Reward sensitivity and internalizing symptoms during the transition to puberty: An examination of

9-and 10-year-olds in the ABCD Study

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Abstract

Early pubertal timing has been linked to increased risk for internalizing disorders. Work in older adolescents and adults suggests that heightened reward sensitivity may buffer risk for internalizing symptoms, but few studies have investigated these associations during the early transition to puberty, a window of vulnerability to mental health risk. In this preregistered study, we investigated the associations among pubertal timing, internalizing symptoms, and reward sensitivity in 11,243 9-10 year-olds from the Adolescent Brain Cognitive Development (ABCD) Study®. Using split-half analysis, we tested hypothesized effects across two subsets of the sample (Sample 1 $N=5,631$; Sample 2 $N=5,612$). Across samples, early pubertal timing was associated with higher internalizing symptoms in females and males, with highest symptoms evident in mid-pubertal adolescents. Additionally, early pubertal timing was robustly associated with greater self-reported reward sensitivity in both females and males. We observed preliminary evidence of a moderating role of self-reported and neural reward sensitivity in the association between early pubertal timing and internalizing symptoms, but several of these effects differed by sex, and no moderation effects replicated across samples. Together, these findings provide novel insights into early indicators of risk for internalizing disorders during the transition to puberty.

Introduction

The onset of puberty is a hallmark of early adolescence accompanied by cascading changes in biological, physiological, and social functioning (Pfeifer & Allen, 2021). This confluence of changes can heighten risk for internalizing disorders, including anxiety, depression, and non-suicidal self-injury (Patton et al., 2007, 2008; Pfeifer & Allen, 2021; Ullsperger & Nikolas, 2017). In particular, early pubertal maturation relative to one's same-age and same-sex peers (i.e., early pubertal timing) has been linked to heightened risk for future internalizing symptoms (Graber, 2013; Mendle et al., 2007; Mendle & Ferrero, 2012; Ullsperger & Nikolas, 2017). As such, the transition to puberty introduces a window of opportunity for substantial development, but also vulnerability to psychopathology (Costello et al., 2003, 2011; Laube & Fuhrmann, 2020).

Although a large body of work has linked early pubertal timing to heightened risk for internalizing symptoms, many studies have focused on single-sex, homogeneous samples — especially white, female samples of European descent (Deardorff et al., 2019, Cheng et al. 2021). Importantly, however, recent work highlights that early pubertal timing may be linked to risk for internalizing symptoms in males as well (Hamlat et al., 2019; Mendle & Ferrero, 2012; Ullsperger & Nikolas, 2017), although these results are less consistent (Mendle et al., 2010; Mendle & Ferrero, 2012). In addition to a predominant focus on homogeneous female samples, a notable portion of studies assessing psychosocial risk during puberty have centered on adolescents ages eleven and older (Galvao et al., 2014; Ullsperger & Nikolas, 2017). Given that the hormonal processes that unfold during puberty are typically initiated prior to age eleven (Dorn et al., 2006; Grumbach & Styne, 2003), it is important to incorporate younger samples in order to capture development of “early maturers” who are thought to be at high risk for internalizing psychopathology (Ullsperger & Nikolas, 2017). Moreover, results from a recent study of 9 to 14 year-old females suggests that increases in internalizing symptoms are specifically linked to physical changes that emerge during early compared to later stages of puberty, highlighting the transition to puberty as a unique window of vulnerability (McGuire et al., 2019). While prior research has provided important insights into puberty-related risk for psychopathology, studies that include a larger, more diverse, and younger sample of youth — particularly those entering the early stages of puberty — are needed.

Experiences of psychopathology during puberty vary widely across individuals and are predictive of later mental health outcomes (Copeland et al., 2021; Graber, 2013; Hofstra et al., 2000). It is therefore crucial to identify factors that modulate risk for psychopathology during this stage (Mendle, 2014). Existing research in adults and older adolescents points to neural and behavioral signatures of reward sensitivity as robust indicators of risk for internalizing disorders. Reduced self-reported and task-measured reward sensitivity predict heightened internalizing symptoms (Alloy et al., 2016; Taubitz et al., 2015; Whitton et al., 2015), patterns that are mirrored by neuroimaging data (Luking et al., 2016). In particular, heightened internalizing symptoms have been associated with attenuated activity within the ventral and dorsal striatum (i.e., nucleus accumbens, caudate, and putamen) during reward anticipation and feedback (Auerbach et al., 2021; Pizzagalli et al., 2009a; Rappaport et al., 2020; Zhang et al., 2013) in adults and older adolescents (Auerbach et al., 2021; Forbes, 2011; Forbes et al., 2009, 2010; Luking et al., 2016; Morgan et al., 2013; Nielson et al., 2021). Similarly, reward-related activity within the orbitofrontal cortex (OFC) has been linked to negative emotion biases evident in internalizing disorders (Dichter et al., 2012b; Downar, 2019; McCabe et al., 2012; Rolls, 2016, 2019; Ubl et al., 2015). Together, these findings suggest that individual differences in reward-related functional activity within orbitofrontal and striatal circuits may relate to risk for internalizing symptoms in older adolescents and adults (Luking et al., 2016).

Similar reward processes may also modulate risk for internalizing symptoms in younger adolescents transitioning to puberty. Notably, hormonal processes initiated early in puberty introduce changes within the aforementioned reward-sensitive circuits (Goddings et al., 2019; Ho et al., 2021; Peper et al., 2013; Piekarski et al., 2017; Wierenga et al., 2018). Pubertal onset may introduce a period in which risk for internalizing symptoms is altered alongside functional changes within these reward processing networks (Nelson et al., 2005; Pfeifer & Allen, 2021). Several studies have characterized pubertal changes in striatal functioning in particular during reward processing. For instance, a longitudinal study of over 200 adolescents found a positive linear relation between self-reported pubertal stage and reward-elicited activity within the nucleus accumbens (Braams et al., 2015). Similar findings have been reported when pubertal development is indexed via hormonal assays. Specifically, individual differences in concentrations of testosterone, a circulating gonadal hormone that increases in both males and females during puberty (Braams et al., 2015; Wierenga et al., 2018), have been shown to predict differences in neural signatures of reward processing (Forbes et al., 2010; Ladouceur et al., 2019; van Wingen et al., 2011). For instance, some studies have found that individuals with higher levels of testosterone demonstrate greater responses to reward within the nucleus accumbens (Braams et al., 2015; Op de Macks et al., 2011) and testosterone administration has been shown to increase accumbens activity during a monetary anticipation task (Hermans et al., 2010). Given the negative association between reward responsiveness and internalizing symptoms, these findings suggest that heightened reward-elicited activity within corticostriatal circuitry may mitigate risk for internalizing as adolescents enter puberty (Luking et al., 2016). Identifying factors that modulate risk for internalizing during the transition to puberty has important implications for early identification, prevention, and intervention (Mendle, 2014). However, relatively little is known about the potential moderating role of reward sensitivity in internalizing symptoms during the crucial window in which young adolescents transition to puberty.

In the present study, we investigated the associations among puberty, reward sensitivity, and internalizing symptoms in a large, population-based sample of 9- and 10-year-olds from the Adolescent Brain Cognitive Development (ABCD) Study® (Jernigan et al., 2018). Baseline data from the ABCD Study are well-suited to address the aforementioned gaps in the literature in several critical ways. First, the narrow age range of the ABCD cohort enables examination of pubertal timing (i.e., pubertal maturation relative to adolescents within one's age cohort) in particular (Barendse et al., in press; Mendle et al., 2010). Investigating these associations within a cohort of 9- and 10-year-olds captures variability in the early transitional stages of puberty, a crucial phase for addressing psychosocial risk (McGuire et al., 2019). Second, the ABCD Study assessed internalizing symptoms — which encompass characteristics of both anxiety and depressive disorders — in a large sample of young adolescents, thereby capturing symptoms on a dimensional spectrum and enabling the identification of subclinical vulnerability that may precede a clinical threshold for diagnosis. Given that internalizing is a common higher-order factor across anxiety and depression (Kotov et al., 2017), understanding related vulnerabilities to internalizing symptoms provides a way to capture the full spectrum of risk, including sub-clinical youth, and could inform intervention that targets adolescents at early stages of risk. Third, the richness of the ABCD dataset allows for comprehensive, multimethod examinations of puberty via parent report and salivary hormonal assays and of reward-related processes via questionnaires, behavioral data, and fMRI measures (Cheng et al., 2021). It is especially important to incorporate multimethod indicators of reward sensitivity given that different measures can have relatively low agreement (Radulescu et al., 2020) and to incorporate both hormonal assays and self-report data when investigating pubertal development (Shirtcliff et al., 2009).

Lastly, the size of the ABCD sample enables the use of split-half analysis, a data-driven technique that tests for within-study replications across subsamples of the data (Karcher & Barch, 2021).

The present study tested two primary hypotheses: (1) that early pubertal timing would be associated with higher internalizing symptoms in early adolescents, ages 9 to 10 years, and (2) that this association would be heightened in adolescents with attenuated reward sensitivity, measured at multiple levels (i.e., self-report, behavioral, and neural). All hypotheses and analyses were preregistered on Open Science Framework (osf.io/3yrwh).

Methods

Data and Code Availability

Data were retrieved from the National Institute of Mental Health Data Archive (NDA) ABCD repository (ABCD Curated Annual Release 3.0, 2020; downloaded in March 2021). A list of all variables of interest, as well as their official (i.e., ABCD-provided) variable names, aliases, and definitions, are available on this study's OSF page (osf.io/7u3jt). The original ABCD data analyzed in the present study can be accessed via the NDA ABCD repository.

The preregistration for this study is available on Open Science Framework (osf.io/3yrwh). Several details were added to our analysis plan after preliminary examination of the data and can be found in an amendment to the preregistration. Scripts for downloading, cleaning, splitting, analyzing, and plotting the data are available on GitHub (github.com/nsaragosaharris/abcd_transitiontopuberty_study).

Participants

Recruitment of the ABCD Study cohort took place in 21 catchment areas across the United States using a modified probability sampling method (Garavan et al., 2018). Special attention was dedicated to recruiting a sample that reflected the United States' sociodemographic variation in terms of sex, race and ethnicity, socioeconomic status, and urbanicity. Informed consent was obtained from all participants and parents according to the ABCD Study protocol (Garavan et al., 2018). Further details on the recruitment methods for the ABCD Study can be found in Garavan et al., (2018).

The ABCD Curated Annual Release 3.0 included baseline data from 11,878 participants ages 8.9 to 11 years of age (Table 1). The sample was then divided into two subsamples to enable split-half analysis in order to test hypotheses in one half of the dataset ("Sample 1") and test for replication in the other half of the dataset ("Sample 2"). Participants were randomly assigned to Sample 1 or Sample 2 using the function 'block_ra' from the R package *randomizr* (Uschner et al., 2018), which ensured that the two samples were matched in terms of sex. After excluding participants with missing parent-reported puberty data (see *Perceived Pubertal Development* section for details), Sample 1 included 5631 participants and Sample 2 included 5612 participants. T-tests of the two testing samples revealed no significant differences between the subsamples on the following variables of interest: age, race, CBCL internalizing factor score, testosterone, PDS score, and BIS/BAS reward responsiveness (see *Measures* for variable descriptions; see Supplement for t-test statistics). Descriptive statistics for the two samples can be found in *Table 1*.

Measures

Demographic variables

Age, sex, race, and ethnicity were assessed via parent report. Age was a continuous variable defined as the age in months at the time of the baseline visit. Sex was defined as sex at birth (female or male; see *Discussion* for discussion of this limitation). Race was a categorical variable with five levels: Asian, Black, Mixed, White, and Other (Native Hawaiian and other Pacific Islander; American Indian and Alaskan Native). Ethnicity was a categorical variable based on yes/no responses to the question “Do you consider the child Hispanic/Latino/Latina?”. Descriptive statistics for Sample 1 and Sample 2 with respect to this set of demographic variables can be found in *Table 1*.

Pubertal development

Perceived pubertal development. Perceived pubertal development was measured through the parental report of the Pubertal Development Scale (PDS) (Petersen et al., 1988), which has good internal consistency (Chronbach's $\alpha = 0.91$ to 0.96) and test-retest reliability ($ICC = 0.81$ to 0.93). Only parent-report of perceived pubertal development was used, as parents may be more accurate reporters of their child's pubertal development particularly at the early stages of pubertal development (Shirtcliff et al., 2009). For further considerations on measuring pubertal processes in the ABCD Study, see Cheng et al. (2021). PDS items include questions about physiological changes in height, body hair, and skin. The female version includes additional questions about breast development and menstruation while the male version includes additional questions regarding voice changes and facial hair growth. Each item has five response options (1 = not yet started, 2 = barely started, 3 = definitely started, 4 = seems complete, or I don't know/Refuse to answer), except for the menstruation item (females only; 1 = no, 4 = yes, or I don't know/Refuse to answer). Two scores are generated from the PDS: PDS stage and PDS score. PDS stage is determined based on the sum of items and is a categorical value with five levels (Carskadon & Acebo, 1993; Petersen et al., 1988): prepubertal, early pubertal, mid-pubertal, late pubertal, and post-pubertal. We used the pre-calculated values for PDS stage from the downloaded 3.0 release data. Individuals who were categorized as post-pubertal were excluded from analysis given the small number in each sample-sex bin (0.4%; $N = 50$ total; 27 females and 7 males in Sample 1; 15 females and 1 male in Sample 2). PDS mean score is a continuous value calculated by averaging across PDS items following Herting et al. (2021). Items on the PDS were considered missing if participants answered, “I don't know” or “refuse to answer”, if the response was left blank, or if the response value was outside of the expected range (1 to 4). Participants with two or more missing answers were excluded from the PDS score calculation (following recommendations from (Herting et al., 2021); 5631 participants in Sample 1 and 5612 participants in Sample 2 met these inclusion criteria. Because pubertal timing can be inferred by pubertal maturation within a narrow age cohort (i.e., “stage-for-age”), wherein higher scores indicate earlier timing relative to one's age-matched peers (Vijayakumar et al., 2018), here we conceptualized higher PDS scores as indicative of early timing in this young and narrow age group. To further delineate the effects of puberty above and beyond age on our outcomes of interest, we also controlled for age in our statistical analysis.

Testosterone. Testosterone was measured through hormonal assays from saliva samples collected between 7:00 a.m. and 7:00 p.m. and assayed using commercially available immunoassays. Details about the protocol for saliva sample collection, storage, and specifications are provided in Herting et al. (2021). We used the pre-calculated values for testosterone concentrations (in pg/mL) from the downloaded 3.0 release data. These values were cleaned following the procedures recommended by Herting et al. (2021). Values in the range of 1 to 600 pg/mL, and within 3 standard deviations of the mean were included in the analyses.

Internalizing symptoms

Internalizing symptoms were measured through the higher order Internalizing factor score from the Child Behavior Checklist (CBCL), a widely used measure of behavioral and emotional problems in youth that was administered to parents (Achenbach, 1991). The Internalizing factor score has been shown to have good internal consistency (Chronbach's $\alpha = 0.90$) and high test-retest reliability ($r = 0.91$) (Achenbach & Verhulst, 2010). We used the raw scores of the Internalizing factor in order to maximize variability, given that the age-normed T-scores are truncated (Thurber & Sheehan, 2012). Internalizing symptoms encompass both depression- and anxiety-related symptoms. In order to determine whether any observed effects of pubertal timing on internalizing symptoms were specific to a specific symptom category, we also tested the Anxious-Depressed, Withdrawn-Depressed, and DSM-5 Depressed subscales of the CBCL. Pre-calculated raw scores for the Internalizing factor, Anxious-Depressed, Withdrawn-Depressed, and DSM-5 Depressed subscales were included in the downloaded 3.0 release data. For the Internalizing factor and subscales, higher scores indicate greater symptom levels.

Reward sensitivity

Self-reported reward sensitivity. Self-reported reward sensitivity was measured through the Reward Responsiveness subscale of the Behavioral Inhibition System/Behavioral Activation System (BIS/BAS) Scale (Carver & White, 1994). A modified version of the abridged BIS/BAS that adapts the scale for youth report and shortens the BAS Reward Responsiveness (BAS-RR) subscale (Pagliaccio et al., 2016) was administered to youth in the ABCD Study (Barch et al., 2018). Preliminary analyses from the initial sample of 1167 ABCD participants demonstrated that the Reward Responsiveness subscale from the modified BIS/BAS (BAS-RR) yielded an alpha of 0.62 (Barch et al., 2018). Following the methods outlined in Pagliaccio et al. (2016), BAS-RR scores were calculated by summing the four relevant items (i.e., “I feel excited and full of energy when I get something”; “When I am doing well at something, I like to keep doing this”; “It would excite me to win a contest”; “I get really excited when I see an opportunity to get something I like”). All four items were rated on a 4-point scale (0=Not true; 3=Very True) and had to be answered in order to compute the sum. Higher scores indicate greater reward sensitivity.

Behavioral reward sensitivity. Behavioral and neural indicators of reward sensitivity were measured using the Monetary Incentive Delay (MID) Task (Knutson et al., 2000a), a widely used task that measures anticipation and receipt of rewards and losses (Dichter et al., 2012a; Hulst et al., 2015; Oldham et al., 2018; Pizzagalli et al., 2009b). On each trial, participants are shown a cue that corresponds to an amount of money, ranging from no reward (i.e., neutral) to small (\$0.20) and large (\$5) rewards, followed by a jittered anticipation event (1500-4000ms). Next, a target appears (150-500ms) during which participants are instructed to press a button as soon as they see the target on the screen in order to win the amount shown (including on neutral trials). Once the target disappears, participants received feedback on the reward trials as to whether the reward was received. Average reaction times in milliseconds by condition (i.e., large reward, small reward, or neutral trials) were provided in the 3.0 release data. A target accuracy rate was set at 60%, with the task difficulty adjusting to the participant's performance after every third reward trial. In analysis of behavioral data, only participants who met the ABCD-provided inclusion criteria for the MID task were included. Further details regarding the determination of inclusion for behavioral tasks in the ABCD Study can be found in Casey et al., 2018. Based on previous research using the MID task (Hulst et al., 2015; Knutson et al., 2000b; Pizzagalli et al., 2009a), two difference scores were calculated as differential indicators of the magnitude of behavioral reward sensitivity: 1) difference in average reaction time on neutral trials versus large reward trials and 2) difference in average reaction time

on small reward trials versus large reward trials (Hulst et al., 2015). In this framework, higher values are equivalent to a greater difference in reaction time between conditions and indicative of greater sensitivity. Difference scores were z-scored, with greater z-scores reflecting greater reward sensitivity relative to the sample.

Neural reward sensitivity. Neural reward sensitivity was operationalized as the blood-oxygen-level-dependent (BOLD) signal during reward anticipation and feedback stages of the MID task. Preliminary results evidencing the quality and age-appropriateness of the task for fMRI analyses in the ABCD sample are provided in Casey et al. (2018) and Chaarani et al. (2021). For analyses of fMRI data in the present study, we determined inclusion criteria based on ABCD-provided indicators of whether or not to include a participant in analyses of fMRI data from the MID task. For specification of quality control practices for neuroimaging data, see the ABCD MRI Quality Control and Recommended Image Inclusion Criteria guidance for the data release 3.0 (<http://dx.doi.org/10.15154/1519007>).

Five preregistered, *a priori* regions of interest (ROIs) were chosen based on meta-analyses of neural reward processing (Sescousse et al., 2013; Silverman et al., 2015; Oldham et al., 2018) and results from the original MID Task studies (Knutson et al., 2000a, 2001). ROIs included subregions of the striatum (nucleus accumbens (NAcc), caudate, and putamen) and the medial and lateral orbitofrontal cortex (mOFC and lOFC). Given conflicting evidence regarding the role of reward anticipation versus reward feedback in predicting internalizing symptoms (Luking et al., 2016), we considered both stages via pre-calculated beta weights from each of the five ROIs. The ABCD Data Analysis and Informatics Center calculated average time courses within each ROI using FreeSurfer's (Fischl, 2012) anatomically-defined cortical parcellations ("aparc") (Desikan et al., 2006; Destrieux et al., 2010) and subcortical segmentations ("aseg") (Fischl et al., 2002). ABCD estimated beta weights at the individual participant level using a general linear model that included motion estimates and their derivatives as nuisance regressors and averaged beta estimates across runs of the task. For a detailed overview of the imaging procedures, processing, quality control practices, ROI values extraction, and analysis methods used in the ABCD Study, see (Casey et al., 2018; Hagler et al., 2019).

Reward anticipation within a given ROI was operationalized as the contrast between average BOLD signal during reward trials compared to no reward trials during reward anticipation. *Reward feedback* within a given ROI was operationalized as the contrast between average BOLD signal in response to reward positive feedback (i.e., a reward was received) compared to reward negative feedback (i.e., a reward was not received) trials during reward feedback. These values were provided in the 3.0 release data. Because we did not have hemisphere-specific hypotheses, beta weights from the right and left hemispheres were averaged to create bilateral estimates for anticipation and feedback within each of the ROIs. These estimates were then z-scored so that greater values indicated greater contrast estimates within a bilateral ROI relative to the sample. Only beta weights from participants who met ABCD inclusion criteria were z-scored. Participants identified as outliers (those with a calculated $z < -3$ or $z > 3$) within a given ROI were excluded from analyses of that ROI given the high prevalence of artifacts that can introduce influential outliers in MRI data (Wager et al., 2005), particularly in developmental samples (Poldrack et al., 2002).

Statistical Analysis

Split half analysis procedure

We tested our preregistered hypotheses independently across Samples 1 and 2. Results were considered robust if, across both samples, the effects were statistically significant ($p < 0.05$) and the coefficient estimates were in the same direction.

Analysis by sex

Extant literature on pubertal development and risk for internalizing psychopathology in females and males support disaggregating analyses by sex. First, physiological indicators of pubertal development, such as menarche in females and a deepening of the voice in males, and the timing of their onset differ by sex, which convolutes cross-sex comparisons (Deardorff et al., 2019). In addition, based on recent work (Hamlat et al., 2019; Ullsperger & Nikolas, 2017), we did not hypothesize sex differences in our effects, particularly in light of work suggesting that sex differences in risk for internalizing disorders do not emerge until age thirteen or older (Angold et al., 1998; Ge et al., 2001; Hankin et al., 1998) and sex differences in reward processing during adolescence are equivocal (Goddings et al., 2019). Therefore, to aid interpretability, we chose to model males and females separately in all statistical analyses and did not treat sex as a moderating variable in our analyses.

Specification of multilevel models

We used a multilevel model approach to account for the non-independent nested structure of ABCD data (i.e., participants are nested within families, which are nested within sites). Mixed effects models were estimated in R 3.6.2 (R Core Team, 2019) using the ‘*glmm4*’ package version 0.2-6 (Wood & Scheipl, 2020) using restricted maximum likelihood estimation. Random-effect intercepts were selected for family and site. The maximum number of participants were included within each analysis (i.e., if a participant was excluded from imaging analyses based on imaging inclusion criteria, they could still be included in all statistical models that did not involve imaging data). Exact degrees of freedom for every analysis can be found in Supplements A and B.

Covariates

To examine the effects of pubertal timing above and beyond the effects of age, age was included as a fixed effect in all models that included PDS or testosterone as a predictor. Empirical findings suggest that race and ethnicity relate to early pubertal timing (Biro et al., 2013; Chumlea et al., 2003) and risk for internalizing psychopathology (McLaughlin et al., 2007). As such, in statistical models that included measures of both pubertal timing and internalizing symptoms, race and ethnicity were included as fixed effects.

Outliers

Outliers were defined as values ≥ 3 standard deviations away from the mean (based on z-scores calculated after exclusion criteria were taken into account). Outliers were removed for MID reaction time data, BAS-RR, testosterone scores, and neuroimaging data. No outliers were excluded based on z-scores for CBCL because (1) variable-specific inclusion criteria were already taken into account when calculating scores for these variables and (2) even the more extreme values were deemed as within plausible range for these variables.

Deviations from preregistered analyses

Parental marital status, education, income covariates were not included in the final models. We added an analysis of the large vs. small reward contrast in MID reaction time data.

Results

Descriptive Statistics

Descriptive statistics for Sample 1 and Sample 2 are displayed in Table 1.

Table 1

	Females		Males	
	Sample 1	Sample 2	Sample 1	Sample 2
N	2701	2691	2930	2921
Age	M=118.87 months (SD=7.51 months) Range=107-132 months	M=118.69 months (SD=7.45 months) Range=107-132 months	M=119.22 months (SD=7.49 months) Range=107-133 months	M=119.11 months (SD=7.51 months) Range=107-132 months
Race (%)				
Asian	61 (2.3%)	74 (2.7%)	65 (2.2%)	75 (2.6%)
Black	406 (15%)	435 (16.2%)	429 (14.6%)	377 (12.9%)
Mixed	345 (12.8%)	320 (11.9%)	351 (12%)	347 (11.9%)
White	1,723 (63.8%)	1,689 (62.8%)	1914 (65.3%)	1,931 (66.1%)
Other	130 (4.8%)	133 (4.9%)	139 (4.8%)	151 (5.1%)
Missing	36 (1.3%)	40 (1.5%)	32 (1.1%)	40 (1.4%)
Hispanic/Latina/o/x (%)	546 (20.2%)	525 (19.5%)	578 (19.7%)	595 (20.4%)

PDS Mean Score	M=1.69 (SD=.74) Range=1-4	M=1.67 (SD=.73) Range=1-4	M=1.35 (SD=.55) Range=1-4	M=1.34 (SD=.56) Range=1-4
PDS Stage (%)				
Pre-puberty	818 (30.3%)	850 (31.6%)	2043 (69.7%)	2058 (70.4%)
Early-puberty	654 (24.2%)	619 (23%)	728 (24.8%)	683 (23.4%)
Mid-puberty	1,163 (43.6%)	1,151 (42.8%)	145 (5%)	166 (5.7%)
Late-puberty	66 (2.4%)	71 (2.6%)	14 (0.5%)	14 (0.5%)
Testosterone (pg/mL) Average	M=35.53 (SD=16.4) Range=1.86- 93.69	M=34.93 (SD=16.35) Range=3.31- 88.16	M=31.40 (SD=15.53) Range=1.33- 93.96	M=31.02 (SD=14.85) Range=0.72 -87.87
BIS/BAS Reward Responsivity (BAS-RR) Score	M=8.7 (SD=2.34) Range=2-12	M=8.69 (SD=2.4) Range=2-12	M=8.98 (SD=2.29) Range=2-12	M=8.94 (SD=2.31) Range=2-12
CBCL Internalizing Raw Score	M=5.03 (SD=5.52) Range=0-41	M=5.0 (SD=5.43) Range=0-51	M=5.05 (SD=5.51) Range=0-49	M=5.14 (SD=5.6) Range=0-42

Table 1. Descriptive statistics for sample demographics, pubertal development, and questionnaire-based measures for Sample 1 and Sample 2. *M=Mean, SD=Standard Deviation*

Research Question 1: Is pubertal development associated with internalizing symptoms?

We first tested whether early pubertal timing, indicated by higher PDS scores after controlling for age, was associated with higher internalizing symptoms. As hypothesized, early pubertal timing in females and males was associated with higher internalizing symptoms in both Sample 1 and Sample 2 (Figure 1; Supplements A & B Model 1.1). To address whether the observed association was specific to a symptom category, we next tested whether PDS was associated with anxiety- or depression-specific subscales of the CBCL. We found that early pubertal timing in females and males was associated with higher Anxious-Depressed, higher Withdrawn-Depressed, and higher DSM-5 Depressed subscales in both Sample 1 and Sample 2, suggesting that the relationship between pubertal timing and internalizing was not driven by a specific symptom category (Supplements A & B Models 1.2-1.4). Contrary to our hypothesis, testosterone was not associated with internalizing symptoms or symptom subscales in females or males across either sample (Supplements A & B Models 1.9-1.12), with the exception of a positive association with the

Withdrawn-Depressed subscale for females and males in Sample 2 (Supplement B Model 1.11). Across both samples, the associations between PDS score and internalizing symptoms in females and males held when testosterone was included in the model (Supplements A & B Models 1.13-1.20).

We next tested the association between internalizing symptoms and categorical PDS stages. Because we were interested in the transition to puberty, we tested CBCL scores by PDS stage (controlling for age), with the pre-pubertal stage as the reference level. Compared to pre-puberty, mid-puberty was consistently associated with internalizing symptoms and subscales across samples and sexes. In Sample 1 females, early, mid, and late pubertal stages were associated with higher internalizing symptoms (Supplement A Model 1.5) and higher scores on the DSM-5 Depressed subscale (Supplement A Model 1.8). In Sample 2 females, only mid-puberty was associated with higher internalizing symptoms (Supplement B Model 1.5), and higher DSM-5 Depressed subscale scores (Supplement B Model 1.8). In Sample 1, early- and mid-pubertal females had higher scores on the Anxious-Depressed subscale (Supplement A Model 1.6); however, this association only replicated in the mid-pubertal stage (Supplement B Model 1.6). Additionally, in Sample 1 females at early, mid, and late pubertal stages had higher scores on the Withdrawn-Depressed subscale than females in the pre-pubertal stage (Supplement A Model 1.7). This finding was replicated in the mid- and late-pubertal stages for females (Supplement B Model 1.7).

Across both samples, males in early and mid-pubertal stages exhibited significantly higher internalizing symptoms than age-matched pre-pubertal males. The relatively low number of males in the late-pubertal stage (N=28 males, compared with N=137 females across samples), may have resulted in insufficient power to detect an effect in the late-pubertal stage. For males in Sample 1, the early-pubertal stage was associated with higher scores on the Anxious-Depressed subscale ($b=.44$, $SE=.14$, $t=3.19$, $p<.01$); however, this association did not replicate. In both samples, males in the mid-pubertal stage had higher scores on the Withdrawn-Depressed subscale (Supplements A & B Model 1.7). Lastly, in Sample 1, males in early- and mid-pubertal stages had higher DSM-5 Depressed scores, and this finding replicated in the early-pubertal stage ($b=.20$, $SE=0.10$, $t=2.08$, $p=.038$). Notably, the associations between pubertal stage and internalizing symptoms in females and males largely held when testosterone was included in the model, as well (Supplements A & B Models 1.13-1.20).

Figure 1. Higher PDS scores in females and males are associated with higher internalizing symptoms after adjusting for age, race, and ethnicity. For illustrative purposes, a limited range of model predicted CBCL scores are plotted here. (For the full range of values, see Table 1.) Females are plotted in purple and males are plotted in green. Lighter colors indicate Sample 1 and darker colors indicate Sample 2.

Research Question 2: Does reward moderate the association between pubertal development and internalizing symptoms?

We next examined whether self-report (i.e., reward responsiveness), behavioral (i.e., MID Task reaction time), or neural (i.e., activation of reward-related ROIs) measures of reward sensitivity moderated the observed association between pubertal timing and internalizing symptoms (controlling for age in all models). To further elucidate the role of reward in the link between pubertal timing and internalizing symptoms, we also examined how these different measures of reward related to these two constructs independently.

Puberty and reward

We first tested whether early pubertal timing (i.e., higher PDS scores, controlling for age), related to self-reported, behavioral, or neural signatures of reward sensitivity. Across both samples in females and males, early pubertal timing was associated with higher BIS/BAS reward responsiveness (BAS-RR) (Figure 2; Supplements A & B Model 2.1). When testing early pubertal timing and behavioral reward sensitivity (i.e., MID reaction time) we did not find robust evidence of an association (Supplements A & B Models 2.2 & 2.19). When testing early pubertal timing and neural reward-related activity, we found a robust positive association between early pubertal timing and medial OFC activity during anticipation for males in Samples 1 and 2 (Supplements A & B Model 2.9). Conversely, early pubertal timing was negatively associated with putamen activity during reward anticipation for females in Sample 1 ($b=-.08$, $SE=.03$, $t=-2.8$, $p=.01$), medial OFC activity during reward anticipation for females in Sample 2 ($b=-.05$, $SE=.02$, $t=-2.51$, $p=.01$) and caudate activity during reward feedback in males ($b=-.08$, $SE=.04$, $t=-2.14$, $p=.03$).

However, these effects did not replicate in Sample 2. In separate models, we also tested whether testosterone levels, controlling for age, were associated with reward sensitivity. Testosterone was not robustly associated with self-report, behavioral, or neural reward sensitivity across both samples. While there was a positive association between testosterone and lateral OFC feedback for females in Sample 2 ($b=.03$, $SE=.01$, $t=2.10$, $p=.036$), this finding was not evident in Sample 1 or in males. There was also a positive association between testosterone and both caudate and putamen feedback for females in Sample 1 (Supplement A Models 2.14-2.15), but this finding was not evident in Sample 2, or in males.

Figure 2. Early pubertal timing, indicated by higher PDS scores while controlling for age, is associated with higher BAS-RR scores across samples. (For the full range of values, see Table 1.) Females are plotted in purple and males are plotted in green. Lighter colors indicate Sample 1 and darker colors indicate Sample 2.

Reward and internalizing symptoms

We did not observe any robust evidence for an association between self-report, behavioral, or neural measures of reward and internalizing symptoms (Supplements A & B Section 3). Although NAcc activity during reward feedback was positively associated with internalizing symptoms in Sample 1 males ($b=.33$, $SE=.16$, $t=2.00$, $p=.046$), this effect did not replicate in Sample 2 (Supplements A & B Model 3.4). There were no other effects of reward on internalizing symptoms in non-interaction models. However, in the interaction models when pubertal timing was also included, we observed non-robust evidence of an association between heightened reward sensitivity and greater internalizing symptoms across three domains of reward: greater self-reported BAS-RR (Sample 2 females; $b=.22$, $SE=.11$, $t=2.09$, $p=.037$), faster reaction time on large reward compared to neutral trials (Sample 2 males; $b=0.76$, $SE=0.32$, $t=2.37$, $p=.018$), and greater putamen activity during reward anticipation (Sample 1 males; $b=.69$, $SE=.35$, $t=1.97$, $p=.049$). However, none of these results replicated across samples.

Reward as a Moderator

Self-reported reward sensitivity. We found evidence for a moderating role of self-reported reward sensitivity (BAS-RR) in females in Sample 2, such that the association between pubertal timing and internalizing symptoms was heightened in females with lower BAS-RR and attenuated in females with higher BAS-RR ($b = -.15$, $SE = .06$, $t = -2.48$, $p = .013$; Figure 3A). However, this finding was not evident for females in Sample 1 ($b = -.11$, $SE = .06$, $t = -1.80$, $p = .07$). Conversely for males, and in contrast to our hypothesis, the positive association between early pubertal timing and internalizing symptoms was heightened in males with higher BAS-RR in Sample 1 ($b = .19$, $SE = .08$, $t = 2.25$, $p = .02$), (Figure 3B). This finding did not replicate in Sample 2. We next tested the interaction between testosterone and BAS-RR, but did not observe any moderation effects on internalizing symptoms (Supplements A & B Model 4.24).

(A)

(B)

Figure 3. The association between early pubertal timing and heightened internalizing symptoms was heightened in females with lower BAS-RR and attenuated in Sample 2 females with higher BAS-RR (A). The opposite effect was observed in sample 1 males (B). Two-dash line represents relatively low BAS-RR score (z-score = -2), solid line represents mean BAS-RR score (z-score = 0), and dotted line represents relatively high BAS-RR score (z-score = 2). Predicted lines are from models that adjust for age, race, and ethnicity.

Behavioral reward sensitivity. We next tested whether behavioral reward sensitivity (i.e., reaction time differences on large rewards versus neutral and small reward trials on the MID task) moderated the association between pubertal timing and internalizing symptoms. As hypothesized, early pubertal timing was associated with higher internalizing symptoms in Sample 1 males who evidenced lower behavioral reward sensitivity (i.e., more similar reaction times for large reward and neutral trials ($b = -.63$, $SE = .22$, $t = -2.82$, $p < .01$; Figure 4)). This finding was not evident in Sample 1 males or in females in either sample. We also tested behavioral reward sensitivity on large reward trials as compared to small reward trials, but did not observe any interaction effect with pubertal timing on internalizing symptoms for females or males in either sample (Supplements A & B Models 4.12-4.13). Additionally, we tested the interaction between behavioral reward sensitivity and testosterone, but did not observe an interaction effect on internalizing symptoms in males or females in either sample (Supplements A & B Models 4.25-4.26).

Figure 4. The association between early pubertal timing and heightened internalizing symptoms was heightened in Sample 2 males who evidenced lower behavioral reward sensitivity (i.e., relatively small differences in reaction time for large reward vs. neutral trials on the MID task) and attenuated in those with higher behavioral reward sensitivity. Two-dash line represents relatively low difference in reaction time for large reward vs. neutral trials (z -score = -2), solid line represents mean difference in reaction time for large reward vs. neutral trials (z -score = 0), and dotted line represents relatively high difference in reaction time for large reward vs. neutral trials (z -score = 2). Predicted lines are from models that adjust for age, race, and ethnicity.

Neural reward sensitivity: Anticipation stage. We next tested whether activity in striatal subregions of interest (i.e., NAcc, caudate, and putamen), along with the medial and lateral OFC, during reward anticipation moderated the association between early pubertal timing and internalizing symptoms (Supplements A & B Section 4). As hypothesized, the positive association between PDS and internalizing symptoms was strengthened with attenuated caudate activity during reward anticipation for females in Sample 2 ($b = -.44$, $SE = .18$, $t = -2.42$, $p = .016$; Figure 5A). This finding did not replicate in Sample 1. Although when modeled in a non-interaction model, testosterone was not associated with internalizing symptoms in either sample (Supplements A & B Models 1.9-1.12), when tested as an interaction, testosterone was positively associated with internalizing symptoms in Sample 2 females who evidence attenuated NAcc activity during reward anticipation ($b = -.03$, $SE = .01$, $t = -2.65$, $p < .01$; Figure 6). ($b = -.03$, $SE = .01$, $t = -2.65$, $p < .01$; Figure 6). As hypothesized, the association between early pubertal timing and internalizing was heightened in Sample 1 males who evidenced lower putamen activity during reward anticipation ($b = -.64$, $SE = .24$, $t = -2.62$, $p = .01$; Figure 5B). This finding did not replicate in Sample 2. We did not observe any moderating role of neural reward activity in the association of testosterone and internalizing symptoms for males in either sample (Supplements A & B Models 4.14-4.23). Medial and

lateral OFC activity during reward anticipation did not play a moderating role for males or females in either sample (Supplements A & B Models 4.20-4.23).

Neural reward sensitivity: Feedback stage. We next tested whether activity in any of the five ROIs during reward feedback moderated the association between early pubertal timing and internalizing symptoms (Supplements A & B Section 4). We found no evidence for a moderating role of neural activity in any of the ROIs during the feedback stage in either sample of females or males.

(A)

(B)

Figure 5. (A) The association between early pubertal timing and heightened internalizing symptoms was heightened in Sample 2 females who evidenced relatively low caudate activation (i.e., low reward

sensitivity) during reward anticipation and attenuated in those with greater caudate activation (i.e., higher reward sensitivity). (B) Similarly, in Sample 1 males, the association was attenuated in individuals who exhibited relatively low putamen activation during reward anticipation and attenuated in those with greater putamen activation during reward anticipation. Two-dash line represents relatively low activation during reward anticipation (z-score = -2), solid line represents mean activation during reward anticipation (z-score = 0), and dotted line represents relatively high activation during reward anticipation (z-score = 2). Predicted lines are from models that adjust for age, race, and ethnicity.

Figure 6. When tested as an interaction, testosterone was positively associated with internalizing symptoms for females in Sample 2 who evidence attenuated NAcc activity during reward anticipation. Two-dash line represents relatively low activation during reward anticipation (z-score = -2), solid line represents mean activation during reward anticipation (z-score = 0), and dotted line represents relatively high activation during reward anticipation (z-score = 2). Predicted lines are from models that adjust for age, race, and ethnicity.

Discussion

We examined associations among pubertal timing, reward sensitivity, and internalizing symptoms in early adolescents from the ABCD Study, leveraging split-half analyses to test the robustness of observed effects across two halves of the data. By studying these associations during the transition to puberty, we captured a window of potential early vulnerability for internalizing symptoms (McGuire et al., 2019). To our knowledge, the relationship between pubertal timing and internalizing symptoms, and the role of reward sensitivity, has yet to be examined in a population-based sample of 9-and 10-year-olds. Overall, we found robust support for differences in internalizing symptoms by pubertal timing even at early stages of the

transition into puberty for males and females, with non-robust differential associations with reward processes.

