmental enrichment.
- Mobile technology might drastically improve diagnostic precision in assessments of ADHD moving forward.