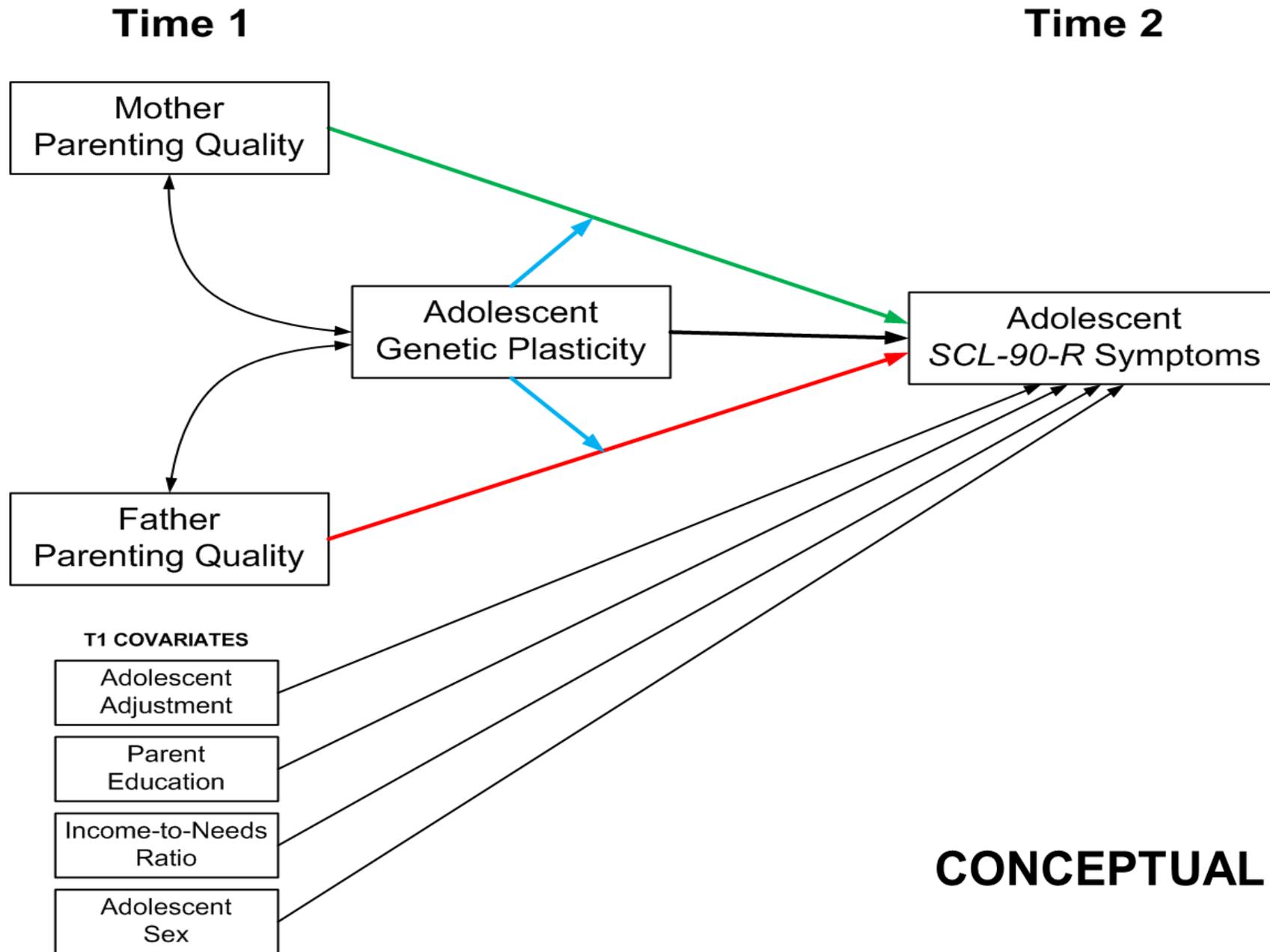


# Parenting and Adolescents' Psychological Adjustment: Longitudinal Moderation by Adolescents' Genetic Sensitivity

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**CONCEPTUAL MODEL**

Diathesis Stress Model

Differential Susceptibility  
Model

## Candidate Gene Approach

Pros: Easier to trace underlying biological pathways

Cons: Difficult to replicate

Complex psychological outcomes are unlikely to be influenced by single candidate genes.

## Polygenic Index Score Approach

Pros: Assesses additive effects of several genetic variants, each with a small effect size.

Cons: Effect of one variant may contradict the effect of another variant

Difficult to determine underlying biological pathways

# Current Study

- Does Adolescents' genetic sensitivity moderate the longitudinal associations between mothers' and fathers' parenting and adolescents' anxiety, depression and hostility?