Pubertal Timing and Internalizing Symptoms

In line with our hypothesis, we found that females and males with early pubertal timing, indicated by greater PDS scores relative to age-matched peers, exhibited higher internalizing symptoms on average. This finding extends existing work by showcasing the association between early pubertal timing and internalizing symptoms during the early years of pubertal development. Notably, early pubertal timing was further associated with higher Anxious-Depressed, higher Withdrawn-Depressed, and higher DSM-5 Depressed subscales of the CBCL in females and males across samples, suggesting that early pubertal timing may be a transdiagnostic risk for internalizing symptoms characteristic of both depression and anxiety as early as 9-10 years of age. Further, robust associations between pubertal timing and internalizing symptoms were only evident when pubertal timing was based on perceived pubertal development, which captures observable physical changes associated with puberty, and not when it was based on testosterone levels. The physical changes that are perceived by others may be particularly relevant when considering potential psychosocial factors that heighten risk for psychopathology during puberty, such as differential treatment or assumptions made about one's social and cognitive maturity based on observable physical changes (Barendse et al., in press; Pfeifer & Allen, 2021; Rudolph, 2014). A similar pattern of results has been found in previous research demonstrating that the association between early pubertal timing and internalizing symptoms may be, in part, associated with psychosocial, rather than hormonal, processes, at least in the early stages of pubertal development (Barendse et al., in press).

Across samples, internalizing symptoms were highest in females progressing through mid-puberty and in males progressing through early and mid-puberty. This finding aligns with prior work demonstrating that the highest risk for internalizing in females is experienced by those farthest along in puberty relative to peers during early adolescence (McGuire et al., 2019). Future work in samples with a greater number of adolescents in late stages of puberty is needed in order to determine whether these effects are indeed specific to early and middle stages of puberty. Together, these findings provide empirical support for theoretical models positing that puberty presents a window of vulnerability and opportunity, during which a milieu of developmental processes shape future health outcomes (Dorn et al., 2019; Piekarski et al., 2017).

The Role of Reward Processes in the Association between Pubertal Timing and Internalizing Symptoms

Given that pubertal development parallels changes within neural circuits subserving reward seeking and reward valuation (Ho et al., 2021) — key circuits linked to risk for adolescent internalizing symptoms (Davey et al., 2008; Forbes, 2011; Luking et al., 2016) — we tested whether self-reported, behavioral, or neural signatures of reward sensitivity moderated the association between early pubertal timing and internalizing symptoms. We hypothesized that, across domains, greater reward sensitivity would attenuate the association between early pubertal timing and internalizing symptoms.

Self-Reported Reward Sensitivity. Across both samples for females and males, early pubertal timing was associated with higher self-reported reward sensitivity. This finding extends prior research demonstrating age-related increases in self-reported reward sensitivity across adolescence (Urošević, 2012). Moreover, as hypothesized, the association between early pubertal timing and internalizing symptoms was attenuated in females (Sample 2 only) with greater self-reported reward sensitivity. This aligns with prior work suggesting that reward responsiveness, as indicated by the BAS-RR subscale, may play a uniquely protective role against internalizing symptoms (Taubitz et al., 2015). However, we observed

an opposite effect in males (Sample 1 only), such that the association between early pubertal timing and internalizing symptoms was heightened in males with greater self-reported reward sensitivity. This difference between females and males may indicate etiological differences in how the association between pubertal timing and internalizing symptoms unfolds (Hoyt et al., 2020; Mendle et al., 2010). Although we observed moderating effects of self-reported reward sensitivity, which differed by sex, neither of these findings replicated across samples. We therefore caution against strong interpretations of these non-robust associations. Nonetheless, it is notable that the BAS-RR subscale is the only adolescent self-report measure used in the study. As such, the use of multiple informants across variables in the study — given the use of parent-reported PDS and internalizing symptoms — renders the moderating effect of self-reported reward sensitivity compelling.

Behavioral Reward Sensitivity. In our analysis of behavioral reward sensitivity in the MID task, we observed additional evidence that reward sensitivity moderates risk for internalizing symptoms in early maturing adolescents. Specifically, the association between early pubertal timing and internalizing symptoms was heightened for males in Sample 2 with lower behavioral reward sensitivity, or smaller differences in reaction time for high reward versus neutral trials. However, this finding did not replicate for males in Sample 1 and was not observed in females. Notably, this contrasts the observed effect of self-reported reward sensitivity observed in Sample 2 males, wherein the association was heightened in those with greater self-reported reward sensitivity. The opposing direction of these two effects could reflect differences in the underlying reward construct being measured by self-report versus task performance. However, because neither of these effects replicated across samples, it is difficult to determine the extent to which self-reported versus task-based measures of reward sensitivity play an underlying role in risk for internalizing symptoms in early maturing males.

Neural Reward Sensitivity. Based on research linking activity within striatal and orbitofrontal regions to reward processing in adolescence (Hulst et al., 2015; Op de Macks et al., 2011; Silverman et al., 2015b) and internalizing symptoms (Downar, 2019; Forbes et al., 2009; Rolls, 2019), we tested whether activation during reward anticipation and reward feedback within these regions moderated risk for internalizing symptoms. As with self-reported and behavioral signatures of reward sensitivity, while we observed some interaction effects in the neural-based analyses, none of the effects replicated. Notably, although we found evidence of a moderating role of caudate and NAcc activity — both in the hypothesized direction — these effects were only evident in females in Sample 2 and were specific to the reward anticipation, as opposed to feedback, stage of the task. Specifically, lower caudate activity during reward anticipation heightened the association between early pubertal timing and internalizing symptoms. Similarly in this sample, females with high testosterone levels (relative to age-matched peers) and lower NAcc activity during reward anticipation evidenced heightened internalizing symptoms. Together, these findings lend support to the hypothesis that attenuated activity in response to rewards in the striatum may be a risk factor for developing internalizing symptoms (Forbes, 2020), particularly in youth who are already at risk due to early pubertal timing. Differences in neural activity during reward anticipation may therefore be an earlier indication of vulnerability in females. The role of neural reward circuitry in pubertal-related risk for internalizing is an important avenue for future longitudinal work to investigate, particularly as these systems undergo changes across later stages of adolescence (Galván, 2013a).

Together, we observed evidence of a potential role of self-report, behavioral, and neural reward sensitivity in the association between pubertal timing and internalizing symptoms. Further, observed moderation effects were largely consistent with our hypotheses, such that risk was heightened in adolescents with lower reward sensitivity across these three domains of measurement. There are several potential

reasons why the observed moderation effects of reward did not replicate across samples in the current study. Notably, reward sensitivity has been shown to peak later than the age of the current sample, between the ages of 14 to 15 (Galván, 2013b), suggesting that potential moderating effects may not emerge until later in the development of the reward system. In addition, it is likely that risk for internalizing during this stage of development is associated with an array of other factors that are not reflected in our reward sensitivity measures.

Strengths & Limitations

The large sample size, diversity, and narrow age range of the ABCD cohort render this a highly unique sample from which to test potential moderators of early pubertal timing and the risk for internalizing symptoms. By focusing on a sample of 9-10 year-olds, the current study captures the transition into puberty, a developmental period posited to be particularly salient in regard to mental health risk (Costello et al., 2011; McGuire et al., 2019; Pfeifer & Allen, 2021). Additionally, this study leveraged adolescent and parental reports in assessing perceived pubertal development, reward sensitivity, and internalizing symptoms, which contributes to the translational value of the findings. Moreover, by including three separate measurements of reward across levels of analysis (i.e., self-report, behavioral, neural), this study reflects potential heterogeneity in reward processing and its potential role in the association between pubertal timing and internalizing symptoms.

This study has several limitations to note. A limitation of this study was the use of a binary sex variable (i.e., male or female) rather than a more comprehensive and inclusive measure of sex identity. Sex identity may be particularly relevant to the psychosocial effects of early pubertal timing. Fortunately, more dimensional measures of sex identity will be incorporated in future waves of the ABCD Study, offering opportunities for future work in this area (Barch et al., 2018). Additionally, future work should further investigate how the observed associations differ by race and ethnicity (Deardorff et al., 2021; Hayward et al., 1999), which were included in our models but not tested as moderators. Another limitation is that, given the cross-sectional nature of this study, we cannot make inferences about the effects of within-individual developmental processes. Thus, observed associations should be tested for replication in future releases of ABCD data that will have at least three waves of all measures in order to test how these processes unfold within individuals over time. In addition, while the CBCL is a comprehensive and normed measure of internalizing symptoms, it relies on the parent's perspective. As such, future longitudinal work should also integrate self-report as adolescents mature (Barch et al., 2018). Given the relatively narrow age range of the sample, it is difficult to differentiate potentially distinct effects of pubertal stage from timing on risk for internalizing symptoms (i.e., it is possible that risk for internalizing symptoms is heightened when an individual transitions into puberty, regardless of age). Nonetheless, given that participants in this sample were only 9 to 10 years of age, advanced pubertal maturation at this young age is likely indicative of early pubertal timing. An additional avenue for future research using these longitudinal data will be to disentangle the effects of pubertal timing from pubertal tempo, or the rate at which an individual is developing through pubertal stages, which we were unable to do in the current study. While future longitudinal research in ABCD can attempt to address tempo, the differential effects of the rate of pubertal change may occur at faster rates than that by which data are collected (Vijayakumar et al., 2018). Nonetheless, the longitudinal nature of the ABCD study offers exciting opportunities to examine these dynamic processes over time and to further elucidate the unique effects of pubertal stage, timing, and tempo on mental health within this population-based sample of youth.

Conclusion

Our findings support the conclusion that early pubertal timing increases vulnerability for internalizing symptoms as well as self-reported reward sensitivity in females and males 9 to 10 years of age. Further research on the potential moderating role of reward sensitivity in vulnerability for internalizing symptoms is warranted. A greater understanding of individual differences in vulnerability to internalizing symptoms during the transition to puberty has important implications for early identification, prevention, and intervention efforts to improve adolescent mental health.

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Author contributions

EAM: Methodology, Formal Analysis, Visualization, Writing (original draft preparation). NMSH: Methodology, Formal Analysis, Visualization, Writing (original draft preparation). KLM: Supervision, Writing (review & editing). RED: Supervision. LMW: Supervision, Conceptualization, Methodology, Formal Analysis, Writing (review & editing).

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Supplement A

Reward sensitivity and internalizing symptoms during the transition to puberty: An examination of 9- and 10-year-olds in the ABCD Study

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Results for Sample 1

1—Int~Puberty—

1.1 Model: CBCL internalizing factor ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + race.ethnicity.5level +
```

```
##      interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.364047   1.858610   1.810 0.070413 .
## PDS_score         0.599362   0.157687   3.801 0.000147 ***
## race.ethnicity.5levelBlack 0.135086   0.792591   0.170 0.864681
## race.ethnicity.5levelMixed 1.837143   0.789510   2.327 0.020044 *
## race.ethnicity.5levelOther 2.439633   0.901292   2.707 0.006837 **
## race.ethnicity.5levelWhite 1.354995   0.742020   1.826 0.067950 .
## interview_age     -0.005834   0.014591  -0.400 0.689307
## demo_race_hispanic1 0.216061   0.316107   0.684 0.494348
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0121
## lmer.REML = 16403 Scale est. = 13.201    n = 2640
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + race.ethnicity.5level +
##      interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.2809201   1.7753641   1.285 0.19898
## PDS_score         0.8365766   0.1977954   4.230 2.42e-05 ***
## race.ethnicity.5levelBlack 1.3712129   0.7410409   1.850 0.06436 .
## race.ethnicity.5levelMixed 2.0935551   0.7424989   2.820 0.00484 **
## race.ethnicity.5levelOther 1.9518383   0.8504461   2.295 0.02180 *
## race.ethnicity.5levelWhite 1.5430121   0.6950591   2.220 0.02650 *
## interview_age     -0.0002827   0.0139368  -0.020 0.98382
## demo_race_hispanic1 0.2406567   0.2999262   0.802 0.42240
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00686
## lmer.REML = 17796 Scale est. = 15.403    n = 2863
```

1.2 Model: CBCL Anxious-Depressed ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
```

```
## cbcl_scr_syn_anxdep_r ~ PDS_score + race.ethnicity.5level + interview_age +
##   demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.738267    1.046826   1.661  0.0969 .
## PDS_score         0.192989    0.088633   2.177  0.0295 *
## race.ethnicity.5levelBlack  0.034518    0.442769   0.078  0.9379
## race.ethnicity.5levelMixed  0.899818    0.441294   2.039  0.0415 *
## race.ethnicity.5levelOther  0.960117    0.504377   1.904  0.0571 .
## race.ethnicity.5levelWhite  0.798545    0.414637   1.926  0.0542 .
## interview_age     -0.002110    0.008232  -0.256  0.7977
## demo_race_hispanic1    0.024025    0.176180   0.136  0.8915
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00724
## lmer.REML = 13376 Scale est. = 4.9862    n = 2640
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ PDS_score + race.ethnicity.5level + interview_age +
##   demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.330887    0.992219   1.341 0.179922
## PDS_score         0.417375    0.110221   3.787 0.000156 ***
## race.ethnicity.5levelBlack  0.617362    0.412907   1.495 0.134983
## race.ethnicity.5levelMixed  1.145515    0.414049   2.767 0.005701 **
## race.ethnicity.5levelOther  1.105289    0.473273   2.335 0.019591 *
## race.ethnicity.5levelWhite  1.049243    0.387670   2.707 0.006839 **
## interview_age     -0.003445    0.007791  -0.442 0.658426
## demo_race_hispanic1    0.095636    0.165991   0.576 0.564557
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00662
## lmer.REML = 14478 Scale est. = 6.4889    n = 2863
```

1.3 Model: CBCL Withdrawn-Depressed ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
```

```
## Formula:
## cbcl_scr_syn_withdep_r ~ PDS_score + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.560842   0.544323   1.030   0.3029
## PDS_score       0.192902   0.046013   4.192 2.85e-05 ***
## race.ethnicity.5levelBlack 0.185794   0.228387   0.814   0.4160
## race.ethnicity.5levelMixed 0.401589   0.227843   1.763   0.0781 .
## race.ethnicity.5levelOther 0.569861   0.260772   2.185   0.0290 *
## race.ethnicity.5levelWhite 0.218364   0.213975   1.021   0.3076
## interview_age   -0.002093   0.004288  -0.488   0.6254
## demo_race_hispanic1 0.175618   0.090490   1.941   0.0524 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0126
## lmer.REML = 9937.2  Scale est. = 1.6344    n = 2640
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ PDS_score + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.4374992  0.5584173   0.783  0.43342
## PDS_score       0.1834951  0.0623571   2.943  0.00328 **
## race.ethnicity.5levelBlack 0.5724725  0.2315140   2.473  0.01347 *
## race.ethnicity.5levelMixed 0.6113634  0.2333716   2.620  0.00885 **
## race.ethnicity.5levelOther 0.4633966  0.2670815   1.735  0.08284 .
## race.ethnicity.5levelWhite 0.3815731  0.2174408   1.755  0.07939 .
## interview_age   -0.0003452  0.0043968  -0.079  0.93743
## demo_race_hispanic1 0.0289864  0.0888073   0.326  0.74415
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00609
## lmer.REML = 11239  Scale est. = 2.0316    n = 2863
```

1.4 Model: CBCL Depressed DSM-5 ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
```

```
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ PDS_score + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.500757   0.632217   0.792 0.428394
## PDS_score      0.191889   0.053684   3.574 0.000357 ***
## race.ethnicity.5levelBlack 0.220848   0.266590   0.828 0.407508
## race.ethnicity.5levelMixed 0.677402   0.266390   2.543 0.011051 *
## race.ethnicity.5levelOther 0.837469   0.304982   2.746 0.006075 **
## race.ethnicity.5levelWhite 0.519547   0.249759   2.080 0.037604 *
## interview_age  -0.001794   0.004979  -0.360 0.718640
## demo_race_hispanic1 0.107590   0.104881   1.026 0.305064
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0102
## lmer.REML = 10738 Scale est. = 1.7625    n = 2640
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ PDS_score + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.492148   0.681833   0.722 0.47048
## PDS_score      0.224419   0.075947   2.955 0.00315 **
## race.ethnicity.5levelBlack 0.494325   0.283505   1.744 0.08133 .
## race.ethnicity.5levelMixed 0.666470   0.284770   2.340 0.01933 *
## race.ethnicity.5levelOther 0.585783   0.325805   1.798 0.07229 .
## race.ethnicity.5levelWhite 0.503771   0.266178   1.893 0.05851 .
## interview_age   0.000558   0.005360   0.104 0.91709
## demo_race_hispanic1 -0.046977   0.112531  -0.417 0.67637
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00221
## lmer.REML = 12347 Scale est. = 2.8477    n = 2863
```

1.5 Model: CBCL internalizing factor ~ Pubertal category

Females

```
##
## Family: gaussian
```

```
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.19492    1.89422   2.215 0.026873 *
## pds_p_ss_categoryEarly  1.04585    0.28906   3.618 0.000302 ***
## pds_p_ss_categoryLate   1.70710    0.71494   2.388 0.017023 *
## pds_p_ss_categoryMid    1.20889    0.27421   4.409 1.08e-05 ***
## race.ethnicity.5levelBlack 0.19295    0.79221   0.244 0.807589
## race.ethnicity.5levelMixed 1.90499    0.78883   2.415 0.015805 *
## race.ethnicity.5levelOther 2.49651    0.89969   2.775 0.005562 **
## race.ethnicity.5levelWhite 1.42253    0.74138   1.919 0.055123 .
## interview_age        -0.01158    0.01481  -0.782 0.434254
## demo_race_hispanic1    0.14868    0.31697   0.469 0.639063
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0143
## lmer.REML = 16394 Scale est. = 13.028    n = 2640
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.790351    1.791324   1.558 0.11941
## pds_p_ss_categoryEarly  0.692142    0.246778   2.805 0.00507 **
## pds_p_ss_categoryLate   0.399464    1.458693   0.274 0.78422
## pds_p_ss_categoryMid    1.178074    0.494928   2.380 0.01736 *
## race.ethnicity.5levelBlack 1.452171    0.742233   1.956 0.05051 .
## race.ethnicity.5levelMixed 2.137389    0.743411   2.875 0.00407 **
## race.ethnicity.5levelOther 1.994357    0.851793   2.341 0.01928 *
## race.ethnicity.5levelWhite 1.580709    0.695941   2.271 0.02320 *
## interview_age        0.002656    0.013927   0.191 0.84879
## demo_race_hispanic1    0.222230    0.301085   0.738 0.46052
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00485
## lmer.REML = 17799 Scale est. = 15.679    n = 2863
```

1.6 Model: CBCL Anxious-Depressed ~ Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.915933   1.067993   1.794  0.07293 .
## pds_p_ss_categoryEarly  0.483184   0.163247   2.960  0.00311 **
## pds_p_ss_categoryLate   0.412744   0.403926   1.022  0.30696
## pds_p_ss_categoryMid    0.404799   0.154202   2.625  0.00871 **
## race.ethnicity.5levelBlack 0.084441   0.442742   0.191  0.84876
## race.ethnicity.5levelMixed 0.937872   0.441088   2.126  0.03357 *
## race.ethnicity.5levelOther 0.990706   0.503685   1.967  0.04930 *
## race.ethnicity.5levelWhite 0.830010   0.414449   2.003  0.04531 *
## interview_age        -0.003648   0.008362  -0.436  0.66271
## demo_race_hispanic1    0.006521   0.176760   0.037  0.97058
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00866
## lmer.REML = 13371 Scale est. = 4.9568    n = 2640
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.614082   1.000348   1.614  0.10674
## pds_p_ss_categoryEarly  0.439962   0.137774   3.193  0.00142 **
## pds_p_ss_categoryLate   0.348194   0.816709   0.426  0.66989
## pds_p_ss_categoryMid    0.435000   0.275220   1.581  0.11409
## race.ethnicity.5levelBlack 0.657875   0.413354   1.592  0.11160
## race.ethnicity.5levelMixed 1.172391   0.414333   2.830  0.00469 **
## race.ethnicity.5levelOther 1.138695   0.473780   2.403  0.01631 *
## race.ethnicity.5levelWhite 1.070465   0.387972   2.759  0.00583 **
## interview_age        -0.002383   0.007777  -0.306  0.75929
## demo_race_hispanic1    0.085058   0.166620   0.510  0.60975
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



```
##
##
## R-sq.(adj) = 0.00522
## lmer.REML = 14480 Scale est. = 6.5751 n = 2863
```

1.7 Model: CBCL Withdrawn-Depressed ~ Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.983908   0.554434   1.775  0.07608 .
## pds_p_ss_categoryEarly 0.254666   0.084977   2.997  0.00275 **
## pds_p_ss_categoryLate  0.905884   0.210356   4.306  1.72e-05 ***
## pds_p_ss_categoryMid   0.374417   0.079913   4.685  2.94e-06 ***
## race.ethnicity.5levelBlack 0.180349   0.227835   0.792  0.42868
## race.ethnicity.5levelMixed 0.414586   0.227277   1.824  0.06824 .
## race.ethnicity.5levelOther 0.568592   0.259949   2.187  0.02881 *
## race.ethnicity.5levelWhite 0.236442   0.213381   1.108  0.26793
## interview_age      -0.005017   0.004349  -1.154  0.24877
## demo_race_hispanic1  0.140478   0.090445   1.553  0.12050
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0172
## lmer.REML = 9927 Scale est. = 1.6132 n = 2640
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.5565464   0.5628504   0.989  0.32284
## pds_p_ss_categoryEarly 0.1336213   0.0780413   1.712  0.08697 .
## pds_p_ss_categoryLate  0.0223448   0.4634322   0.048  0.96155
## pds_p_ss_categoryMid   0.3988227   0.1560753   2.555  0.01066 *
## race.ethnicity.5levelBlack 0.5787781   0.2317015   2.498  0.01255 *
## race.ethnicity.5levelMixed 0.6172272   0.2334494   2.644  0.00824 **
## race.ethnicity.5levelOther 0.4623218   0.2672974   1.730  0.08381 .
```

```
## race.ethnicity.5levelWhite 0.3887382 0.2175459 1.787 0.07406 .
## interview_age 0.0002541 0.0043870 0.058 0.95382
## demo_race_hispanic1 0.0215693 0.0892130 0.242 0.80897
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00556
## lmer.REML = 11240 Scale est. = 2.0434 n = 2863
```

1.8 Model: CBCL Depressed DSM-5 ~ Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.861575   0.644696   1.336 0.18153
## pds_p_ss_categoryEarly 0.256133   0.098889   2.590 0.00965 **
## pds_p_ss_categoryLate 0.731980   0.244492   2.994 0.00278 **
## pds_p_ss_categoryMid 0.380329   0.093369   4.073 4.77e-05 ***
## race.ethnicity.5levelBlack 0.216245   0.266521   0.811 0.41723
## race.ethnicity.5levelMixed 0.687983   0.266189   2.585 0.00980 **
## race.ethnicity.5levelOther 0.840944   0.304487   2.762 0.00579 **
## race.ethnicity.5levelWhite 0.535046   0.249565   2.144 0.03213 *
## interview_age   -0.004198   0.005054  -0.831 0.40625
## demo_race_hispanic1 0.079854   0.105192   0.759 0.44785
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0122
## lmer.REML = 10734 Scale est. = 1.7498 n = 2640
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.6734292 0.6869407   0.980 0.3270
## pds_p_ss_categoryEarly 0.2219863 0.0948566   2.340 0.0193 *
```

```
## pds_p_ss_categoryLate      -0.0676606  0.5620808  -0.120  0.9042
## pds_p_ss_categoryMid       0.4770340  0.1897216   2.514  0.0120 *
## race.ethnicity.5levelBlack  0.4945426  0.2836059   1.744  0.0813 .
## race.ethnicity.5levelMixed  0.6740106  0.2847557   2.367  0.0180 *
## race.ethnicity.5levelOther  0.5872294  0.3259433   1.802  0.0717 .
## race.ethnicity.5levelWhite  0.5138833  0.2661769   1.931  0.0536 .
## interview_age              0.0008821  0.0053471   0.165  0.8690
## demo_race_hispanic1        -0.0588658  0.1128725  -0.522  0.6020
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00245
## lmer.REML = 12346  Scale est. = 2.8531    n = 2863
```

1.9 Model: CBCL internalizing factor ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.98935    1.92717   1.032  0.30205
## hormone_scr_ert_mean_z  0.11092    0.14103   0.787  0.43165
## race.ethnicity.5levelBlack  0.35281    0.79371   0.445  0.65671
## race.ethnicity.5levelMixed  1.82435    0.79375   2.298  0.02162 *
## race.ethnicity.5levelOther  2.64127    0.90874   2.907  0.00369 **
## race.ethnicity.5levelWhite  1.43759    0.74505   1.930  0.05378 .
## interview_age    0.01330    0.01488   0.894  0.37145
## demo_race_hispanic1  0.11174    0.32610   0.343  0.73189
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00669
## lmer.REML = 15262  Scale est. = 12.986    n = 2455
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
```

```
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.288704    1.886421   1.213  0.22514
## hormone_scr_ert_mean_z  0.042062    0.145369   0.289  0.77234
## race.ethnicity.5levelBlack 1.730202    0.770231   2.246  0.02476 *
## race.ethnicity.5levelMixed 2.137600    0.772813   2.766  0.00571 **
## race.ethnicity.5levelOther 1.867855    0.890529   2.097  0.03605 *
## race.ethnicity.5levelWhite 1.586971    0.723139   2.195  0.02828 *
## interview_age      0.008748    0.014636   0.598  0.55009
## demo_race_hispanic1  0.361685    0.311735   1.160  0.24606
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.000816
## lmer.REML = 16637  Scale est. = 16.117    n = 2662
```

1.10 Model: CBCL Anxious-Depressed ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.356564    1.089604   1.245  0.2132
## hormone_scr_ert_mean_z  0.096447    0.079720   1.210  0.2265
## race.ethnicity.5levelBlack 0.032975    0.445097   0.074  0.9409
## race.ethnicity.5levelMixed 0.856813    0.445341   1.924  0.0545 .
## race.ethnicity.5levelOther 1.034197    0.510424   2.026  0.0429 *
## race.ethnicity.5levelWhite 0.849795    0.417979   2.033  0.0421 *
## interview_age      0.003515    0.008426   0.417  0.6766
## demo_race_hispanic1 -0.026234    0.182648  -0.144  0.8858
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00677
## lmer.REML = 12463  Scale est. = 4.9139    n = 2455
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
```

```
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.4506517   1.0531635   1.377  0.16850
## hormone_scr_ert_mean_z -0.0163616   0.0811269  -0.202  0.84018
## race.ethnicity.5levelBlack 0.8160606   0.4291215   1.902  0.05732 .
## race.ethnicity.5levelMixed 1.1553141   0.4310551   2.680  0.00740 **
## race.ethnicity.5levelOther 1.0693544   0.4955891   2.158  0.03104 *
## race.ethnicity.5levelWhite 1.0419610   0.4034186   2.583  0.00985 **
## interview_age      0.0002377   0.0081704   0.029  0.97679
## demo_race_hispanic1 0.1487317   0.1724590   0.862  0.38854
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00155
## lmer.REML = 13552  Scale est. = 6.9729    n = 2662
```

1.11 Model: CBCL Withdrawn-Depressed ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.188476   0.559617   0.337  0.7363
## hormone_scr_ert_mean_z 0.028288   0.040942   0.691  0.4897
## race.ethnicity.5levelBlack 0.276466   0.226294   1.222  0.2219
## race.ethnicity.5levelMixed 0.432674   0.226727   1.908  0.0565 .
## race.ethnicity.5levelOther 0.595452   0.260329   2.287  0.0223 *
## race.ethnicity.5levelWhite 0.253102   0.212688   1.190  0.2342
## interview_age      0.003404   0.004338   0.785  0.4327
## demo_race_hispanic1 0.144974   0.092467   1.568  0.1170
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00436
## lmer.REML = 9204.8  Scale est. = 1.6289    n = 2455
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
```

```
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.390499   0.584535   0.668  0.50416
## hormone_scr_ert_mean_z 0.032110   0.044736   0.718  0.47296
## race.ethnicity.5levelBlack 0.677569   0.236922   2.860  0.00427 **
## race.ethnicity.5levelMixed 0.653259   0.239425   2.728  0.00641 **
## race.ethnicity.5levelOther 0.451677   0.275602   1.639  0.10136
## race.ethnicity.5levelWhite 0.415233   0.222934   1.863  0.06263 .
## interview_age      0.001831   0.004546   0.403  0.68714
## demo_race_hispanic1 0.058716   0.090960   0.646  0.51865
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0036
## lmer.REML = 10467  Scale est. = 2.1906    n = 2662
```

1.12 Model: CBCL Depressed DSM-5 ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.126990   0.654459   0.194  0.84616
## hormone_scr_ert_mean_z 0.032777   0.047943   0.684  0.49425
## race.ethnicity.5levelBlack 0.288922   0.265880   1.087  0.27729
## race.ethnicity.5levelMixed 0.688931   0.267039   2.580  0.00994 **
## race.ethnicity.5levelOther 0.886017   0.306909   2.887  0.00392 **
## race.ethnicity.5levelWhite 0.551231   0.249945   2.205  0.02752 *
## interview_age      0.003798   0.005072   0.749  0.45402
## demo_race_hispanic1 0.067683   0.107691   0.628  0.52974
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00536
## lmer.REML = 9990.2  Scale est. = 1.7457    n = 2455
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
```

```
##      interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.484792   0.722624   0.671   0.5024
## hormone_scr_ert_mean_z 0.014469   0.055563   0.260   0.7946
## race.ethnicity.5levelBlack 0.593223   0.293932   2.018   0.0437 *
## race.ethnicity.5levelMixed 0.706967   0.295869   2.389   0.0169 *
## race.ethnicity.5levelOther 0.535419   0.340694   1.572   0.1162
## race.ethnicity.5levelWhite 0.514409   0.276302   1.862   0.0627 .
## interview_age      0.003136   0.005614   0.559   0.5764
## demo_race_hispanic1 -0.020224   0.116498  -0.174   0.8622
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = -0.000396
## lmer.REML = 11562 Scale est. = 2.8469    n = 2662
```

1.13 Model: CBCL internalizing factor ~ Testosterone + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + PDS_score +
##      race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.516389   1.928130   1.305 0.191984
## hormone_scr_ert_mean_z -0.011605   0.144809  -0.080 0.936130
## PDS_score          0.606502   0.169662   3.575 0.000357 ***
## race.ethnicity.5levelBlack -0.039791   0.799334  -0.050 0.960302
## race.ethnicity.5levelMixed 1.642126   0.793441   2.070 0.038592 *
## race.ethnicity.5levelOther 2.406230   0.908905   2.647 0.008164 **
## race.ethnicity.5levelWhite 1.345234   0.743649   1.809 0.070579 .
## interview_age      0.001635   0.015196   0.108 0.914321
## demo_race_hispanic1  0.099045   0.325274   0.304 0.760774
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.011
## lmer.REML = 15251 Scale est. = 12.934    n = 2455
```

Males

```
##
## Family: gaussian
## Link function: identity
##
```

```
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + PDS_score +
##     race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.354331   1.879856   1.252   0.2105
## hormone_scr_ert_mean_z -0.030295   0.145767  -0.208   0.8354
## PDS_score         0.946480   0.210791   4.490 7.42e-06 ***
## race.ethnicity.5levelBlack 1.361023   0.772027   1.763   0.0780 .
## race.ethnicity.5levelMixed 2.047911   0.770394   2.658   0.0079 **
## race.ethnicity.5levelOther 1.743224   0.887939   1.963   0.0497 *
## race.ethnicity.5levelWhite 1.549586   0.720716   2.150   0.0316 *
## interview_age     -0.001733   0.014772  -0.117   0.9066
## demo_race_hispanic1  0.280794   0.311400   0.902   0.3673
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00709
## lmer.REML = 16618 Scale est. = 15.845    n = 2662
```

1.14 Model: CBCL internalizing factor ~ Testosterone + Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##     race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.230046   1.957474   1.650 0.09905 .
## hormone_scr_ert_mean_z 0.009319   0.143430   0.065 0.94820
## pds_p_ss_categoryEarly 0.930597   0.298032   3.122 0.00181 **
## pds_p_ss_categoryLate 1.103831   0.773750   1.427 0.15382
## pds_p_ss_categoryMid  1.227407   0.288817   4.250 2.22e-05 ***
## race.ethnicity.5levelBlack 0.001752   0.799273   0.002 0.99825
## race.ethnicity.5levelMixed 1.690778   0.793001   2.132 0.03310 *
## race.ethnicity.5levelOther 2.475647   0.907556   2.728 0.00642 **
## race.ethnicity.5levelWhite 1.400154   0.743189   1.884 0.05969 .
## interview_age     -0.002717   0.015394  -0.176 0.85992
## demo_race_hispanic1  0.051251   0.326287   0.157 0.87520
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0124
## lmer.REML = 15243 Scale est. = 12.777    n = 2455
```


Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##   race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.0338221   1.8943098   1.602  0.10938
## hormone_scr_ert_mean_z 0.0001906   0.1456180   0.001  0.99896
## pds_p_ss_categoryEarly 0.8193234   0.2598210   3.153  0.00163 **
## pds_p_ss_categoryLate 0.8442856   1.5928930   0.530  0.59613
## pds_p_ss_categoryMid  1.2422686   0.5223302   2.378  0.01746 *
## race.ethnicity.5levelBlack 1.4368909   0.7737626   1.857  0.06342 .
## race.ethnicity.5levelMixed 2.0943552   0.7716685   2.714  0.00669 **
## race.ethnicity.5levelOther 1.8063668   0.8896852   2.030  0.04242 *
## race.ethnicity.5levelWhite 1.5950864   0.7218353   2.210  0.02721 *
## interview_age      0.0007330   0.0147796   0.050  0.96045
## demo_race_hispanic1 0.2526813   0.3127912   0.808  0.41926
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00472
## lmer.REML = 16621  Scale est. = 16.151    n = 2662
```

1.15 Model: CBCL Anxious-Depressed ~ Testosterone + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + PDS_score +
##   race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.5085714   1.0921893   1.381  0.1673
## hormone_scr_ert_mean_z 0.0604191   0.0820705   0.736  0.4617
## PDS_score       0.1757743   0.0959317   1.832  0.0670 .
## race.ethnicity.5levelBlack -0.0813774   0.4492013  -0.181  0.8563
## race.ethnicity.5levelMixed 0.8036564   0.4460337   1.802  0.0717 .
## race.ethnicity.5levelOther 0.9652041   0.5115285   1.887  0.0593 .
## race.ethnicity.5levelWhite 0.8226179   0.4179988   1.968  0.0492 *
## interview_age      0.0001454   0.0086195   0.017  0.9865
## demo_race_hispanic1 -0.0298528   0.1825416  -0.164  0.8701
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
##
## R-sq.(adj) = 0.00769
## lmer.REML = 12463 Scale est. = 4.9213 n = 2455
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + PDS_score +
##   race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.493694   1.050366   1.422  0.1551
## hormone_scr_ert_mean_z -0.053354   0.081421  -0.655  0.5123
## PDS_score       0.482040   0.117552   4.101 4.24e-05 ***
## race.ethnicity.5levelBlack 0.625500   0.430524   1.453  0.1464
## race.ethnicity.5levelMixed 1.107946   0.430019   2.577  0.0100 *
## race.ethnicity.5levelOther 1.006492   0.494473   2.035  0.0419 *
## race.ethnicity.5levelWhite 1.021452   0.402377   2.539  0.0112 *
## interview_age   -0.005176   0.008255  -0.627  0.5307
## demo_race_hispanic1 0.108151   0.172504   0.627  0.5307
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00678
## lmer.REML = 13538 Scale est. = 6.8744 n = 2662
```

1.16 Model: CBCL Anxious-Depressed ~ Testosterone + Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##   race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.641011   1.109420   1.479  0.13923
## hormone_scr_ert_mean_z 0.071923   0.081310   0.885  0.37649
## pds_p_ss_categoryEarly 0.455204   0.169054   2.693  0.00714 **
## pds_p_ss_categoryLate 0.101533   0.440028   0.231  0.81753
## pds_p_ss_categoryMid 0.401992   0.163236   2.463  0.01386 *
## race.ethnicity.5levelBlack -0.041493   0.449227  -0.092  0.92642
## race.ethnicity.5levelMixed 0.831790   0.445833   1.866  0.06220 .
## race.ethnicity.5levelOther 0.999392   0.510807   1.956  0.05052 .
```

```
## race.ethnicity.5levelWhite  0.848107    0.417800    2.030  0.04247 *
## interview_age              -0.001117    0.008738   -0.128  0.89827
## demo_race_hispanic1       -0.039209    0.183181   -0.214  0.83053
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0089
## lmer.REML = 12458  Scale est. = 4.8824    n = 2455
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##    race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.847072    1.057852   1.746 0.080917 .
## hormone_scr_ert_mean_z -0.036787    0.081305  -0.452 0.650977
## pds_p_ss_categoryEarly  0.483928    0.145225   3.332 0.000873 ***
## pds_p_ss_categoryLate   0.599782    0.894018   0.671 0.502353
## pds_p_ss_categoryMid    0.474670    0.290617   1.633 0.102521
## race.ethnicity.5levelBlack 0.673737    0.431316   1.562 0.118395
## race.ethnicity.5levelMixed 1.140006    0.430553   2.648 0.008150 **
## race.ethnicity.5levelOther 1.053088    0.495261   2.126 0.033568 *
## race.ethnicity.5levelWhite 1.050101    0.402860   2.607 0.009195 **
## interview_age        -0.004115    0.008252  -0.499 0.618098
## demo_race_hispanic1    0.094049    0.173295   0.543 0.587377
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00479
## lmer.REML = 13541  Scale est. = 6.9735    n = 2662
```

1.17 Model: CBCL Withdrawn-Depressed ~ Testosterone + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + PDS_score +
##    race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.453e-01  5.595e-01   0.617 0.537147
```

```
## hormone_scr_ert_mean_z      -9.991e-03  4.208e-02  -0.237  0.812332
## PDS_score                   1.825e-01  4.910e-02   3.717  0.000206 ***
## race.ethnicity.5levelBlack  1.588e-01  2.278e-01   0.697  0.485872
## race.ethnicity.5levelMixed  3.786e-01  2.265e-01   1.671  0.094838 .
## race.ethnicity.5levelOther  5.241e-01  2.603e-01   2.013  0.044202 *
## race.ethnicity.5levelWhite  2.258e-01  2.121e-01   1.064  0.287241
## interview_age               -8.579e-05  4.425e-03  -0.019  0.984533
## demo_race_hispanic1        1.397e-01  9.203e-02   1.518  0.129068
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00942
## lmer.REML = 9195.3  Scale est. = 1.6056    n = 2455
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + PDS_score +
##      race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.4126580  0.5835381   0.707  0.47953
## hormone_scr_ert_mean_z  0.0148393  0.0449711   0.330  0.74145
## PDS_score       0.2141085  0.0656348   3.262  0.00112 **
## race.ethnicity.5levelBlack  0.5867078  0.2381327   2.464  0.01381 *
## race.ethnicity.5levelMixed  0.6305339  0.2390971   2.637  0.00841 **
## race.ethnicity.5levelOther  0.4254271  0.2752322   1.546  0.12230
## race.ethnicity.5levelWhite  0.4066557  0.2225500   1.827  0.06777 .
## interview_age      -0.0005826  0.0045981  -0.127  0.89919
## demo_race_hispanic1  0.0383757  0.0910183   0.422  0.67333
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00703
## lmer.REML = 10460  Scale est. = 2.1766    n = 2662
```

1.18 Model: CBCL Withdrawn-Depressed ~ Testosterone + Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##      race.ethnicity.5level + interview_age + demo_race_hispanic
##
```

```
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.675084   0.568042   1.188  0.23478
## hormone_scr_ert_mean_z -0.009769   0.041665  -0.234  0.81464
## pds_p_ss_categoryEarly  0.224127   0.086839   2.581  0.00991 **
## pds_p_ss_categoryLate   0.687064   0.226587   3.032  0.00245 **
## pds_p_ss_categoryMid    0.353545   0.083446   4.237 2.35e-05 ***
## race.ethnicity.5levelBlack 0.155685   0.227556   0.684  0.49394
## race.ethnicity.5levelMixed 0.389760   0.226221   1.723  0.08503 .
## race.ethnicity.5levelOther 0.529425   0.259799   2.038  0.04168 *
## race.ethnicity.5levelWhite 0.240926   0.211748   1.138  0.25532
## interview_age        -0.002197   0.004484  -0.490  0.62424
## demo_race_hispanic1    0.113657   0.092119   1.234  0.21739
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0118
## lmer.REML = 9191.2  Scale est. = 1.5913    n = 2455
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##      race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      5.626e-01  5.873e-01   0.958  0.3382
## hormone_scr_ert_mean_z  2.007e-02  4.487e-02   0.447  0.6546
## pds_p_ss_categoryEarly  1.544e-01  8.119e-02   1.901  0.0574 .
## pds_p_ss_categoryLate   5.605e-02  5.007e-01   0.112  0.9109
## pds_p_ss_categoryMid    4.500e-01  1.626e-01   2.767  0.0057 **
## race.ethnicity.5levelBlack 5.899e-01  2.384e-01   2.474  0.0134 *
## race.ethnicity.5levelMixed 6.339e-01  2.392e-01   2.650  0.0081 **
## race.ethnicity.5levelOther 4.253e-01  2.755e-01   1.543  0.1228
## race.ethnicity.5levelWhite 4.130e-01  2.227e-01   1.855  0.0638 .
## interview_age        6.142e-05  4.593e-03   0.013  0.9893
## demo_race_hispanic1    2.913e-02  9.145e-02   0.319  0.7501
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00625
## lmer.REML = 10462  Scale est. = 2.1968    n = 2662
```

1.19 Model: CBCL Depressed DSM-5 ~ Testosterone + PDS

Females

