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Author Note

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Abstract

Physical discipline increases children's risk of showing externalizing problems whereas inductive discipline is negatively associated with children's risk of externalizing problems. Studies of parenting infrequently examine both positive and negative discipline techniques despite use of inductive and physical discipline being inversely related to each other and to child externalizing problems. A burgeoning literature on the biopsychosocial determinants of parenting is identifying cognitive and physiological mechanisms underlying the initiation and regulation of positive and negative parenting techniques. This cross-sectional study of parents of preschool-aged children (N = 70; 89% mothers, 43% racial-ethnic minorities) advances the parenting literature by examining predictors of parents' inductive and physical discipline use across their cognitive functioning, cardiovascular psychophysiology, children's externalizing behavior, and their interactions with one another. No main effects or interactions predicted inductive discipline, but the interaction between parents' inhibitory control and nonverbal intelligence predicted physical discipline, such that parents who scored low in both domains endorsed the most use of physical discipline in response to child misbehavior. Another interaction between parents' sympathetic activity and child externalizing behavior also predicted physical discipline. These findings are discussed in relation to parenting interventions.

Keywords: Inductive discipline, physical discipline, respiratory sinus arrhythmia, pre-ejection period, executive functions

Cognitive and Psychophysiological Predictors of Inductive and Physical Discipline Among Parents of Preschool-Aged Children

Children who experience physical discipline are at increased risk of externalizing problems (Gershoff et al., 2002; Lansford et al., 2011). Inductive discipline, in which children are reasoned with about rules and the consequences of their misbehavior, is linked to fewer externalizing symptoms (Choe et al., 2013). Research on the biopsychosocial determinants of parenting is clarifying cognitive and physiological mechanisms of positive and negative caregiving, but interactions among these mechanisms are poorly understood and infrequently tested (Deater-Deckard & Sturge-Apple, 2017). Elucidating intraindividual and contextual antecedents of parents' discipline choices can inform interventions designed to prevent harsh caregiving, child maladjustment, and maltreatment. This cross-sectional study of parents of preschool-aged children advances the parenting literature by testing unique effects and interactions among predictors of inductive and physical discipline across parents' cognitive skills, resting autonomic activity, and child externalizing problems.

Cognitive Correlates of Parental Discipline Use

The role of parents' executive functions (EFs) in their discipline use is growing in recognition because of the regulatory skills needed to refrain from harsh disciplinary reactions to children's misbehavior (Lunkenheimer et al., 2023). Strong EFs help inhibit impulsive behavior and emotions, such as anger and frustration (Diamond, 2013), which often accompany parents' disciplinary choices (Critchley & Sanson, 2006). Evidence suggests parents with strong EFs are less likely to use harsh discipline (Bridgett et al., 2017; Deater-Deckard & Bell, 2017) in favor of developmentally appropriate, sensitive parenting (Distefano et al., 2018; Shaffer & Obradović, 2017). However, these studies did not account for other cognitive skills as potential confounds.

Notably, high maternal IQ has been linked to engagement in more positive and less negative parenting (Kovan et al., 2009; Whiteside-Mansell et al., 1996). Maternal IQ has also been shown to discriminate between parenting styles better than other maternal, family, and child factors (Whiteside-Mansell et al., 1996). As studies have linked IQ to EFs (Ferguson et al., 2021; Friedman et al., 2006), parents with strong EFs and high IQs may show higher quality caregiving than parents low in either or both domains. Parents' similar performance on IQ and EF tasks may also stem from tasks assessing overlapping cognitive skills. The current study is the first to test parents' IQ, EFs (specifically inhibitory control, the ability to control one's attention, behavior, emotion, and thinking by suppressing prepotent responses in favor of more socially appropriate actions; Diamond, 2013), and their interaction as predictors of physical and inductive discipline.

Autonomic Correlates of Parental Discipline Use

Parents' caregiving is linked to their autonomic nervous system (ANS) activity, as indexed by cardiovascular activity at rest and during parent–child interactions (Deater-Deckard & Sturge-Apple, 2017). Negative parenting behaviors are linked to both hyper- and hypo-arousal of the ANS (Lunkenheimer et al., 2023; Sturge-Apple et al., 2011). For example, Miller et al. (2015) found mothers' parasympathetic dominance and parasympathetic–sympathetic co-activation were inversely related to their observed negativity during challenging parent–child interactions. Activity in parasympathetic and sympathetic branches of the ANS can be assessed via respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP), respectively. RSA reflects heart rate variability linked to breathing, such that higher RSA indicates greater parasympathetic regulation and a calmer state. PEP reflects the time span between ventricular depolarization and blood entering the aorta during a heartbeat, which is almost exclusively determined by sympathetic influence. Shorter PEP reflects greater cardiac contractility, blood flow, and

sympathetic arousal (Beauchaine & Webb, 2017; Berntson et al., 2017; Hastings & Kahle, 2019).