```
##
```

```
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + PDS_score +
##     race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.2847402   0.6551781    0.435  0.66389
## hormone_scr_ert_mean_z -0.0043878   0.0492851   -0.089  0.92907
## PDS_score         0.1822921   0.0577433    3.157  0.00161 **
## race.ethnicity.5levelBlack 0.1673208   0.2681581    0.624  0.53271
## race.ethnicity.5levelMixed 0.6324275   0.2671364    2.367  0.01799 *
## race.ethnicity.5levelOther 0.8147984   0.3071627    2.653  0.00804 **
## race.ethnicity.5levelWhite 0.5222341   0.2496410    2.092  0.03655 *
## interview_age      0.0003155   0.0051817    0.061  0.95146
## demo_race_hispanic1  0.0636657   0.1074903    0.592  0.55371
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00871
## lmer.REML = 9984.2  Scale est. = 1.7421    n = 2455
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + PDS_score +
##     race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.5047512   0.7214946    0.700  0.48424
## hormone_scr_ert_mean_z -0.0060578   0.0558437   -0.108  0.91362
## PDS_score         0.2628445   0.0810019    3.245  0.00119 **
## race.ethnicity.5levelBlack 0.4870818   0.2953160    1.649  0.09919 .
## race.ethnicity.5levelMixed 0.6807554   0.2954991    2.304  0.02131 *
## race.ethnicity.5levelOther 0.5015710   0.3403008    1.474  0.14063
## race.ethnicity.5levelWhite 0.5035789   0.2759050    1.825  0.06808 .
## interview_age      0.0002189   0.0056777    0.039  0.96925
## demo_race_hispanic1 -0.0428367   0.1166713   -0.367  0.71353
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0025
## lmer.REML = 11554  Scale est. = 2.8294    n = 2662
```

1.20 Model: CBCL Depressed DSM-5 ~ Testosterone + Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##   race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.584728   0.665454   0.879   0.37966
## hormone_scr_ert_mean_z -0.003839   0.048826  -0.079   0.93733
## pds_p_ss_categoryEarly  0.221817   0.101911   2.177   0.02961 *
## pds_p_ss_categoryLate   0.484378   0.264889   1.829   0.06758 .
## pds_p_ss_categoryMid    0.387541   0.098255   3.944 8.23e-05 ***
## race.ethnicity.5levelBlack 0.152286   0.268220   0.568   0.57025
## race.ethnicity.5levelMixed 0.633976   0.267029   2.374   0.01766 *
## race.ethnicity.5levelOther 0.819772   0.306764   2.672   0.00758 **
## race.ethnicity.5levelWhite 0.531661   0.249522   2.131   0.03321 *
## interview_age        -0.001587   0.005251  -0.302   0.76251
## demo_race_hispanic1    0.044392   0.107867   0.412   0.68071
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0101
## lmer.REML =  9981  Scale est. = 1.7258    n = 2455
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##   race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.7268462  0.7259919   1.001   0.31683
## hormone_scr_ert_mean_z -0.0005143  0.0557023  -0.009   0.99263
## pds_p_ss_categoryEarly  0.2573965  0.0999176   2.576   0.01005 *
## pds_p_ss_categoryLate   0.0662398  0.6141321   0.108   0.91412
## pds_p_ss_categoryMid    0.5178059  0.2004361   2.583   0.00984 **
## race.ethnicity.5levelBlack 0.4839540  0.2955999   1.637   0.10171
## race.ethnicity.5levelMixed 0.6866470  0.2955955   2.323   0.02026 *
## race.ethnicity.5levelOther 0.5076279  0.3405749   1.491   0.13621
## race.ethnicity.5levelWhite 0.5144570  0.2759656   1.864   0.06240 .
## interview_age        0.0005560  0.0056712   0.098   0.92191
## demo_race_hispanic1   -0.0579582  0.1170954  -0.495   0.62067
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00241
## lmer.REML = 11554  Scale est. = 2.8215    n = 2662
```

2—Reward~Puberty—

2.1 Model: BIS-BAS-RR ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## bisbas_ss_basm_rr_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.395004   0.306222   1.290  0.19719
## PDS_score    0.074620   0.027064   2.757  0.00587 **
## interview_age -0.004768   0.002628  -1.814  0.06972 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00449
## lmer.REML = 7547.8  Scale est. = 0.75326    n = 2690
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## bisbas_ss_basm_rr_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.151113   0.289140   0.523  0.60127
## PDS_score    0.091019   0.033898   2.685  0.00729 **
## interview_age -0.001715   0.002449  -0.700  0.48382
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00282
## lmer.REML = 8064.5  Scale est. = 0.72377    n = 2913
```


2.2 Model : Reaction Time ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_neutral_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.571406   0.316653  -1.805   0.0713 .
## PDS_score    -0.020896   0.028544  -0.732   0.4642
## interview_age  0.005458   0.002729   2.000   0.0456 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00104
## lmer.REML = 5939.4  Scale est. = 0.67983    n = 2201
##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_small_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.347746   0.318216  -1.093   0.275
## PDS_score    -0.026961   0.028607  -0.942   0.346
## interview_age  0.003429   0.002742   1.250   0.211
##
##
## R-sq.(adj) =  0.000134
## lmer.REML = 5963.6  Scale est. = 0.77204    n = 2201
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_neutral_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.1377075  0.2925250   0.471   0.6379
## PDS_score    -0.0677145  0.0353646  -1.915   0.0556 .
## interview_age -0.0004923  0.0024809  -0.198   0.8427
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
##
## R-sq.(adj) = 0.00137
## lmer.REML = 5951.9 Scale est. = 0.66838 n = 2303

##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_small_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.0768858  0.2956580   0.260   0.795
## PDS_score    -0.0336578  0.0356573  -0.944   0.345
## interview_age -0.0002174  0.0025086  -0.087   0.931
##
##
## R-sq.(adj) = -0.000241
## lmer.REML = 6019.1 Scale est. = 0.7024 n = 2303
```

2.3 Model: Caudate Anticipation ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_rvsn_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.483420  0.318838  -1.516   0.1296
## PDS_score    -0.049471  0.028595  -1.730   0.0838 .
## interview_age 0.004869  0.002743   1.775   0.0760 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00193
## lmer.REML = 5350.3 Scale est. = 0.77536 n = 2044
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_rvsn_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
```

```
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.209124  0.340919  -0.613   0.540
## PDS_score   -0.003916  0.041426  -0.095   0.925
## interview_age 0.001764  0.002892   0.610   0.542
##
##
## R-sq.(adj) = -0.000702
## lmer.REML = 5743.7  Scale est. = 0.74176  n = 2067
```

2.4 Model B: Putamen Anticipation ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_rvsn_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.372726  0.310423  -1.201  0.23001
## PDS_score    -0.077949  0.027849  -2.799  0.00517 **
## interview_age 0.004245  0.002670   1.590  0.11202
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00378
## lmer.REML = 5233.6  Scale est. = 0.73005  n = 2041
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_rvsn_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.475074  0.329473  -1.442   0.149
## PDS_score    0.015271  0.040212   0.380   0.704
## interview_age 0.003848  0.002798   1.375   0.169
##
##
## R-sq.(adj) = 0.000503
## lmer.REML = 5589.5  Scale est. = 0.75739  n = 2064
```

2.5 Model: Accumbens Anticipation ~ PDS

Females

```
##
```

```
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_rvsnt_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.0968160  0.2446591  -0.396   0.692
## PDS_score    -0.0008552  0.0219117  -0.039   0.969
## interview_age  0.0009134  0.0021051   0.434   0.664
##
##
## R-sq.(adj) = -0.000795
## lmer.REML = 4276.4  Scale est. = 0.44122  n = 2044
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_rvsnt_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.318694  0.255800   1.246   0.213
## PDS_score      0.006030  0.030835   0.196   0.845
## interview_age -0.002683  0.002173  -1.235   0.217
##
##
## R-sq.(adj) = -0.000226
## lmer.REML = 4583.4  Scale est. = 0.50525  n = 2066
```

2.6 Model: Caudate Feedback ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.879700  0.304751   2.887  0.00394 **
## PDS_score     -0.021140  0.027194  -0.777  0.43703
## interview_age -0.007289  0.002625  -2.777  0.00553 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
```

```
## R-sq.(adj) = 0.00389
## lmer.REML = 5192.5 Scale est. = 0.73778 n = 2042
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.031564  0.307208  -0.103   0.9182
## PDS_score    -0.078845  0.036926  -2.135   0.0329 *
## interview_age 0.001472  0.002611   0.564   0.5729
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0013
## lmer.REML = 5332.8 Scale est. = 0.76745 n = 2065
```

2.7 Model: Putamen Feedback ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.553835  0.291446   1.900   0.0575 .
## PDS_score     0.005590  0.026008   0.215   0.8298
## interview_age -0.005130  0.002509  -2.044   0.0410 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00101
## lmer.REML = 5000.7 Scale est. = 0.67013 n = 2042
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_posvsneg_feedback_z ~ PDS_score + interview_age
```

```
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.2672445  0.3067924   0.871   0.384
## PDS_score    -0.0619678  0.0369846  -1.676   0.094 .
## interview_age -0.0008925  0.0026000  -0.343   0.731
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.000443
## lmer.REML = 5304.4  Scale est. = 0.74767   n = 2068
```

2.8 Model: Accumbens Feedback ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.457769  0.230801   1.983   0.0475 *
## PDS_score    -0.001013  0.020566  -0.049   0.9607
## interview_age -0.003938  0.001988  -1.981   0.0477 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00106
## lmer.REML = 4078.6  Scale est. = 0.42369   n = 2050
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.066775  0.248298  -0.269   0.788
## PDS_score    -0.041154  0.030143  -1.365   0.172
## interview_age  0.001413  0.002106   0.671   0.502
##
##
## R-sq.(adj) = -2.21e-05
## lmer.REML = 4403.4  Scale est. = 0.40091   n = 2061
```

2.9 Model: OFC Anticipation ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_rvs_n_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.0590386  0.2040969   0.289   0.772
## PDS_score    0.0037308  0.0182241   0.205   0.838
## interview_age -0.0004418  0.0017592  -0.251   0.802
##
##
## R-sq.(adj) = -0.000933
## lmer.REML = 3536.8  Scale est. = 0.29608  n = 2038
##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_rvs_n_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.039678  0.234446   0.169   0.866
## PDS_score    0.008097  0.020912   0.387   0.699
## interview_age -0.000431  0.002020  -0.213   0.831
##
##
## R-sq.(adj) = -0.000901
## lmer.REML = 4110.5  Scale est. = 0.43526  n = 2039
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_rvs_n_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.242985  0.216367  -1.123   0.262
## PDS_score    0.031944  0.026501   1.205   0.228
## interview_age 0.001747  0.001839   0.950   0.342
##
##
## R-sq.(adj) = 0.00126
## lmer.REML = 3846.2  Scale est. = 0.29898  n = 2060
```

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_rvsn_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.1174623  0.2355002  -0.499  0.61799
## PDS_score    0.0776497  0.0286198   2.713  0.00672 **
## interview_age 0.0001156  0.0020019   0.058  0.95395
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00338
## lmer.REML = 4197.2  Scale est. = 0.37935    n = 2055
```

2.10 Model: OFC Feedback ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.250497  0.179292   1.397   0.163
## PDS_score    0.009944  0.016003   0.621   0.534
## interview_age -0.002448  0.001545  -1.585   0.113
##
##
## R-sq.(adj) =  0.000286
## lmer.REML = 3018.9  Scale est. = 0.22332    n = 2039
##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.0649136  0.2204114   0.295   0.768
## PDS_score    0.0101010  0.0197079   0.513   0.608
## interview_age -0.0007488  0.0018984  -0.394   0.693
##
##
## R-sq.(adj) = -0.000837
```



```
## lmer.REML = 3842.5  Scale est. = 0.34392  n = 2040
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## l0FC_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -0.255465   0.194367  -1.314    0.189
## PDS_score      0.008297   0.023443   0.354    0.723
## interview_age  0.002312   0.001652   1.399    0.162
##
##
## R-sq.(adj) =  0.000168
## lmer.REML = 3469.7  Scale est. = 0.30665  n = 2070
##
## Family: gaussian
## Link function: identity
##
## Formula:
## m0FC_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -0.0389465  0.2241386  -0.174    0.862
## PDS_score      0.0047312  0.0273317   0.173    0.863
## interview_age  0.0005657  0.0019042   0.297    0.766
##
##
## R-sq.(adj) = -0.000974
## lmer.REML =  4032  Scale est. = 0.29495  n = 2068
```

2.11 Model: Caudate Anticipation ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_rvsn_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -0.591761   0.335016  -1.766   0.0775 .
## hormone_scr_ert_mean_z -0.030690   0.026111  -1.175   0.2400
## interview_age  0.005087   0.002808   1.812   0.0702 .
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0013
## lmer.REML = 5024.1  Scale est. = 0.79373    n = 1914
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_rvsn_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.074125   0.349808  -0.212    0.832
## hormone_scr_ert_mean_z  0.013253   0.028742   0.461    0.645
## interview_age    0.000623   0.002915   0.214    0.831
##
##
## R-sq.(adj) = -0.000807
## lmer.REML = 5205.4  Scale est. = 0.63774    n = 1912
```

2.12 Model B: Putamen Anticipation ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_rvsn_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.383966   0.325368  -1.180    0.238
## hormone_scr_ert_mean_z -0.020326   0.025357  -0.802    0.423
## interview_age    0.003171   0.002727   1.163    0.245
##
##
## R-sq.(adj) = -4.16e-05
## lmer.REML = 4908.1  Scale est. = 0.74258    n = 1912
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_rvsn_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
```

```
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.327936   0.346500  -0.946   0.344
## hormone_scr_ert_mean_z  0.041862   0.028598   1.464   0.143
## interview_age    0.002867   0.002885   0.994   0.321
##
##
## R-sq.(adj) =  0.00137
## lmer.REML = 5165.6  Scale est. = 0.67645   n = 1912
```

2.13 Model: Accumbens Anticipation ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_rvsnt_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.244643   0.254957  -0.960   0.3374
## hormone_scr_ert_mean_z -0.034201   0.019891  -1.719   0.0857 .
## interview_age    0.002162   0.002140   1.010   0.3124
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.000903
## lmer.REML = 3995.4  Scale est. = 0.43175   n = 1915
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_rvsnt_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.3072737   0.2726446   1.127   0.260
## hormone_scr_ert_mean_z -0.0002691   0.0222342  -0.012   0.990
## interview_age    -0.0025160   0.0022728  -1.107   0.268
##
##
## R-sq.(adj) = -0.000402
## lmer.REML = 4290.1  Scale est. = 0.48971   n = 1915
```

2.14 Model: Caudate Feedback ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.045803   0.320271   3.265 0.001113 **
## hormone_scr_ert_mean_z 0.051043   0.024845   2.054 0.040066 *
## interview_age  -0.009016   0.002691  -3.350 0.000823 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00575
## lmer.REML = 4869.7  Scale est. = 0.74228   n = 1910
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.131005   0.322819   0.406   0.685
## hormone_scr_ert_mean_z 0.032040   0.026431   1.212   0.226
## interview_age  -0.000708   0.002690  -0.263   0.792
##
##
## R-sq.(adj) = -0.000313
## lmer.REML = 4926.5  Scale est. = 0.76028   n = 1913
```

2.15 Model: Putamen Feedback ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.713151   0.303944   2.346 0.01906 *
```

```
## hormone_scr_ert_mean_z 0.066484 0.023695 2.806 0.00507 **
## interview_age -0.006442 0.002554 -2.523 0.01173 *
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00502
## lmer.REML = 4670.9 Scale est. = 0.66712 n = 1911
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.452903  0.320646   1.412   0.158
## hormone_scr_ert_mean_z 0.030225  0.026440   1.143   0.253
## interview_age  -0.003121  0.002665  -1.171   0.242
##
##
## R-sq.(adj) = -5.75e-05
## lmer.REML = 4892.1 Scale est. = 0.70784 n = 1917
```

2.16 Model: Accumbens Feedback ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.471274  0.236219   1.995  0.0462 *
## hormone_scr_ert_mean_z 0.004098  0.018377   0.223  0.8235
## interview_age  -0.004118  0.001985  -2.075  0.0382 *
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00121
## lmer.REML = 3728.7 Scale est. = 0.40449 n = 1918
```

Males

```
##
## Family: gaussian
```

```
## Link function: identity
##
## Formula:
## accumbens_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.0951261  0.2637942   0.361   0.718
## hormone_scr_ert_mean_z 0.0302771  0.0216948   1.396   0.163
## interview_age   -0.0003079  0.0021966  -0.140   0.889
##
##
## R-sq.(adj) = 0.000179
## lmer.REML = 4110.6  Scale est. = 0.40831  n = 1909
```

2.17 Model: OFC Anticipation ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_rvsn_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.0141014  0.2148549  -0.066   0.948
## hormone_scr_ert_mean_z -0.0125712  0.0167194  -0.752   0.452
## interview_age     0.0002391  0.0018052   0.132   0.895
##
##
## R-sq.(adj) = -0.000731
## lmer.REML = 3330.6  Scale est. = 0.30454  n = 1908
##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_rvsn_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.0841768  0.2462446   0.342   0.733
## hormone_scr_ert_mean_z 0.0049225  0.0191536   0.257   0.797
## interview_age   -0.0007006  0.0020693  -0.339   0.735
##
##
## R-sq.(adj) = -0.000971
## lmer.REML = 3856.2  Scale est. = 0.43719  n = 1908
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_rvs_n_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.355274   0.229261  -1.550   0.121
## hormone_scr_ert_mean_z -0.030847   0.018868  -1.635   0.102
## interview_age     0.003033   0.001911   1.587   0.113
##
##
## R-sq.(adj) =  0.00138
## lmer.REML = 3591.8  Scale est. = 0.29077  n = 1909
##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_rvs_n_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.249360   0.250089  -0.997   0.319
## hormone_scr_ert_mean_z -0.019065   0.020418  -0.934   0.351
## interview_age     0.002128   0.002085   1.020   0.308
##
##
## R-sq.(adj) = -0.000168
## lmer.REML = 3920.4  Scale est. = 0.37746  n = 1905
```

2.18 Model: OFC Feedback ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.326363   0.187426   1.741   0.0818 .
## hormone_scr_ert_mean_z 0.025014   0.014583   1.715   0.0865 .
## interview_age   -0.002987   0.001575  -1.896   0.0581 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
##
## R-sq.(adj) = 0.00188
## lmer.REML = 2823.9 Scale est. = 0.21672 n = 1910

##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.147132  0.228833  0.643    0.52
## hormone_scr_ert_mean_z 0.014706  0.017849  0.824    0.41
## interview_age   -0.001327  0.001921 -0.691    0.49
##
##
## R-sq.(adj) = -0.000438
## lmer.REML = 3568.5 Scale est. = 0.33149 n = 1912
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.122210  0.204604 -0.597    0.550
## hormone_scr_ert_mean_z 0.001823  0.016784  0.109    0.914
## interview_age  0.001347  0.001705  0.790    0.430
##
##
## R-sq.(adj) = -0.000688
## lmer.REML = 3218.3 Scale est. = 0.3098 n = 1919

##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.0571267  0.2376761  0.240    0.810
## hormone_scr_ert_mean_z 0.0164587  0.0194398  0.847    0.397
## interview_age   -0.0001319  0.0019825 -0.067    0.947
##
##
## R-sq.(adj) = -0.000783
```



```
## lmer.REML = 3764.8  Scale est. = 0.30053  n = 1917
```

2.19 Model: MID Reaction Time ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_neutral_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.681474   0.329314  -2.069   0.0386 *
## hormone_scr_ert_mean_z -0.029941   0.025743  -1.163   0.2449
## interview_age    0.006150   0.002765    2.224   0.0262 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00186
## lmer.REML = 5546.3  Scale est. = 0.69013  n = 2062
##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_small_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.396605   0.332388  -1.193   0.233
## hormone_scr_ert_mean_z -0.016785   0.025964  -0.646   0.518
## interview_age    0.003421   0.002791    1.226   0.220
##
##
## R-sq.(adj) =  3.89e-06
## lmer.REML = 5585.5  Scale est. = 0.75016  n = 2062
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_neutral_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.089835   0.306788   0.293   0.770
## hormone_scr_ert_mean_z -0.011286   0.025188  -0.448   0.654
```

```
## interview_age          -0.000843   0.002557  -0.330    0.742
##
##
## R-sq.(adj) =  -0.000666
## lmer.REML = 5529.7  Scale est. = 0.66098   n = 2142

##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_small_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.1260063   0.3077940    0.409    0.682
## hormone_scr_ert_mean_z -0.0333926   0.0251146   -1.330    0.184
## interview_age   -0.0009739   0.0025665   -0.379    0.704
##
##
## R-sq.(adj) =  9.15e-05
## lmer.REML = 5558.9  Scale est. = 0.67172   n = 2142
```

2.20 Model: BIS-BAS-RR ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## bisbas_ss_basm_rr_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.330045   0.321009    1.028    0.304
## hormone_scr_ert_mean_z -0.018668   0.024980   -0.747    0.455
## interview_age   -0.003113   0.002685   -1.160    0.246
##
##
## R-sq.(adj) =  0.000515
## lmer.REML = 7031.4  Scale est. = 0.70731   n = 2504
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## bisbas_ss_basm_rr_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)          0.255006   0.302870   0.842   0.3999
## hormone_scr_ert_mean_z 0.045069   0.024816   1.816   0.0695 .
## interview_age        -0.001467   0.002523  -0.581   0.5610
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00114
## lmer.REML = 7488.5  Scale est. = 0.70183   n = 2708
```

3—Int~Reward—

3.1 Model: CBCL internalizing factor ~ Nucleus Accumbens activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ accumbens_rvsnt_ant_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.052176    2.071394   1.956 0.05057 .
## accumbens_rvsnt_ant_z -0.043681    0.171115  -0.255 0.79854
## interview_age   -0.006634    0.015772  -0.421 0.67410
## race.ethnicity.5levelBlack  0.961315    0.887252   1.083 0.27873
## race.ethnicity.5levelMixed  2.510150    0.877107   2.862 0.00426 **
## race.ethnicity.5levelOther  2.570818    0.993973   2.586 0.00977 **
## race.ethnicity.5levelWhite  1.391087    0.825806   1.685 0.09224 .
## demo_race_hispanic1    0.551391    0.349161   1.579 0.11445
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00793
## lmer.REML = 12329  Scale est. = 11.287   n = 1999
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ accumbens_rvsnt_ant_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)                0.90981    2.01145    0.452 0.651089
## accumbens_rvs_n_ant_z      -0.13397    0.15780   -0.849 0.396000
## interview_age              0.01412    0.01545    0.914 0.361018
## race.ethnicity.5levelBlack  1.42784    0.86544    1.650 0.099129 .
## race.ethnicity.5levelMixed  2.86668    0.86090    3.330 0.000885 ***
## race.ethnicity.5levelOther  2.88778    0.99103    2.914 0.003609 **
## race.ethnicity.5levelWhite  2.12172    0.80947    2.621 0.008830 **
## demo_race_hispanic1        0.09777    0.33410    0.293 0.769826
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00616
## lmer.REML = 12392  Scale est. = 17.372    n = 2024
```

3.2 Model: CBCL internalizing factor ~ Caudate activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ caudate_rvs_n_ant_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.160983    2.075918    2.004 0.04516 *
## caudate_rvs_n_ant_z -0.046176    0.131676   -0.351 0.72587
## interview_age     -0.007467    0.015809   -0.472 0.63675
## race.ethnicity.5levelBlack  0.986848    0.888683    1.110 0.26693
## race.ethnicity.5levelMixed  2.487496    0.877216    2.836 0.00462 **
## race.ethnicity.5levelOther  2.540475    0.993072    2.558 0.01060 *
## race.ethnicity.5levelWhite  1.395773    0.826508    1.689 0.09142 .
## demo_race_hispanic1    0.533009    0.348799    1.528 0.12664
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00767
## lmer.REML = 12328  Scale est. = 11.357    n = 1998
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ caudate_rvs_n_ant_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
```

```
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.13846    2.02066   0.563  0.57322
## caudate_rvs_n_ant_z -0.11700    0.12316  -0.950  0.34225
## interview_age      0.01280    0.01548   0.827  0.40846
## race.ethnicity.5levelBlack 1.35206    0.88553   1.527  0.12696
## race.ethnicity.5levelMixed 2.78962    0.88126   3.165  0.00157 **
## race.ethnicity.5levelOther 2.88797    1.00597   2.871  0.00414 **
## race.ethnicity.5levelWhite 2.05860    0.83114   2.477  0.01334 *
## demo_race_hispanic1    0.13001    0.33630   0.387  0.69911
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00574
## lmer.REML = 12383 Scale est. = 17.514    n = 2022
```

3.3 Model: CBCL internalizing factor ~ Putamen activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ putamen_rvs_n_ant_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.985373    2.067539   1.928  0.05405 .
## putamen_rvs_n_ant_z -0.092672    0.135033  -0.686  0.49261
## interview_age     -0.006113    0.015749  -0.388  0.69797
## race.ethnicity.5levelBlack 1.044319    0.883990   1.181  0.23760
## race.ethnicity.5levelMixed 2.522607    0.873375   2.888  0.00391 **
## race.ethnicity.5levelOther 2.565497    0.990442   2.590  0.00966 **
## race.ethnicity.5levelWhite 1.370892    0.822614   1.667  0.09577 .
## demo_race_hispanic1    0.551256    0.347961   1.584  0.11330
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00803
## lmer.REML = 12293 Scale est. = 11.28    n = 1995
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ putamen_rvs_n_ant_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
```

```
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.94564    2.01703   0.469  0.63924
## putamen_rvsnt_z  -0.16425    0.12296  -1.336  0.18174
## interview_age      0.01425    0.01545   0.922  0.35646
## race.ethnicity.5levelBlack  1.42743    0.88405   1.615  0.10654
## race.ethnicity.5levelMixed  2.82456    0.87774   3.218  0.00131 **
## race.ethnicity.5levelOther  2.75170    1.00721   2.732  0.00635 **
## race.ethnicity.5levelWhite  2.08091    0.82917   2.510  0.01216 *
## demo_race_hispanic1    0.08926    0.33586   0.266  0.79046
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00557
## lmer.REML = 12378  Scale est. = 17.128    n = 2023
```

3.4 Model: CBCL internalizing factor ~ Accumbens activity (feedback stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ accumbens_posvsneg_feedback_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.838930    2.065678   1.858  0.06325 .
## accumbens_posvsneg_feedback_z -0.046257    0.178948  -0.258  0.79605
## interview_age     -0.004964    0.015734  -0.315  0.75243
## race.ethnicity.5levelBlack    1.004141    0.883574   1.136  0.25590
## race.ethnicity.5levelMixed    2.419609    0.873629   2.770  0.00566 **
## race.ethnicity.5levelOther    2.610210    0.987916   2.642  0.00830 **
## race.ethnicity.5levelWhite    1.417874    0.823111   1.723  0.08512 .
## demo_race_hispanic1    0.471797    0.348750   1.353  0.17626
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00659
## lmer.REML = 12353  Scale est. = 11.268    n = 2005
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ accumbens_posvsneg_feedback_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
```

```
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.77475    1.99660   0.388 0.698032
## accumbens_posvsneg_feedback_z 0.32566    0.16284   2.000 0.045644 *
## interview_age      0.01477    0.01534   0.963 0.335823
## race.ethnicity.5levelBlack  1.51036    0.85866   1.759 0.078735 .
## race.ethnicity.5levelMixed  2.91146    0.85216   3.417 0.000647 ***
## race.ethnicity.5levelOther  3.04869    0.98188   3.105 0.001930 **
## race.ethnicity.5levelWhite  2.12718    0.80145   2.654 0.008013 **
## demo_race_hispanic1      0.06274    0.33218   0.189 0.850220
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00785
## lmer.REML = 12336 Scale est. = 17.742    n = 2021
```

3.5 Model: CBCL internalizing factor ~ Caudate activity (feedback stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ caudate_posvsneg_feedback_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.174121    2.078905   2.008 0.04479 *
## caudate_posvsneg_feedback_z -0.178458    0.133986  -1.332 0.18304
## interview_age     -0.007524    0.015835  -0.475 0.63473
## race.ethnicity.5levelBlack  1.026575    0.888082   1.156 0.24784
## race.ethnicity.5levelMixed  2.438043    0.876042   2.783 0.00544 **
## race.ethnicity.5levelOther  2.443722    0.992035   2.463 0.01385 *
## race.ethnicity.5levelWhite  1.358837    0.825732   1.646 0.10000
## demo_race_hispanic1      0.542136    0.350534   1.547 0.12212
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0083
## lmer.REML = 12316 Scale est. = 11.382    n = 1997
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ caudate_posvsneg_feedback_z + interview_age +
```

```
##      race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.421202    2.024330   0.702  0.48272
## caudate_posvsneg_feedback_z 0.118954    0.130857   0.909  0.36344
## interview_age      0.009903    0.015487   0.639  0.52261
## race.ethnicity.5levelBlack  1.426455    0.874856   1.631  0.10315
## race.ethnicity.5levelMixed  2.846507    0.869937   3.272  0.00109 **
## race.ethnicity.5levelOther  2.962154    0.995131   2.977  0.00295 **
## race.ethnicity.5levelWhite  2.094779    0.819002   2.558  0.01061 *
## demo_race_hispanic1        0.154159    0.335180   0.460  0.64562
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00595
## lmer.REML = 12389  Scale est. = 17.501    n = 2023
```

3.6 Model: CBCL internalizing factor ~ Putamen activity (feedback stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ putamen_posvsneg_feedback_z + interview_age +
##      race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.937682    2.075294   1.897  0.05792 .
## putamen_posvsneg_feedback_z -0.091652    0.141345  -0.648  0.51678
## interview_age      -0.005695    0.015808  -0.360  0.71870
## race.ethnicity.5levelBlack  1.061865    0.888416   1.195  0.23214
## race.ethnicity.5levelMixed  2.459395    0.876016   2.807  0.00504 **
## race.ethnicity.5levelOther  2.506314    0.994597   2.520  0.01182 *
## race.ethnicity.5levelWhite  1.375676    0.826241   1.665  0.09607 .
## demo_race_hispanic1        0.556521    0.350406   1.588  0.11240
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00756
## lmer.REML = 12310  Scale est. = 11.343    n = 1996
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
```



```
## cbcl_scr_syn_internal_r ~ putamen_posvsneg_feedback_z + interview_age +
##      race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.05524    2.01873   0.523 0.601223
## putamen_posvsneg_feedback_z 0.14036    0.13237   1.060 0.289116
## interview_age      0.01249    0.01549   0.806 0.420296
## race.ethnicity.5levelBlack  1.46805    0.86859   1.690 0.091153 .
## race.ethnicity.5levelMixed  2.91149    0.86315   3.373 0.000757 ***
## race.ethnicity.5levelOther  2.98856    0.99153   3.014 0.002610 **
## race.ethnicity.5levelWhite  2.17694    0.81221   2.680 0.007416 **
## demo_race_hispanic1      0.08749    0.33699   0.260 0.795178
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00591
## lmer.REML = 12432 Scale est. = 17.729    n = 2028
```

3.7 Model: CBCL internalizing factor ~ OFC activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ lOFC_rvsn_ant_z + interview_age + race.ethnicity.5level +
##      demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.945689    2.088229   1.889 0.05897 .
## lOFC_rvsn_ant_z    0.092356    0.206649   0.447 0.65498
## interview_age     -0.005135    0.015862  -0.324 0.74617
## race.ethnicity.5levelBlack  0.949446    0.895071   1.061 0.28893
## race.ethnicity.5levelMixed  2.410749    0.885797   2.722 0.00655 **
## race.ethnicity.5levelOther  2.446597    1.001979   2.442 0.01470 *
## race.ethnicity.5levelWhite  1.303526    0.834533   1.562 0.11845
## demo_race_hispanic1    0.566955    0.349537   1.622 0.10496
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0076
## lmer.REML = 12300 Scale est. = 11.614    n = 1994
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ mOFC_rvsn_ant_z + interview_age + race.ethnicity.5level +
```

```
##      demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.887753   2.085389   1.864  0.06243 .
## mOFC_rvs_n_ant_z    0.184766   0.174982    1.056  0.29114
## interview_age     -0.004795   0.015837   -0.303  0.76210
## race.ethnicity.5levelBlack  0.946118   0.895477    1.057  0.29084
## race.ethnicity.5levelMixed  2.424899   0.886298    2.736  0.00627 **
## race.ethnicity.5levelOther  2.516611   1.004105    2.506  0.01228 *
## race.ethnicity.5levelWhite  1.342866   0.835098    1.608  0.10799
## demo_race_hispanic1    0.557219   0.349619    1.594  0.11114
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0082
## lmer.REML = 12308 Scale est. = 11.42      n = 1995
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ lOFC_rvs_n_ant_z + interview_age + race.ethnicity.5level +
##      demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.649e-01  1.995e+00   0.133  0.89436
## lOFC_rvs_n_ant_z    3.840e-03  1.865e-01   0.021  0.98357
## interview_age     1.992e-02  1.533e-02   1.300  0.19371
## race.ethnicity.5levelBlack  1.417e+00  8.574e-01   1.653  0.09856 .
## race.ethnicity.5levelMixed  2.804e+00  8.524e-01   3.290  0.00102 **
## race.ethnicity.5levelOther  2.880e+00  9.798e-01   2.940  0.00332 **
## race.ethnicity.5levelWhite  2.044e+00  8.009e-01   2.552  0.01080 *
## demo_race_hispanic1   -6.687e-05  3.323e-01   0.000  0.99984
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00548
## lmer.REML = 12332 Scale est. = 17.059      n = 2021
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ mOFC_rvs_n_ant_z + interview_age + race.ethnicity.5level +
##      demo_race_hispanic
##
## Parametric coefficients:
```

```
##                                Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   0.42987    2.00279   0.215  0.83007
## mOFC_rvs_n_ant_z              0.27046    0.17117   1.580  0.11426
## interview_age                 0.01874    0.01538   1.218  0.22323
## race.ethnicity.5levelBlack    1.34471    0.86121   1.561  0.11858
## race.ethnicity.5levelMixed    2.73744    0.85492   3.202  0.00139 **
## race.ethnicity.5levelOther    2.86734    0.98038   2.925  0.00349 **
## race.ethnicity.5levelWhite    2.03045    0.80355   2.527  0.01159 *
## demo_race_hispanic1          0.03911    0.33258   0.118  0.90639
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00707
## lmer.REML = 12301 Scale est. = 17.183    n = 2014
```

3.8 Model: CBCL internalizing factor ~ OFC activity (feedback stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ lOFC_posvsneg_feedback_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##                                Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   3.918460    2.071655   1.891  0.05871 .
## lOFC_posvsneg_feedback_z      -0.196960    0.231572  -0.851  0.39513
## interview_age                 -0.005545    0.015784  -0.351  0.72540
## race.ethnicity.5levelBlack    1.018741    0.883760   1.153  0.24916
## race.ethnicity.5levelMixed    2.433765    0.872756   2.789  0.00534 **
## race.ethnicity.5levelOther    2.741777    0.994022   2.758  0.00586 **
## race.ethnicity.5levelWhite    1.391187    0.822128   1.692  0.09077 .
## demo_race_hispanic1          0.465982    0.348214   1.338  0.18098
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00806
## lmer.REML = 12285 Scale est. = 11.271    n = 1994
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ mOFC_posvsneg_feedback_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##                                Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)          4.023520    2.074379    1.940  0.05257 .
## mOFC_posvsneg_feedback_z -0.167758    0.189547   -0.885  0.37624
## interview_age        -0.006339    0.015808   -0.401  0.68849
## race.ethnicity.5levelBlack 1.004855    0.886400    1.134  0.25708
## race.ethnicity.5levelMixed 2.433716    0.874753    2.782  0.00545 **
## race.ethnicity.5levelOther 2.575923    0.991115    2.599  0.00942 **
## race.ethnicity.5levelWhite 1.380283    0.823927    1.675  0.09404 .
## demo_race_hispanic1      0.518458    0.348645    1.487  0.13716
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00815
## lmer.REML = 12295  Scale est. = 11.469    n = 1994
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ lOFC_posvsneg_feedback_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.77055    1.99466   0.386 0.699312
## lOFC_posvsneg_feedback_z 0.04810    0.20526   0.234 0.814738
## interview_age   0.01541    0.01532   1.006 0.314405
## race.ethnicity.5levelBlack 1.46420    0.85984   1.703 0.088745 .
## race.ethnicity.5levelMixed 2.88778    0.85380   3.382 0.000733 ***
## race.ethnicity.5levelOther 2.84553    0.98502   2.889 0.003908 **
## race.ethnicity.5levelWhite 2.08630    0.80307   2.598 0.009447 **
## demo_race_hispanic1      0.06155    0.33289   0.185 0.853316
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00565
## lmer.REML = 12392  Scale est. = 17.111    n = 2029
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ mOFC_posvsneg_feedback_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.80386    1.99379   0.403 0.686858
## mOFC_posvsneg_feedback_z 0.27553    0.17865   1.542 0.123160
## interview_age   0.01508    0.01531   0.985 0.324691
```

```
## race.ethnicity.5levelBlack 1.44976 0.85958 1.687 0.091839 .
## race.ethnicity.5levelMixed 2.90987 0.85377 3.408 0.000667 ***
## race.ethnicity.5levelOther 2.90159 0.98245 2.953 0.003179 **
## race.ethnicity.5levelWhite 2.08983 0.80305 2.602 0.009326 **
## demo_race_hispanic1 0.03963 0.33252 0.119 0.905135
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00704
## lmer.REML = 12380 Scale est. = 17.178 n = 2027
```

3.9 Model: CBCL internalizing factor ~ BIS-BAS-RR

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ bisbas_ss_basm_rr + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.87599    1.89810   1.515  0.12984
## bisbas_ss_basm_rr -0.06648    0.04530  -1.468  0.14231
## interview_age    0.01054    0.01412   0.746  0.45561
## race.ethnicity.5levelBlack 0.57633    0.78656   0.733  0.46379
## race.ethnicity.5levelMixed 2.01387    0.78875   2.553  0.01073 *
## race.ethnicity.5levelOther 2.77250    0.90192   3.074  0.00213 **
## race.ethnicity.5levelWhite 1.38776    0.74259   1.869  0.06176 .
## demo_race_hispanic1 0.18709    0.31806   0.588  0.55645
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00746
## lmer.REML = 16337 Scale est. = 13.091 n = 2629
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ bisbas_ss_basm_rr + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.183626    1.837663   1.188  0.23483
## bisbas_ss_basm_rr 0.003817    0.044574   0.086  0.93177
```