Meta-analyses show higher baseline RSA is related to better top-down self-regulation of behavior and emotion in adults (Holzman & Bridgett, 2017), supporting resting RSA levels as a correlate of parenting quality. For example, Joosen et al. (2013) found more sensitive mothers had higher resting RSA than less sensitive mothers. Other studies collectively suggest that higher parasympathetic regulation contributes to more positive parenting behaviors (Deater-Deckard & Sturge-Apple, 2017; Miller et all., 2015). Thus, mothers with high resting RSA may be more adept at emotion regulation and more likely to engage in inductive than physical discipline.

Compared to RSA, fewer studies have examined parents' PEP in relation to parenting. An exception is Oosterman et al. (2019) who found no link between harsh discipline and RSA or PEP in Dutch mothers. However, they did not test interactions or other parenting correlates. The complex, coordinated actions of the ANS branches (Berntson et al., 2017; Hastings & Kahle, 2019) necessitate studying the interaction of RSA and PEP when predicting discipline. Because hyperarousal of the ANS, particularly sympathetic activity, is related to emotionally reactive forms of parenting (Lunkenheimer et al., 2023; Miller et al., 2015; Sturge-Apple et al., 2011), parents' with shorter PEP at rest may be more prone to using physical than inductive discipline.

The Current Study

Examining additive and interactive effects of parents' psychophysiological, cognitive, and contextual variables can clarify the biopsychosocial determinants of parental discipline use across multiple levels of analysis. Longitudinal studies show positive bidirectional links between physical discipline and child externalizing problems (Choe et al., 2013; Gershoff et al., 2018; Lansford et al., 2011). We therefore account for child externalizing behavior for added context when predicting parental discipline, which is typically elicited by child misbehavior (Holden et

al., 2014). This multimethod, cross-sectional study advances the parenting literature by testing whether parents' cognitive skills, cardiovascular activity, child externalizing behavior, and their two-way interactions predict endorsement of physical or inductive discipline. We hypothesize that parents' high inhibitory control (IC), IQ, RSA, shorter PEP, low child externalizing behavior, and their two-way interactions at these levels (e.g., high IC and low externalizing) will predict greater endorsement of inductive discipline and less endorsement of physical discipline.

Method

Participants and Procedure

Seventy parents (*M* = 37.97 years, *SD* = 4.04, 88.6% mothers) of 44- to 59-month-old children (*M* = 51.41 months, *SD* = 4.93, 48.6% girls) were recruited from preschools, daycare centers, and local events using flyers in a suburban city with a large university from July 2017 to November 2019. Most parents were married to their child's other biological parent (91.4%). For gross annual household income, 54.3% of parents reported $100,000 or more, 20.0% reported $80,000–$100,000, 7.1% reported $60,000–$80,000, 7.1% reported $40,000–$60,000, 5.7% reported $20,000–$40,000, and 5.7% did not report income. For educational attainment, 32.9% of parents had master's degrees, 30.0% had college degrees, 27.1% had doctoral/professional degrees, 2.9% had associate's degrees, 1.4% had vocational/technical degrees, and 5.7% did not report their education. Seven parents identified as being Hispanic/Latino (10.0%), and three did not report their ethnicity (4.3%). Most parents identified as White (62.9%), 15.7% as Asian or Asian American, 14.3% as biracial or multiracial, 4.3% as other, and 2.9% as African American or Black. Aside from the three parents who did not report their ethnicity (4.3%), 52.9% of parents were non-Hispanic White, and 42.9% were members of racial-ethnic minority groups. This sample's racial-ethnic composition was representative of the city population of about

74,000 individuals but included a higher percentage of adults with post-graduate education levels (60.0% in the sample vs. 49.1% in the city; U.S. Census Bureau, 2021).