```
## interview_age          0.009560    0.013816    0.692    0.48905
## race.ethnicity.5levelBlack 1.610755    0.750902    2.145    0.03203 *
## race.ethnicity.5levelMixed 2.100595    0.755919    2.779    0.00549 **
## race.ethnicity.5levelOther 1.983774    0.862904    2.299    0.02158 *
## race.ethnicity.5levelWhite 1.502642    0.709067    2.119    0.03416 *
## demo_race_hispanic1      0.317069    0.301590    1.051    0.29320
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.000948
## lmer.REML = 17729  Scale est. = 15.738    n = 2847
```

3.10 Model: CBCL internalizing factor ~ MID Reaction Time

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ rt_diff_large_neutral_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.55400    1.98160   2.298  0.02165 *
## rt_diff_large_neutral_z  0.13920    0.12178   1.143  0.25318
## interview_age     -0.01062    0.01514  -0.702  0.48306
## race.ethnicity.5levelBlack  0.95841    0.84017   1.141  0.25411
## race.ethnicity.5levelMixed  2.34332    0.83412   2.809  0.00501 **
## race.ethnicity.5levelOther  2.81105    0.94816   2.965  0.00306 **
## race.ethnicity.5levelWhite  1.38364    0.78299   1.767  0.07735 .
## demo_race_hispanic1      0.49857    0.34170   1.459  0.14470
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00833
## lmer.REML = 13269  Scale est. = 11.8    n = 2153
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ rt_diff_large_small_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.464661    1.980676   2.254  0.02429 *
## rt_diff_large_small_z -0.123532    0.120640  -1.024  0.30597
## interview_age     -0.009608    0.015124  -0.635  0.52528
```

```
## race.ethnicity.5levelBlack 0.926365 0.839755 1.103 0.27009
## race.ethnicity.5levelMixed 2.326042 0.833976 2.789 0.00533 **
## race.ethnicity.5levelOther 2.779393 0.948352 2.931 0.00342 **
## race.ethnicity.5levelWhite 1.364444 0.782899 1.743 0.08151 .
## demo_race_hispanic1 0.485413 0.341768 1.420 0.15567
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00793
## lmer.REML = 13269 Scale est. = 11.747 n = 2153
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ rt_diff_large_neutral_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.23765    1.93604   0.639  0.52271
## rt_diff_large_neutral_z 0.07626    0.12536   0.608  0.54304
## interview_age      0.01698    0.01481   1.146  0.25173
## race.ethnicity.5levelBlack 0.95348    0.84099   1.134  0.25702
## race.ethnicity.5levelMixed 2.18027    0.83793   2.602  0.00933 **
## race.ethnicity.5levelOther 2.00082    0.96151   2.081  0.03755 *
## race.ethnicity.5levelWhite 1.45145    0.79076   1.836  0.06656 .
## demo_race_hispanic1 0.16620    0.32281   0.515  0.60671
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00317
## lmer.REML = 13877 Scale est. = 16.854 n = 2257
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ rt_diff_large_small_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.28604    1.93561   0.664  0.5065
## rt_diff_large_small_z -0.07689    0.12414  -0.619  0.5357
## interview_age      0.01678    0.01481   1.133  0.2574
## race.ethnicity.5levelBlack 0.93933    0.84074   1.117  0.2640
## race.ethnicity.5levelMixed 2.15237    0.83755   2.570  0.0102 *
## race.ethnicity.5levelOther 1.96006    0.96117   2.039  0.0415 *
```

```
## race.ethnicity.5levelWhite 1.42757 0.79053 1.806 0.0711 .
## demo_race_hispanic1 0.16026 0.32289 0.496 0.6197
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00316
## lmer.REML = 13877 Scale est. = 16.926 n = 2257
```

4—Int~Puberty x Reward—

4.1 Model: CBCL internalizing factor ~ PDS x Accumbens activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * accumbens_rvsn_ant_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.93246    2.07818   2.373 0.017717 *
## PDS_score         0.66789    0.17883   3.735 0.000193 ***
## accumbens_rvsn_ant_z -0.74666    0.42905  -1.740 0.081967 .
## race.ethnicity.5levelBlack 0.54545    0.89101   0.612 0.540495
## race.ethnicity.5levelMixed 2.34273    0.87490   2.678 0.007473 **
## race.ethnicity.5levelOther 2.34680    0.99199   2.366 0.018089 *
## race.ethnicity.5levelWhite 1.35252    0.82265   1.644 0.100314
## demo_race_hispanic1 0.49442    0.34785   1.421 0.155373
## interview_age     -0.02243    0.01629  -1.377 0.168697
## PDS_score:accumbens_rvsn_ant_z 0.42529    0.23874   1.781 0.074993 .
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0145
## lmer.REML = 12315 Scale est. = 11.173 n = 1999
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * accumbens_rvsn_ant_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
```



```
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.110491    2.008771   0.553  0.58045
## PDS_score         0.740908    0.231386   3.202  0.00139 **
## accumbens_rvsnt_z -0.176926    0.431793  -0.410  0.68204
## race.ethnicity.5levelBlack  1.132855    0.868851   1.304  0.19243
## race.ethnicity.5levelMixed  2.813468    0.859400   3.274  0.00108 **
## race.ethnicity.5levelOther  2.805836    0.989336   2.836  0.00461 **
## race.ethnicity.5levelWhite  2.102584    0.807941   2.602  0.00933 **
## demo_race_hispanic1    0.031163    0.334900   0.093  0.92587
## interview_age         0.004686    0.015705   0.298  0.76543
## PDS_score:accumbens_rvsnt_z  0.028997    0.297822   0.097  0.92245
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00996
## lmer.REML = 12383 Scale est. = 17.312    n = 2024
```

4.2 Model: CBCL internalizing factor ~ PDS x Caudate activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * caudate_rvsnt_z + race.ethnicity.5level +
##   demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      5.16482    2.08805   2.474  0.013462 *
## PDS_score         0.69019    0.17965   3.842  0.000126 ***
## caudate_rvsnt_z  -0.11993    0.32559  -0.368  0.712651
## race.ethnicity.5levelBlack  0.54705    0.89316   0.612  0.540289
## race.ethnicity.5levelMixed  2.29666    0.87576   2.622  0.008796 **
## race.ethnicity.5levelOther  2.30580    0.99182   2.325  0.020181 *
## race.ethnicity.5levelWhite  1.32860    0.82400   1.612  0.107037
## demo_race_hispanic1    0.49035    0.34786   1.410  0.158803
## interview_age       -0.02440    0.01638  -1.490  0.136466
## PDS_score:caudate_rvsnt_z  0.05174    0.18124   0.285  0.775296
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0131
## lmer.REML = 12316 Scale est. = 11.35    n = 1998
```

Males

```
##
## Family: gaussian
## Link function: identity
```

```
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * caudate_rvs_n_ant_z + race.ethnicity.5level +
##   demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.330434   2.016643   0.660 0.509505
## PDS_score       0.764180   0.231367   3.303 0.000974 ***
## caudate_rvs_n_ant_z 0.289141   0.350447   0.825 0.409433
## race.ethnicity.5levelBlack 1.031591   0.888271   1.161 0.245639
## race.ethnicity.5levelMixed 2.698742   0.879861   3.067 0.002189 **
## race.ethnicity.5levelOther 2.786111   1.003964   2.775 0.005569 **
## race.ethnicity.5levelWhite 2.024026   0.829244   2.441 0.014740 *
## demo_race_hispanic1 0.053239   0.336319   0.158 0.874237
## interview_age    0.003358   0.015718   0.214 0.830824
## PDS_score:caudate_rvs_n_ant_z -0.302925   0.243097  -1.246 0.212869
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0105
## lmer.REML = 12373  Scale est. = 17.352    n = 2022
```

4.3 Model: CBCL internalizing factor ~ PDS x Putamen activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * putamen_rvs_n_ant_z + race.ethnicity.5level +
##   demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.97477   2.07632   2.396 0.016669 *
## PDS_score       0.69413   0.17949   3.867 0.000114 ***
## putamen_rvs_n_ant_z -0.37583   0.32746  -1.148 0.251214
## race.ethnicity.5levelBlack 0.59070   0.88838   0.665 0.506182
## race.ethnicity.5levelMixed 2.32554   0.87167   2.668 0.007695 **
## race.ethnicity.5levelOther 2.29813   0.98931   2.323 0.020281 *
## race.ethnicity.5levelWhite 1.29941   0.81989   1.585 0.113158
## demo_race_hispanic1 0.50620   0.34697   1.459 0.144749
## interview_age    -0.02287   0.01628  -1.404 0.160369
## PDS_score:putamen_rvs_n_ant_z 0.18597   0.18035   1.031 0.302586
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.014
```

```
## lmer.REML = 12281 Scale est. = 11.319 n = 1995
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * putamen_rvsnt_z + race.ethnicity.5level +
## demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.069415   2.010972   0.532 0.594930
## PDS_score       0.795180   0.232011   3.427 0.000622 ***
## putamen_rvsnt_z 0.685059   0.347481   1.972 0.048803 *
## race.ethnicity.5levelBlack 1.112071   0.885549   1.256 0.209335
## race.ethnicity.5levelMixed 2.732836   0.874919   3.124 0.001812 **
## race.ethnicity.5levelOther 2.668475   1.003956   2.658 0.007924 **
## race.ethnicity.5levelWhite 2.059818   0.826294   2.493 0.012752 *
## demo_race_hispanic1 -0.002783   0.335825  -0.008 0.993388
## interview_age    0.005000   0.015680   0.319 0.749830
## PDS_score:putamen_rvsnt_z -0.641137   0.244624  -2.621 0.008836 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## R-sq.(adj) = 0.0126
## lmer.REML = 12362 Scale est. = 16.639 n = 2023
```

4.4 Model: CBCL internalizing factor ~ PDS x Lateral OFC activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * lOFC_rvsnt_z + race.ethnicity.5level +
## demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.90115   2.09807   2.336 0.019589 *
## PDS_score       0.66515   0.17977   3.700 0.000222 ***
## lOFC_rvsnt_z    0.01527   0.52247   0.029 0.976689
## race.ethnicity.5levelBlack 0.52114   0.89989   0.579 0.562581
## race.ethnicity.5levelMixed 2.24412   0.88436   2.538 0.011239 *
## race.ethnicity.5levelOther 2.23647   1.00065   2.235 0.025527 *
## race.ethnicity.5levelWhite 1.24974   0.83231   1.502 0.133380
## demo_race_hispanic1 0.51354   0.34902   1.471 0.141342
## interview_age   -0.02142   0.01641  -1.305 0.192031
```

```
## PDS_score:lOFC_rvs_n_ant_z 0.03931 0.28333 0.139 0.889677
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0124
## lmer.REML = 12288 Scale est. = 11.562 n = 1994
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * lOFC_rvs_n_ant_z + race.ethnicity.5level +
## demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.44213    1.99293   0.222  0.82445
## PDS_score         0.64668    0.23294   2.776  0.00555 **
## lOFC_rvs_n_ant_z -0.45904    0.50823  -0.903  0.36652
## race.ethnicity.5levelBlack 1.15256    0.86113   1.338  0.18091
## race.ethnicity.5levelMixed 2.77674    0.85121   3.262  0.00112 **
## race.ethnicity.5levelOther 2.81757    0.97872   2.879  0.00403 **
## race.ethnicity.5levelWhite 2.03354    0.79959   2.543  0.01106 *
## demo_race_hispanic1 -0.05669    0.33250  -0.170  0.86464
## interview_age      0.01160    0.01560   0.744  0.45719
## PDS_score:lOFC_rvs_n_ant_z 0.32821    0.34564   0.950  0.34245
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0085
## lmer.REML = 12324 Scale est. = 16.899 n = 2021
```

4.5 Model: CBCL internalizing factor ~ PDS x Medial OFC activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * mOFC_rvs_n_ant_z + race.ethnicity.5level +
## demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.84149    2.09453   2.311  0.020908 *
## PDS_score         0.66802    0.17956   3.720  0.000204 ***
## mOFC_rvs_n_ant_z -0.03687    0.43630  -0.085  0.932667
```

```
## race.ethnicity.5levelBlack 0.51760 0.90004 0.575 0.565296
## race.ethnicity.5levelMixed 2.25855 0.88469 2.553 0.010757 *
## race.ethnicity.5levelOther 2.31830 1.00294 2.312 0.020907 *
## race.ethnicity.5levelWhite 1.29551 0.83274 1.556 0.119937
## demo_race_hispanic1 0.49881 0.34895 1.429 0.153030
## interview_age -0.02114 0.01638 -1.291 0.196961
## PDS_score:mOFC_rvsn_ant_z 0.13133 0.23937 0.549 0.583311
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0134
## lmer.REML = 12296 Scale est. = 11.364 n = 1995
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * mOFC_rvsn_ant_z + race.ethnicity.5level +
## demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.624062   2.000859   0.312  0.75515
## PDS_score      0.683251   0.232281   2.941  0.00330 **
## mOFC_rvsn_ant_z 0.219209   0.460608   0.476  0.63419
## race.ethnicity.5levelBlack 1.077705  0.864995   1.246  0.21294
## race.ethnicity.5levelMixed 2.695055  0.854542   3.154  0.00164 **
## race.ethnicity.5levelOther 2.785797  0.979830   2.843  0.00451 **
## race.ethnicity.5levelWhite 2.014115  0.802688   2.509  0.01218 *
## demo_race_hispanic1 -0.015705  0.332742  -0.047  0.96236
## interview_age    0.009928  0.015649   0.634  0.52589
## PDS_score:mOFC_rvsn_ant_z 0.015746  0.300671   0.052  0.95824
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0101
## lmer.REML = 12294 Scale est. = 17.078 n = 2014
```

4.6 Model: CBCL internalizing factor ~ PDS x Accumbens activity (feedback)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * accumbens_posvsneg_feedback_z +
## race.ethnicity.5level + demo_race_hispanic + interview_age
##
```

```
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.86589    2.07602   2.344  0.01918
## PDS_score         0.68636    0.17813   3.853  0.00012
## accumbens_posvsneg_feedback_z -0.39320    0.44400  -0.886  0.37595
## race.ethnicity.5levelBlack      0.54437    0.88849   0.613  0.54015
## race.ethnicity.5levelMixed      2.21939    0.87236   2.544  0.01103
## race.ethnicity.5levelOther      2.36260    0.98666   2.395  0.01673
## race.ethnicity.5levelWhite      1.34627    0.82071   1.640  0.10108
## demo_race_hispanic1      0.42095    0.34808   1.209  0.22667
## interview_age      -0.02196    0.01627  -1.349  0.17744
## PDS_score:accumbens_posvsneg_feedback_z  0.20945    0.24541   0.853  0.39350
##
## (Intercept)      *
## PDS_score         ***
## accumbens_posvsneg_feedback_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed      *
## race.ethnicity.5levelOther      *
## race.ethnicity.5levelWhite
## demo_race_hispanic1
## interview_age
## PDS_score:accumbens_posvsneg_feedback_z
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0121
## lmer.REML = 12340  Scale est. = 11.244    n = 2005
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * accumbens_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.974341    1.993967   0.489  0.625147
## PDS_score         0.709079    0.229247   3.093  0.002008
## accumbens_posvsneg_feedback_z  0.015265    0.446047   0.034  0.972703
## race.ethnicity.5levelBlack      1.234169    0.861883   1.432  0.152315
## race.ethnicity.5levelMixed      2.847060    0.850813   3.346  0.000834
## race.ethnicity.5levelOther      2.960141    0.980339   3.020  0.002564
## race.ethnicity.5levelWhite      2.098703    0.800058   2.623  0.008777
## demo_race_hispanic1     -0.001489    0.332586  -0.004  0.996427
## interview_age      0.005746    0.015588   0.369  0.712435
## PDS_score:accumbens_posvsneg_feedback_z  0.235992    0.304036   0.776  0.437724
##
## (Intercept)
```

```

## PDS_score **
## accumbens_posvsneg_feedback_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed ***
## race.ethnicity.5levelOther **
## race.ethnicity.5levelWhite **
## demo_race_hispanic1
## interview_age
## PDS_score:accumbens_posvsneg_feedback_z
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0113
## lmer.REML = 12328 Scale est. = 17.656 n = 2021

```

4.7 Model: CBCL internalizing factor ~ PDS x Caudate activity (feedback)

Females

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * caudate_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    5.24064    2.08996   2.508  0.0122 *
## PDS_score       0.70970    0.17965   3.951 8.07e-05 ***
## caudate_posvsneg_feedback_z -0.42312    0.33771  -1.253  0.2104
## race.ethnicity.5levelBlack  0.54975    0.89324   0.615  0.5383
## race.ethnicity.5levelMixed  2.22349    0.87503   2.541  0.0111 *
## race.ethnicity.5levelOther  2.17874    0.99090   2.199  0.0280 *
## race.ethnicity.5levelWhite  1.27525    0.82348   1.549  0.1216
## demo_race_hispanic1    0.49242    0.34972   1.408  0.1593
## interview_age    -0.02506    0.01638  -1.530  0.1263
## PDS_score:caudate_posvsneg_feedback_z  0.15205    0.18800   0.809  0.4187
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0138
## lmer.REML = 12303 Scale est. = 11.31 n = 1997

```

Males

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * caudate_posvsneg_feedback_z +

```

```
##      race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.662714   2.020642   0.823 0.410682
## PDS_score       0.794117   0.232017   3.423 0.000633 ***
## caudate_posvsneg_feedback_z -0.149997   0.355454  -0.422 0.673080
## race.ethnicity.5levelBlack    1.113313   0.877511   1.269 0.204689
## race.ethnicity.5levelMixed    2.793385   0.867905   3.219 0.001309 **
## race.ethnicity.5levelOther    2.896433   0.993050   2.917 0.003577 **
## race.ethnicity.5levelWhite    2.067674   0.817029   2.531 0.011458 *
## demo_race_hispanic1          0.068190   0.335459   0.203 0.838942
## interview_age       -0.000349   0.015732  -0.022 0.982303
## PDS_score:caudate_posvsneg_feedback_z 0.207256   0.237647   0.872 0.383250
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0107
## lmer.REML = 12379 Scale est. = 17.388    n = 2023
```

4.8 Model: CBCL internalizing factor ~ PDS x Putamen activity (feedback)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * putamen_posvsneg_feedback_z +
##      race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.86580   2.08450   2.334 0.019680 *
## PDS_score       0.67167   0.17939   3.744 0.000186 ***
## putamen_posvsneg_feedback_z 0.04503   0.35173   0.128 0.898143
## race.ethnicity.5levelBlack    0.63545   0.89359   0.711 0.477091
## race.ethnicity.5levelMixed    2.29627   0.87490   2.625 0.008742 **
## race.ethnicity.5levelOther    2.27889   0.99332   2.294 0.021882 *
## race.ethnicity.5levelWhite    1.32205   0.82379   1.605 0.108689
## demo_race_hispanic1          0.51174   0.34948   1.464 0.143267
## interview_age       -0.02187   0.01634  -1.338 0.181011
## PDS_score:putamen_posvsneg_feedback_z -0.08259   0.19310  -0.428 0.668914
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0131
## lmer.REML = 12299 Scale est. = 11.345    n = 1996
```

Males

```
##
```



```

## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * putamen_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.358783   2.015957   0.674 0.500380
## PDS_score       0.760030   0.231803   3.279 0.001060 **
## putamen_posvsneg_feedback_z -0.306904   0.361874  -0.848 0.396484
## race.ethnicity.5levelBlack    1.152753   0.871332   1.323 0.185993
## race.ethnicity.5levelMixed    2.856253   0.861081   3.317 0.000926 ***
## race.ethnicity.5levelOther    2.929340   0.989325   2.961 0.003103 **
## race.ethnicity.5levelWhite    2.150420   0.810173   2.654 0.008010 **
## demo_race_hispanic1          0.005966   0.337119   0.018 0.985883
## interview_age              0.002089   0.015740   0.133 0.894431
## PDS_score:putamen_posvsneg_feedback_z 0.334041   0.243549   1.372 0.170354
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0108
## lmer.REML = 12422 Scale est. = 17.593    n = 2028

```

4.9 Model: CBCL internalizing factor ~ PDS x Lateral OFC activity (feedback stage)

Females

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * lOFC_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.92052    2.08082   2.365 0.018140 *
## PDS_score       0.68518    0.17862   3.836 0.000129 ***
## lOFC_posvsneg_feedback_z -0.67670    0.57385  -1.179 0.238452
## race.ethnicity.5levelBlack    0.54472    0.88932   0.613 0.540267
## race.ethnicity.5levelMixed    2.21866    0.87231   2.543 0.011052 *
## race.ethnicity.5levelOther    2.47787    0.99339   2.494 0.012699 *
## race.ethnicity.5levelWhite    1.30039    0.82024   1.585 0.113041
## demo_race_hispanic1          0.41769    0.34743   1.202 0.229419
## interview_age      -0.02219    0.01632  -1.360 0.173911
## PDS_score:lOFC_posvsneg_feedback_z 0.26950    0.31121   0.866 0.386603
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##

```

```
##
## R-sq.(adj) = 0.0134
## lmer.REML = 12272 Scale est. = 11.19 n = 1994
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * lOFC_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.979171   1.992072   0.492 0.623102
## PDS_score       0.705574   0.230936   3.055 0.002278 **
## lOFC_posvsneg_feedback_z -0.260592   0.564728  -0.461 0.644528
## race.ethnicity.5levelBlack  1.164644   0.863426   1.349 0.177532
## race.ethnicity.5levelMixed  2.820399   0.852772   3.307 0.000958 ***
## race.ethnicity.5levelOther  2.748041   0.983799   2.793 0.005267 **
## race.ethnicity.5levelWhite  2.053822   0.801858   2.561 0.010499 *
## demo_race_hispanic1 -0.004806   0.333205  -0.014 0.988495
## interview_age    0.006403   0.015580   0.411 0.681151
## PDS_score:lOFC_posvsneg_feedback_z 0.221057   0.382530   0.578 0.563408
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00919
## lmer.REML = 12384 Scale est. = 17.008 n = 2029
```

4.10 Model: CBCL internalizing factor ~ PDS x Medial OFC activity (feedback stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * mOFC_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    5.04965   2.08298   2.424 0.01543 *
## PDS_score       0.68950   0.17888   3.855 0.00012 ***
## mOFC_posvsneg_feedback_z -0.69715   0.48406  -1.440 0.14996
## race.ethnicity.5levelBlack  0.53721   0.89106   0.603 0.54665
## race.ethnicity.5levelMixed  2.19349   0.87432   2.509 0.01219 *
## race.ethnicity.5levelOther  2.30312   0.98997   2.326 0.02009 *
## race.ethnicity.5levelWhite  1.28148   0.82167   1.560 0.11901
```

```
## demo_race_hispanic1          0.46194    0.34777    1.328    0.18423
## interview_age                -0.02318    0.01634   -1.419    0.15610
## PDS_score:mOFC_posvsneg_feedback_z  0.30275    0.26566    1.140    0.25459
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0142
## lmer.REML = 12281  Scale est. = 11.435    n = 1994
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * mOFC_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.031307   1.991116   0.518 0.604547
## PDS_score       0.708314   0.230857   3.068 0.002182 **
## mOFC_posvsneg_feedback_z -0.061820   0.505986  -0.122 0.902771
## race.ethnicity.5levelBlack  1.158695   0.862802   1.343 0.179441
## race.ethnicity.5levelMixed  2.837685   0.852570   3.328 0.000889 ***
## race.ethnicity.5levelOther  2.807415   0.980892   2.862 0.004252 **
## race.ethnicity.5levelWhite  2.061024   0.801557   2.571 0.010204 *
## demo_race_hispanic1    -0.023184   0.332785  -0.070 0.944465
## interview_age      0.005845   0.015565   0.376 0.707313
## PDS_score:mOFC_posvsneg_feedback_z  0.248273   0.349561   0.710 0.477635
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0108
## lmer.REML = 12371  Scale est. = 17.106    n = 2027
```

4.11 Model: CBCL internalizing factor ~ PDS x BIS-BAS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * bisbas_ss_basm_rr + race.ethnicity.5level +
##   demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.191763   2.099766   1.044 0.29667
## PDS_score       1.574106   0.551603   2.854 0.00436 **
```

```
## bisbas_ss_basm_rr      0.114562    0.111110    1.031    0.30260
## race.ethnicity.5levelBlack 0.201260    0.791776    0.254    0.79937
## race.ethnicity.5levelMixed 1.868473    0.787599    2.372    0.01775 *
## race.ethnicity.5levelOther 2.513910    0.901229    2.789    0.00532 **
## race.ethnicity.5levelWhite 1.340999    0.740403    1.811    0.07023 .
## demo_race_hispanic1      0.164739    0.316995    0.520    0.60332
## interview_age            -0.004925    0.014590   -0.338    0.73572
## PDS_score:bisbas_ss_basm_rr -0.107740    0.059762   -1.803    0.07153 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0132
## lmer.REML = 16324  Scale est. = 13.08      n = 2629
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * bisbas_ss_basm_rr + race.ethnicity.5level +
##      demo_race_hispanic + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.7423551   2.0817585    2.278  0.02280 *
## PDS_score      -0.8680368   0.7884713   -1.101  0.27103
## bisbas_ss_basm_rr -0.2504578   0.1186368   -2.111  0.03485 *
## race.ethnicity.5levelBlack 1.2560711   0.7530189    1.668  0.09542 .
## race.ethnicity.5levelMixed 1.9861319   0.7534441    2.636  0.00843 **
## race.ethnicity.5levelOther 1.8190748   0.8603645    2.114  0.03458 *
## race.ethnicity.5levelWhite 1.4449332   0.7064644    2.045  0.04092 *
## demo_race_hispanic1  0.2504211   0.3008454    0.832  0.40526
## interview_age    -0.0009387   0.0140026   -0.067  0.94656
## PDS_score:bisbas_ss_basm_rr 0.1859961   0.0825012    2.254  0.02424 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00812
## lmer.REML = 17710  Scale est. = 15.557      n = 2847
```

4.12 Model: CBCL internalizing factor ~ PDS x MID reaction time (large reward vs. neutral)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * rt_diff_large_neutral_z +
```

```
##      race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      5.501255    1.992802   2.761 0.005819 **
## PDS_score         0.641957    0.172929   3.712 0.000211 ***
## rt_diff_large_neutral_z 0.154540    0.311198   0.497 0.619525
## race.ethnicity.5levelBlack 0.560716    0.845384   0.663 0.507230
## race.ethnicity.5levelMixed 2.155255    0.833294   2.586 0.009763 **
## race.ethnicity.5levelOther 2.598824    0.947143   2.744 0.006123 **
## race.ethnicity.5levelWhite 1.320738    0.781113   1.691 0.091013 .
## demo_race_hispanic1 0.456433    0.341115   1.338 0.181018
## interview_age     -0.026474    0.015690  -1.687 0.091696 .
## PDS_score:rt_diff_large_neutral_z -0.008305    0.171296  -0.048 0.961335
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0132
## lmer.REML = 13258 Scale est. = 11.823    n = 2153
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * rt_diff_large_neutral_z +
##      race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.437100    1.933083   0.743 0.45730
## PDS_score         0.624857    0.221216   2.825 0.00477 **
## rt_diff_large_neutral_z 0.605150    0.344894   1.755 0.07946 .
## race.ethnicity.5levelBlack 0.739558    0.843849   0.876 0.38090
## race.ethnicity.5levelMixed 2.156381    0.836600   2.578 0.01001 *
## race.ethnicity.5levelOther 2.032814    0.962054   2.113 0.03471 *
## race.ethnicity.5levelWhite 1.469532    0.789459   1.861 0.06281 .
## demo_race_hispanic1 0.100016    0.322811   0.310 0.75672
## interview_age     0.008459    0.015042   0.562 0.57393
## PDS_score:rt_diff_large_neutral_z -0.382233    0.238948  -1.600 0.10982
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0071
## lmer.REML = 13868 Scale est. = 16.958    n = 2257
```

4.13 Model: CBCL internalizing factor ~ PDS x MID reaction time (large vs. small reward)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * rt_diff_large_small_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    5.41915    1.99084   2.722 0.006540 **
## PDS_score       0.62916    0.17250   3.647 0.000271 ***
## rt_diff_large_small_z -0.54782    0.29953  -1.829 0.067548 .
## race.ethnicity.5levelBlack 0.56487    0.84371   0.670 0.503245
## race.ethnicity.5levelMixed 2.14230    0.83251   2.573 0.010139 *
## race.ethnicity.5levelOther 2.55705    0.94673   2.701 0.006969 **
## race.ethnicity.5levelWhite 1.29990    0.78025   1.666 0.095859 .
## demo_race_hispanic1 0.45983    0.34088   1.349 0.177498
## interview_age   -0.02539    0.01567  -1.621 0.105253
## PDS_score:rt_diff_large_small_z 0.25824    0.16474   1.568 0.117135
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0143
## lmer.REML = 13256 Scale est. = 11.79    n = 2153
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * rt_diff_large_small_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.462262    1.934052   0.756 0.44969
## PDS_score       0.628312    0.221085   2.842 0.00452 **
## rt_diff_large_small_z 0.090408    0.345473   0.262 0.79358
## race.ethnicity.5levelBlack 0.694926    0.844009   0.823 0.41039
## race.ethnicity.5levelMixed 2.103226    0.836744   2.514 0.01202 *
## race.ethnicity.5levelOther 1.902684    0.960826   1.980 0.04780 *
## race.ethnicity.5levelWhite 1.409154    0.789449   1.785 0.07440 .
## demo_race_hispanic1 0.097283    0.323145   0.301 0.76340
## interview_age    0.008768    0.015050   0.583 0.56023
## PDS_score:rt_diff_large_small_z -0.119670    0.241539  -0.495 0.62033
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00569
## lmer.REML = 13871  Scale est. = 16.827    n = 2257
```

4.14 Model: CBCL internalizing factor ~ Testosterone x Accumbens activity (anticipation stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      accumbens_rvs_n_ant_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##                                Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   4.460740    2.119085   2.105 0.035422
## PDS_score                      0.665395    0.191155   3.481 0.000511
## hormone_scr_ert_mean           0.002798    0.008101   0.345 0.729815
## accumbens_rvs_n_ant_z          0.182512    0.418879   0.436 0.663095
## race.ethnicity.5levelBlack      0.220171    0.899271   0.245 0.806613
## race.ethnicity.5levelMixed      2.173556    0.878765   2.473 0.013471
## race.ethnicity.5levelOther      2.237816    0.998934   2.240 0.025195
## race.ethnicity.5levelWhite      1.325853    0.823882   1.609 0.107726
## demo_race_hispanic1             0.355402    0.358674   0.991 0.321874
## interview_age                  -0.018447    0.016899  -1.092 0.275143
## hormone_scr_ert_mean:accumbens_rvs_n_ant_z -0.006376    0.011134  -0.573 0.566914
##
## (Intercept)                    *
## PDS_score                      ***
## hormone_scr_ert_mean
## accumbens_rvs_n_ant_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed      *
## race.ethnicity.5levelOther      *
## race.ethnicity.5levelWhite
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:accumbens_rvs_n_ant_z
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0115
## lmer.REML = 11518  Scale est. = 10.565    n = 1870
```

Males

```
##
```

```

## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      accumbens_rvsnt_ant_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.827482   2.101594   0.394  0.69382
## PDS_score         0.803710   0.247925   3.242  0.00121
## hormone_scr_ert_mean -0.001469  0.008279  -0.177  0.85920
## accumbens_rvsnt_ant_z -0.223974  0.362232  -0.618  0.53644
## race.ethnicity.5levelBlack  1.003326  0.916447   1.095  0.27375
## race.ethnicity.5levelMixed  2.772588  0.901195   3.077  0.00212
## race.ethnicity.5levelOther  2.732707  1.034747   2.641  0.00834
## race.ethnicity.5levelWhite  2.068040  0.847370   2.441  0.01476
## demo_race_hispanic1  0.093109  0.347147   0.268  0.78857
## interview_age       0.007231  0.016641   0.435  0.66395
## hormone_scr_ert_mean:accumbens_rvsnt_ant_z  0.003830  0.010773   0.355  0.72227
##
## (Intercept)
## PDS_score          **
## hormone_scr_ert_mean
## accumbens_rvsnt_ant_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed      **
## race.ethnicity.5levelOther      **
## race.ethnicity.5levelWhite      *
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:accumbens_rvsnt_ant_z
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00989
## lmer.REML = 11513 Scale est. = 17.508    n = 1873

```

4.15 Model: CBCL internalizing factor ~ Testosterone x Caudate activity (anticipation stage) + PDS

Females

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      caudate_rvsnt_ant_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##

```



```
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.534882   2.1219447   2.137 0.032717
## PDS_score         0.6845890   0.1914868   3.575 0.000359
## hormone_scr_ert_mean 0.0028676   0.0081083   0.354 0.723629
## caudate_rvsnt_z   -0.0035716   0.3299659  -0.011 0.991365
## race.ethnicity.5levelBlack 0.2633481   0.8995029   0.293 0.769730
## race.ethnicity.5levelMixed 2.1525889   0.8777123   2.452 0.014278
## race.ethnicity.5levelOther 2.2184539   0.9953510   2.229 0.025945
## race.ethnicity.5levelWhite 1.3332409   0.8235547   1.619 0.105642
## demo_race_hispanic1 0.3429821   0.3576367   0.959 0.337672
## interview_age     -0.0193397   0.0169371  -1.142 0.253662
## hormone_scr_ert_mean:caudate_rvsnt_z 0.0001989   0.0087533   0.023 0.981876
##
## (Intercept)      *
## PDS_score         ***
## hormone_scr_ert_mean
## caudate_rvsnt_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed      *
## race.ethnicity.5levelOther      *
## race.ethnicity.5levelWhite
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:caudate_rvsnt_z
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0113
## lmer.REML = 11506 Scale est. = 10.618    n = 1868
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   caudate_rvsnt_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.085264   2.112341   0.514 0.607472
## PDS_score         0.817312   0.247909   3.297 0.000996
## hormone_scr_ert_mean -0.001257   0.008331  -0.151 0.880078
## caudate_rvsnt_z     0.210667   0.287271   0.733 0.463445
## race.ethnicity.5levelBlack 0.898481   0.937823   0.958 0.338162
## race.ethnicity.5levelMixed 2.713893   0.923809   2.938 0.003347
## race.ethnicity.5levelOther 2.659580   1.052711   2.526 0.011606
## race.ethnicity.5levelWhite 1.977981   0.871688   2.269 0.023374
## demo_race_hispanic1 0.092823   0.349225   0.266 0.790425
```

```
## interview_age 0.005767 0.016687 0.346 0.729694
## hormone_scr_ert_mean:caudate_rvsnt_ant_z -0.009248 0.008064 -1.147 0.251597
##
## (Intercept)
## PDS_score ***
## hormone_scr_ert_mean
## caudate_rvsnt_ant_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed **
## race.ethnicity.5levelOther *
## race.ethnicity.5levelWhite *
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:caudate_rvsnt_ant_z
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0103
## lmer.REML = 11507 Scale est. = 17.744 n = 1871
```

4.16 Model: CBCL internalizing factor ~ Testosterone x Putamen activity (anticipation stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
## putamen_rvsnt_ant_z + race.ethnicity.5level + demo_race_hispanic +
## interview_age
##
## Parametric coefficients:
## Estimate Std. Error t value Pr(>|t|)
## (Intercept) 4.341820 2.117114 2.051 0.040425
## PDS_score 0.685162 0.191490 3.578 0.000355
## hormone_scr_ert_mean 0.001752 0.008077 0.217 0.828324
## putamen_rvsnt_ant_z -0.194659 0.331833 -0.587 0.557532
## race.ethnicity.5levelBlack 0.318982 0.895454 0.356 0.721714
## race.ethnicity.5levelMixed 2.189852 0.874549 2.504 0.012366
## race.ethnicity.5levelOther 2.243043 0.994948 2.254 0.024285
## race.ethnicity.5levelWhite 1.316069 0.820336 1.604 0.108817
## demo_race_hispanic1 0.361351 0.357142 1.012 0.311772
## interview_age -0.017509 0.016893 -1.036 0.300127
## hormone_scr_ert_mean:putamen_rvsnt_ant_z 0.004550 0.008692 0.523 0.600715
##
## (Intercept) *
## PDS_score ***
## hormone_scr_ert_mean
## putamen_rvsnt_ant_z
## race.ethnicity.5levelBlack
```

```
## race.ethnicity.5levelMixed          *
## race.ethnicity.5levelOther          *
## race.ethnicity.5levelWhite
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:putamen_rvsnt_z
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0114
## lmer.REML = 11482  Scale est. = 10.569    n = 1866
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      putamen_rvsnt_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##      Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.934510    2.107235   0.443 0.657473
## PDS_score       0.833556    0.248783   3.351 0.000823
## hormone_scr_ert_mean -0.001062    0.008318  -0.128 0.898383
## putamen_rvsnt_z    0.361272    0.284515   1.270 0.204322
## race.ethnicity.5levelBlack    0.931856    0.936204   0.995 0.319693
## race.ethnicity.5levelMixed    2.713552    0.919864   2.950 0.003218
## race.ethnicity.5levelOther    2.461640    1.054510   2.334 0.019681
## race.ethnicity.5levelWhite    1.962977    0.869640   2.257 0.024109
## demo_race_hispanic1    0.054678    0.348490   0.157 0.875342
## interview_age    0.007025    0.016652   0.422 0.673168
## hormone_scr_ert_mean:putamen_rvsnt_z -0.015096    0.007797  -1.936 0.053022
##
## (Intercept)
## PDS_score          ***
## hormone_scr_ert_mean
## putamen_rvsnt_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed    **
## race.ethnicity.5levelOther    *
## race.ethnicity.5levelWhite    *
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:putamen_rvsnt_z .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0113
```

```
## lmer.REML = 11495 Scale est. = 17.146 n = 1871
```

4.17 Model: CBCL internalizing factor ~ Testosterone x Accumbens activity (feedback stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   accumbens_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##                                     Estimate Std. Error t value
## (Intercept)                       4.189255    2.110672   1.985
## PDS_score                          0.677795    0.190161   3.564
## hormone_scr_ert_mean                0.002331    0.008078   0.289
## accumbens_posvsneg_feedback_z      0.319909    0.465170   0.688
## race.ethnicity.5levelBlack          0.284555    0.894195   0.318
## race.ethnicity.5levelMixed          2.101703    0.874015   2.405
## race.ethnicity.5levelOther          2.296337    0.991434   2.316
## race.ethnicity.5levelWhite          1.361645    0.820086   1.660
## demo_race_hispanic1                 0.271252    0.357796   0.758
## interview_age                      -0.016437    0.016839  -0.976
## hormone_scr_ert_mean:accumbens_posvsneg_feedback_z -0.010360    0.012227  -0.847
##                                     Pr(>|t|)
## (Intercept)                       0.047314 *
## PDS_score                          0.000374 ***
## hormone_scr_ert_mean                0.772937
## accumbens_posvsneg_feedback_z      0.491712
## race.ethnicity.5levelBlack          0.750350
## race.ethnicity.5levelMixed          0.016285 *
## race.ethnicity.5levelOther          0.020657 *
## race.ethnicity.5levelWhite          0.097009 .
## demo_race_hispanic1                 0.448475
## interview_age                      0.329146
## hormone_scr_ert_mean:accumbens_posvsneg_feedback_z 0.396926
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## R-sq.(adj) = 0.0107
## lmer.REML = 11518 Scale est. = 10.473 n = 1873
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
```

```

## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   accumbens_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value
## (Intercept)      0.656423   2.086433   0.315
## PDS_score         0.765509   0.245555   3.117
## hormone_scr_ert_mean -0.002612  0.008365  -0.312
## accumbens_posvsneg_feedback_z  0.304056  0.375225   0.810
## race.ethnicity.5levelBlack    1.112216  0.908426   1.224
## race.ethnicity.5levelMixed    2.833993  0.891611   3.179
## race.ethnicity.5levelOther    2.908731  1.024126   2.840
## race.ethnicity.5levelWhite    2.084747  0.838662   2.486
## demo_race_hispanic1          0.062542  0.345129   0.181
## interview_age              0.008752  0.016534   0.529
## hormone_scr_ert_mean:accumbens_posvsneg_feedback_z  0.001400  0.010561   0.133
##
##               Pr(>|t|)
## (Intercept)      0.75309
## PDS_score         0.00185 **
## hormone_scr_ert_mean  0.75491
## accumbens_posvsneg_feedback_z  0.41785
## race.ethnicity.5levelBlack    0.22098
## race.ethnicity.5levelMixed    0.00150 **
## race.ethnicity.5levelOther    0.00456 **
## race.ethnicity.5levelWhite    0.01301 *
## demo_race_hispanic1          0.85622
## interview_age              0.59665
## hormone_scr_ert_mean:accumbens_posvsneg_feedback_z  0.89454
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0113
## lmer.REML = 11454  Scale est. = 18.024    n = 1869

```

4.18 Model: CBCL internalizing factor ~ Testosterone x Caudate activity (Feedback stage) + PDS

Females

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   caudate_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value
## (Intercept)      4.554e+00  2.125e+00   2.143
## PDS_score         7.006e-01  1.917e-01   3.656

```