Parents screened for eligibility scheduled 2-hour lab visits on campus. After parents gave consent, the research team explained the purpose of wearing recording units, obtained child assent, and proceeded with electrode placement. Seven adhesive electrodes were placed on the parent: one on each clavicle and bottom rib, one below the sternum, and one on both the lower and upper spine. About 30 minutes into the visit, electrodes were plugged into mobile recording units as BioLab software acquired biometric data (MindWare Technologies, Ltd., Gahanna, Ohio). The parent and child were asked to sit on a sofa to watch a 5-min video. A researcher then led the child to another room to continue watching videos. Another researcher asked the parent to sit and do nothing until they returned. After a 3-min waiting period sitting alone, the researcher returned to administer cognitive tests and questionnaires. The parent was compensated modestly in this IRB-approved study following APA ethical standards. This study was not preregistered.

Measures

Parental Discipline. Parents completed the 27-item Parenting Dimensions Inventory-Short Version (PDI-S; Power, 2002). In one section, parents read five scenarios in which their child misbehaves (e.g., "After arguing over toys, your child hits a playmate.") and rated the likelihood they would respond to each scenario across seven types of control on a 4-point scale [0 = "very unlikely to do", 3 = "very likely to do"]. Means were calculated across scenarios for each control type and divided by the mean calculated across all scenarios and responses to create ratio scores. Ratios greater than 1.0 reflect a tendency to use that type of control more often than others. Physical discipline was indexed by the ratio score for *Physical Punishment* (5-item α = .90; M = 0.11, SD = 0.21), the mean of "spanking or hitting" responses. A composite measure of

inductive discipline (scale α = .88) was created by averaging ratio scores for *Reasoning* (5-item α = .82; *M* = 2.07, *SD* = 0.50), the mean of "talk to child (discuss alternatives, reasons for wanting the child to do/not do something)" responses, and *Reminding* (5-item α = .84; *M* = 1.96, *SD* = 0.48), the mean of "remind your child of the rule or repeat direction" responses. The first component in a principal component analysis (PCA) explained 89.32% of variance with loadings of .95 for Reasoning and Reminding scales, which were highly intercorrelated ($r = .79$, $p < .001$).

Child Externalizing Problems. Parents rated their child's behavior on a 3-point scale [0 = "Not True", 2 = "Very True or Often True"] on the 99-item Child Behavior Checklist (CBCL) Ages 1.5–5 (Achenbach & Rescorla, 2000). Items from the Attention Problems and Aggressive Behavior syndrome scales were summed into the externalizing broadband (24-item α = .92). Raw scores were converted into gender-normed *T*-scores with 8.7% and 4.3% of children in the borderline ($T > 59$ and < 64) and clinical ($T > 63$) ranges of externalizing problems, respectively.

Sociodemographic Covariates. Parents reported their level of educational attainment [1 = "partial high school", 8 = "doctoral or professional degree"], gross annual household income [1 = "under $20,000", 6 = "over $100,000"], relationship status, and primary language at home. The parent's age in years at the visit was calculated from their birthdate, biological sex was coded as 1= female and -1 male, and race–ethnicity was coded as 1 = racial-ethnic minority (i.e., Hispanic ethnicity and/or non-White race) and -1 = racial-ethnic majority (non-Hispanic White).

Parent Inhibitory Control. Two computerized tasks assessed IC under conditions of conflict by requiring the parent to inhibit learned associations and instead choose stimuli based on changing instructions (Diamond, 2013). Color-word interference was adapted from the Delis-Kaplan Executive Function System (Deli et al., 2001). The task began with a 10-trial congruent condition in which the parent had to select a colored key matching the name of a color written in

the same color, followed by a 10-trial incongruent condition in which they had to select a colored key corresponding to the name of a color written in another color. A difference score was calculated from averaged reaction times for the incongruent and congruent conditions to create a total score (α = .94) with higher values indicating better IC. Happy/sad is an emotional Stroop-like task adapted from Lagattuta et al. (2011). The parent was instructed to press a key with a happy face in response to the verbal cue "sad" and a key with a sad face in response to "happy". Both options required inhibiting an automatic association, so reaction times for both conditions rather than their difference were used. Reaction times for both conditions and color-word interference's total score were standardized and averaged into a total score (α = .84) with higher values indicating better IC performance. Two parents did not have scores because of computer problems. The first component in a PCA explained 75.95% of variance with loadings of .91 for sad reaction times, .88 for happy reaction times, and .83 for color-word interference control.