```

## hormone_scr_ert_mean                2.420e-03  8.112e-03  0.298
## caudate_posvsneg_feedback_z         -1.997e-01  3.265e-01 -0.612
## race.ethnicity.5levelBlack           2.948e-01  8.991e-01  0.328
## race.ethnicity.5levelMixed           2.101e+00  8.768e-01  2.396
## race.ethnicity.5levelOther           2.103e+00  9.960e-01  2.112
## race.ethnicity.5levelWhite           1.291e+00  8.229e-01  1.569
## demo_race_hispanic1                 3.428e-01  3.598e-01  0.953
## interview_age                       -1.950e-02  1.697e-02 -1.149
## hormone_scr_ert_mean:caudate_posvsneg_feedback_z -8.058e-06  8.468e-03 -0.001
##                                     Pr(>|t|)
## (Intercept)                         0.032269 *
## PDS_score                           0.000264 ***
## hormone_scr_ert_mean                 0.765486
## caudate_posvsneg_feedback_z          0.540722
## race.ethnicity.5levelBlack           0.743000
## race.ethnicity.5levelMixed           0.016683 *
## race.ethnicity.5levelOther           0.034831 *
## race.ethnicity.5levelWhite           0.116767
## demo_race_hispanic1                 0.340801
## interview_age                       0.250598
## hormone_scr_ert_mean:caudate_posvsneg_feedback_z 0.999241
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0122
## lmer.REML = 11483  Scale est. = 10.562    n = 1865

```

Males

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   caudate_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##                                     Estimate Std. Error t value
## (Intercept)                     1.3853505  2.1141365  0.655
## PDS_score                        0.8405454  0.2482247  3.386
## hormone_scr_ert_mean             -0.0003595  0.0083567 -0.043
## caudate_posvsneg_feedback_z      0.0394484  0.3248035  0.121
## race.ethnicity.5levelBlack       0.9893125  0.9257562  1.069
## race.ethnicity.5levelMixed       2.7620204  0.9104401  3.034
## race.ethnicity.5levelOther       2.7653144  1.0394684  2.660
## race.ethnicity.5levelWhite       2.0516687  0.8573196  2.393
## demo_race_hispanic1             0.1355263  0.3485331  0.389
## interview_age                    0.0018915  0.0166800  0.113
## hormone_scr_ert_mean:caudate_posvsneg_feedback_z 0.0037307  0.0092346  0.404
##                                     Pr(>|t|)
## (Intercept)                     0.512369

```

```

## PDS_score 0.000723 ***
## hormone_scr_ert_mean 0.965687
## caudate_posvsneg_feedback_z 0.903345
## race.ethnicity.5levelBlack 0.285365
## race.ethnicity.5levelMixed 0.002449 **
## race.ethnicity.5levelOther 0.007874 **
## race.ethnicity.5levelWhite 0.016804 *
## demo_race_hispanic1 0.697433
## interview_age 0.909724
## hormone_scr_ert_mean:caudate_posvsneg_feedback_z 0.686270
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0103
## lmer.REML = 11503 Scale est. = 17.709 n = 1871

```

4.19 Model: CBCL internalizing factor ~ Testosterone x Putamen activity (Feedback stage) + PDS

Females

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      putamen_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
## Estimate Std. Error t value
## (Intercept) 4.287337 2.120112 2.022
## PDS_score 0.674074 0.191044 3.528
## hormone_scr_ert_mean 0.002856 0.008144 0.351
## putamen_posvsneg_feedback_z -0.057460 0.364195 -0.158
## race.ethnicity.5levelBlack 0.353506 0.899655 0.393
## race.ethnicity.5levelMixed 2.143254 0.876523 2.445
## race.ethnicity.5levelOther 2.180848 0.997524 2.186
## race.ethnicity.5levelWhite 1.325057 0.823209 1.610
## demo_race_hispanic1 0.360481 0.359323 1.003
## interview_age -0.017350 0.016925 -1.025
## hormone_scr_ert_mean:putamen_posvsneg_feedback_z -0.003165 0.009367 -0.338
##
## Pr(>|t|)
## (Intercept) 0.043297 *
## PDS_score 0.000428 ***
## hormone_scr_ert_mean 0.725826
## putamen_posvsneg_feedback_z 0.874653
## race.ethnicity.5levelBlack 0.694413
## race.ethnicity.5levelMixed 0.014571 *
## race.ethnicity.5levelOther 0.028921 *
## race.ethnicity.5levelWhite 0.107650
## demo_race_hispanic1 0.315884

```

```
## interview_age 0.305453
## hormone_scr_ert_mean:putamen_posvsneg_feedback_z 0.735491
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0116
## lmer.REML = 11483 Scale est. = 10.565 n = 1865
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      putamen_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value
## (Intercept)  0.9611155  2.1101773   0.455
## PDS_score    0.8176842  0.2484107   3.292
## hormone_scr_ert_mean 0.0002681  0.0083787   0.032
## putamen_posvsneg_feedback_z 0.3306721  0.3251871   1.017
## race.ethnicity.5levelBlack 1.0236441  0.9185222   1.114
## race.ethnicity.5levelMixed 2.8148709  0.9028527   3.118
## race.ethnicity.5levelOther 2.8319892  1.0337642   2.739
## race.ethnicity.5levelWhite 2.1176635  0.8496222   2.492
## demo_race_hispanic1 0.0681445  0.3504727   0.194
## interview_age 0.0051637  0.0166850   0.309
## hormone_scr_ert_mean:putamen_posvsneg_feedback_z -0.0049109  0.0091615  -0.536
##
##              Pr(>|t|)
## (Intercept)  0.64883
## PDS_score    0.00101 **
## hormone_scr_ert_mean 0.97447
## putamen_posvsneg_feedback_z 0.30935
## race.ethnicity.5levelBlack 0.26523
## race.ethnicity.5levelMixed 0.00185 **
## race.ethnicity.5levelOther 0.00621 **
## race.ethnicity.5levelWhite 0.01277 *
## demo_race_hispanic1 0.84586
## interview_age 0.75699
## hormone_scr_ert_mean:putamen_posvsneg_feedback_z 0.59199
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0101
## lmer.REML = 11552 Scale est. = 17.82 n = 1877
```


4.20 Model: CBCL internalizing factor ~ Testosterone x Lateral OFC activity (anticipation stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   lOFC_rvs_n_ant_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.386035   2.139491   2.050 0.040501 *
## PDS_score       0.658410   0.191838   3.432 0.000612 ***
## hormone_scr_ert_mean 0.003086   0.008159   0.378 0.705274
## lOFC_rvs_n_ant_z 0.330589   0.491379   0.673 0.501173
## race.ethnicity.5levelBlack 0.227744   0.906920   0.251 0.801751
## race.ethnicity.5levelMixed 2.115228   0.887612   2.383 0.017270 *
## race.ethnicity.5levelOther 2.179843   1.007403   2.164 0.030605 *
## race.ethnicity.5levelWhite 1.276544   0.832855   1.533 0.125512
## demo_race_hispanic1 0.358385   0.359093   0.998 0.318396
## interview_age   -0.017460   0.017050  -1.024 0.305924
## hormone_scr_ert_mean:lOFC_rvs_n_ant_z -0.007097   0.012725  -0.558 0.577087
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0109
## lmer.REML = 11483  Scale est. = 10.83    n = 1864
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   lOFC_rvs_n_ant_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.143556   2.082627   0.069 0.94505
## PDS_score       0.732637   0.247926   2.955 0.00317 **
## hormone_scr_ert_mean -0.003482   0.008272  -0.421 0.67386
## lOFC_rvs_n_ant_z 0.319893   0.424799   0.753 0.45152
## race.ethnicity.5levelBlack 0.983069   0.907154   1.084 0.27865
## race.ethnicity.5levelMixed 2.709157   0.891327   3.039 0.00240 **
## race.ethnicity.5levelOther 2.662592   1.023037   2.603 0.00932 **
## race.ethnicity.5levelWhite 1.966634   0.837446   2.348 0.01896 *
```

```
## demo_race_hispanic1          -0.020222    0.345180   -0.059   0.95329
## interview_age                 0.014830    0.016517    0.898   0.36937
## hormone_scr_ert_mean:lOFC_rvsnt_z -0.011983    0.012283   -0.976   0.32939
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00876
## lmer.REML = 11454  Scale est. = 17.139    n = 1870
```

4.21 Model: CBCL internalizing factor ~ Testosterone x Medial OFC activity (anticipation stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   mOFC_rvsnt_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    4.202280   2.132609   1.970 0.048931 *
## PDS_score       0.676571   0.191614   3.531 0.000424 ***
## hormone_scr_ert_mean 0.002583   0.008127   0.318 0.750694
## mOFC_rvsnt_z    0.063317   0.437193   0.145 0.884864
## race.ethnicity.5levelBlack 0.216029   0.906342   0.238 0.811634
## race.ethnicity.5levelMixed 2.115741   0.887454   2.384 0.017223 *
## race.ethnicity.5levelOther 2.218632   1.008524   2.200 0.027938 *
## race.ethnicity.5levelWhite 1.295692   0.832708   1.556 0.119879
## demo_race_hispanic1  0.351711   0.358836   0.980 0.327142
## interview_age    -0.016049   0.016989  -0.945 0.344951
## hormone_scr_ert_mean:mOFC_rvsnt_z 0.002991   0.011334   0.264 0.791898
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0115
## lmer.REML = 11480  Scale est. = 10.572    n = 1864
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   mOFC_rvsnt_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
```

```
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.3794183   2.0930053   0.181  0.85617
## PDS_score         0.7418269   0.2477609   2.994  0.00279 **
## hormone_scr_ert_mean -0.0047195   0.0082694  -0.571  0.56826
## mOFC_rvsn_ant_z    0.2166667   0.3858311   0.562  0.57448
## race.ethnicity.5levelBlack 1.0066067   0.9112426   1.105  0.26945
## race.ethnicity.5levelMixed 2.6544268   0.8948998   2.966  0.00305 **
## race.ethnicity.5levelOther 2.6516682   1.0247281   2.588  0.00974 **
## race.ethnicity.5levelWhite 1.9777066   0.8411090   2.351  0.01881 *
## demo_race_hispanic1  0.0431677   0.3460332   0.125  0.90073
## interview_age      0.0130179   0.0165828   0.785  0.43254
## hormone_scr_ert_mean:mOFC_rvsn_ant_z -0.0003209   0.0108689  -0.030  0.97645
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00947
## lmer.REML = 11431 Scale est. = 17.29    n = 1864
```

4.22 Model: CBCL internalizing factor ~ Testosterone x Lateral OFC activity (feedback stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   lOFC_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value
## (Intercept)      4.334290   2.117637   2.047
## PDS_score         0.673271   0.190513   3.534
## hormone_scr_ert_mean 0.001130   0.008091   0.140
## lOFC_posvsneg_feedback_z 0.550378   0.567460   0.970
## race.ethnicity.5levelBlack 0.298496   0.894428   0.334
## race.ethnicity.5levelMixed 2.147933   0.873735   2.458
## race.ethnicity.5levelOther 2.515196   0.999082   2.518
## race.ethnicity.5levelWhite 1.364823   0.819389   1.666
## demo_race_hispanic1  0.238185   0.357406   0.666
## interview_age     -0.017253   0.016901  -1.021
## hormone_scr_ert_mean:lOFC_posvsneg_feedback_z -0.019692   0.014952  -1.317
##
##               Pr(>|t|)
## (Intercept)      0.040823 *
## PDS_score         0.000419 ***
## hormone_scr_ert_mean 0.888980
## lOFC_posvsneg_feedback_z 0.332224
## race.ethnicity.5levelBlack 0.738622
## race.ethnicity.5levelMixed 0.014049 *
```

```
## race.ethnicity.5levelOther          0.011903 *
## race.ethnicity.5levelWhite          0.095950 .
## demo_race_hispanic1                 0.505222
## interview_age                       0.307481
## hormone_scr_ert_mean:lOFC_posvsneg_feedback_z 0.188010
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0128
## lmer.REML = 11471 Scale est. = 10.543    n = 1865
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   lOFC_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##                                Estimate Std. Error t value
## (Intercept)                  0.708612   2.083849   0.340
## PDS_score                     0.780740   0.246067   3.173
## hormone_scr_ert_mean          -0.003771   0.008293  -0.455
## lOFC_posvsneg_feedback_z      0.082718   0.469392   0.176
## race.ethnicity.5levelBlack     1.065934   0.909266   1.172
## race.ethnicity.5levelMixed     2.800502   0.892576   3.138
## race.ethnicity.5levelOther     2.630253   1.028645   2.557
## race.ethnicity.5levelWhite     2.031878   0.839607   2.420
## demo_race_hispanic1           0.054049   0.346076   0.156
## interview_age                 0.009165   0.016504   0.555
## hormone_scr_ert_mean:lOFC_posvsneg_feedback_z 0.001315   0.013021   0.101
##                                Pr(>|t|)
## (Intercept)                  0.73386
## PDS_score                     0.00153 **
## hormone_scr_ert_mean          0.64939
## lOFC_posvsneg_feedback_z      0.86014
## race.ethnicity.5levelBlack     0.24123
## race.ethnicity.5levelMixed     0.00173 **
## race.ethnicity.5levelOther     0.01064 *
## race.ethnicity.5levelWhite     0.01561 *
## demo_race_hispanic1           0.87591
## interview_age                 0.57873
## hormone_scr_ert_mean:lOFC_posvsneg_feedback_z 0.91958
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00915
## lmer.REML = 11513 Scale est. = 17.224    n = 1878
```

4.23 Model: CBCL internalizing factor ~ Testosterone x Medial OFC activity (feedback stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      mOFC_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##                                Estimate Std. Error t value
## (Intercept)                  4.369334   2.116941   2.064
## PDS_score                    0.684020   0.190714   3.587
## hormone_scr_ert_mean         0.002015   0.008095   0.249
## mOFC_posvsneg_feedback_z     0.562287   0.484833   1.160
## race.ethnicity.5levelBlack   0.271402   0.896065   0.303
## race.ethnicity.5levelMixed   2.143308   0.874392   2.451
## race.ethnicity.5levelOther   2.290652   0.993534   2.306
## race.ethnicity.5levelWhite   1.335606   0.819977   1.629
## demo_race_hispanic1         0.315052   0.357365   0.882
## interview_age                -0.017840   0.016903  -1.055
## hormone_scr_ert_mean:mOFC_posvsneg_feedback_z -0.019533   0.012998  -1.503
##                                Pr(>|t|)
## (Intercept)                  0.039158 *
## PDS_score                    0.000344 ***
## hormone_scr_ert_mean         0.803458
## mOFC_posvsneg_feedback_z     0.246298
## race.ethnicity.5levelBlack   0.762013
## race.ethnicity.5levelMixed   0.014330 *
## race.ethnicity.5levelOther   0.021245 *
## race.ethnicity.5levelWhite   0.103518
## demo_race_hispanic1         0.378109
## interview_age                0.291362
## hormone_scr_ert_mean:mOFC_posvsneg_feedback_z 0.133070
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0133
## lmer.REML = 11481  Scale est. = 10.705    n = 1866
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      mOFC_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
```

```
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value
## (Intercept)      0.698369   2.080425   0.336
## PDS_score         0.787679   0.246180   3.200
## hormone_scr_ert_mean -0.003648   0.008294  -0.440
## mOFC_posvsneg_feedback_z 0.534975   0.419242   1.276
## race.ethnicity.5levelBlack 1.032102   0.908791   1.136
## race.ethnicity.5levelMixed 2.828046   0.892475   3.169
## race.ethnicity.5levelOther 2.683977   1.025478   2.617
## race.ethnicity.5levelWhite 2.028699   0.839404   2.417
## demo_race_hispanic1 0.025745   0.345377   0.075
## interview_age      0.009149   0.016473   0.555
## hormone_scr_ert_mean:mOFC_posvsneg_feedback_z -0.006684   0.012015  -0.556
##
##              Pr(>|t|)
## (Intercept)      0.73715
## PDS_score         0.00140 **
## hormone_scr_ert_mean 0.66016
## mOFC_posvsneg_feedback_z 0.20210
## race.ethnicity.5levelBlack 0.25623
## race.ethnicity.5levelMixed 0.00156 **
## race.ethnicity.5levelOther 0.00893 **
## race.ethnicity.5levelWhite 0.01575 *
## demo_race_hispanic1 0.94059
## interview_age      0.57869
## hormone_scr_ert_mean:mOFC_posvsneg_feedback_z 0.57807
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0111
## lmer.REML = 11500  Scale est. = 17.336    n = 1876
```

4.24 Model: CBCL internalizing factor ~ Testosterone x BIS-BAS RR + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      bisbas_ss_basm_rr + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.020293   2.129138   1.419 0.156158
## PDS_score         0.626624   0.169756   3.691 0.000228
## hormone_scr_ert_mean -0.009565   0.025287  -0.378 0.705274
## bisbas_ss_basm_rr   -0.084205   0.110618  -0.761 0.446597
## race.ethnicity.5levelBlack -0.041861   0.799020  -0.052 0.958222
## race.ethnicity.5levelMixed  1.640258   0.791942   2.071 0.038447
```

```
## race.ethnicity.5levelOther      2.486882    0.909634    2.734 0.006304
## race.ethnicity.5levelWhite      1.312543    0.742548    1.768 0.077250
## demo_race_hispanic1             0.027915    0.326365    0.086 0.931844
## interview_age                   0.003614    0.015214    0.238 0.812240
## hormone_scr_ert_mean:bisbas_ss_basm_rr 0.001030    0.002812    0.366 0.714173
##
## (Intercept)
## PDS_score                        ***
## hormone_scr_ert_mean
## bisbas_ss_basm_rr
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed      *
## race.ethnicity.5levelOther     **
## race.ethnicity.5levelWhite      .
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:bisbas_ss_basm_rr
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.011
## lmer.REML = 15183  Scale est. = 12.902    n = 2443
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##     bisbas_ss_basm_rr + race.ethnicity.5level + demo_race_hispanic +
##     interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.9448720   2.0990033   1.403   0.1607
## PDS_score       0.9727679   0.2130504   4.566 5.2e-06
## hormone_scr_ert_mean -0.0077391   0.0275009  -0.281   0.7784
## bisbas_ss_basm_rr  -0.0374799   0.1024260  -0.366   0.7145
## race.ethnicity.5levelBlack    1.2176099   0.7861775   1.549   0.1216
## race.ethnicity.5levelMixed    1.9522652   0.7835021   2.492   0.0128
## race.ethnicity.5levelOther    1.6180798   0.9000651   1.798   0.0723
## race.ethnicity.5levelWhite    1.4443559   0.7343462   1.967   0.0493
## demo_race_hispanic1    0.3039554   0.3133667   0.970   0.3322
## interview_age    -0.0030757   0.0148819  -0.207   0.8363
## hormone_scr_ert_mean:bisbas_ss_basm_rr 0.0007827   0.0029404   0.266   0.7901
##
## (Intercept)
## PDS_score                        ***
## hormone_scr_ert_mean
## bisbas_ss_basm_rr
## race.ethnicity.5levelBlack
```

```
## race.ethnicity.5levelMixed          *
## race.ethnicity.5levelOther          .
## race.ethnicity.5levelWhite          *
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:bisbas_ss_basm_rr
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00648
## lmer.REML = 16521  Scale est. = 16.034    n = 2641
```

4.25 Model: CBCL internalizing factor ~ Testosterone x MID Reaction Time + PDS (large reward vs. neutral)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   rt_diff_large_neutral_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##                                Estimate Std. Error t value
## (Intercept)                   4.907852   2.030911   2.417
## PDS_score                     0.640865   0.184675   3.470
## hormone_scr_ert_mean          0.002747   0.007808   0.352
## rt_diff_large_neutral_z      -0.234637   0.297943  -0.788
## race.ethnicity.5levelBlack    0.234371   0.848919   0.276
## race.ethnicity.5levelMixed    2.018688   0.835051   2.417
## race.ethnicity.5levelOther    2.518939   0.951958   2.646
## race.ethnicity.5levelWhite    1.333646   0.780222   1.709
## demo_race_hispanic1          0.310120   0.350440   0.885
## interview_age                 -0.021805   0.016262  -1.341
## hormone_scr_ert_mean:rt_diff_large_neutral_z 0.010522   0.007540   1.395
##                                Pr(>|t|)
## (Intercept)                   0.015756 *
## PDS_score                     0.000531 ***
## hormone_scr_ert_mean          0.725032
## rt_diff_large_neutral_z      0.431069
## race.ethnicity.5levelBlack    0.782514
## race.ethnicity.5levelMixed    0.015719 *
## race.ethnicity.5levelOther    0.008207 **
## race.ethnicity.5levelWhite    0.087547 .
## demo_race_hispanic1          0.376293
## interview_age                 0.180118
## hormone_scr_ert_mean:rt_diff_large_neutral_z 0.163025
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



```
##
##
## R-sq.(adj) = 0.0141
## lmer.REML = 12398 Scale est. = 11.344 n = 2014

Males

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
## rt_diff_large_neutral_z + race.ethnicity.5level + demo_race_hispanic +
## interview_age
##
## Parametric coefficients:
##
## Estimate Std. Error t value
## (Intercept) 1.417e+00 2.019e+00 0.702
## PDS_score 7.079e-01 2.365e-01 2.994
## hormone_scr_ert_mean 3.882e-05 7.949e-03 0.005
## rt_diff_large_neutral_z 4.941e-01 2.912e-01 1.697
## race.ethnicity.5levelBlack 6.221e-01 8.861e-01 0.702
## race.ethnicity.5levelMixed 2.099e+00 8.748e-01 2.399
## race.ethnicity.5levelOther 1.774e+00 1.003e+00 1.769
## race.ethnicity.5levelWhite 1.389e+00 8.256e-01 1.683
## demo_race_hispanic1 1.517e-01 3.361e-01 0.451
## interview_age 8.579e-03 1.592e-02 0.539
## hormone_scr_ert_mean:rt_diff_large_neutral_z -9.990e-03 8.000e-03 -1.249
##
## Pr(>|t|)
## (Intercept) 0.48275
## PDS_score 0.00279 **
## hormone_scr_ert_mean 0.99610
## rt_diff_large_neutral_z 0.08994 .
## race.ethnicity.5levelBlack 0.48277
## race.ethnicity.5levelMixed 0.01651 *
## race.ethnicity.5levelOther 0.07711 .
## race.ethnicity.5levelWhite 0.09253 .
## demo_race_hispanic1 0.65185
## interview_age 0.58996
## hormone_scr_ert_mean:rt_diff_large_neutral_z 0.21194
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0066
## lmer.REML = 12948 Scale est. = 17.517 n = 2097
```

4.26 Model: CBCL internalizing factor ~ Testosterone x MID Reaction Time + PDS (large vs. small reward)

Females

```
##
## Family: gaussian
```

```

## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   rt_diff_large_small_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value
## (Intercept)      4.831194   2.029794   2.380
## PDS_score         0.653073   0.184699   3.536
## hormone_scr_ert_mean 0.001929   0.007810   0.247
## rt_diff_large_small_z -0.398204   0.291988  -1.364
## race.ethnicity.5levelBlack 0.219699   0.848951   0.259
## race.ethnicity.5levelMixed 2.006919   0.835252   2.403
## race.ethnicity.5levelOther 2.487240   0.952491   2.611
## race.ethnicity.5levelWhite 1.329151   0.780631   1.703
## demo_race_hispanic1 0.281757   0.350482   0.804
## interview_age    -0.020947   0.016244  -1.289
## hormone_scr_ert_mean:rt_diff_large_small_z 0.007625   0.007555   1.009
##
##               Pr(>|t|)
## (Intercept)      0.017399 *
## PDS_score         0.000416 ***
## hormone_scr_ert_mean 0.804974
## rt_diff_large_small_z 0.172793
## race.ethnicity.5levelBlack 0.795825
## race.ethnicity.5levelMixed 0.016362 *
## race.ethnicity.5levelOther 0.009087 **
## race.ethnicity.5levelWhite 0.088786 .
## demo_race_hispanic1 0.421543
## interview_age     0.197374
## hormone_scr_ert_mean:rt_diff_large_small_z 0.312973
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0132
## lmer.REML = 12399  Scale est. = 11.209    n = 2014

```

Males

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   rt_diff_large_small_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value
## (Intercept)      1.490e+00  2.021e+00   0.737
## PDS_score         6.957e-01  2.364e-01   2.943

```

```

## hormone_scr_ert_mean -1.804e-05 7.958e-03 -0.002
## rt_diff_large_small_z -3.445e-02 2.898e-01 -0.119
## race.ethnicity.5levelBlack 5.962e-01 8.868e-01 0.672
## race.ethnicity.5levelMixed 2.051e+00 8.751e-01 2.343
## race.ethnicity.5levelOther 1.703e+00 1.004e+00 1.697
## race.ethnicity.5levelWhite 1.352e+00 8.260e-01 1.637
## demo_race_hispanic1 1.438e-01 3.362e-01 0.428
## interview_age 8.480e-03 1.594e-02 0.532
## hormone_scr_ert_mean:rt_diff_large_small_z -6.380e-04 8.294e-03 -0.077
## Pr(>|t|)
## (Intercept) 0.46128
## PDS_score 0.00329 **
## hormone_scr_ert_mean 0.99819
## rt_diff_large_small_z 0.90539
## race.ethnicity.5levelBlack 0.50146
## race.ethnicity.5levelMixed 0.01921 *
## race.ethnicity.5levelOther 0.08992 .
## race.ethnicity.5levelWhite 0.10178
## demo_race_hispanic1 0.66891
## interview_age 0.59480
## hormone_scr_ert_mean:rt_diff_large_small_z 0.93869
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00521
## lmer.REML = 12951 Scale est. = 17.541 n = 2097

```

Supplement B

Reward sensitivity and internalizing symptoms during the transition to puberty: An examination of 9- and 10-year-olds in the ABCD Study

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Results for Sample 2

1—Int~Puberty—

1.1 Model: CBCL internalizing factor ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + race.ethnicity.5level +
```



```
##      interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.00435    1.81456   0.553   0.5800
## PDS_score         0.78180    0.15854   4.931 8.69e-07 ***
## race.ethnicity.5levelBlack -0.25319    0.71823  -0.353   0.7245
## race.ethnicity.5levelMixed  1.22839    0.71864   1.709   0.0875 .
## race.ethnicity.5levelOther  0.39856    0.82932   0.481   0.6309
## race.ethnicity.5levelWhite  0.99113    0.66629   1.488   0.1370
## interview_age      0.01562    0.01471   1.062   0.2885
## demo_race_hispanic1  0.25310    0.32178   0.787   0.4316
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0128
## lmer.REML = 16187  Scale est. = 17.323    n = 2620
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + race.ethnicity.5level +
##      interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.916514    1.836811   1.588 0.112440
## PDS_score         0.668998    0.198120   3.377 0.000743 ***
## race.ethnicity.5levelBlack -0.774862    0.788636  -0.983 0.325920
## race.ethnicity.5levelMixed  0.474852    0.785132   0.605 0.545356
## race.ethnicity.5levelOther -0.839169    0.884062  -0.949 0.342590
## race.ethnicity.5levelWhite -0.009381    0.734578  -0.013 0.989812
## interview_age      0.010284    0.014072   0.731 0.464926
## demo_race_hispanic1  0.615472    0.322318   1.910 0.056296 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00513
## lmer.REML = 17791  Scale est. = 15.892    n = 2845
```

1.2 Model: CBCL Anxious-Depressed ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
```

```
## cbcl_scr_syn_anxdep_r ~ PDS_score + race.ethnicity.5level + interview_age +
##      demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.108103    1.010173   1.097 0.272767
## PDS_score         0.327885    0.088132   3.720 0.000203 ***
## race.ethnicity.5levelBlack -0.296592    0.397328  -0.746 0.455452
## race.ethnicity.5levelMixed  0.756457    0.398018   1.901 0.057470 .
## race.ethnicity.5levelOther  0.204912    0.459613   0.446 0.655753
## race.ethnicity.5levelWhite  0.584367    0.368865   1.584 0.113262
## interview_age      0.003237    0.008208   0.394 0.693331
## demo_race_hispanic1  0.074772    0.177107   0.422 0.672924
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0128
## lmer.REML = 13136 Scale est. = 6.6266    n = 2620
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ PDS_score + race.ethnicity.5level + interview_age +
##      demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.599640    1.022995   2.541 0.01110 *
## PDS_score         0.285806    0.110323   2.591 0.00963 **
## race.ethnicity.5levelBlack -0.321560    0.433851  -0.741 0.45865
## race.ethnicity.5levelMixed  0.392497    0.432187   0.908 0.36387
## race.ethnicity.5levelOther -0.183938    0.488335  -0.377 0.70645
## race.ethnicity.5levelWhite  0.287702    0.404120   0.712 0.47657
## interview_age     -0.005896    0.007862  -0.750 0.45336
## demo_race_hispanic1  0.258338    0.177288   1.457 0.14518
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00484
## lmer.REML = 14479 Scale est. = 6.5927    n = 2845
```

1.3 Model: CBCL Withdrawn-Depressed ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
```

```
## Formula:
## cbcl_scr_syn_withdep_r ~ PDS_score + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.264236   0.542461   0.487   0.626
## PDS_score         0.222482   0.047112   4.722 2.45e-06 ***
## race.ethnicity.5levelBlack -0.192139  0.212400  -0.905   0.366
## race.ethnicity.5levelMixed -0.016699  0.212612  -0.079   0.937
## race.ethnicity.5levelOther -0.052069  0.245382  -0.212   0.832
## race.ethnicity.5levelWhite -0.104268  0.197265  -0.529   0.597
## interview_age      0.003147   0.004407   0.714   0.475
## demo_race_hispanic1  0.155883   0.094464   1.650   0.099 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.01
## lmer.REML = 9892.2  Scale est. = 2.4029    n = 2620
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ PDS_score + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)     -0.116765   0.604252  -0.193  0.84679
## PDS_score         0.186099   0.065327   2.849  0.00442 **
## race.ethnicity.5levelBlack -0.163704  0.258403  -0.634  0.52644
## race.ethnicity.5levelMixed  0.003069  0.257628   0.012  0.99050
## race.ethnicity.5levelOther -0.193555  0.290579  -0.666  0.50540
## race.ethnicity.5levelWhite -0.219280  0.240916  -0.910  0.36280
## interview_age      0.009619   0.004640   2.073  0.03826 *
## demo_race_hispanic1  0.131680   0.104057   1.265  0.20581
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0035
## lmer.REML = 11496  Scale est. = 1.9084    n = 2845
```

1.4 Model: CBCL Depressed DSM-5 ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
```

```
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ PDS_score + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.877508   0.632006   1.388  0.16512
## PDS_score         0.192397   0.055287   3.480  0.00051 ***
## race.ethnicity.5levelBlack -0.076952  0.249336  -0.309  0.75763
## race.ethnicity.5levelMixed  0.219642  0.249929   0.879  0.37958
## race.ethnicity.5levelOther  0.024488  0.288648   0.085  0.93240
## race.ethnicity.5levelWhite  0.128716  0.231475   0.556  0.57821
## interview_age     -0.001469  0.005136  -0.286  0.77490
## demo_race_hispanic1  0.126429  0.111105   1.138  0.25525
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0042
## lmer.REML = 10689 Scale est. = 2.2893    n = 2620
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ PDS_score + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.233652   0.701046   0.333  0.7389
## PDS_score         0.155703   0.075749   2.056  0.0399 *
## race.ethnicity.5levelBlack -0.032645  0.300786  -0.109  0.9136
## race.ethnicity.5levelMixed  0.201438  0.299714   0.672  0.5016
## race.ethnicity.5levelOther -0.250785  0.337693  -0.743  0.4578
## race.ethnicity.5levelWhite -0.022856  0.280336  -0.082  0.9350
## interview_age      0.007708  0.005377   1.433  0.1519
## demo_race_hispanic1  0.145907  0.121775   1.198  0.2310
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00214
## lmer.REML = 12335 Scale est. = 2.3675    n = 2845
```

1.5 Model: CBCL internalizing factor ~ Pubertal category

Females

```
##
## Family: gaussian
```

```
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.29818    1.86143   0.697 0.485610
## pds_p_ss_categoryEarly  0.30134    0.28987   1.040 0.298645
## pds_p_ss_categoryLate   0.78997    0.69372   1.139 0.254914
## pds_p_ss_categoryMid    0.99238    0.26806   3.702 0.000218 ***
## race.ethnicity.5levelBlack -0.12030    0.71934  -0.167 0.867198
## race.ethnicity.5levelMixed  1.25918    0.72006   1.749 0.080456 .
## race.ethnicity.5levelOther  0.42346    0.83096   0.510 0.610371
## race.ethnicity.5levelWhite  1.00589    0.66757   1.507 0.131986
## interview_age         0.01957    0.01499   1.305 0.191958
## demo_race_hispanic1     0.19558    0.32298   0.606 0.544867
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0091
## lmer.REML = 16196  Scale est. = 17.558    n = 2620
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.17467    1.84243   1.723  0.0850 .
## pds_p_ss_categoryEarly  0.54530    0.25715   2.121  0.0340 *
## pds_p_ss_categoryLate   0.13229    1.51040   0.088  0.9302
## pds_p_ss_categoryMid    1.15880    0.47474   2.441  0.0147 *
## race.ethnicity.5levelBlack -0.67208    0.78857  -0.852  0.3941
## race.ethnicity.5levelMixed  0.54813    0.78620   0.697  0.4857
## race.ethnicity.5levelOther -0.80966    0.88486  -0.915  0.3603
## race.ethnicity.5levelWhite  0.08372    0.73582   0.114  0.9094
## interview_age         0.01334    0.01401   0.952  0.3410
## demo_race_hispanic1     0.59163    0.32336   1.830  0.0674 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00371
## lmer.REML = 17790  Scale est. = 15.869    n = 2845
```

1.6 Model: CBCL Anxious-Depressed ~ Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.119072    1.035379   1.081  0.27987
## pds_p_ss_categoryEarly  0.197344    0.161806   1.220  0.22272
## pds_p_ss_categoryLate   0.160095    0.387250   0.413  0.67934
## pds_p_ss_categoryMid    0.389693    0.149135   2.613  0.00903 **
## race.ethnicity.5levelBlack -0.212867    0.397768  -0.535  0.59259
## race.ethnicity.5levelMixed  0.774922    0.398616   1.944  0.05200 .
## race.ethnicity.5levelOther  0.218712    0.460309   0.475  0.63473
## race.ethnicity.5levelWhite  0.592456    0.369390   1.604  0.10886
## interview_age          0.005779    0.008357   0.692  0.48925
## demo_race_hispanic1      0.054532    0.177675   0.307  0.75893
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0101
## lmer.REML = 13144 Scale est. = 6.6835    n = 2620
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.687409    1.026074   2.619  0.00886 **
## pds_p_ss_categoryEarly  0.194061    0.143214   1.355  0.17551
## pds_p_ss_categoryLate  -0.138855    0.837828  -0.166  0.86838
## pds_p_ss_categoryMid    0.443593    0.264477   1.677  0.09361 .
## race.ethnicity.5levelBlack -0.263727    0.433894  -0.608  0.54336
## race.ethnicity.5levelMixed  0.421136    0.432782   0.973  0.33059
## race.ethnicity.5levelOther -0.170960    0.488787  -0.350  0.72654
## race.ethnicity.5levelWhite  0.322229    0.404845   0.796  0.42614
## interview_age        -0.004282    0.007828  -0.547  0.58446
## demo_race_hispanic1      0.252704    0.177898   1.420  0.15557
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
##
## R-sq.(adj) = 0.00332
## lmer.REML = 14480 Scale est. = 6.5953 n = 2845
```

1.7 Model: CBCL Withdrawn-Depressed ~ Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.418975   0.555757   0.754 0.450988
## pds_p_ss_categoryEarly  0.032612   0.086804   0.376 0.707168
## pds_p_ss_categoryLate   0.459686   0.207547   2.215 0.026856 *
## pds_p_ss_categoryMid    0.273222   0.079746   3.426 0.000622 ***
## race.ethnicity.5levelBlack -0.169202   0.212645  -0.796 0.426277
## race.ethnicity.5levelMixed -0.008629   0.212914  -0.041 0.967677
## race.ethnicity.5levelOther -0.045437   0.245728  -0.185 0.853315
## race.ethnicity.5levelWhite -0.098009   0.197526  -0.496 0.619808
## interview_age         0.003771   0.004484   0.841 0.400526
## demo_race_hispanic1    0.136455   0.094750   1.440 0.149941
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0074
## lmer.REML = 9902.1 Scale est. = 2.4201 n = 2620
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)     -0.049942   0.605632  -0.082 0.9343
## pds_p_ss_categoryEarly  0.133326   0.084727   1.574 0.1157
## pds_p_ss_categoryLate  -0.239646   0.496766  -0.482 0.6296
## pds_p_ss_categoryMid    0.423045   0.156482   2.703 0.0069 **
## race.ethnicity.5levelBlack -0.135176   0.258114  -0.524 0.6005
## race.ethnicity.5levelMixed  0.030948   0.257723   0.120 0.9044
## race.ethnicity.5levelOther -0.182826   0.290590  -0.629 0.5293
```

```
## race.ethnicity.5levelWhite -0.186501    0.241083   -0.774    0.4392
## interview_age              0.010469    0.004617    2.267    0.0234 *
## demo_race_hispanic1       0.122082    0.104223    1.171    0.2416
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00376
## lmer.REML = 11496  Scale est. = 1.9188    n = 2845
```

1.8 Model: CBCL Depressed DSM-5 ~ Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.9682718  0.6476525   1.495   0.1350
## pds_p_ss_categoryEarly 0.0097474  0.1012280   0.096   0.9233
## pds_p_ss_categoryLate  0.3158399  0.2422368   1.304   0.1924
## pds_p_ss_categoryMid   0.2210179  0.0934547   2.365   0.0181 *
## race.ethnicity.5levelBlack -0.0494567  0.2494354  -0.198   0.8428
## race.ethnicity.5levelMixed 0.2280100  0.2501254   0.912   0.3621
## race.ethnicity.5levelOther 0.0302076  0.2888797   0.105   0.9167
## race.ethnicity.5levelWhite 0.1336232  0.2316532   0.577   0.5641
## interview_age        -0.0004703  0.0052282  -0.090   0.9283
## demo_race_hispanic1    0.1124883  0.1114040   1.010   0.3127
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00221
## lmer.REML = 10696  Scale est. = 2.3302    n = 2620
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ pds_p_ss_category + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.321584   0.702747   0.458   0.6473
## pds_p_ss_categoryEarly 0.204077   0.098249   2.077   0.0379 *
```



```
## pds_p_ss_categoryLate      0.092273    0.576904    0.160    0.8729
## pds_p_ss_categoryMid       0.224454    0.181432    1.237    0.2161
## race.ethnicity.5levelBlack -0.015673    0.300551   -0.052    0.9584
## race.ethnicity.5levelMixed  0.212696    0.299914    0.709    0.4783
## race.ethnicity.5levelOther -0.245720    0.337777   -0.727    0.4670
## race.ethnicity.5levelWhite -0.001727    0.280616   -0.006    0.9951
## interview_age              0.008072    0.005351    1.508    0.1316
## demo_race_hispanic1        0.140084    0.122081    1.147    0.2513
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00154
## lmer.REML = 12334 Scale est. = 2.3659    n = 2845
```

1.9 Model: CBCL internalizing factor ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.58840    1.89587  -0.310   0.7563
## hormone_scr_ert_mean_z  0.10775    0.12779   0.843   0.3992
## race.ethnicity.5levelBlack  0.06747    0.72604   0.093   0.9260
## race.ethnicity.5levelMixed  1.40821    0.73130   1.926   0.0543 .
## race.ethnicity.5levelOther  0.34120    0.84818   0.402   0.6875
## race.ethnicity.5levelWhite  1.07588    0.67571   1.592   0.1115
## interview_age     0.03870    0.01505   2.571   0.0102 *
## demo_race_hispanic1  0.18496    0.33264   0.556   0.5782
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00549
## lmer.REML = 14923 Scale est. = 17.57    n = 2412
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
```