Parent Intelligence. The standardized norm-referenced Test of Nonverbal Intelligence, 4th Ed. (Brown et al., 2010) assessed parents' abstract reasoning, aptitude, and problem solving without requiring complex language or motor responses common in other IQ tests. The untimed test includes 60 items, takes 15 minutes to administer, and is appropriate for a wide age range. Parents were presented with a picture book in which each page showed an array of abstract figures with one missing and four to six options to choose from that completed the figure. Raw scores were converted into age-standardized index scores for age-adjusted nonverbal IQ. On average, parents ranked in the 61st to 63rd percentile or the "normal" range for their age groups.

Autonomic Activity. Parents' ANS activity was acquired continuously with mobile recording units during a roughly 3-min waiting period (MindWare Technologies, Ltd., Gahanna, Ohio). Trained research assistants edited electrocardiogram (ECG) data offline using MindWare

Heart Rate Variability (HRV 3.2.4) analysis software; visually inspecting the waveform within 30-sec epochs to remove artifacts and manually insert mid-beats for R waves misplaced by the peak detection algorithm. Data were detrended by a first order polynomial, cosine tapered, subjected to a Fast Fourier Transform, and a frequency domain measure of RSA was derived from the natural log of the high frequency/RSA band (0.12–0.4 Hz; Berntson et al., 2017). Trained research assistants edited impedance cardiography (ICG) data using MindWare Cardiac Impedance (IMP 3.1.5) analysis software to quantify PEP by isolating the time interval in ms between the heart's initial electrical stimulation (R wave) and the aortic valve's opening (B point; Berntson et al., 2017). ICG data were ensemble averaged within 30-sec epochs with R waves obtained from edited ECG data for inspection of accurate Q, R, S placement and detection of the B, Z, and X points. Mean values across 30-sec epochs of the 3-min waiting period were calculated for RSA and PEP to index their resting levels. Epochs in which at least 10% of R waves required editing were excluded from analyses. Sixty-five parents (92.9%) provided psychophysiological data and did not differ from parents who did not provide these data.

Data Analysis Plan

Analyses were conducted in SPSS 28. Hypotheses were tested with physical or inductive discipline as the dependent variable in hierarchical regression analyses with predictors entered in three steps: 1) sociodemographic covariates; 2) parent nonverbal IQ, IC, RSA, PEP, and child externalizing; 3) interaction term between two main study variables. We tested 20 regression equations to examine each interaction term in relation to physical or inductive discipline. Simple slopes and regions of significance (RoS) for significant interactions were tested using online tools (Preacher et al., 2006). All independent variables were mean centered to limit issues of multicollinearity. Effect sizes are reported as unstandardized and standardized coefficients and

R^2 values. Study data and materials are available from the first author upon reasonable request.

Results

Supplemental Table 1 shows descriptive statistics and intercorrelations. Data were missing in one case for the CBCL and up to eight cases for the PDI-S. Parents missing nonverbal IQs had higher RSA at rest (M = 8.70, SD = 0.14; n = 2) than parents with nonverbal IQs (M = 6.43, SD = 1.03; n = 62), $t(62) = -3.08$, $p = .003$. Parents missing RSA values were more likely to be racial-ethnic minorities than non-Hispanic White (n = 5 vs. 1), whereas parents with RSA values were more likely to be White than minorities (n = 36 vs. 25), $\chi^2(1) = 3.96$, $p = .047$.

Sex differences were only found for IC scores: men (M = 0.59, SD = 0.69, n = 8) performed better than women (M = -0.09, SD = 0.86, n = 60), $t(66) = 2.14$, $p = .036$. Non-Hispanic White parents had shorter PEP (M = 99.65, SD = 11.27, n = 33), indicating higher sympathetic activity than racial-ethnic minority parents (M = 108.53, SD = 17.82, n = 26), $t(57) = -2.33$, $p = .023$. Non-Hispanic White parents endorsed less physical discipline use (M = .04, SD = .14, n = 32) than racial-ethnic minority parents (M = .16, SD = .25, n = 28), $t(41.42) = -2.24$, $p = .031$. Only race-ethnicity and income were related to discipline and used as covariates.

Table 1 shows two hierarchical regression analyses that significantly predicted physical discipline. Step 1 in both models tested parent race-ethnicity and household income with income negatively predicting physical discipline (B = -0.05, SE = 0.02, β = -.27, $p = .041$), $F(2, 51) = 4.75$, $p = .013$, $R^2 = .16$. Step 2 in both models added nonverbal IQ, IC, RSA, PEP, and child externalizing as predictors and did not improve the model over Step 1, $\Delta R^2 = .15$, $p = .092$.

Step 3a of Table 1 also tests an interaction between parent nonverbal IQ and IC, which was a significant improvement over Step 2, $\Delta R^2 = .06$, $p = .037$, $F(8, 45) = 3.36$, $p = .004$, $R^2 = .37$. Only this interaction predicted physical discipline in the regression (B = 0.01, SE = 0.00, β =

.30, p = .037). Figure 1 shows direct tests of simple slopes indicating that among parents who scored one standard deviation (*SD*) below the sample mean for IC, low nonverbal IQ was associated with greater physical discipline than high nonverbal IQ (B = -0.01, t = -2.24, p = .029). Nonverbal IQ was only associated with physical discipline for parents with low IC, such that parents who scored low in both nonverbal IQ and IC endorsed the most physical discipline. A RoS test showed parents' IQ was negatively related to endorsement of physical discipline only for those who scored about half a *SD* below the mean or lower on IC (*Supplemental Figure 3*). When five fathers were excluded from analysis, the interaction was marginally significant (B = 0.01, SE = 0.00, β = .25, p = .083), the regression explained variance in physical discipline, F(8, 40) = 3.08, p = .008, R^2 = .38, and was a marginal improvement over Step 2, ΔR^2 = .05, p = .083.

Step 3b of Table 1 tests an interaction between child externalizing and parent PEP, which was an improvement over Step 2, ΔR^2 = .08, p = .018, F(8, 45) = 3.61, p = .003, R^2 = .39. Only an interaction between child externalizing and parent PEP predicted physical discipline (B = 0.00, SE = 0.00, β = .33, p = .018). Supplemental Figure 1 shows tests of simple slopes were marginally significant for parents with shorter (B = -0.01, t = -1.91, p = .061) or longer PEP (B = 0.01, t = 1.81, p = .077). Lower child externalizing was related to greater physical discipline for parents who scored one *SD* below PEP's mean. Higher child externalizing was related to greater physical discipline for parents who scored one *SD* above the mean. A RoS test showed child externalizing was related to physical discipline for parents who scored 1.09 *SD* below and 1.08 *SD* above PEP's mean (*Supplemental Figure 4*). When five fathers were removed, the interaction remained significant (B = 0.00, SE = 0.00, β = .35, p = .023), the regression explained variance in physical discipline, F(8, 40) = 3.53 p = .004, R^2 = .41, and was an improvement over Step 2, ΔR^2 = .08, p = .023. Supplemental Figure 2 shows tests of simple slopes were only significant for

mothers who scored one *SD* below PEP's mean (*B* = -0.01, *SE* = 0.01, *t* = -2.14, *p* = .037). Lower child externalizing was associated with greater physical discipline for mothers with shorter PEP at rest. A RoS test showed child externalizing was related to physical discipline for mothers who scored 0.68 *SD* below and 1.91 *SD* above the mean for PEP (*Supplemental Figure 5*).

Supplemental Table 2 shows similar hierarchical regression models failed to predict inductive discipline. Across all analyses no variable predicted inductive discipline. Post hoc power analyses in G*Power (Faul et al., 2009) showed this study was underpowered (.58–.69) in regression analyses detecting the two observed interactions; however, interactions replicated after nonsignificant predictors were removed from analyses to increase statistical power. These novel findings therefore should be replicated in future research studies utilizing larger samples.

Discussion

This study is the first to test multiple cognitive and psychophysiological factors and their interactions in predicting physical and inductive discipline in parents of preschool-aged children. As parents' discipline choices are often imbued with their emotional reactions to children's misbehavior (Critchley & Sanson, 2006), we accounted for parents' physiological arousal, regulation via their IC, children's externalizing problems, family income, and race-ethnicity. Consistent with past studies, parents who endorsed greater physical discipline reported lower family incomes, performed worse on cognitive tasks, were more likely to be racial-ethnic minorities, and endorsed less inductive discipline (Choe et al., 2013; Gershoff, 2002; Lansford et al., 2011). Parent age was unrelated to discipline choices, contrary to evidence linking parents' younger age to greater corporal punishment (Straus & Stewart, 1999). No demographic covariate predicted physical discipline when considered alongside cognitive and psychophysiological functioning and child externalizing problems. Although many variables were related to each

other, nothing predicted inductive discipline and only interactions explained physical discipline.