```
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.899083    1.889763   2.063  0.0392 *
## hormone_scr_ert_mean_z    0.212517    0.137895   1.541  0.1234
## race.ethnicity.5levelBlack -0.568702    0.807003  -0.705  0.4811
## race.ethnicity.5levelMixed  0.335008    0.805950   0.416  0.6777
## race.ethnicity.5levelOther -0.685630    0.904677  -0.758  0.4486
## race.ethnicity.5levelWhite  0.030670    0.753821   0.041  0.9675
## interview_age         0.009715    0.014337   0.678  0.4981
## demo_race_hispanic1      0.489810    0.331154   1.479  0.1392
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00042
## lmer.REML = 16472  Scale est. = 14.46    n = 2642
```

1.10 Model: CBCL Anxious-Depressed ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.246311    1.058561   0.233  0.8160
## hormone_scr_ert_mean_z    0.021214    0.071383   0.297  0.7663
## race.ethnicity.5levelBlack -0.113521    0.402044  -0.282  0.7777
## race.ethnicity.5levelMixed  0.846649    0.405621   2.087  0.0370 *
## race.ethnicity.5levelOther  0.210060    0.470839   0.446  0.6555
## race.ethnicity.5levelWhite  0.606329    0.374550   1.619  0.1056
## interview_age         0.014486    0.008427   1.719  0.0857 .
## demo_race_hispanic1      0.043422    0.183333   0.237  0.8128
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00903
## lmer.REML = 12126  Scale est. = 6.9684    n = 2412
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
```

```
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.146407   1.052772   2.989  0.00283 **
## hormone_scr_ert_mean_z    0.108699   0.076696   1.417  0.15652
## race.ethnicity.5levelBlack -0.251384   0.444621  -0.565  0.57186
## race.ethnicity.5levelMixed  0.301577   0.444391   0.679  0.49743
## race.ethnicity.5levelOther -0.096607   0.500455  -0.193  0.84694
## race.ethnicity.5levelWhite  0.322423   0.415384   0.776  0.43770
## interview_age      -0.007316   0.008014  -0.913  0.36137
## demo_race_hispanic1    0.195907   0.181974   1.077  0.28177
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00302
## lmer.REML = 13393 Scale est. = 5.931      n = 2642
```

1.11 Model: CBCL Withdrawn-Depressed ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.138926   0.570104   0.244  0.8075
## hormone_scr_ert_mean_z    0.088436   0.038358   2.306  0.0212 *
## race.ethnicity.5levelBlack -0.123831   0.215785  -0.574  0.5661
## race.ethnicity.5levelMixed  0.048052   0.217443   0.221  0.8251
## race.ethnicity.5levelOther -0.073636   0.252289  -0.292  0.7704
## race.ethnicity.5levelWhite -0.056536   0.200991  -0.281  0.7785
## interview_age      0.006859   0.004536   1.512  0.1307
## demo_race_hispanic1    0.163599   0.098347   1.663  0.0963 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00292
## lmer.REML = 9148.6 Scale est. = 2.3955      n = 2412
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
```

```
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.047203   0.627853   0.075   0.9401
## hormone_scr_ert_mean_z 0.095756   0.045715   2.095   0.0363 *
## race.ethnicity.5levelBlack -0.119550   0.266113  -0.449   0.6533
## race.ethnicity.5levelMixed -0.005032   0.266281  -0.019   0.9849
## race.ethnicity.5levelOther -0.132943   0.299645  -0.444   0.6573
## race.ethnicity.5levelWhite -0.197039   0.248871  -0.792   0.4286
## interview_age      0.010438   0.004780   2.184   0.0291 *
## demo_race_hispanic1 0.071487   0.107503   0.665   0.5061
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00156
## lmer.REML = 10676 Scale est. = 1.9212 n = 2642
```

1.12 Model: CBCL Depressed DSM-5 ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.447529   0.663099   0.675   0.500
## hormone_scr_ert_mean_z 0.026237   0.044780   0.586   0.558
## race.ethnicity.5levelBlack 0.050817   0.252725   0.201   0.841
## race.ethnicity.5levelMixed 0.285666   0.255243   1.119   0.263
## race.ethnicity.5levelOther 0.047108   0.296330   0.159   0.874
## race.ethnicity.5levelWhite 0.186265   0.235506   0.791   0.429
## interview_age      0.004325   0.005280   0.819   0.413
## demo_race_hispanic1 0.111748   0.115175   0.970   0.332
##
##
## R-sq.(adj) = -0.000601
## lmer.REML = 9882.9 Scale est. = 2.3724 n = 2412
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + race.ethnicity.5level +
##   interview_age + demo_race_hispanic
##
```

```
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.6508466  0.7211978   0.902   0.367
## hormone_scr_ert_mean_z  0.0730120  0.0525888   1.388   0.165
## race.ethnicity.5levelBlack  0.0009905  0.3074520   0.003   0.997
## race.ethnicity.5levelMixed  0.1380055  0.3073824   0.449   0.653
## race.ethnicity.5levelOther -0.2001698  0.3452992  -0.580   0.562
## race.ethnicity.5levelWhite -0.0291272  0.2874023  -0.101   0.919
## interview_age      0.0061520  0.0054800   1.123   0.262
## demo_race_hispanic1    0.0978837  0.1249811   0.783   0.434
##
##
## R-sq.(adj) =  -0.000238
## lmer.REML = 11404  Scale est. = 2.2002    n = 2642
```

1.13 Model: CBCL internalizing factor ~ Testosterone + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + PDS_score +
##      race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.33756    1.89574   0.178   0.8587
## hormone_scr_ert_mean_z -0.03792    0.13031  -0.291   0.7711
## PDS_score         0.85453    0.16968   5.036 5.1e-07 ***
## race.ethnicity.5levelBlack -0.44337    0.72907  -0.608   0.5432
## race.ethnicity.5levelMixed  1.23365    0.72796   1.695   0.0903 .
## race.ethnicity.5levelOther  0.23221    0.84369   0.275   0.7832
## race.ethnicity.5levelWhite  0.99393    0.67214   1.479   0.1393
## interview_age      0.02034    0.01542   1.320   0.1871
## demo_race_hispanic1    0.17177    0.33083   0.519   0.6037
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0147
## lmer.REML = 14900  Scale est. = 17.848    n = 2412
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + PDS_score +
##      race.ethnicity.5level + interview_age + demo_race_hispanic
##
```

```
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      3.752979   1.885963   1.990  0.04670 *
## hormone_scr_ert_mean_z  0.158132   0.138484   1.142  0.25361
## PDS_score         0.720305   0.207602   3.470  0.00053 ***
## race.ethnicity.5levelBlack -0.870122   0.810175  -1.074  0.28292
## race.ethnicity.5levelMixed  0.309951   0.804389   0.385  0.70003
## race.ethnicity.5levelOther -0.718299   0.902921  -0.796  0.42638
## race.ethnicity.5levelWhite  0.036473   0.752308   0.048  0.96134
## interview_age       0.003177   0.014430   0.220  0.82574
## demo_race_hispanic1    0.450151   0.330410   1.362  0.17319
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00371
## lmer.REML = 16461 Scale est. = 14.336    n = 2642
```

1.14 Model: CBCL internalizing factor ~ Testosterone + Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##   race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.912555   1.941468   0.470  0.638374
## hormone_scr_ert_mean_z  0.001666   0.130158   0.013  0.989790
## pds_p_ss_categoryEarly  0.381718   0.300605   1.270  0.204267
## pds_p_ss_categoryLate  0.861404   0.733155   1.175  0.240140
## pds_p_ss_categoryMid    1.101982   0.283267   3.890  0.000103 ***
## race.ethnicity.5levelBlack -0.307044   0.730142  -0.421  0.674138
## race.ethnicity.5levelMixed  1.280351   0.729283   1.756  0.079279 .
## race.ethnicity.5levelOther  0.272161   0.845286   0.322  0.747500
## race.ethnicity.5levelWhite  1.022832   0.673362   1.519  0.128896
## interview_age       0.022194   0.015760   1.408  0.159203
## demo_race_hispanic1    0.111079   0.332203   0.334  0.738130
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0109
## lmer.REML = 14908 Scale est. = 18.211    n = 2412
```

Males

```
##
## Family: gaussian
## Link function: identity
```

```
##
## Formula:
## cbcl_scr_syn_internal_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##     race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      4.142120   1.889599   2.192  0.0285 *
## hormone_scr_ert_mean_z  0.181137   0.138179   1.311  0.1900
## pds_p_ss_categoryEarly  0.582867   0.266033   2.191  0.0285 *
## pds_p_ss_categoryLate   1.747173   1.764711   0.990  0.3222
## pds_p_ss_categoryMid    1.088781   0.487639   2.233  0.0256 *
## race.ethnicity.5levelBlack -0.794355   0.810471  -0.980  0.3271
## race.ethnicity.5levelMixed  0.376452   0.805626   0.467  0.6403
## race.ethnicity.5levelOther -0.693923   0.903968  -0.768  0.4428
## race.ethnicity.5levelWhite  0.123067   0.753888   0.163  0.8703
## interview_age         0.005707   0.014393   0.397  0.6918
## demo_race_hispanic1     0.429382   0.331283   1.296  0.1950
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00197
## lmer.REML = 16461 Scale est. = 14.357    n = 2642
```

1.15 Model: CBCL Anxious-Depressed ~ Testosterone + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + PDS_score +
##     race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.632326   1.060713   0.596  0.551143
## hormone_scr_ert_mean_z -0.040964   0.072987  -0.561  0.574682
## PDS_score         0.361022   0.094791   3.809  0.000143 ***
## race.ethnicity.5levelBlack -0.329163   0.404850  -0.813  0.416270
## race.ethnicity.5levelMixed  0.772989   0.404805   1.910  0.056312 .
## race.ethnicity.5levelOther  0.163698   0.469512   0.349  0.727378
## race.ethnicity.5levelWhite  0.570732   0.373560   1.528  0.126689
## interview_age         0.006785   0.008645   0.785  0.432662
## demo_race_hispanic1     0.037176   0.182850   0.203  0.838905
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0136
## lmer.REML = 12114 Scale est. = 7.0424    n = 2412
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + PDS_score +
##   race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.078712   1.051670   2.927  0.00345 **
## hormone_scr_ert_mean_z  0.084837   0.077087   1.101  0.27120
## PDS_score       0.317965   0.115748   2.747  0.00605 **
## race.ethnicity.5levelBlack -0.381898   0.446735  -0.855  0.39270
## race.ethnicity.5levelMixed  0.293345   0.443936   0.661  0.50881
## race.ethnicity.5levelOther -0.108275   0.499930  -0.217  0.82855
## race.ethnicity.5levelWhite  0.327723   0.414948   0.790  0.42972
## interview_age    -0.010196   0.008072  -1.263  0.20666
## demo_race_hispanic1  0.178279   0.181741   0.981  0.32671
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.005
## lmer.REML = 13388 Scale est. = 5.8891    n = 2642
```

1.16 Model: CBCL Anxious-Depressed ~ Testosterone + Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##   race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.773423   1.085295   0.713  0.47614
## hormone_scr_ert_mean_z -0.017396   0.072868  -0.239  0.81133
## pds_p_ss_categoryEarly  0.225519   0.168531   1.338  0.18098
## pds_p_ss_categoryLate   0.178064   0.410573   0.434  0.66455
## pds_p_ss_categoryMid    0.432008   0.158428   2.727  0.00644 **
## race.ethnicity.5levelBlack -0.242418   0.405357  -0.598  0.54987
## race.ethnicity.5levelMixed  0.799509   0.405428   1.972  0.04872 *
## race.ethnicity.5levelOther  0.183128   0.470254   0.389  0.69700
## race.ethnicity.5levelWhite  0.587116   0.374115   1.569  0.11670
## interview_age    0.008384   0.008828   0.950  0.34240
## demo_race_hispanic1  0.017869   0.183568   0.097  0.92246
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



```
##
##
## R-sq.(adj) = 0.0106
## lmer.REML = 12122 Scale est. = 7.1003 n = 2412

Males

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_anxdep_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
## race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.234521   1.053722   3.070 0.00217 **
## hormone_scr_ert_mean_z 0.096882   0.076940   1.259 0.20807
## pds_p_ss_categoryEarly 0.220235   0.148338   1.485 0.13775
## pds_p_ss_categoryLate 0.530839   0.979371   0.542 0.58785
## pds_p_ss_categoryMid 0.421888   0.272042   1.551 0.12107
## race.ethnicity.5levelBlack -0.334917 0.447014 -0.749 0.45379
## race.ethnicity.5levelMixed 0.318882 0.444663 0.717 0.47336
## race.ethnicity.5levelOther -0.097193 0.500552 -0.194 0.84606
## race.ethnicity.5levelWhite 0.359042 0.415895 0.863 0.38805
## interview_age    -0.008814 0.008052 -1.095 0.27380
## demo_race_hispanic1 0.172489 0.182335 0.946 0.34423
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00304
## lmer.REML = 13390 Scale est. = 5.8982 n = 2642
```

1.17 Model: CBCL Withdrawn-Depressed ~ Testosterone + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + PDS_score +
## race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.380851   0.570439   0.668 0.504
## hormone_scr_ert_mean_z 0.049851   0.039186   1.272 0.203
## PDS_score       0.223460   0.050802   4.399 1.14e-05 ***
## race.ethnicity.5levelBlack -0.254858 0.216892 -1.175 0.240
## race.ethnicity.5levelMixed 0.005020 0.216720 0.023 0.982
## race.ethnicity.5levelOther -0.100248 0.251276 -0.399 0.690
```

```
## race.ethnicity.5levelWhite -0.077138 0.200171 -0.385 0.700
## interview_age 0.002054 0.004649 0.442 0.659
## demo_race_hispanic1 0.160983 0.097860 1.645 0.100
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0105
## lmer.REML = 9133.5 Scale est. = 2.417 n = 2412
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + PDS_score +
##   race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.009185   0.627347   0.015  0.9883
## hormone_scr_ert_mean_z 0.082733   0.045961   1.800  0.0720 .
## PDS_score       0.172784   0.069191   2.497  0.0126 *
## race.ethnicity.5levelBlack -0.191849 0.267518  -0.717  0.4733
## race.ethnicity.5levelMixed -0.010887 0.266093  -0.041  0.9674
## race.ethnicity.5levelOther -0.140084 0.299417  -0.468  0.6399
## race.ethnicity.5levelWhite -0.195420 0.248683  -0.786  0.4320
## interview_age    0.008893   0.004815   1.847  0.0649 .
## demo_race_hispanic1 0.061537   0.107395   0.573  0.5667
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00288
## lmer.REML = 10673 Scale est. = 1.9032 n = 2642
```

1.18 Model: CBCL Withdrawn-Depressed ~ Testosterone + Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##   race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.565466   0.583518   0.969  0.33261
## hormone_scr_ert_mean_z 0.059498   0.039125   1.521  0.12846
## pds_p_ss_categoryEarly 0.043272   0.090511   0.478  0.63263
```

```
## pds_p_ss_categoryLate      0.400304    0.220162    1.818  0.06915 .
## pds_p_ss_categoryMid       0.270165    0.084946    3.180  0.00149 **
## race.ethnicity.5levelBlack -0.228817    0.217195   -1.054  0.29221
## race.ethnicity.5levelMixed  0.017235    0.217068    0.079  0.93672
## race.ethnicity.5levelOther -0.088386    0.251682   -0.351  0.72548
## race.ethnicity.5levelWhite -0.068333    0.200471   -0.341  0.73324
## interview_age              0.002397    0.004746    0.505  0.61360
## demo_race_hispanic1        0.142701    0.098246    1.452  0.14650
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00748
## lmer.REML = 9143.5  Scale est. = 2.4268    n = 2412
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_withdep_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##    race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.101878   0.628081   0.162   0.8712
## hormone_scr_ert_mean_z 0.088241   0.045832   1.925   0.0543 .
## pds_p_ss_categoryEarly 0.127704   0.088587   1.442   0.1495
## pds_p_ss_categoryLate  0.117300   0.585850   0.200   0.8413
## pds_p_ss_categoryMid   0.371621   0.162505   2.287   0.0223 *
## race.ethnicity.5levelBlack -0.177559   0.267411  -0.664   0.5068
## race.ethnicity.5levelMixed  0.012404   0.266285   0.047   0.9628
## race.ethnicity.5levelOther -0.129933   0.299540  -0.434   0.6645
## race.ethnicity.5levelWhite -0.167151   0.249010  -0.671   0.5021
## interview_age        0.009446   0.004800   1.968   0.0492 *
## demo_race_hispanic1    0.052275   0.107577   0.486   0.6271
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00269
## lmer.REML = 10674  Scale est. = 1.9109    n = 2642
```

1.19 Model: CBCL Depressed DSM-5 ~ Testosterone + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + PDS_score +
```

```
##      race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      6.638e-01  6.648e-01   0.998  0.31814
## hormone_scr_ert_mean_z -7.852e-03  4.581e-02  -0.171  0.86391
## PDS_score         2.015e-01  5.963e-02   3.379  0.00074 ***
## race.ethnicity.5levelBlack -7.061e-02  2.547e-01  -0.277  0.78162
## race.ethnicity.5levelMixed  2.447e-01  2.549e-01   0.960  0.33723
## race.ethnicity.5levelOther  2.076e-02  2.958e-01   0.070  0.94403
## race.ethnicity.5levelWhite  1.666e-01  2.350e-01   0.709  0.47843
## interview_age       2.027e-05  5.420e-03   0.004  0.99702
## demo_race_hispanic1    1.084e-01  1.149e-01   0.943  0.34562
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00342
## lmer.REML = 9875.3  Scale est. = 2.3737    n = 2412
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + PDS_score +
##      race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.613775   0.720746   0.852  0.3945
## hormone_scr_ert_mean_z  0.059851   0.052884   1.132  0.2578
## PDS_score         0.175053   0.079463   2.203  0.0277 *
## race.ethnicity.5levelBlack -0.072251   0.309125  -0.234  0.8152
## race.ethnicity.5levelMixed  0.131845   0.307221   0.429  0.6678
## race.ethnicity.5levelOther -0.208077   0.345108  -0.603  0.5466
## race.ethnicity.5levelWhite -0.027842   0.287231  -0.097  0.9228
## interview_age       0.004578   0.005522   0.829  0.4072
## demo_race_hispanic1    0.088087   0.124866   0.705  0.4806
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.000797
## lmer.REML = 11402  Scale est. = 2.1828    n = 2642
```

1.20 Model: CBCL Depressed DSM-5 ~ Testosterone + Pubertal category

Females

```
##
## Family: gaussian
## Link function: identity
```

```
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##     race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      8.368e-01  6.799e-01   1.231   0.2185
## hormone_scr_ert_mean_z  3.854e-05  4.570e-02   0.001   0.9993
## pds_p_ss_categoryEarly  4.362e-02  1.057e-01   0.413   0.6799
## pds_p_ss_categoryLate   3.427e-01  2.577e-01   1.330   0.1836
## pds_p_ss_categoryMid    2.535e-01  9.950e-02   2.548   0.0109 *
## race.ethnicity.5levelBlack -4.804e-02  2.548e-01  -0.189   0.8504
## race.ethnicity.5levelMixed  2.554e-01  2.551e-01   1.001   0.3169
## race.ethnicity.5levelOther  2.987e-02  2.959e-01   0.101   0.9196
## race.ethnicity.5levelWhite  1.739e-01  2.352e-01   0.739   0.4598
## interview_age          2.387e-04  5.533e-03   0.043   0.9656
## demo_race_hispanic1      9.236e-02  1.153e-01   0.801   0.4231
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00168
## lmer.REML = 9881.7  Scale est. = 2.4162    n = 2412
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_dsm5_depress_r ~ hormone_scr_ert_mean_z + pds_p_ss_category +
##     race.ethnicity.5level + interview_age + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.736704   0.721455   1.021   0.307
## hormone_scr_ert_mean_z  0.062284   0.052723   1.181   0.238
## pds_p_ss_categoryEarly  0.238701   0.101715   2.347   0.019 *
## pds_p_ss_categoryLate   0.712799   0.674345   1.057   0.291
## pds_p_ss_categoryMid    0.168636   0.186509   0.904   0.366
## race.ethnicity.5levelBlack -0.061152   0.308981  -0.198   0.843
## race.ethnicity.5levelMixed  0.138644   0.307424   0.451   0.652
## race.ethnicity.5levelOther -0.206533   0.345199  -0.598   0.550
## race.ethnicity.5levelWhite -0.009696   0.287588  -0.034   0.973
## interview_age          0.004832   0.005503   0.878   0.380
## demo_race_hispanic1      0.084580   0.125132   0.676   0.499
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.000259
## lmer.REML = 11400  Scale est. = 2.178    n = 2642
```

2—Reward~Puberty—

2.1 Model: BIS-BAS-RR ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## bisbas_ss_basm_rr_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.424214   0.314340   1.350  0.17728
## PDS_score      0.075218   0.028002   2.686  0.00727 **
## interview_age -0.005045   0.002713  -1.859  0.06310 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00417
## lmer.REML = 7604.2  Scale est. = 0.75362    n = 2683
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## bisbas_ss_basm_rr_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.115506   0.286732   0.403  0.6871
## PDS_score      0.069481   0.032804   2.118  0.0343 *
## interview_age -0.001230   0.002423  -0.508  0.6118
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00131
## lmer.REML = 8047.3  Scale est. = 0.7764     n = 2906
```

2.2 Model : Reaction Time ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_neutral_z ~ PDS_score + interview_age
```

```
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.698797   0.318038  -2.197   0.0281 *
## PDS_score    0.019366   0.028585   0.678   0.4982
## interview_age 0.005860   0.002754   2.128   0.0335 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00183
## lmer.REML = 6057.3  Scale est. = 0.75998    n = 2242

##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_small_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.5555087  0.3317066  -1.675   0.0941 .
## PDS_score    0.0009982  0.0298834   0.033   0.9734
## interview_age 0.0047315  0.0028702   1.649   0.0994 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.000456
## lmer.REML = 6221.6  Scale est. = 0.83792    n = 2242
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_neutral_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.581559   0.302387  -1.923   0.0546 .
## PDS_score    -0.057182   0.035722  -1.601   0.1096
## interview_age 0.005337   0.002557   2.087   0.0370 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00226
## lmer.REML = 6209.9  Scale est. = 0.75935    n = 2318

##
## Family: gaussian
```

```
## Link function: identity
##
## Formula:
## rt_diff_large_small_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.0319118  0.2986180   0.107   0.915
## PDS_score    -0.0126890  0.0351299  -0.361   0.718
## interview_age -0.0002895  0.0025251  -0.115   0.909
##
##
## R-sq.(adj) = -0.000795
## lmer.REML = 6161.9  Scale est. = 0.8291    n = 2318
```

2.3 Model: Caudate Anticipation ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_rvsnt_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.354322  0.315627  -1.123   0.262
## PDS_score    -0.027115  0.028254  -0.960   0.337
## interview_age  0.003233  0.002729   1.185   0.236
##
##
## R-sq.(adj) =  0.000154
## lmer.REML = 5413.7  Scale est. = 0.73298    n = 2071
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_rvsnt_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.51255   0.32285  -1.588   0.113
## PDS_score     0.03469   0.03908   0.887   0.375
## interview_age  0.00392   0.00272   1.441   0.150
##
##
## R-sq.(adj) =  0.00028
## lmer.REML = 5534.9  Scale est. = 0.81709    n = 2059
```


2.4 Model B: Putamen Anticipation ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_rvsnt_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -0.492088   0.313014  -1.572   0.116
## PDS_score    -0.010024   0.027981  -0.358   0.720
## interview_age  0.004141   0.002706   1.531   0.126
##
##
## R-sq.(adj) =  0.000294
## lmer.REML = 5384.4  Scale est. = 0.70432  n = 2071
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_rvsnt_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  -0.359661   0.313801  -1.146   0.252
## PDS_score    -0.004214   0.038041  -0.111   0.912
## interview_age  0.003216   0.002644   1.217   0.224
##
##
## R-sq.(adj) = -0.000355
## lmer.REML =  5430  Scale est. = 0.65183  n = 2064
```

2.5 Model: Accumbens Anticipation ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_rvsnt_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   0.1374282  0.2480263   0.554   0.580
## PDS_score     -0.0319156  0.0221177  -1.443   0.149
## interview_age -0.0006455  0.0021450  -0.301   0.763
```

```
##
##
## R-sq.(adj) = 0.000265
## lmer.REML = 4425.7 Scale est. = 0.48435 n = 2066
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_rvs_n_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.164387  0.253649   0.648   0.517
## PDS_score     0.021930  0.030516   0.719   0.472
## interview_age -0.001572  0.002137  -0.736   0.462
##
##
## R-sq.(adj) = -0.000251
## lmer.REML = 4549.1 Scale est. = 0.43644 n = 2060
```

2.6 Model: Caudate Feedback ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.010955  0.309581  -0.035   0.972
## PDS_score     0.037116  0.027726   1.339   0.181
## interview_age -0.000575  0.002675  -0.215   0.830
##
##
## R-sq.(adj) = -0.000269
## lmer.REML = 5311.2 Scale est. = 0.61773 n = 2067
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
```

```
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.0084908  0.3152619  -0.027   0.979
## PDS_score     -0.0055288  0.0379833  -0.146   0.884
## interview_age  0.0002172  0.0026587   0.082   0.935
##
##
## R-sq.(adj) =  -0.00096
## lmer.REML = 5454.9  Scale est. = 0.82148   n = 2058
```

2.7 Model: Putamen Feedback ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.126483  0.305477   0.414   0.679
## PDS_score       0.035447  0.027397   1.294   0.196
## interview_age  -0.001628  0.002635  -0.618   0.537
##
##
## R-sq.(adj) =  -0.000225
## lmer.REML = 5245.6  Scale est. = 0.6817    n = 2067
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.280092  0.313510   0.893   0.372
## PDS_score       0.023857  0.037698   0.633   0.527
## interview_age  -0.002342  0.002639  -0.888   0.375
##
##
## R-sq.(adj) =  -0.00054
## lmer.REML = 5415.4  Scale est. = 0.75208    n = 2063
```

2.8 Model: Accumbens Feedback ~ PDS

Females

```
##
## Family: gaussian
```

```
## Link function: identity
##
## Formula:
## accumbens_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.370594  0.241795  -1.533   0.126
## PDS_score    0.011952  0.021694   0.551   0.582
## interview_age 0.002769  0.002090   1.325   0.185
##
##
## R-sq.(adj) =  0.000574
## lmer.REML = 4288.8  Scale est. = 0.43394  n = 2066
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.0020214  0.2569941   0.008   0.994
## PDS_score    -0.0309742  0.0310057  -0.999   0.318
## interview_age 0.0004582  0.0021641   0.212   0.832
##
##
## R-sq.(adj) = -0.000175
## lmer.REML = 4590.2  Scale est. = 0.39554  n = 2063
```

2.9 Model: OFC Anticipation ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_rvsnt_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.0801892  0.2006050   0.400   0.689
## PDS_score    -0.0171588  0.0180734  -0.949   0.343
## interview_age -0.0004233  0.0017341  -0.244   0.807
##
##
## R-sq.(adj) = -0.000415
## lmer.REML = 3499.7  Scale est. = 0.31577  n = 2058
```

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_rvsn_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.203967  0.231252   0.882   0.3779
## PDS_score    -0.052075  0.020727  -2.512   0.0121 *
## interview_age -0.001062  0.001998  -0.531   0.5952
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00257
## lmer.REML = 4086.2  Scale est. = 0.41983    n = 2059
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_rvsn_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.430299  0.218848  -1.966   0.0494 *
## PDS_score     0.028632  0.026701   1.072   0.2837
## interview_age  0.003009  0.001844   1.632   0.1028
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0015
## lmer.REML = 3904.8  Scale est. = 0.3435    n = 2050

##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_rvsn_ant_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.182563  0.248071  -0.736   0.462
## PDS_score     0.061647  0.030155   2.044   0.041 *
## interview_age  0.000624  0.002093   0.298   0.766
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
##
## R-sq.(adj) = 0.00218
## lmer.REML = 4452.2 Scale est. = 0.44504 n = 2056
```

2.10 Model: OFC Feedback ~ PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.0625161  0.1799161   0.347   0.728
## PDS_score    0.0085022  0.0161609   0.526   0.599
## interview_age -0.0009009  0.0015555  -0.579   0.563
##
##
## R-sq.(adj) = -0.000829
## lmer.REML = 3071.4 Scale est. = 0.25421 n = 2067
##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.0059043  0.2119441  -0.028   0.978
## PDS_score    0.0043212  0.0190101   0.227   0.820
## interview_age -0.0002242  0.0018349  -0.122   0.903
##
##
## R-sq.(adj) = -0.000935
## lmer.REML = 3789.9 Scale est. = 0.33159 n = 2071
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##           Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.143268  0.190247  -0.753   0.451
## PDS_score    -0.018364  0.023129  -0.794   0.427
```

```
## interview_age 0.001470 0.001604 0.917 0.359
##
##
## R-sq.(adj) = -0.000382
## lmer.REML = 3342.5 Scale est. = 0.22175 n = 2049
##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_posvsneg_feedback_z ~ PDS_score + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.0474262 0.2248786 -0.211 0.833
## PDS_score   -0.0212195 0.0274023 -0.774 0.439
## interview_age 0.0008927 0.0018959 0.471 0.638
##
##
## R-sq.(adj) = -0.000619
## lmer.REML = 4058.1 Scale est. = 0.32892 n = 2058
```

2.11 Model: Caudate Anticipation ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_rvsnt_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.370425 0.333248 -1.112 0.266
## hormone_scr_ert_mean_z -0.028395 0.023066 -1.231 0.218
## interview_age 0.003062 0.002799 1.094 0.274
##
##
## R-sq.(adj) = 0.000328
## lmer.REML = 5000.1 Scale est. = 0.75615 n = 1910
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_rvsnt_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)          -0.300649    0.334059   -0.900    0.368
## hormone_scr_ert_mean_z -0.024672    0.026726   -0.923    0.356
## interview_age         0.002565    0.002787    0.921    0.357
##
##
## R-sq.(adj) =  -0.000397
## lmer.REML = 5136.4  Scale est. = 0.79936   n = 1918
```

2.12 Model B: Putamen Anticipation ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_rvsnt_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.379670   0.328321  -1.156   0.248
## hormone_scr_ert_mean_z -0.001503   0.022764  -0.066   0.947
## interview_age    0.003011   0.002758   1.092   0.275
##
##
## R-sq.(adj) =  -0.000306
## lmer.REML = 4943.3  Scale est. = 0.68206   n = 1908
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_rvsnt_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.418619   0.328577  -1.274   0.203
## hormone_scr_ert_mean_z -0.040782   0.026360  -1.547   0.122
## interview_age    0.003609   0.002740   1.317   0.188
##
##
## R-sq.(adj) =  0.000375
## lmer.REML = 5066.6  Scale est. = 0.59903   n = 1918
```

2.13 Model: Accumbens Anticipation ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
```



```
##
## Formula:
## accumbens_rvs_n_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.0844118  0.2599716   0.325   0.745
## hormone_scr_ert_mean_z -0.0072545  0.0180052  -0.403   0.687
## interview_age   -0.0006619  0.0021859  -0.303   0.762
##
##
## R-sq.(adj) =  -0.000902
## lmer.REML =  4060  Scale est. = 0.42311   n = 1904
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_rvs_n_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.187783  0.263998   0.711   0.477
## hormone_scr_ert_mean_z -0.006666  0.021230  -0.314   0.754
## interview_age   -0.001506  0.002202  -0.684   0.494
##
##
## R-sq.(adj) =  -0.000906
## lmer.REML = 4219.9  Scale est. = 0.43043   n = 1912
```

2.14 Model: Caudate Feedback ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.0568049  0.3232067  -0.176   0.861
## hormone_scr_ert_mean_z  0.0071246  0.0223643   0.319   0.750
## interview_age   0.0003372  0.0027138   0.124   0.901
##
##
## R-sq.(adj) =  -0.00099
## lmer.REML = 4856.5  Scale est. = 0.59878   n = 1904
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## caudate_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.126187  0.329109  -0.383   0.701
## hormone_scr_ert_mean_z -0.040710  0.026049  -1.563   0.118
## interview_age    0.001053  0.002748   0.383   0.702
##
##
## R-sq.(adj) =  0.000243
## lmer.REML = 5073.4  Scale est. = 0.82479   n = 1911
```

2.15 Model: Putamen Feedback ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.230207  0.318250   0.723   0.470
## hormone_scr_ert_mean_z 0.007299  0.022026   0.331   0.740
## interview_age   -0.001990  0.002667  -0.746   0.456
##
##
## R-sq.(adj) = -0.000986
## lmer.REML = 4798.1  Scale est. = 0.66167   n = 1907
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## putamen_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.173230  0.326708   0.530   0.5960
## hormone_scr_ert_mean_z -0.050286  0.026138  -1.924   0.0545 .
## interview_age   -0.001264  0.002717  -0.465   0.6420
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.001
## lmer.REML = 5026.8  Scale est. = 0.76047    n = 1916
```

2.16 Model: Accumbens Feedback ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.357162   0.254263  -1.405   0.160
## hormone_scr_ert_mean_z  0.001299   0.017597   0.074   0.941
## interview_age    0.002877   0.002134   1.348   0.178
##
##
## R-sq.(adj) =  0.000314
## lmer.REML = 3943.9  Scale est. = 0.4281    n = 1903
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## accumbens_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.031129   0.267097  -0.117   0.907
## hormone_scr_ert_mean_z -0.026143   0.021464  -1.218   0.223
## interview_age    0.000316   0.002223   0.142   0.887
##
##
## R-sq.(adj) =  0.00018
## lmer.REML = 4255.1  Scale est. = 0.44144    n = 1918
```

2.17 Model: OFC Anticipation ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
```

```
## l0FC_rvs_n_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.186690   0.209887   0.889   0.3739
## hormone_scr_ert_mean_z 0.027886   0.014519   1.921   0.0549 .
## interview_age   -0.001553   0.001762  -0.881   0.3783
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.000808
## lmer.REML = 3201.9  Scale est. = 0.31132   n = 1897
##
## Family: gaussian
## Link function: identity
##
## Formula:
## m0FC_rvs_n_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.381908   0.243216   1.570   0.117
## hormone_scr_ert_mean_z 0.022892   0.016784   1.364   0.173
## interview_age   -0.003253   0.002041  -1.594   0.111
##
##
## R-sq.(adj) =  0.000771
## lmer.REML = 3751.4  Scale est. = 0.41502   n = 1898
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## l0FC_rvs_n_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.435509   0.227540  -1.914   0.0558 .
## hormone_scr_ert_mean_z -0.028088   0.018222  -1.541   0.1234
## interview_age    0.003326   0.001897   1.754   0.0797 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.000367
## lmer.REML = 3622.9  Scale est. = 0.33812   n = 1905
##
## Family: gaussian
## Link function: identity
```

```
##
## Formula:
## mOFC_rvsn_ant_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.0815257  0.2576774  -0.316   0.752
## hormone_scr_ert_mean_z -0.0023632  0.0205077  -0.115   0.908
## interview_age     0.0004441  0.0021514   0.206   0.836
##
##
## R-sq.(adj) =  -0.0011
## lmer.REML = 4117.4  Scale est. = 0.43928   n = 1909
```

2.18 Model: OFC Feedback ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## lOFC_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.098388  0.184822  0.532   0.595
## hormone_scr_ert_mean_z 0.026870  0.012806  2.098   0.036 *
## interview_age   -0.001046  0.001553  -0.673   0.501
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0014
## lmer.REML = 2744.3  Scale est. = 0.24398   n = 1903
##
## Family: gaussian
## Link function: identity
##
## Formula:
## mOFC_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.0224570  0.2209530  0.102   0.919
## hormone_scr_ert_mean_z 0.0233374  0.0153236  1.523   0.128
## interview_age   -0.0003668  0.0018579  -0.197   0.844
##
##
## R-sq.(adj) =  0.000188
## lmer.REML = 3457.2  Scale est. = 0.34202   n = 1908
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## l0FC_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.118197   0.198826  -0.594    0.552
## hormone_scr_ert_mean_z -0.005021   0.015867  -0.316    0.752
## interview_age     0.001036   0.001660   0.624    0.532
##
##
## R-sq.(adj) =  -0.000803
## lmer.REML = 3117.2  Scale est. = 0.2257    n = 1903
##
## Family: gaussian
## Link function: identity
##
## Formula:
## m0FC_posvsneg_feedback_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.0391713   0.2334212  -0.168    0.867
## hormone_scr_ert_mean_z -0.0128044   0.0186036  -0.688    0.491
## interview_age     0.0005317   0.0019493   0.273    0.785
##
##
## R-sq.(adj) =  -0.000827
## lmer.REML = 3749.4  Scale est. = 0.34359    n = 1909
```

2.19 Model: MID Reaction Time ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_neutral_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.794927   0.336301  -2.364   0.0182 *
## hormone_scr_ert_mean_z -0.020970   0.023451  -0.894   0.3713
## interview_age     0.006924   0.002828   2.448   0.0144 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
##
## R-sq.(adj) = 0.00207
## lmer.REML = 5626.2 Scale est. = 0.76893 n = 2072

##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_small_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.577319   0.349829  -1.650   0.0990 .
## hormone_scr_ert_mean_z -0.019399   0.024402  -0.795   0.4267
## interview_age    0.004959   0.002940   1.687   0.0918 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.000473
## lmer.REML = 5770.9 Scale est. = 0.86785 n = 2072
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_neutral_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.577423   0.315765  -1.829   0.0676 .
## hormone_scr_ert_mean_z -0.024311   0.024997  -0.973   0.3309
## interview_age    0.004647   0.002637   1.762   0.0781 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00114
## lmer.REML = 5796.6 Scale est. = 0.74443 n = 2163

##
## Family: gaussian
## Link function: identity
##
## Formula:
## rt_diff_large_small_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.0893826   0.3125127  -0.286   0.775
## hormone_scr_ert_mean_z -0.0255099   0.0245021  -1.041   0.298
```

```
## interview_age          0.0005244  0.0026111  0.201  0.841
##
##
## R-sq.(adj) = -0.000423
## lmer.REML = 5767.3  Scale est. = 0.83515  n = 2163
```

2.20 Model: BIS-BAS-RR ~ Testosterone

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## bisbas_ss_basm_rr_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.395479   0.330718   1.196   0.232
## hormone_scr_ert_mean_z 0.012195   0.023182   0.526   0.599
## interview_age  -0.003716   0.002772  -1.340   0.180
##
##
## R-sq.(adj) = 0.000886
## lmer.REML = 6993.9  Scale est. = 0.78939  n = 2470
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## bisbas_ss_basm_rr_z ~ hormone_scr_ert_mean_z + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.061948   0.299399  -0.207   0.836
## hormone_scr_ert_mean_z -0.044822   0.023633  -1.897   0.058 .
## interview_age    0.001090   0.002497   0.436   0.663
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = -0.000309
## lmer.REML = 7476.5  Scale est. = 0.78515  n = 2700
```


3—Int~Reward—

3.1 Model: CBCL internalizing factor ~ Nucleus Accumbens activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ accumbens_rvsnt_ant_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.63582    2.02287  -0.314   0.7533
## accumbens_rvsnt_ant_z -0.27173    0.16789  -1.619   0.1057
## interview_age     0.03819    0.01589   2.404   0.0163 *
## race.ethnicity.5levelBlack 0.29624    0.78881   0.376   0.7073
## race.ethnicity.5levelMixed 1.17149    0.78961   1.484   0.1381
## race.ethnicity.5levelOther 0.39909    0.93625   0.426   0.6700
## race.ethnicity.5levelWhite 1.19862    0.72913   1.644   0.1004
## demo_race_hispanic1    0.10198    0.35925   0.284   0.7765
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0053
## lmer.REML = 12407 Scale est. = 15.495    n = 2010
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ accumbens_rvsnt_ant_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)     2.50616    2.16923   1.155   0.2481
## accumbens_rvsnt_ant_z 0.02060    0.16556   0.124   0.9010
## interview_age     0.01707    0.01616   1.056   0.2909
## race.ethnicity.5levelBlack 0.04518    0.99500   0.045   0.9638
## race.ethnicity.5levelMixed 0.64773    0.99180   0.653   0.5138
## race.ethnicity.5levelOther -0.70547    1.10712  -0.637   0.5241
## race.ethnicity.5levelWhite 0.26109    0.93234   0.280   0.7795
## demo_race_hispanic1    0.93574    0.37843   2.473   0.0135 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
##
## R-sq.(adj) = 0.00207
## lmer.REML = 12573 Scale est. = 13.638 n = 2014
```

3.2 Model: CBCL internalizing factor ~ Caudate activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ caudate_rvsn_ant_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.397963   2.025610  -0.196   0.8443
## caudate_rvsn_ant_z -0.006064   0.132425  -0.046   0.9635
## interview_age     0.035825   0.015916   2.251   0.0245 *
## race.ethnicity.5levelBlack 0.331027   0.790602   0.419   0.6755
## race.ethnicity.5levelMixed 1.219810   0.790694   1.543   0.1231
## race.ethnicity.5levelOther 0.460034   0.939225   0.490   0.6243
## race.ethnicity.5levelWhite 1.259727   0.730689   1.724   0.0849 .
## demo_race_hispanic1    0.096638   0.359320   0.269   0.7880
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## R-sq.(adj) = 0.00367
## lmer.REML = 12446 Scale est. = 15.793 n = 2014
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ caudate_rvsn_ant_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)     2.44496   2.16996   1.127   0.25999
## caudate_rvsn_ant_z 0.15635   0.13096   1.194   0.23265
## interview_age     0.01737   0.01615   1.075   0.28232
## race.ethnicity.5levelBlack 0.12790   0.99785   0.128   0.89802
## race.ethnicity.5levelMixed 0.72781   0.99470   0.732   0.46444
## race.ethnicity.5levelOther -0.76966   1.10931  -0.694   0.48788
## race.ethnicity.5levelWhite 0.31568   0.93620   0.337   0.73601
## demo_race_hispanic1    1.01845   0.38205   2.666   0.00774 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
##
## R-sq.(adj) = 0.00325
## lmer.REML = 12604 Scale est. = 12.689 n = 2018
```