Among parents with poor IC, the lower their nonverbal IQ the more likely they were to endorse physical discipline. Nonverbal IQ was unrelated to physical discipline for parents with IC scores greater than half a *SD* below the mean. Parents who scored below the means for both executive and intellectual functioning were most likely to endorse physical discipline use. These findings support our hypotheses and extend evidence of negative links between mothers' EFs and harsh parenting (Bridgett et al., 2017; Deater-Deckard & Bell, 2017). Among our low-risk sample, mothers' IC scores were only modestly related to their nonverbal IQ scores, consistent with others' findings (Ferguson et al., 2021; Friedman et al., 2006). Parents' nonverbal IQs, but not IC, were negatively related to their family income, which suggests lower intellectual functioning linked to socioeconomic disadvantage contributes to parents' physical discipline use.

An interaction between resting PEP and child externalizing problems indicated that for parents with high sympathetic arousal at rest, greater perceptions of child externalizing were related to less endorsement of physical discipline, whereas greater perceptions of externalizing were related to greater endorsement of physical discipline for parents with low sympathetic arousal. This is contrary to our hypothesis that parents with shorter PEP would be more prone to physical discipline use. Low sympathetic arousal putatively signifies heightened vulnerability to externalizing problems (Beauchaine & Webb, 2017). As such, greater child externalizing was related to greater endorsement of physical discipline among parents with longer PEP, suggesting that parents low in sympathetic arousal are more likely to respond to children's misbehavior with physical discipline. We consider these findings tentative until they are independently replicated.

Contrary to Oosterman et al.'s (2019) finding that parents' PEP is unrelated to harsh discipline, we found low family income and resting sympathetic activity correlated with greater

physical discipline, which further suggests physical discipline is related to interactions between intraindividual and contextual factors that may be malleable targets of parenting interventions in early childhood. Parents of 4- and 5-years-olds report the highest rates of corporal punishment (Straus & Stewart, 1999) and are at elevated risk of perpetrating physical abuse (Gershoff, 2002). Interactions between vulnerabilities across domains highlighted in this study may help identify and treat parents who benefit most from parenting-related outreach, intervention, and training.

The current study advances the parenting literature by testing additive and interactive effects between parents' psychophysiological, cognitive, and contextual determinants of parental discipline across multiple levels of analysis, but it has notable limitations. Our cross-sectional findings with a small and highly educated sample are derived from statistically underpowered analyses and have limited generalizability. Our study's correlational design could not establish the temporal order of the focal variables. Parents' cognition and physiology were assessed in the lab where they reported both their hypothetical likelihood of using inductive and physical discipline in response to vignettes of children's misbehavior and their children's externalizing behavior over the past two months. Future studies with observations of parenting behavior (Bridgett et al., 2017), novel methods such as audio recordings in families' homes (Holden et al., 2014), and statistical techniques such as propensity score matching (Gershoff et al., 2018), may uncover causal effects of the biopsychosocial predictors of distinct forms of parental discipline. Longitudinal studies with larger samples are needed to test other interactions between ecological, neuropsychological, and psychophysiological systems to further clarify mechanisms underlying parental discipline. Early interventions may improve parenting by targeting these mechanisms.

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Table 1

Hierarchical Regression Predicting Parent Endorsement of Physical Discipline Use

	Step 1		Step 2		Step 3a		Step 3b	
Variable	*B (SE)*	*β*	*B (SE)*	*β*	*B (SE)*	*β*	*B (SE)*	*β*
Parent Race-Ethnicity	.05 (.03)	.25†	.03 (.03)	.16	.03 (.03)	.12	.04 (.03)	.17
Household Income	**-.05 (.02)**	**-.27***	-.04 (.02)	-.21	-.04 (.02)	-.22†	-.04 (.02)	-.21
Nonverbal IQ			.00 (.00)	-.11	.00 (.00)	-.18	.00 (.00)	-.11
Inhibitory Control (IC)			-.06 (.04)	-.26†	-.03 (.04)	-.12	-.06 (.03)	-.24†
Child Externalizing (EXT)			.00 (.00)	.04	.00 (.00)	-.04	.00 (.00)	-.08
Parent RSA			.02 (.03)	.09	.01 (.03)	.07	.00 (.03)	-.01
Parent PEP			.00 (.00)	.18	.00 (.00)	.17	.00 (.00)	.14
3a) Nonverbal IQ-by-IC					**.01 (.00)**	**.30***		
3b) Child EXT-by-Parent PEP							**.00 (.00)**	**.33***
R^2	.16		.31		.37		.39	
F for change in R^2	**4.75***		2.03†		**4.62***		**6.01***	