3.3 Model: CBCL internalizing factor ~ Putamen activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ putamen_rvsn_ant_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.57325    2.02419  -0.283  0.7771
## putamen_rvsn_ant_z -0.05862    0.13366  -0.439  0.6610
## interview_age    0.03731    0.01591   2.345  0.0191 *
## race.ethnicity.5levelBlack 0.32437    0.79065   0.410  0.6817
## race.ethnicity.5levelMixed 1.20223    0.79114   1.520  0.1288
## race.ethnicity.5levelOther 0.39471    0.93747   0.421  0.6738
## race.ethnicity.5levelWhite 1.26717    0.73072   1.734  0.0830 .
## demo_race_hispanic1    0.08629    0.35928   0.240  0.8102
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0041
## lmer.REML = 12445 Scale est. = 15.532 n = 2014
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ putamen_rvsn_ant_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.63538    2.17260   1.213  0.2253
## putamen_rvsn_ant_z -0.02636    0.13541  -0.195  0.8457
## interview_age    0.01590    0.01618   0.983  0.3259
## race.ethnicity.5levelBlack 0.05770    0.99758   0.058  0.9539
## race.ethnicity.5levelMixed 0.71410    0.99436   0.718  0.4727
## race.ethnicity.5levelOther -0.73964    1.11097  -0.666  0.5056
## race.ethnicity.5levelWhite 0.30112    0.93609   0.322  0.7477
## demo_race_hispanic1    0.97492    0.37889   2.573  0.0101 *
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00268
## lmer.REML = 12597  Scale est. = 12.749    n = 2017
```

3.4 Model: CBCL internalizing factor ~ Accumbens activity (feedback stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ accumbens_posvsneg_feedback_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.85021    2.02908  -0.419   0.6753
## accumbens_posvsneg_feedback_z  0.22662    0.17303   1.310   0.1904
## interview_age   0.03746    0.01592   2.353   0.0187 *
## race.ethnicity.5levelBlack  0.61263    0.79658   0.769   0.4419
## race.ethnicity.5levelMixed  1.50028    0.79596   1.885   0.0596 .
## race.ethnicity.5levelOther  0.73026    0.93935   0.777   0.4370
## race.ethnicity.5levelWhite  1.51483    0.73613   2.058   0.0397 *
## demo_race_hispanic1    0.07632    0.36124   0.211   0.8327
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00504
## lmer.REML = 12407  Scale est. = 15.533    n = 2009
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ accumbens_posvsneg_feedback_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.06132    2.18328   1.402   0.1610
## accumbens_posvsneg_feedback_z -0.22098    0.16751  -1.319   0.1873
## interview_age   0.01306    0.01624   0.804   0.4213
## race.ethnicity.5levelBlack  -0.02227    1.00962  -0.022   0.9824
## race.ethnicity.5levelMixed   0.67937    1.00620   0.675   0.4996
## race.ethnicity.5levelOther  -0.85671    1.11969  -0.765   0.4443
## race.ethnicity.5levelWhite   0.24756    0.94823   0.261   0.7941
## demo_race_hispanic1    0.95982    0.37858   2.535   0.0113 *
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00352
## lmer.REML = 12605  Scale est. = 13.512    n = 2017
```

3.5 Model: CBCL internalizing factor ~ Caudate activity (feedback stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ caudate_posvsneg_feedback_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.87180    2.02851  -0.430   0.6674
## caudate_posvsneg_feedback_z -0.02388    0.13579  -0.176   0.8604
## interview_age    0.03779    0.01591   2.374   0.0177 *
## race.ethnicity.5levelBlack  0.54766    0.79675   0.687   0.4919
## race.ethnicity.5levelMixed  1.44607    0.79595   1.817   0.0694 .
## race.ethnicity.5levelOther  0.66563    0.93920   0.709   0.4786
## race.ethnicity.5levelWhite  1.51365    0.73637   2.056   0.0400 *
## demo_race_hispanic1    0.13049    0.36011   0.362   0.7171
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00475
## lmer.REML = 12415  Scale est. = 15.565    n = 2010
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ caudate_posvsneg_feedback_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.12692    2.18176   1.433   0.1520
## caudate_posvsneg_feedback_z -0.10375    0.13642  -0.760   0.4471
## interview_age    0.01220    0.01626   0.750   0.4533
## race.ethnicity.5levelBlack  0.02769    0.99837   0.028   0.9779
## race.ethnicity.5levelMixed  0.69387    0.99419   0.698   0.4853
## race.ethnicity.5levelOther -0.83148    1.10900  -0.750   0.4535
## race.ethnicity.5levelWhite  0.25358    0.93637   0.271   0.7866
```

```
## demo_race_hispanic1          0.95500    0.37724    2.532    0.0114 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00258
## lmer.REML = 12571  Scale est. = 14.212    n = 2010
```

3.6 Model: CBCL internalizing factor ~ Putamen activity (feedback stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ putamen_posvsneg_feedback_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.46133    2.02633  -0.228   0.8199
## putamen_posvsneg_feedback_z -0.05774    0.13711  -0.421   0.6737
## interview_age    0.03631    0.01592   2.280   0.0227 *
## race.ethnicity.5levelBlack  0.30667    0.79070   0.388   0.6982
## race.ethnicity.5levelMixed  1.22111    0.79101   1.544   0.1228
## race.ethnicity.5levelOther  0.38953    0.93671   0.416   0.6776
## race.ethnicity.5levelWhite  1.26081    0.73015   1.727   0.0844 .
## demo_race_hispanic1    0.11865    0.36148   0.328   0.7428
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00434
## lmer.REML = 12420  Scale est. = 15.822    n = 2010
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ putamen_posvsneg_feedback_z + interview_age +
##    race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   3.027e+00  2.181e+00   1.388   0.1653
## putamen_posvsneg_feedback_z  3.449e-05  1.374e-01   0.000   0.9998
## interview_age  1.291e-02  1.624e-02   0.795   0.4269
## race.ethnicity.5levelBlack  6.761e-02  9.993e-01   0.068   0.9461
## race.ethnicity.5levelMixed  7.251e-01  9.950e-01   0.729   0.4663
## race.ethnicity.5levelOther -7.980e-01  1.110e+00  -0.719   0.4722
```

```
## race.ethnicity.5levelWhite 2.849e-01 9.367e-01 0.304 0.7610
## demo_race_hispanic1 9.101e-01 3.780e-01 2.408 0.0162 *
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00206
## lmer.REML = 12606 Scale est. = 14.499 n = 2015
```

3.7 Model: CBCL internalizing factor ~ OFC activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ lOFC_rvsn_ant_z + interview_age + race.ethnicity.5level +
## demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.86822    2.03412  -0.427  0.6696
## lOFC_rvsn_ant_z -0.01292    0.20912  -0.062  0.9508
## interview_age    0.03767    0.01596   2.360  0.0184 *
## race.ethnicity.5levelBlack 0.60576    0.79837   0.759  0.4481
## race.ethnicity.5levelMixed 1.47630    0.79783   1.850  0.0644 .
## race.ethnicity.5levelOther 0.76513    0.94344   0.811  0.4175
## race.ethnicity.5levelWhite 1.51674    0.73763   2.056  0.0399 *
## demo_race_hispanic1 0.09209    0.36101   0.255  0.7987
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00402
## lmer.REML = 12363 Scale est. = 15.301 n = 2001

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ mOFC_rvsn_ant_z + interview_age + race.ethnicity.5level +
## demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -1.03733    2.03567  -0.510  0.6104
## mOFC_rvsn_ant_z 0.18161    0.18035   1.007  0.3141
## interview_age   0.03893    0.01597   2.437  0.0149 *
## race.ethnicity.5levelBlack 0.61800    0.79748   0.775  0.4385
## race.ethnicity.5levelMixed 1.46932    0.79875   1.840  0.0660 .
## race.ethnicity.5levelOther 0.74866    0.94144   0.795  0.4266
## race.ethnicity.5levelWhite 1.54414    0.73776   2.093  0.0365 *
```

```
## demo_race_hispanic1      0.08501    0.36080    0.236    0.8138
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00489
## lmer.REML = 12368  Scale est. = 15.262    n = 2002
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ lOFC_rvs_n_ant_z + interview_age + race.ethnicity.5level +
##      demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.29279    2.16369   1.060  0.2894
## lOFC_rvs_n_ant_z    -0.13550    0.19216  -0.705  0.4808
## interview_age       0.01904    0.01606   1.186  0.2360
## race.ethnicity.5levelBlack -0.10997    1.00241  -0.110  0.9127
## race.ethnicity.5levelMixed  0.69028    0.99775   0.692  0.4891
## race.ethnicity.5levelOther -0.82599    1.10749  -0.746  0.4559
## race.ethnicity.5levelWhite  0.23421    0.93934   0.249  0.8031
## demo_race_hispanic1    0.97588    0.37929   2.573  0.0102 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00314
## lmer.REML = 12469  Scale est. = 12.567    n = 2003
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ mOFC_rvs_n_ant_z + interview_age + race.ethnicity.5level +
##      demo_race_hispanic
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.18493    2.17314   1.005  0.315
## mOFC_rvs_n_ant_z   -0.15883    0.16765  -0.947  0.344
## interview_age       0.01988    0.01614   1.232  0.218
## race.ethnicity.5levelBlack  0.05775    1.00706   0.057  0.954
## race.ethnicity.5levelMixed  0.69071    1.00246   0.689  0.491
## race.ethnicity.5levelOther -0.79054    1.11409  -0.710  0.478
## race.ethnicity.5levelWhite  0.23193    0.94480   0.245  0.806
## demo_race_hispanic1    0.93454    0.38015   2.458  0.014 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



```
##
##
## R-sq.(adj) = 0.00269
## lmer.REML = 12534 Scale est. = 12.533 n = 2010
```

3.8 Model: CBCL internalizing factor ~ OFC activity (feedback stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ lOFC_posvsneg_feedback_z + interview_age +
##     race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.63984    2.02223  -0.316  0.7517
## lOFC_posvsneg_feedback_z  0.02285    0.23223   0.098  0.9216
## interview_age    0.03776    0.01590   2.375  0.0176 *
## race.ethnicity.5levelBlack 0.39308    0.78874   0.498  0.6183
## race.ethnicity.5levelMixed 1.17361    0.78846   1.488  0.1368
## race.ethnicity.5levelOther 0.38523    0.93389   0.413  0.6800
## race.ethnicity.5levelWhite 1.24893    0.72802   1.716  0.0864 .
## demo_race_hispanic1    0.12395    0.36012   0.344  0.7307
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00351
## lmer.REML = 12407 Scale est. = 15.788 n = 2010
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ mOFC_posvsneg_feedback_z + interview_age +
##     race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.96767    2.02412  -0.478  0.6327
## mOFC_posvsneg_feedback_z  0.28617    0.19681   1.454  0.1461
## interview_age    0.03816    0.01588   2.403  0.0163 *
## race.ethnicity.5levelBlack 0.68305    0.79645   0.858  0.3912
## race.ethnicity.5levelMixed 1.53987    0.79531   1.936  0.0530 .
## race.ethnicity.5levelOther 0.66745    0.93948   0.710  0.4775
## race.ethnicity.5levelWhite 1.54852    0.73601   2.104  0.0355 *
## demo_race_hispanic1    0.09935    0.36026   0.276  0.7827
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
##
## R-sq.(adj) = 0.00547
## lmer.REML = 12435 Scale est. = 15.59 n = 2014

Males

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ lOFC_posvsneg_feedback_z + interview_age +
## race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.87055     2.17887   1.317   0.1878
## lOFC_posvsneg_feedback_z  0.17988     0.22534   0.798   0.4248
## interview_age      0.01451     0.01621   0.895   0.3707
## race.ethnicity.5levelBlack -0.03104     1.00762  -0.031   0.9754
## race.ethnicity.5levelMixed  0.66698     1.00338   0.665   0.5063
## race.ethnicity.5levelOther -0.86137     1.11476  -0.773   0.4398
## race.ethnicity.5levelWhite  0.25512     0.94393   0.270   0.7870
## demo_race_hispanic1    0.96068     0.38039   2.525   0.0116 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0027
## lmer.REML = 12499 Scale est. = 13.601 n = 2003

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ mOFC_posvsneg_feedback_z + interview_age +
## race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.80356     2.17159   1.291   0.197
## mOFC_posvsneg_feedback_z  0.06810     0.18813   0.362   0.717
## interview_age      0.01505     0.01615   0.932   0.351
## race.ethnicity.5levelBlack -0.05313     1.00545  -0.053   0.958
## race.ethnicity.5levelMixed  0.70071     1.00083   0.700   0.484
## race.ethnicity.5levelOther -0.83480     1.11175  -0.751   0.453
## race.ethnicity.5levelWhite  0.25642     0.94229   0.272   0.786
## demo_race_hispanic1    0.94940     0.37740   2.516   0.012 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00278
## lmer.REML = 12550 Scale est. = 13.64 n = 2012
```

3.9 Model: CBCL internalizing factor ~ BIS-BAS-RR

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ bisbas_ss_basm_rr + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.28402    1.84169  -0.154   0.8774
## bisbas_ss_basm_rr -0.01772    0.04412  -0.402   0.6879
## interview_age     0.03766    0.01412   2.667   0.0077 **
## race.ethnicity.5levelBlack  0.25551    0.71510   0.357   0.7209
## race.ethnicity.5levelMixed  1.34417    0.72065   1.865   0.0623 .
## race.ethnicity.5levelOther  0.40110    0.83194   0.482   0.6298
## race.ethnicity.5levelWhite  1.03255    0.66784   1.546   0.1222
## demo_race_hispanic1    0.26718    0.32301   0.827   0.4082
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00385
## lmer.REML = 16155 Scale est. = 17.08      n = 2613
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ bisbas_ss_basm_rr + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)     3.224382    1.881622   1.714   0.0867 .
## bisbas_ss_basm_rr -0.062272    0.044778  -1.391   0.1644
## interview_age     0.019325    0.013946   1.386   0.1659
## race.ethnicity.5levelBlack -0.516753    0.785041  -0.658   0.5104
## race.ethnicity.5levelMixed  0.500363    0.785415   0.637   0.5241
## race.ethnicity.5levelOther -0.777057    0.884180  -0.879   0.3796
## race.ethnicity.5levelWhite -0.001334    0.734923  -0.002   0.9986
## demo_race_hispanic1    0.627179    0.324501   1.933   0.0534 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00177
## lmer.REML = 17700 Scale est. = 15.925      n = 2830
```

3.10 Model: CBCL internalizing factor ~ MID Reaction Time

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ rt_diff_large_neutral_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.76469    1.96215  -0.390  0.69678
## rt_diff_large_neutral_z    0.08900    0.12273   0.725  0.46845
## interview_age     0.04063    0.01548   2.625  0.00873 **
## race.ethnicity.5levelBlack  0.19161    0.76490   0.251  0.80222
## race.ethnicity.5levelMixed  1.00178    0.76537   1.309  0.19071
## race.ethnicity.5levelOther  0.39482    0.88392   0.447  0.65516
## race.ethnicity.5levelWhite  0.99430    0.70794   1.404  0.16032
## demo_race_hispanic1      0.25243    0.34970   0.722  0.47047
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00363
## lmer.REML = 13477 Scale est. = 16.697    n = 2179

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ rt_diff_large_small_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.77702    1.95961  -0.397  0.6918
## rt_diff_large_small_z    0.14688    0.11773   1.248  0.2123
## interview_age     0.04055    0.01547   2.622  0.0088 **
## race.ethnicity.5levelBlack  0.22132    0.76478   0.289  0.7723
## race.ethnicity.5levelMixed  1.03140    0.76538   1.348  0.1779
## race.ethnicity.5levelOther  0.42040    0.88362   0.476  0.6343
## race.ethnicity.5levelWhite  1.02009    0.70762   1.442  0.1496
## demo_race_hispanic1      0.24694    0.34946   0.707  0.4799
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0041
## lmer.REML = 13476 Scale est. = 16.677    n = 2179
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ rt_diff_large_neutral_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.97192    2.06219   1.441   0.1497
## rt_diff_large_neutral_z -0.07996    0.12321  -0.649   0.5164
## interview_age      0.01937    0.01530   1.266   0.2056
## race.ethnicity.5levelBlack -0.71967    0.93831  -0.767   0.4432
## race.ethnicity.5levelMixed -0.09994    0.93920  -0.106   0.9153
## race.ethnicity.5levelOther -1.27883    1.03906  -1.231   0.2185
## race.ethnicity.5levelWhite -0.40678    0.88195  -0.461   0.6447
## demo_race_hispanic1      0.74914    0.35964   2.083   0.0374 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = -0.00064
## lmer.REML = 14119 Scale est. = 12.38      n = 2262
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ rt_diff_large_small_z + interview_age +
##   race.ethnicity.5level + demo_race_hispanic
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.99074    2.05972   1.452   0.1466
## rt_diff_large_small_z -0.16662    0.12411  -1.343   0.1795
## interview_age      0.01908    0.01528   1.249   0.2119
## race.ethnicity.5levelBlack -0.68411    0.93842  -0.729   0.4661
## race.ethnicity.5levelMixed -0.08892    0.93882  -0.095   0.9245
## race.ethnicity.5levelOther -1.27577    1.03877  -1.228   0.2195
## race.ethnicity.5levelWhite -0.39841    0.88173  -0.452   0.6514
## demo_race_hispanic1      0.76807    0.35969   2.135   0.0328 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.000124
## lmer.REML = 14118 Scale est. = 12.336      n = 2262
```

4—Int~Puberty x Reward—

4.1 Model: CBCL internalizing factor ~ PDS x Accumbens activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * accumbens_rvsnt_ant_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.77200    2.04095   0.378   0.705
## PDS_score         0.93801    0.17923   5.234 1.84e-07 ***
## accumbens_rvsnt_ant_z 0.13655    0.41196   0.331   0.740
## race.ethnicity.5levelBlack -0.31095    0.79209  -0.393   0.695
## race.ethnicity.5levelMixed  0.99979    0.78464   1.274   0.203
## race.ethnicity.5levelOther  0.31596    0.92933   0.340   0.734
## race.ethnicity.5levelWhite  1.14295    0.72391   1.579   0.115
## demo_race_hispanic1  0.10693    0.35665   0.300   0.764
## interview_age      0.01433    0.01658   0.864   0.388
## PDS_score:accumbens_rvsnt_ant_z -0.21652    0.22244  -0.973   0.330
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0181
## lmer.REML = 12381  Scale est. = 15.847    n = 2010
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * accumbens_rvsnt_ant_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.455518    2.163755   1.135 0.256578
## PDS_score         0.889234    0.243100   3.658 0.000261 ***
## accumbens_rvsnt_ant_z 0.383249    0.411342   0.932 0.351601
## race.ethnicity.5levelBlack -0.384489    0.998857  -0.385 0.700331
## race.ethnicity.5levelMixed  0.598120    0.989122   0.605 0.545448
## race.ethnicity.5levelOther -0.775711    1.104137  -0.703 0.482418
## race.ethnicity.5levelWhite  0.225982    0.929938   0.243 0.808025
## demo_race_hispanic1  0.899102    0.377394   2.382 0.017293 *
## interview_age      0.008367    0.016274   0.514 0.607236
```

```
## PDS_score:accumbens_rvsnt_z -0.270590 0.271708 -0.996 0.319426
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00677
## lmer.REML = 12560 Scale est. = 13.505 n = 2014
```

4.2 Model: CBCL internalizing factor ~ PDS x Caudate activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * caudate_rvsnt_z + race.ethnicity.5level +
##   demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.95469    2.03804   0.468  0.6395
## PDS_score       0.91368    0.17921   5.098 3.75e-07 ***
## caudate_rvsnt_z 0.74877    0.33308   2.248  0.0247 *
## race.ethnicity.5levelBlack -0.24603    0.79297  -0.310  0.7564
## race.ethnicity.5levelMixed  1.03899    0.78470   1.324  0.1856
## race.ethnicity.5levelOther  0.36634    0.93107   0.393  0.6940
## race.ethnicity.5levelWhite  1.21556    0.72461   1.678  0.0936 .
## demo_race_hispanic1  0.10129    0.35622   0.284  0.7762
## interview_age    0.01267    0.01657   0.765  0.4444
## PDS_score:caudate_rvsnt_z -0.44212    0.18304  -2.415  0.0158 *
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0188
## lmer.REML = 12417 Scale est. = 16.384 n = 2014
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * caudate_rvsnt_z + race.ethnicity.5level +
##   demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.329478    2.163969   1.076 0.281840
## PDS_score       0.893128    0.244906   3.647 0.000272 ***
## caudate_rvsnt_z -0.084803    0.356195  -0.238 0.811843
```

```
## race.ethnicity.5levelBlack    -0.281789    1.001168   -0.281  0.778386
## race.ethnicity.5levelMixed     0.683120    0.991977    0.689  0.491126
## race.ethnicity.5levelOther    -0.859636    1.106710   -0.777  0.437398
## race.ethnicity.5levelWhite     0.294290    0.933555    0.315  0.752616
## demo_race_hispanic1           0.986004    0.380766    2.590  0.009680 **
## interview_age                  0.009087    0.016287    0.558  0.576943
## PDS_score:caudate_rvsnt_z     0.173997    0.245695    0.708  0.478913
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00741
## lmer.REML = 12592  Scale est. = 12.577    n = 2018
```

4.3 Model: CBCL internalizing factor ~ PDS x Putamen activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * putamen_rvsnt_z + race.ethnicity.5level +
##   demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.85569    2.03719   0.420   0.6745
## PDS_score       0.92594    0.17910   5.170 2.57e-07 ***
## putamen_rvsnt_z 0.51517    0.33779   1.525   0.1274
## race.ethnicity.5levelBlack -0.27463    0.79368  -0.346   0.7294
## race.ethnicity.5levelMixed  1.01544    0.78561   1.293   0.1963
## race.ethnicity.5levelOther  0.31711    0.93009   0.341   0.7332
## race.ethnicity.5levelWhite  1.21262    0.72506   1.672   0.0946 .
## demo_race_hispanic1    0.09662    0.35647   0.271   0.7864
## interview_age    0.01346    0.01656   0.813   0.4164
## PDS_score:putamen_rvsnt_z -0.33513    0.18396  -1.822   0.0686 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.018
## lmer.REML = 12418  Scale est. = 16.013    n = 2014
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * putamen_rvsnt_z + race.ethnicity.5level +
##   demo_race_hispanic + interview_age
```



```
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.53921    2.16562   1.173 0.241133
## PDS_score         0.92368    0.24530   3.765 0.000171 ***
## putamen_rvsnt_z  0.28357    0.36927   0.768 0.442633
## race.ethnicity.5levelBlack -0.36352    1.00110  -0.363 0.716553
## race.ethnicity.5levelMixed  0.67823    0.99153   0.684 0.494037
## race.ethnicity.5levelOther -0.79158    1.10784  -0.715 0.474986
## race.ethnicity.5levelWhite  0.28345    0.93340   0.304 0.761410
## demo_race_hispanic1  0.92766    0.37746   2.458 0.014071 *
## interview_age      0.00711    0.01630   0.436 0.662637
## PDS_score:putamen_rvsnt_z -0.23069    0.25278  -0.913 0.361574
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0075
## lmer.REML = 12585 Scale est. = 12.574    n = 2017
```

4.4 Model: CBCL internalizing factor ~ PDS x Lateral OFC activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * lOFC_rvsnt_z + race.ethnicity.5level +
##   demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.54072    2.05077   0.264  0.7921
## PDS_score         0.88175    0.18133   4.863 1.25e-06 ***
## lOFC_rvsnt_z      0.62047    0.49823   1.245  0.2132
## race.ethnicity.5levelBlack  0.03954    0.80302   0.049  0.9607
## race.ethnicity.5levelMixed  1.30077    0.79355   1.639  0.1013
## race.ethnicity.5levelOther  0.67842    0.93727   0.724  0.4693
## race.ethnicity.5levelWhite  1.46816    0.73318   2.002  0.0454 *
## demo_race_hispanic1  0.08453    0.35856   0.236  0.8136
## interview_age      0.01455    0.01665   0.874  0.3822
## PDS_score:lOFC_rvsnt_z -0.36763    0.27263  -1.348  0.1777
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0157
## lmer.REML = 12340 Scale est. = 15.727    n = 2001
```

Males

```
##
```

```
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * lOFC_rvsn_ant_z + race.ethnicity.5level +
##      demo_race_hispanic + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.19443    2.15958   1.016  0.30969
## PDS_score         0.78739    0.24505   3.213  0.00133 **
## lOFC_rvsn_ant_z   -0.06796    0.51328  -0.132  0.89468
## race.ethnicity.5levelBlack -0.45434    1.00652  -0.451  0.65175
## race.ethnicity.5levelMixed  0.67177    0.99634   0.674  0.50024
## race.ethnicity.5levelOther -0.87011    1.10587  -0.787  0.43149
## race.ethnicity.5levelWhite  0.22466    0.93808   0.239  0.81075
## demo_race_hispanic1    0.93966    0.37871   2.481  0.01318 *
## interview_age        0.01162    0.01619   0.718  0.47293
## PDS_score:lOFC_rvsn_ant_z -0.05944    0.35126  -0.169  0.86565
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00605
## lmer.REML = 12460 Scale est. = 12.451    n = 2003
```

4.5 Model: CBCL internalizing factor ~ PDS x Medial OFC activity (anticipation stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * mOFC_rvsn_ant_z + race.ethnicity.5level +
##      demo_race_hispanic + interview_age
##
## Parametric coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.42146    2.04914   0.206  0.8371
## PDS_score         0.88874    0.18142   4.899 1.04e-06 ***
## mOFC_rvsn_ant_z   0.71722    0.43302   1.656  0.0978 .
## race.ethnicity.5levelBlack 0.04807    0.80239   0.060  0.9522
## race.ethnicity.5levelMixed 1.30840    0.79473   1.646  0.0999 .
## race.ethnicity.5levelOther 0.69313    0.93547   0.741  0.4588
## race.ethnicity.5levelWhite 1.52006    0.73372   2.072  0.0384 *
## demo_race_hispanic1    0.07873    0.35818   0.220  0.8260
## interview_age        0.01508    0.01662   0.907  0.3645
## PDS_score:mOFC_rvsn_ant_z -0.28976    0.23681  -1.224  0.2212
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
##
## R-sq.(adj) = 0.0171
## lmer.REML = 12345 Scale est. = 15.852 n = 2002
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * mOFC_rvs_n_ant_z + race.ethnicity.5level +
## demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.17056    2.16561   1.002 0.316327
## PDS_score         0.88367    0.24506   3.606 0.000319 ***
## mOFC_rvs_n_ant_z  0.57277    0.42423   1.350 0.177124
## race.ethnicity.5levelBlack -0.35509    1.00926  -0.352 0.725000
## race.ethnicity.5levelMixed  0.60786    0.99944   0.608 0.543123
## race.ethnicity.5levelOther -0.85975    1.11024  -0.774 0.438800
## race.ethnicity.5levelWhite  0.18778    0.94161   0.199 0.841951
## demo_race_hispanic1  0.90296    0.37838   2.386 0.017109 *
## interview_age      0.01110    0.01625   0.683 0.494435
## PDS_score:mOFC_rvs_n_ant_z -0.56612    0.29454  -1.922 0.054742 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0097
## lmer.REML = 12520 Scale est. = 12.473 n = 2010
```

4.6 Model: CBCL internalizing factor ~ PDS x Accumbens activity (feedback)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * accumbens_posvsneg_feedback_z +
## race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.732221    2.043733   0.358 0.7202
## PDS_score         0.897986    0.180161   4.984 6.75e-07
## accumbens_posvsneg_feedback_z  0.258370    0.434089   0.595 0.5518
## race.ethnicity.5levelBlack  -0.009524    0.801237  -0.012 0.9905
## race.ethnicity.5levelMixed  1.305136    0.792490   1.647 0.0997
## race.ethnicity.5levelOther  0.607052    0.933486   0.650 0.5156
## race.ethnicity.5levelWhite  1.434905    0.731666   1.961 0.0500
## demo_race_hispanic1  0.086535    0.358899   0.241 0.8095
```

```
## interview_age                0.012923    0.016589    0.779    0.4361
## PDS_score:accumbens_posvsneg_feedback_z -0.034845    0.235193   -0.148    0.8822
##
## (Intercept)
## PDS_score                    ***
## accumbens_posvsneg_feedback_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed    .
## race.ethnicity.5levelOther
## race.ethnicity.5levelWhite    .
## demo_race_hispanic1
## interview_age
## PDS_score:accumbens_posvsneg_feedback_z
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0162
## lmer.REML = 12385   Scale est. = 15.95      n = 2009
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * accumbens_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.878751    2.177441   1.322 0.186292
## PDS_score       0.911640    0.244066   3.735 0.000193
## accumbens_posvsneg_feedback_z 0.264996    0.468717   0.565 0.571888
## race.ethnicity.5levelBlack  -0.437580    1.012377  -0.432 0.665621
## race.ethnicity.5levelMixed   0.677955    1.003409   0.676 0.499340
## race.ethnicity.5levelOther  -0.851006    1.116987  -0.762 0.446224
## race.ethnicity.5levelWhite   0.273046    0.945801   0.289 0.772846
## demo_race_hispanic1         0.908780    0.377558   2.407 0.016174
## interview_age    0.004782    0.016360   0.292 0.770110
## PDS_score:accumbens_posvsneg_feedback_z -0.369607    0.335512  -1.102 0.270759
##
## (Intercept)
## PDS_score                    ***
## accumbens_posvsneg_feedback_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed
## race.ethnicity.5levelOther
## race.ethnicity.5levelWhite
## demo_race_hispanic1          *
## interview_age
## PDS_score:accumbens_posvsneg_feedback_z
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00807
## lmer.REML = 12592  Scale est. = 13.357    n = 2017
```

4.7 Model: CBCL internalizing factor ~ PDS x Caudate activity (feedback)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * caudate_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.79441    2.04022   0.389  0.6970
## PDS_score         0.90585    0.17932   5.052 4.78e-07 ***
## caudate_posvsneg_feedback_z -0.56189    0.33878  -1.659  0.0974 .
## race.ethnicity.5levelBlack -0.08439    0.80103  -0.105  0.9161
## race.ethnicity.5levelMixed  1.21615    0.79183   1.536  0.1247
## race.ethnicity.5levelOther  0.51918    0.93338   0.556  0.5781
## race.ethnicity.5levelWhite  1.43132    0.73161   1.956  0.0506 .
## demo_race_hispanic1      0.15113    0.35791   0.422  0.6729
## interview_age          0.01242    0.01655   0.751  0.4529
## PDS_score:caudate_posvsneg_feedback_z 0.29937    0.18504   1.618  0.1059
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0173
## lmer.REML = 12390  Scale est. = 15.498    n = 2010
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * caudate_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.976186    2.175613   1.368 0.171473
## PDS_score         0.880627    0.244980   3.595 0.000333 ***
## caudate_posvsneg_feedback_z 0.228050    0.381493   0.598 0.550053
## race.ethnicity.5levelBlack -0.386586    1.002390  -0.386 0.699786
## race.ethnicity.5levelMixed  0.667064    0.991895   0.673 0.501334
## race.ethnicity.5levelOther -0.864330    1.106582  -0.781 0.434847
```

```
## race.ethnicity.5levelWhite          0.243423    0.934196    0.261 0.794451
## demo_race_hispanic1                 0.911520    0.376542    2.421 0.015576 *
## interview_age                       0.004248    0.016378    0.259 0.795363
## PDS_score:caudate_posvsneg_feedback_z -0.253038    0.269833   -0.938 0.348481
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00699
## lmer.REML = 12559  Scale est. = 13.907    n = 2010
```

4.8 Model: CBCL internalizing factor ~ PDS x Putamen activity (feedback)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * putamen_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.16888    2.03565   0.574   0.566
## PDS_score       0.95437    0.17954   5.316 1.18e-07 ***
## putamen_posvsneg_feedback_z -0.56731    0.34726  -1.634   0.102
## race.ethnicity.5levelBlack -0.32326    0.79406  -0.407   0.684
## race.ethnicity.5levelMixed  1.04020    0.78627   1.323   0.186
## race.ethnicity.5levelOther  0.28592    0.93012   0.307   0.759
## race.ethnicity.5levelWhite  1.21883    0.72519   1.681   0.093 .
## demo_race_hispanic1    0.11739    0.35894   0.327   0.744
## interview_age    0.01033    0.01654   0.624   0.533
## PDS_score:putamen_posvsneg_feedback_z 0.28452    0.18772   1.516   0.130
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0176
## lmer.REML = 12393  Scale est. = 15.793    n = 2010
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * putamen_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.938805    2.176406   1.350 0.17707
```

```

## PDS_score                0.865453    0.245811    3.521  0.00044 ***
## putamen_posvsneg_feedback_z 0.118559    0.374689    0.316  0.75172
## race.ethnicity.5levelBlack -0.327828    1.003221   -0.327  0.74387
## race.ethnicity.5levelMixed  0.695975    0.992645    0.701  0.48330
## race.ethnicity.5levelOther -0.837104    1.107351   -0.756  0.44977
## race.ethnicity.5levelWhite  0.273448    0.934434    0.293  0.76983
## demo_race_hispanic1        0.857657    0.377115    2.274  0.02306 *
## interview_age              0.004621    0.016382    0.282  0.77794
## PDS_score:putamen_posvsneg_feedback_z -0.097198    0.261328   -0.372  0.70998
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00649
## lmer.REML = 12596  Scale est. = 14.374    n = 2015

```

4.9 Model: CBCL internalizing factor ~ PDS x Lateral OFC activity (feedback stage)

Females

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * lOFC_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.92701    2.03846   0.455   0.649
## PDS_score       0.86852    0.18074   4.805 1.66e-06 ***
## lOFC_posvsneg_feedback_z -0.31213    0.56443  -0.553   0.580
## race.ethnicity.5levelBlack -0.19693    0.79360  -0.248   0.804
## race.ethnicity.5levelMixed  0.98903    0.78500   1.260   0.208
## race.ethnicity.5levelOther  0.28542    0.92850   0.307   0.759
## race.ethnicity.5levelWhite  1.18368    0.72395   1.635   0.102
## demo_race_hispanic1    0.12639    0.35805   0.353   0.724
## interview_age    0.01364    0.01659   0.822   0.411
## PDS_score:lOFC_posvsneg_feedback_z 0.17292    0.30096   0.575   0.566
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0137
## lmer.REML = 12386  Scale est. = 16.122    n = 2010

```

Males

```

##
## Family: gaussian
## Link function: identity
##
## Formula:

```

```
## cbcl_scr_syn_internal_r ~ PDS_score * lOFC_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.781066   2.173804   1.279 0.200921
## PDS_score         0.836270   0.245885   3.401 0.000684 ***
## lOFC_posvsneg_feedback_z -0.033326   0.566396  -0.059 0.953087
## race.ethnicity.5levelBlack -0.392572   1.011038  -0.388 0.697846
## race.ethnicity.5levelMixed  0.644283   1.000982   0.644 0.519876
## race.ethnicity.5levelOther -0.900011   1.112141  -0.809 0.418462
## race.ethnicity.5levelWhite  0.249360   0.941656   0.265 0.791184
## demo_race_hispanic1    0.913767   0.379284   2.409 0.016078 *
## interview_age         0.006473   0.016337   0.396 0.692002
## PDS_score:lOFC_posvsneg_feedback_z 0.168492   0.381253   0.442 0.658580
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00623
## lmer.REML = 12489  Scale est. = 13.559    n = 2003
```

4.10 Model: CBCL internalizing factor ~ PDS x Medial OFC activity (feedback stage)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * mOFC_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.74223   2.03903   0.364  0.7159
## PDS_score         0.89080   0.18011   4.946 8.21e-07 ***
## mOFC_posvsneg_feedback_z -0.49262   0.48540  -1.015  0.3103
## race.ethnicity.5levelBlack  0.05135   0.80109   0.064  0.9489
## race.ethnicity.5levelMixed  1.27777   0.79211   1.613  0.1069
## race.ethnicity.5levelOther  0.52956   0.93373   0.567  0.5707
## race.ethnicity.5levelWhite  1.44839   0.73158   1.980  0.0479 *
## demo_race_hispanic1    0.09621   0.35804   0.269  0.7882
## interview_age         0.01285   0.01655   0.776  0.4377
## PDS_score:mOFC_posvsneg_feedback_z 0.44003   0.25859   1.702  0.0890 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0172
## lmer.REML = 12411  Scale est. = 15.619    n = 2014
```


Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * mOFC_posvsneg_feedback_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.720835   2.167351   1.255 0.209490
## PDS_score       0.840753   0.244719   3.436 0.000603 ***
## mOFC_posvsneg_feedback_z -0.073848   0.485874  -0.152 0.879210
## race.ethnicity.5levelBlack -0.413100   1.008785  -0.410 0.682214
## race.ethnicity.5levelMixed  0.683753   0.998355   0.685 0.493499
## race.ethnicity.5levelOther -0.865858   1.109137  -0.781 0.435095
## race.ethnicity.5levelWhite  0.257823   0.939937   0.274 0.783884
## demo_race_hispanic1    0.907199   0.376347   2.411 0.016019 *
## interview_age      0.006855   0.016289   0.421 0.673917
## PDS_score:mOFC_posvsneg_feedback_z 0.113739   0.334080   0.340 0.733549
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00642
## lmer.REML = 12540 Scale est. = 13.606    n = 2012
```

4.11 Model: CBCL internalizing factor ~ PDS x BIS-BAS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * bisbas_ss_basm_rr + race.ethnicity.5level +
##   demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.82007   2.00463  -0.409 0.68251
## PDS_score      2.07922   0.54268   3.831 0.00013 ***
## bisbas_ss_basm_rr  0.22482   0.10746   2.092 0.03653 *
## race.ethnicity.5levelBlack -0.20759   0.71808  -0.289 0.77253
## race.ethnicity.5levelMixed  1.23262   0.71707   1.719 0.08574 .
## race.ethnicity.5levelOther  0.33424   0.82728   0.404 0.68623
## race.ethnicity.5levelWhite  0.98373   0.66399   1.482 0.13858
## demo_race_hispanic1  0.25986   0.32109   0.809 0.41842
## interview_age    0.01402   0.01471   0.953 0.34071
## PDS_score:bisbas_ss_basm_rr -0.14543   0.05856  -2.484 0.01307 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
##
## R-sq.(adj) = 0.0143
## lmer.REML = 16130 Scale est. = 17.079 n = 2613

Males

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * bisbas_ss_basm_rr + race.ethnicity.5level +
## demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.48400    2.11797   1.173  0.2410
## PDS_score         1.32053    0.78208   1.688  0.0914 .
## bisbas_ss_basm_rr  0.02346    0.11928   0.197  0.8441
## race.ethnicity.5levelBlack -0.84910    0.78892  -1.076  0.2819
## race.ethnicity.5levelMixed  0.46370    0.78388   0.592  0.5542
## race.ethnicity.5levelOther -0.83182    0.88259  -0.942  0.3460
## race.ethnicity.5levelWhite -0.01519    0.73341  -0.021  0.9835
## demo_race_hispanic1  0.56831    0.32398   1.754  0.0795 .
## interview_age      0.01157    0.01408   0.822  0.4112
## PDS_score:bisbas_ss_basm_rr -0.06676    0.08247  -0.809  0.4183
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00511
## lmer.REML = 17691 Scale est. = 15.855 n = 2830
```

4.12 Model: CBCL internalizing factor ~ PDS x MID reaction time (large reward vs. neutral)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * rt_diff_large_neutral_z +
## race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.95157    1.97175   0.483  0.629
## PDS_score         0.99869    0.17495   5.709 1.3e-08 ***
## rt_diff_large_neutral_z  0.12193    0.31251   0.390  0.696
## race.ethnicity.5levelBlack -0.42743    0.76669  -0.557  0.577
## race.ethnicity.5levelMixed  0.79385    0.76032   1.044  0.297
## race.ethnicity.5levelOther  0.29260    0.87738   0.333  0.739
```

```
## race.ethnicity.5levelWhite      0.94302      0.70264      1.342      0.180
## demo_race_hispanic1            0.25469      0.34704      0.734      0.463
## interview_age                   0.01350      0.01609      0.839      0.402
## PDS_score:rt_diff_large_neutral_z -0.02866      0.17136     -0.167      0.867
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0171
## lmer.REML = 13448  Scale est. = 17.055    n = 2179
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * rt_diff_large_neutral_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.83647    2.05292   1.382 0.167209
## PDS_score         0.86126    0.22493   3.829 0.000132 ***
## rt_diff_large_neutral_z 0.76378    0.32201   2.372 0.017780 *
## race.ethnicity.5levelBlack -1.12357    0.94030  -1.195 0.232250
## race.ethnicity.5levelMixed -0.12755    0.93527  -0.136 0.891532
## race.ethnicity.5levelOther -1.39170    1.03455  -1.345 0.178690
## race.ethnicity.5levelWhite -0.40754    0.87819  -0.464 0.642644
## demo_race_hispanic1    0.70001    0.35802   1.955 0.050681 .
## interview_age        0.01138    0.01541   0.738 0.460374
## PDS_score:rt_diff_large_neutral_z -0.62851    0.22296  -2.819 0.004861 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00595
## lmer.REML = 14098  Scale est. = 12.135    n = 2262
```

4.13 Model: CBCL internalizing factor ~ PDS x MID reaction time (large vs. small reward)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * rt_diff_large_small_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
```

```
## (Intercept)          0.948396    1.969550    0.482    0.630
## PDS_score            0.998096    0.174900    5.707 1.31e-08 ***
## rt_diff_large_small_z 0.131991    0.291413    0.453    0.651
## race.ethnicity.5levelBlack -0.398080    0.766670   -0.519    0.604
## race.ethnicity.5levelMixed 0.822991    0.760405    1.082    0.279
## race.ethnicity.5levelOther 0.318006    0.877059    0.363    0.717
## race.ethnicity.5levelWhite 0.967847    0.702348    1.378    0.168
## demo_race_hispanic1    0.251364    0.346794    0.725    0.469
## interview_age         0.013342    0.016080    0.830    0.407
## PDS_score:rt_diff_large_small_z 0.004203    0.159261    0.026    0.979
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0176
## lmer.REML = 13448 Scale est. = 17.019    n = 2179
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score * rt_diff_large_small_z +
##   race.ethnicity.5level + demo_race_hispanic + interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.046734   2.052414   1.484 0.137826
## PDS_score       0.863210   0.225290   3.832 0.000131 ***
## rt_diff_large_small_z 0.323944   0.327589   0.989 0.322831
## race.ethnicity.5levelBlack -1.088601   0.941799  -1.156 0.247855
## race.ethnicity.5levelMixed -0.155016   0.935945  -0.166 0.868467
## race.ethnicity.5levelOther -1.386062   1.035551  -1.338 0.180876
## race.ethnicity.5levelWhite -0.448114   0.878909  -0.510 0.610205
## demo_race_hispanic1    0.723235   0.358872   2.015 0.043992 *
## interview_age     0.009806   0.015408   0.636 0.524558
## PDS_score:rt_diff_large_small_z -0.361426   0.229120  -1.577 0.114831
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00522
## lmer.REML = 14102 Scale est. = 12.133    n = 2262
```

4.14 Model: CBCL internalizing factor ~ Testosterone x Accumbens activity (anticipation stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
```

```

## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   accumbens_rvsnt_ant_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.181291   2.081064  -0.087  0.93059
## PDS_score       1.028257   0.190070   5.410 7.13e-08
## hormone_scr_ert_mean -0.002649   0.007808  -0.339  0.73446
## accumbens_rvsnt_ant_z  0.748352   0.395459   1.892  0.05860
## race.ethnicity.5levelBlack -0.489731   0.799326  -0.613  0.54016
## race.ethnicity.5levelMixed  0.901860   0.791070   1.140  0.25441
## race.ethnicity.5levelOther  0.025106   0.942731   0.027  0.97876
## race.ethnicity.5levelWhite  1.193196   0.725804   1.644  0.10035
## demo_race_hispanic1  0.059304   0.364861   0.163  0.87090
## interview_age     0.021642   0.017153   1.262  0.20721
## hormone_scr_ert_mean:accumbens_rvsnt_ant_z -0.025498   0.009632  -2.647  0.00818
##
## (Intercept)
## PDS_score          ***
## hormone_scr_ert_mean
## accumbens_rvsnt_ant_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed
## race.ethnicity.5levelOther
## race.ethnicity.5levelWhite
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:accumbens_rvsnt_ant_z **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0241
## lmer.REML = 11374  Scale est. = 15.52    n = 1850

```

Males

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   accumbens_rvsnt_ant_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.731558   2.218974   1.231 0.218479
## PDS_score       0.941556   0.257207   3.661 0.000259
## hormone_scr_ert_mean  0.011798   0.009054   1.303 0.192752
## accumbens_rvsnt_ant_z  0.090278   0.411942   0.219 0.826555

```

```
## race.ethnicity.5levelBlack          -0.501684    1.041845   -0.482  0.630194
## race.ethnicity.5levelMixed           0.431402    1.029140    0.419  0.675128
## race.ethnicity.5levelOther          -0.752323    1.145798   -0.657  0.511524
## race.ethnicity.5levelWhite           0.279589    0.967968    0.289  0.772735
## demo_race_hispanic1                 0.745713    0.391612    1.904  0.057037
## interview_age                       0.003260    0.016842    0.194  0.846545
## hormone_scr_ert_mean:accumbens_rvsnt_z -0.006021    0.012170   -0.495  0.620844
##
## (Intercept)
## PDS_score                           ***
## hormone_scr_ert_mean
## accumbens_rvsnt_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed
## race.ethnicity.5levelOther
## race.ethnicity.5levelWhite
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:accumbens_rvsnt_z
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0058
## lmer.REML = 11641  Scale est. = 12.616    n = 1867
```

4.15 Model: CBCL internalizing factor ~ Testosterone x Caudate activity (anticipation stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   caudate_rvsnt_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.165775   2.091116   0.079   0.9368
## PDS_score       0.995050   0.190494   5.224 1.95e-07
## hormone_scr_ert_mean -0.002227   0.007845  -0.284   0.7765
## caudate_rvsnt_z   0.378963   0.306118   1.238   0.2159
## race.ethnicity.5levelBlack -0.474215   0.802532  -0.591   0.5547
## race.ethnicity.5levelMixed  0.913794   0.793343   1.152   0.2495
## race.ethnicity.5levelOther  0.066373   0.947244   0.070   0.9441
## race.ethnicity.5levelWhite  1.221957   0.728462   1.677   0.0936
## demo_race_hispanic1  0.023850   0.365429   0.065   0.9480
## interview_age     0.019016   0.017253   1.102   0.2705
## hormone_scr_ert_mean:caudate_rvsnt_z -0.009497   0.007717  -1.231   0.2186
##
```

```
## (Intercept)
## PDS_score ***
## hormone_scr_ert_mean
## caudate_rvsnt_ant_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed
## race.ethnicity.5levelOther
## race.ethnicity.5levelWhite .
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:caudate_rvsnt_ant_z
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0196
## lmer.REML = 11425  Scale est. = 16.042    n = 1855
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   caudate_rvsnt_ant_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.683096   2.223564   1.207 0.227715
## PDS_score       0.958701   0.259708   3.691 0.000229
## hormone_scr_ert_mean 0.011834   0.009062   1.306 0.191751
## caudate_rvsnt_ant_z 0.379173   0.318703   1.190 0.234302
## race.ethnicity.5levelBlack -0.435280   1.042708  -0.417 0.676396
## race.ethnicity.5levelMixed  0.504033   1.029705   0.489 0.624551
## race.ethnicity.5levelOther -0.807830   1.145976  -0.705 0.480944
## race.ethnicity.5levelWhite  0.342370   0.969902   0.353 0.724133
## demo_race_hispanic1  0.814593   0.394821   2.063 0.039233
## interview_age    0.003252   0.016889   0.193 0.847332
## hormone_scr_ert_mean:caudate_rvsnt_ant_z -0.008757   0.009119  -0.960 0.337000
##
## (Intercept)
## PDS_score ***
## hormone_scr_ert_mean
## caudate_rvsnt_ant_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed
## race.ethnicity.5levelOther
## race.ethnicity.5levelWhite
## demo_race_hispanic1 *
## interview_age
## hormone_scr_ert_mean:caudate_rvsnt_ant_z
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00634
## lmer.REML = 11682  Scale est. = 12.616    n = 1872
```

4.16 Model: CBCL internalizing factor ~ Testosterone x Putamen activity (anticipation stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      putamen_rvsnt_ant_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.138727    2.090567   0.066   0.9471
## PDS_score         1.010336    0.190694   5.298 1.31e-07
## hormone_scr_ert_mean -0.002053    0.007858  -0.261   0.7939
## putamen_rvsnt_ant_z  0.229449    0.311016   0.738   0.4608
## race.ethnicity.5levelBlack -0.520634    0.802461  -0.649   0.5166
## race.ethnicity.5levelMixed  0.899355    0.793768   1.133   0.2574
## race.ethnicity.5levelOther  0.009675    0.945429   0.010   0.9918
## race.ethnicity.5levelWhite  1.227171    0.728365   1.685   0.0922
## demo_race_hispanic1    0.017266    0.365130   0.047   0.9623
## interview_age        0.019075    0.017255   1.105   0.2691
## hormone_scr_ert_mean:putamen_rvsnt_ant_z -0.006497    0.007955  -0.817   0.4142
##
## (Intercept)
## PDS_score          ***
## hormone_scr_ert_mean
## putamen_rvsnt_ant_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed
## race.ethnicity.5levelOther
## race.ethnicity.5levelWhite      .
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:putamen_rvsnt_ant_z
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0202
## lmer.REML = 11414  Scale est. = 16.009    n = 1853
```


Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      putamen_rvsnt_ant_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.822472    2.224804   1.269 0.204729
## PDS_score       0.970709    0.260034   3.733 0.000195
## hormone_scr_ert_mean 0.010804    0.009047   1.194 0.232522
## putamen_rvsnt_ant_z 0.035317    0.332133   0.106 0.915330
## race.ethnicity.5levelBlack -0.518482    1.042955  -0.497 0.619158
## race.ethnicity.5levelMixed  0.479308    1.030214   0.465 0.641806
## race.ethnicity.5levelOther -0.786175    1.147678  -0.685 0.493421
## race.ethnicity.5levelWhite  0.318837    0.970303   0.329 0.742498
## demo_race_hispanic1    0.766117    0.391575   1.957 0.050555
## interview_age      0.002391    0.016902   0.141 0.887499
## hormone_scr_ert_mean:putamen_rvsnt_ant_z -0.004326    0.009672  -0.447 0.654679
##
## (Intercept)
## PDS_score          ***
## hormone_scr_ert_mean
## putamen_rvsnt_ant_z
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed
## race.ethnicity.5levelOther
## race.ethnicity.5levelWhite
## demo_race_hispanic1      .
## interview_age
## hormone_scr_ert_mean:putamen_rvsnt_ant_z
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00626
## lmer.REML = 11681 Scale est. = 12.707    n = 1872
```

4.17 Model: CBCL internalizing factor ~ Testosterone x Accumbens activity (feedback stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      accumbens_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
```

```
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value
## (Intercept)    -0.190478   2.096649  -0.091
## PDS_score       0.960917   0.191780   5.011
## hormone_scr_ert_mean    -0.001236   0.007857  -0.157
## accumbens_posvsneg_feedback_z    0.168432   0.424783   0.397
## race.ethnicity.5levelBlack    -0.222052   0.810009  -0.274
## race.ethnicity.5levelMixed     1.183490   0.799554   1.480
## race.ethnicity.5levelOther     0.317332   0.947940   0.335
## race.ethnicity.5levelWhite     1.453078   0.734562   1.978
## demo_race_hispanic1     0.014620   0.368046   0.040
## interview_age     0.020263   0.017274   1.173
## hormone_scr_ert_mean:accumbens_posvsneg_feedback_z    0.001104   0.010674   0.103
##
##              Pr(>|t|)
## (Intercept)           0.9276
## PDS_score             5.95e-07 ***
## hormone_scr_ert_mean     0.8750
## accumbens_posvsneg_feedback_z    0.6918
## race.ethnicity.5levelBlack    0.7840
## race.ethnicity.5levelMixed     0.1390
## race.ethnicity.5levelOther     0.7378
## race.ethnicity.5levelWhite     0.0481 *
## demo_race_hispanic1     0.9683
## interview_age           0.2409
## hormone_scr_ert_mean:accumbens_posvsneg_feedback_z    0.9177
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0194
## lmer.REML = 11378  Scale est. = 16.001    n = 1848
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      accumbens_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error
## (Intercept)    3.2093646   2.2321742
## PDS_score       0.9702666   0.2581040
## hormone_scr_ert_mean    0.0097531   0.0090674
## accumbens_posvsneg_feedback_z    -0.3649853   0.4096384
## race.ethnicity.5levelBlack    -0.5738800   1.0575576
## race.ethnicity.5levelMixed     0.4784749   1.0451087
## race.ethnicity.5levelOther    -0.9241075   1.1587736
```

```
## race.ethnicity.5levelWhite          0.2600827  0.9856752
## demo_race_hispanic1                 0.7865190  0.3919504
## interview_age                       0.0000917  0.0169152
## hormone_scr_ert_mean:accumbens_posvsneg_feedback_z 0.0056884  0.0120614
##                                     t value Pr(>|t|)
## (Intercept)                        1.438 0.150666
## PDS_score                          3.759 0.000176 ***
## hormone_scr_ert_mean               1.076 0.282233
## accumbens_posvsneg_feedback_z      -0.891 0.373048
## race.ethnicity.5levelBlack          -0.543 0.587438
## race.ethnicity.5levelMixed          0.458 0.647133
## race.ethnicity.5levelOther          -0.797 0.425270
## race.ethnicity.5levelWhite          0.264 0.791915
## demo_race_hispanic1                2.007 0.044928 *
## interview_age                      0.005 0.995675
## hormone_scr_ert_mean:accumbens_posvsneg_feedback_z 0.472 0.637251
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00633
## lmer.REML = 11692  Scale est. = 12.536    n = 1873
```

4.18 Model: CBCL internalizing factor ~ Testosterone x Caudate activity (Feedback stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   caudate_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##                                     Estimate Std. Error t value
## (Intercept)                    -0.2182333   2.0973788  -0.104
## PDS_score                      0.9674489   0.1909243   5.067
## hormone_scr_ert_mean           -0.0004755   0.0078346  -0.061
## caudate_posvsneg_feedback_z    -0.1399139   0.3318574  -0.422
## race.ethnicity.5levelBlack     -0.2926314   0.8113746  -0.361
## race.ethnicity.5levelMixed      1.1277259   0.8007878   1.408
## race.ethnicity.5levelOther      0.2609209   0.9475736   0.275
## race.ethnicity.5levelWhite      1.4575607   0.7357836   1.981
## demo_race_hispanic1            0.0668363   0.3667752   0.182
## interview_age                  0.0202858   0.0172731   1.174
## hormone_scr_ert_mean:caudate_posvsneg_feedback_z 0.0013410   0.0084975   0.158
##                                     Pr(>|t|)
## (Intercept)                     0.9171
## PDS_score                       4.44e-07 ***
## hormone_scr_ert_mean             0.9516
```

```
## caudate_posvsneg_feedback_z          0.6734
## race.ethnicity.5levelBlack            0.7184
## race.ethnicity.5levelMixed            0.1592
## race.ethnicity.5levelOther            0.7831
## race.ethnicity.5levelWhite            0.0477 *
## demo_race_hispanic1                  0.8554
## interview_age                         0.2404
## hormone_scr_ert_mean:caudate_posvsneg_feedback_z 0.8746
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0196
## lmer.REML = 11385  Scale est. = 16.087    n = 1849
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   caudate_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value
## (Intercept)      3.2734222   2.2345928   1.465
## PDS_score         0.9313613   0.2593189   3.592
## hormone_scr_ert_mean 0.0096474   0.0091153   1.058
## caudate_posvsneg_feedback_z -0.1904534   0.3266383  -0.583
## race.ethnicity.5levelBlack -0.5006482   1.0460636  -0.479
## race.ethnicity.5levelMixed  0.5112107   1.0319437   0.495
## race.ethnicity.5levelOther -0.8595030   1.1485001  -0.748
## race.ethnicity.5levelWhite  0.2885766   0.9725685   0.297
## demo_race_hispanic1      0.7714019   0.3912141   1.972
## interview_age      -0.0004641   0.0169756  -0.027
## hormone_scr_ert_mean:caudate_posvsneg_feedback_z 0.0045107   0.0094310   0.478
##
##               Pr(>|t|)
## (Intercept)      0.143122
## PDS_score         0.000337 ***
## hormone_scr_ert_mean 0.290025
## caudate_posvsneg_feedback_z 0.559916
## race.ethnicity.5levelBlack 0.632278
## race.ethnicity.5levelMixed 0.620386
## race.ethnicity.5levelOther 0.454332
## race.ethnicity.5levelWhite 0.766717
## demo_race_hispanic1      0.048779 *
## interview_age      0.978192
## hormone_scr_ert_mean:caudate_posvsneg_feedback_z 0.632502
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
```

```
##
## R-sq.(adj) = 0.00561
## lmer.REML = 11649 Scale est. = 13.19 n = 1864
```

4.19 Model: CBCL internalizing factor ~ Testosterone x Putamen activity (Feedback stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      putamen_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value
## (Intercept)    0.118158   2.089886   0.057
## PDS_score      1.024707   0.191144   5.361
## hormone_scr_ert_mean -0.002045   0.007853  -0.260
## putamen_posvsneg_feedback_z 0.083296   0.337089   0.247
## race.ethnicity.5levelBlack -0.486371   0.803308  -0.605
## race.ethnicity.5levelMixed  0.913244   0.793817   1.150
## race.ethnicity.5levelOther -0.045591   0.944110  -0.048
## race.ethnicity.5levelWhite  1.224540   0.728436   1.681
## demo_race_hispanic1    0.100062   0.366661   0.273
## interview_age    0.018886   0.017236   1.096
## hormone_scr_ert_mean:putamen_posvsneg_feedback_z -0.005448   0.008453  -0.645
##
##              Pr(>|t|)
## (Intercept)    0.9549
## PDS_score      9.32e-08 ***
## hormone_scr_ert_mean    0.7946
## putamen_posvsneg_feedback_z 0.8049
## race.ethnicity.5levelBlack 0.5449
## race.ethnicity.5levelMixed 0.2501
## race.ethnicity.5levelOther 0.9615
## race.ethnicity.5levelWhite 0.0929 .
## demo_race_hispanic1    0.7850
## interview_age    0.2734
## hormone_scr_ert_mean:putamen_posvsneg_feedback_z 0.5193
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0207
## lmer.REML = 11406 Scale est. = 16.487 n = 1852
```

Males

```
##
## Family: gaussian
## Link function: identity
```

```

##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      putamen_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value
## (Intercept)      3.222e+00  2.233e+00   1.443
## PDS_score         9.077e-01  2.588e-01   3.507
## hormone_scr_ert_mean      9.898e-03  9.102e-03   1.087
## putamen_posvsneg_feedback_z  6.944e-02  3.307e-01   0.210
## race.ethnicity.5levelBlack -4.320e-01  1.047e+00  -0.413
## race.ethnicity.5levelMixed  5.610e-01  1.033e+00   0.543
## race.ethnicity.5levelOther -8.051e-01  1.149e+00  -0.700
## race.ethnicity.5levelWhite  3.285e-01  9.728e-01   0.338
## demo_race_hispanic1      7.186e-01  3.918e-01   1.834
## interview_age      -9.080e-05  1.697e-02  -0.005
## hormone_scr_ert_mean:putamen_posvsneg_feedback_z -7.763e-05  9.786e-03  -0.008
##
##              Pr(>|t|)
## (Intercept)      0.149262
## PDS_score         0.000463 ***
## hormone_scr_ert_mean      0.276976
## putamen_posvsneg_feedback_z  0.833722
## race.ethnicity.5levelBlack  0.679916
## race.ethnicity.5levelMixed  0.587093
## race.ethnicity.5levelOther  0.483756
## race.ethnicity.5levelWhite  0.735609
## demo_race_hispanic1      0.066837 .
## interview_age      0.995732
## hormone_scr_ert_mean:putamen_posvsneg_feedback_z 0.993671
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00537
## lmer.REML = 11684  Scale est. = 13.524    n = 1869

```

4.20 Model: CBCL internalizing factor ~ Testosterone x Lateral OFC activity (anticipation stage) + PDS

Females

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      lOFC_rvsnt_ant_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)

```

```
## (Intercept) -0.268455 2.100528 -0.128 0.8983
## PDS_score 0.953250 0.192624 4.949 8.15e-07 ***
## hormone_scr_ert_mean -0.001903 0.007873 -0.242 0.8090
## lOFC_rvs_n_ant_z 0.501350 0.495478 1.012 0.3117
## race.ethnicity.5levelBlack -0.166442 0.811717 -0.205 0.8376
## race.ethnicity.5levelMixed 1.195693 0.801183 1.492 0.1358
## race.ethnicity.5levelOther 0.403246 0.951841 0.424 0.6719
## race.ethnicity.5levelWhite 1.486229 0.735957 2.019 0.0436 *
## demo_race_hispanic1 0.002523 0.367033 0.007 0.9945
## interview_age 0.021066 0.017312 1.217 0.2238
## hormone_scr_ert_mean:lOFC_rvs_n_ant_z -0.009991 0.012957 -0.771 0.4408
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0189
## lmer.REML = 11345 Scale est. = 15.993 n = 1842
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
## lOFC_rvs_n_ant_z + race.ethnicity.5level + demo_race_hispanic +
## interview_age
##
## Parametric coefficients:
## Estimate Std. Error t value Pr(>|t|)
## (Intercept) 2.661574 2.215272 1.201 0.22972
## PDS_score 0.842574 0.259871 3.242 0.00121 **
## hormone_scr_ert_mean 0.010894 0.009006 1.210 0.22658
## lOFC_rvs_n_ant_z 0.313675 0.467634 0.671 0.50245
## race.ethnicity.5levelBlack -0.609689 1.048009 -0.582 0.56080
## race.ethnicity.5levelMixed 0.455567 1.034061 0.441 0.65958
## race.ethnicity.5levelOther -0.861293 1.144960 -0.752 0.45200
## race.ethnicity.5levelWhite 0.241569 0.974216 0.248 0.80419
## demo_race_hispanic1 0.755810 0.391691 1.930 0.05381 .
## interview_age 0.005425 0.016777 0.323 0.74645
## hormone_scr_ert_mean:lOFC_rvs_n_ant_z -0.014912 0.012811 -1.164 0.24459
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00604
## lmer.REML = 11561 Scale est. = 12.61 n = 1859
```

4.21 Model: CBCL internalizing factor ~ Testosterone x Medial OFC activity (anticipation stage) + PDS

Females

```
##
```

```
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      mOFC_rvs_n_ant_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -0.335356   2.103623   -0.159    0.873
## PDS_score        0.953065   0.192757    4.944 8.34e-07 ***
## hormone_scr_ert_mean -0.001117  0.007860   -0.142    0.887
## mOFC_rvs_n_ant_z    0.415906   0.424412    0.980    0.327
## race.ethnicity.5levelBlack -0.176200  0.811137   -0.217    0.828
## race.ethnicity.5levelMixed  1.170896  0.801983    1.460    0.144
## race.ethnicity.5levelOther  0.367373  0.949882    0.387    0.699
## race.ethnicity.5levelWhite  1.498526  0.736273    2.035    0.042 *
## demo_race_hispanic1 -0.004546  0.367034   -0.012    0.990
## interview_age      0.021341  0.017329    1.232    0.218
## hormone_scr_ert_mean:mOFC_rvs_n_ant_z -0.006879  0.010767   -0.639    0.523
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.019
## lmer.REML = 11351 Scale est. = 15.87      n = 1843
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      mOFC_rvs_n_ant_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    2.496560   2.227316    1.121 0.262483
## PDS_score        0.918440   0.260289    3.529 0.000428 ***
## hormone_scr_ert_mean  0.010672  0.009070    1.177 0.239497
## mOFC_rvs_n_ant_z   -0.091310  0.403846   -0.226 0.821148
## race.ethnicity.5levelBlack -0.420739  1.053129   -0.400 0.689561
## race.ethnicity.5levelMixed  0.490566  1.039464    0.472 0.637024
## race.ethnicity.5levelOther -0.790655  1.152608   -0.686 0.492817
## race.ethnicity.5levelWhite  0.278907  0.980399    0.284 0.776072
## demo_race_hispanic1  0.712338  0.392943    1.813 0.070020 .
## interview_age      0.005702  0.016873    0.338 0.735450
## hormone_scr_ert_mean:mOFC_rvs_n_ant_z -0.002681  0.011440   -0.234 0.814748
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



```
##
##
## R-sq.(adj) = 0.00519
## lmer.REML = 11615 Scale est. = 12.518 n = 1864
```

4.22 Model: CBCL internalizing factor ~ Testosterone x Lateral OFC activity (feedback stage) + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   lOFC_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value
## (Intercept)    -0.044937   2.092752  -0.021
## PDS_score       0.925586   0.192200   4.816
## hormone_scr_ert_mean -0.001409  0.007855  -0.179
## lOFC_posvsneg_feedback_z 0.007051  0.551494   0.013
## race.ethnicity.5levelBlack -0.395454  0.802080  -0.493
## race.ethnicity.5levelMixed 0.886869  0.792606   1.119
## race.ethnicity.5levelOther -0.015041  0.943164  -0.016
## race.ethnicity.5levelWhite 1.204774  0.726589   1.658
## demo_race_hispanic1 0.062441  0.366832   0.170
## interview_age 0.021466  0.017291   1.241
## hormone_scr_ert_mean:lOFC_posvsneg_feedback_z -0.002902  0.014645  -0.198
##
##               Pr(>|t|)
## (Intercept)      0.9829
## PDS_score        1.59e-06 ***
## hormone_scr_ert_mean 0.8576
## lOFC_posvsneg_feedback_z 0.9898
## race.ethnicity.5levelBlack 0.6220
## race.ethnicity.5levelMixed 0.2633
## race.ethnicity.5levelOther 0.9873
## race.ethnicity.5levelWhite 0.0975 .
## demo_race_hispanic1 0.8649
## interview_age 0.2146
## hormone_scr_ert_mean:lOFC_posvsneg_feedback_z 0.8430
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.0166
## lmer.REML = 11373 Scale est. = 16.334 n = 1848
```

Males

```
##
## Family: gaussian
```

```

## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   lOFC_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##
##               Estimate Std. Error t value
## (Intercept)      3.132598   2.228475   1.406
## PDS_score         0.902886   0.260047   3.472
## hormone_scr_ert_mean 0.010987   0.009038   1.216
## lOFC_posvsneg_feedback_z 0.075070   0.526484   0.143
## race.ethnicity.5levelBlack -0.575538   1.057172  -0.544
## race.ethnicity.5levelMixed  0.469622   1.042176   0.451
## race.ethnicity.5levelOther -0.895749   1.154674  -0.776
## race.ethnicity.5levelWhite  0.271549   0.981503   0.277
## demo_race_hispanic1  0.763738   0.393804   1.939
## interview_age      0.001034   0.016891   0.061
## hormone_scr_ert_mean:lOFC_posvsneg_feedback_z 0.005022   0.014863   0.338
##
##               Pr(>|t|)
## (Intercept)      0.159977
## PDS_score         0.000528 ***
## hormone_scr_ert_mean 0.224303
## lOFC_posvsneg_feedback_z 0.886632
## race.ethnicity.5levelBlack 0.586223
## race.ethnicity.5levelMixed 0.652318
## race.ethnicity.5levelOther 0.437990
## race.ethnicity.5levelWhite 0.782067
## demo_race_hispanic1  0.052606 .
## interview_age      0.951180
## hormone_scr_ert_mean:lOFC_posvsneg_feedback_z 0.735490
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00464
## lmer.REML = 11580  Scale est. = 12.527    n = 1858

```

4.23 Model: CBCL internalizing factor ~ Testosterone x Medial OFC activity (feedback stage) + PDS

Females

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   mOFC_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:

```

```

##                                Estimate Std. Error t value
## (Intercept)                   -0.314760   2.093249  -0.150
## PDS_score                     0.954451   0.191597   4.982
## hormone_scr_ert_mean          -0.001444   0.007850  -0.184
## mOFC_posvsneg_feedback_z      0.425475   0.479556   0.887
## race.ethnicity.5levelBlack    -0.145210   0.809952  -0.179
## race.ethnicity.5levelMixed    1.225959   0.799258   1.534
## race.ethnicity.5levelOther    0.225314   0.948784   0.237
## race.ethnicity.5levelWhite    1.475471   0.734587   2.009
## demo_race_hispanic1           0.036169   0.366841   0.099
## interview_age                 0.021263   0.017250   1.233
## hormone_scr_ert_mean:mOFC_posvsneg_feedback_z -0.006730   0.012439  -0.541
##                                Pr(>|t|)
## (Intercept)                   0.8805
## PDS_score                     6.9e-07 ***
## hormone_scr_ert_mean          0.8540
## mOFC_posvsneg_feedback_z      0.3751
## race.ethnicity.5levelBlack    0.8577
## race.ethnicity.5levelMixed    0.1252
## race.ethnicity.5levelOther    0.8123
## race.ethnicity.5levelWhite    0.0447 *
## demo_race_hispanic1           0.9215
## interview_age                 0.2179
## hormone_scr_ert_mean:mOFC_posvsneg_feedback_z 0.5886
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.019
## lmer.REML = 11407 Scale est. = 16.118    n = 1853

```

Males

```

##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   mOFC_posvsneg_feedback_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##                                Estimate Std. Error t value
## (Intercept)                 2.999888   2.221616   1.350
## PDS_score                   0.911077   0.259259   3.514
## hormone_scr_ert_mean         0.012363   0.009020   1.371
## mOFC_posvsneg_feedback_z    -0.464001   0.437954  -1.059
## race.ethnicity.5levelBlack  -0.655102   1.053972  -0.622
## race.ethnicity.5levelMixed   0.480853   1.039058   0.463
## race.ethnicity.5levelOther  -0.893475   1.151337  -0.776
## race.ethnicity.5levelWhite   0.254733   0.979137   0.260
## demo_race_hispanic1          0.766724   0.390613   1.963
## interview_age                0.001901   0.016837   0.113

```

```
## hormone_scr_ert_mean:mOFC_posvsneg_feedback_z 0.018415 0.012444 1.480
## Pr(>|t|)
## (Intercept) 0.177079
## PDS_score 0.000452 ***
## hormone_scr_ert_mean 0.170648
## mOFC_posvsneg_feedback_z 0.289522
## race.ethnicity.5levelBlack 0.534311
## race.ethnicity.5levelMixed 0.643578
## race.ethnicity.5levelOther 0.437829
## race.ethnicity.5levelWhite 0.794769
## demo_race_hispanic1 0.049810 *
## interview_age 0.910138
## hormone_scr_ert_mean:mOFC_posvsneg_feedback_z 0.139086
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00579
## lmer.REML = 11612 Scale est. = 12.558 n = 1864
```

4.24 Model: CBCL internalizing factor ~ Testosterone x BIS-BAS RR + PDS

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
## bisbas_ss_basm_rr + race.ethnicity.5level + demo_race_hispanic +
## interview_age
##
## Parametric coefficients:
## Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.530598 2.090056 -0.254 0.800
## PDS_score 0.864135 0.169223 5.106 3.54e-07
## hormone_scr_ert_mean 0.026192 0.025996 1.008 0.314
## bisbas_ss_basm_rr 0.091454 0.107910 0.848 0.397
## race.ethnicity.5levelBlack -0.424060 0.728587 -0.582 0.561
## race.ethnicity.5levelMixed 1.164004 0.726406 1.602 0.109
## race.ethnicity.5levelOther 0.225036 0.843315 0.267 0.790
## race.ethnicity.5levelWhite 0.991807 0.669711 1.481 0.139
## demo_race_hispanic1 0.175401 0.330640 0.530 0.596
## interview_age 0.021104 0.015400 1.370 0.171
## hormone_scr_ert_mean:bisbas_ss_basm_rr -0.003168 0.002824 -1.122 0.262
##
## (Intercept)
## PDS_score ***
## hormone_scr_ert_mean
## bisbas_ss_basm_rr
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed
## race.ethnicity.5levelOther
## race.ethnicity.5levelWhite
```

```
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:bisbas_ss_basm_rr
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0149
## lmer.REML = 14837  Scale est. = 17.701    n = 2402
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##     bisbas_ss_basm_rr + race.ethnicity.5level + demo_race_hispanic +
##     interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    3.348717   2.120258   1.579  0.11437
## PDS_score       0.768346   0.207688   3.700  0.00022
## hormone_scr_ert_mean 0.020069   0.028073   0.715  0.47473
## bisbas_ss_basm_rr -0.023059   0.107484  -0.215  0.83014
## race.ethnicity.5levelBlack -0.948772   0.811286  -1.169  0.24232
## race.ethnicity.5levelMixed  0.307208   0.803385   0.382  0.70220
## race.ethnicity.5levelOther -0.683594   0.902876  -0.757  0.44904
## race.ethnicity.5levelWhite  0.041298   0.751295   0.055  0.95617
## demo_race_hispanic1  0.404732   0.332297   1.218  0.22334
## interview_age     0.005281   0.014439   0.366  0.71460
## hormone_scr_ert_mean:bisbas_ss_basm_rr -0.001311   0.003061  -0.428  0.66839
##
## (Intercept)
## PDS_score          ***
## hormone_scr_ert_mean
## bisbas_ss_basm_rr
## race.ethnicity.5levelBlack
## race.ethnicity.5levelMixed
## race.ethnicity.5levelOther
## race.ethnicity.5levelWhite
## demo_race_hispanic1
## interview_age
## hormone_scr_ert_mean:bisbas_ss_basm_rr
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00346
## lmer.REML = 16373  Scale est. = 14.305    n = 2627
```

4.25 Model: CBCL internalizing factor ~ Testosterone x MID Reaction Time + PDS (large reward vs. neutral)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   rt_diff_large_neutral_z + race.ethnicity.5level + demo_race_hispanic +
##   interview_age
##
## Parametric coefficients:
##               Estimate Std. Error t value
## (Intercept)    0.039314   2.026226   0.019
## PDS_score       1.063347   0.186331   5.707
## hormone_scr_ert_mean -0.002558  0.007693  -0.333
## rt_diff_large_neutral_z -0.282271  0.292040  -0.967
## race.ethnicity.5levelBlack -0.664826  0.776886  -0.856
## race.ethnicity.5levelMixed  0.645403  0.769617   0.839
## race.ethnicity.5levelOther  0.057359  0.891157   0.064
## race.ethnicity.5levelWhite  0.922120  0.707218   1.304
## demo_race_hispanic1    0.202435  0.355969   0.569
## interview_age      0.021392  0.016782   1.275
## hormone_scr_ert_mean:rt_diff_large_neutral_z  0.012999  0.007525   1.728
##               Pr(>|t|)
## (Intercept)      0.9845
## PDS_score        1.32e-08 ***
## hormone_scr_ert_mean    0.7395
## rt_diff_large_neutral_z  0.3339
## race.ethnicity.5levelBlack  0.3922
## race.ethnicity.5levelMixed  0.4018
## race.ethnicity.5levelOther  0.9487
## race.ethnicity.5levelWhite  0.1924
## demo_race_hispanic1    0.5696
## interview_age      0.2026
## hormone_scr_ert_mean:rt_diff_large_neutral_z  0.0842 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## R-sq.(adj) =  0.0215
## lmer.REML = 12403  Scale est. = 16.792    n = 2011
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##   rt_diff_large_neutral_z + race.ethnicity.5level + demo_race_hispanic +
```

```
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value
## (Intercept)      3.198511    2.092217   1.529
## PDS_score         0.930405    0.236663   3.931
## hormone_scr_ert_mean 0.014041    0.008397   1.672
## rt_diff_large_neutral_z -0.005543    0.296296  -0.019
## race.ethnicity.5levelBlack -1.162362    0.979840  -1.186
## race.ethnicity.5levelMixed -0.178371    0.972383  -0.183
## race.ethnicity.5levelOther -1.268748    1.071979  -1.184
## race.ethnicity.5levelWhite -0.379270    0.915079  -0.414
## demo_race_hispanic1      0.538766    0.367909   1.464
## interview_age         0.004539    0.015822   0.287
## hormone_scr_ert_mean:rt_diff_large_neutral_z -0.001282    0.008319  -0.154
##
##              Pr(>|t|)
## (Intercept)         0.1265
## PDS_score            8.72e-05 ***
## hormone_scr_ert_mean 0.0947 .
## rt_diff_large_neutral_z 0.9851
## race.ethnicity.5levelBlack 0.2356
## race.ethnicity.5levelMixed 0.8545
## race.ethnicity.5levelOther 0.2367
## race.ethnicity.5levelWhite 0.6786
## demo_race_hispanic1      0.1432
## interview_age         0.7742
## hormone_scr_ert_mean:rt_diff_large_neutral_z 0.8775
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) = 0.00301
## lmer.REML = 13114 Scale est. = 11.135 n = 2108
```

4.26 Model: CBCL internalizing factor ~ Testosterone x MID Reaction Time + PDS (large vs. small reward)

Females

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      rt_diff_large_small_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##
##              Estimate Std. Error t value
## (Intercept)    -0.070043    2.023009  -0.035
## PDS_score       1.065072    0.186270   5.718
## hormone_scr_ert_mean -0.001710    0.007682  -0.223
## rt_diff_large_small_z -0.014365    0.276745  -0.052
```

```
## race.ethnicity.5levelBlack      -0.615144    0.776967   -0.792
## race.ethnicity.5levelMixed      0.687679    0.770018    0.893
## race.ethnicity.5levelOther      0.088308    0.891011    0.099
## race.ethnicity.5levelWhite      0.958944    0.707178    1.356
## demo_race_hispanic1            0.178810    0.355703    0.503
## interview_age                   0.021788    0.016768    1.299
## hormone_scr_ert_mean:rt_diff_large_small_z 0.008134    0.007337    1.109
##                                Pr(>|t|)
## (Intercept)                    0.972
## PDS_score                      1.24e-08 ***
## hormone_scr_ert_mean           0.824
## rt_diff_large_small_z         0.959
## race.ethnicity.5levelBlack     0.429
## race.ethnicity.5levelMixed     0.372
## race.ethnicity.5levelOther     0.921
## race.ethnicity.5levelWhite     0.175
## demo_race_hispanic1           0.615
## interview_age                  0.194
## hormone_scr_ert_mean:rt_diff_large_small_z 0.268
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.0226
## lmer.REML = 12402  Scale est. = 16.838    n = 2011
```

Males

```
##
## Family: gaussian
## Link function: identity
##
## Formula:
## cbcl_scr_syn_internal_r ~ PDS_score + hormone_scr_ert_mean *
##      rt_diff_large_small_z + race.ethnicity.5level + demo_race_hispanic +
##      interview_age
##
## Parametric coefficients:
##                                Estimate Std. Error t value
## (Intercept)                 3.165433    2.090264    1.514
## PDS_score                   0.939039    0.236898    3.964
## hormone_scr_ert_mean        0.013675    0.008398    1.628
## rt_diff_large_small_z       0.154436    0.302065    0.511
## race.ethnicity.5levelBlack  -1.147194    0.979330   -1.171
## race.ethnicity.5levelMixed  -0.192253    0.971665   -0.198
## race.ethnicity.5levelOther  -1.265398    1.070963   -1.182
## race.ethnicity.5levelWhite  -0.384432    0.914220   -0.421
## demo_race_hispanic1         0.543519    0.368173    1.476
## interview_age                0.004821    0.015803    0.305
## hormone_scr_ert_mean:rt_diff_large_small_z -0.007747    0.008768   -0.884
##                                Pr(>|t|)
## (Intercept)                  0.130
## PDS_score                    7.62e-05 ***
## hormone_scr_ert_mean         0.104
```



```

## rt_diff_large_small_z          0.609
## race.ethnicity.5levelBlack     0.242
## race.ethnicity.5levelMixed     0.843
## race.ethnicity.5levelOther     0.238
## race.ethnicity.5levelWhite     0.674
## demo_race_hispanic1           0.140
## interview_age                  0.760
## hormone_scr_ert_mean:rt_diff_large_small_z 0.377
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## R-sq.(adj) =  0.00349
## lmer.REML = 13113  Scale est. = 11.048    n = 2108

```