Note: Parent race-ethnicity: -1 = non-Hispanic White, 1 = racial-ethnic minority. IQ = intelligence quotient. RSA = respiratory sinus arrhythmia. PEP = pre-ejection period.

†$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

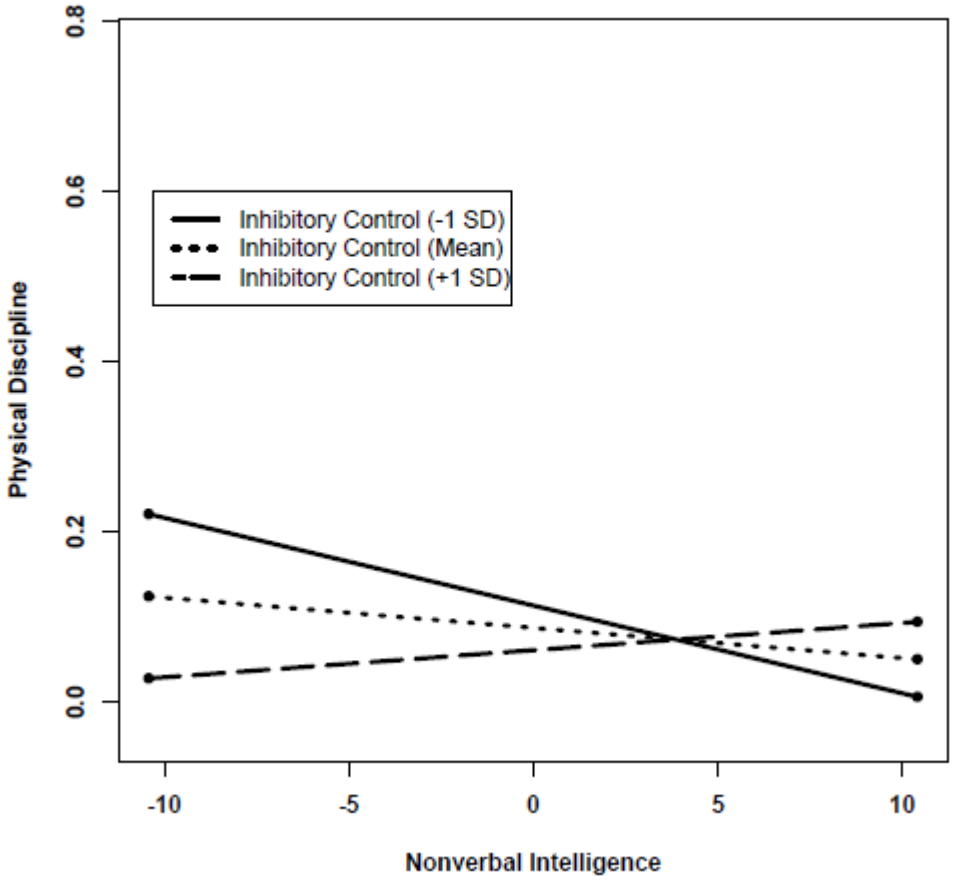

Figure 1. The plotted two-way interaction between parent nonverbal intelligence quotient and inhibitory control predicting physical discipline. Direct tests of simple slopes were statistically significant for parents who scored one standard deviation (*SD*) below the sample mean for inhibitory control (*B* = -0.01, *SE* = 0.00, *t* = -2.24, *p* = .029), but not for parents who scored at the mean (*B* = 0.00, *SE* = 0.00, *t* = -1.26, *p* = .213) or one *SD* above the sample mean for inhibitory control (*B* = 0.00, *SE* = 0.00, *t* = 0.85, *p* = .402). Nonverbal intelligence was negatively associated with endorsement of physical discipline only for parents with low inhibitory control.