# Family Transitions Project

## Participants

- N = 323 families, 177 female adolescents, 146 male adolescents
- Age at Time 1 = 12.6 years, age at Time 2 = 13.6 years

# Measures

- Mothers' and Fathers' Parenting Quality
- Observations of videotaped family interaction
- Combined 5 positive and 3 negative codes for each parent
- High scores = more hostility and less warmth
- Adolescents' Psychological Adjustment

SCL-90-R

Depression

Anxiety

Hostility

# Measures continued

- Polygenic Sensitivity Score

short (s) allele of 5-HTTLPR in *5-HTT* (accounting for SNP rs25531)

A1 allele of the Taq1A polymorphism in *ANKK1/DRD2*

7R allele of exon-3 VNTR in *DRD4*

10R allele of the 5' VNTR in *DAT*

Met allele of the Val158Met polymorphism in *COMT*

Scoring: 0 = none of these alleles

1 = one of these alleles

2 = two of these alleles

Polygenic Sensitivity index score = sum of scores on the 5 polymorphisms, range = 1–8 ( $M = 4.41$ ,  $SD = 1.36$ )

# Multiple Regression Analyses

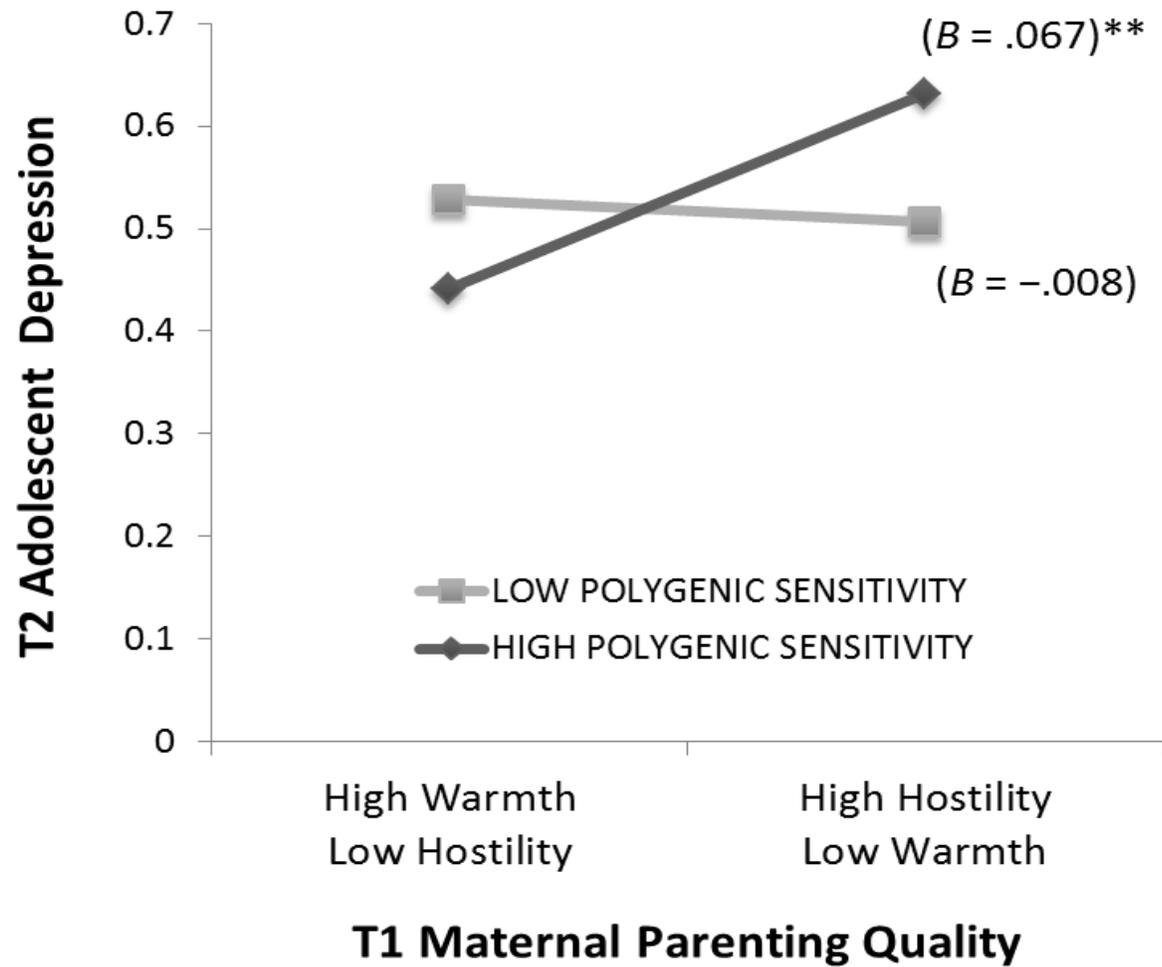
Autoregressive approach to model change in adolescent depressive, anxiety, and hostility symptoms from T1 to T2.

Run Separately for mothers and fathers.

Controls: adolescent sex, parent educational attainment, and family income-to-needs ratio.

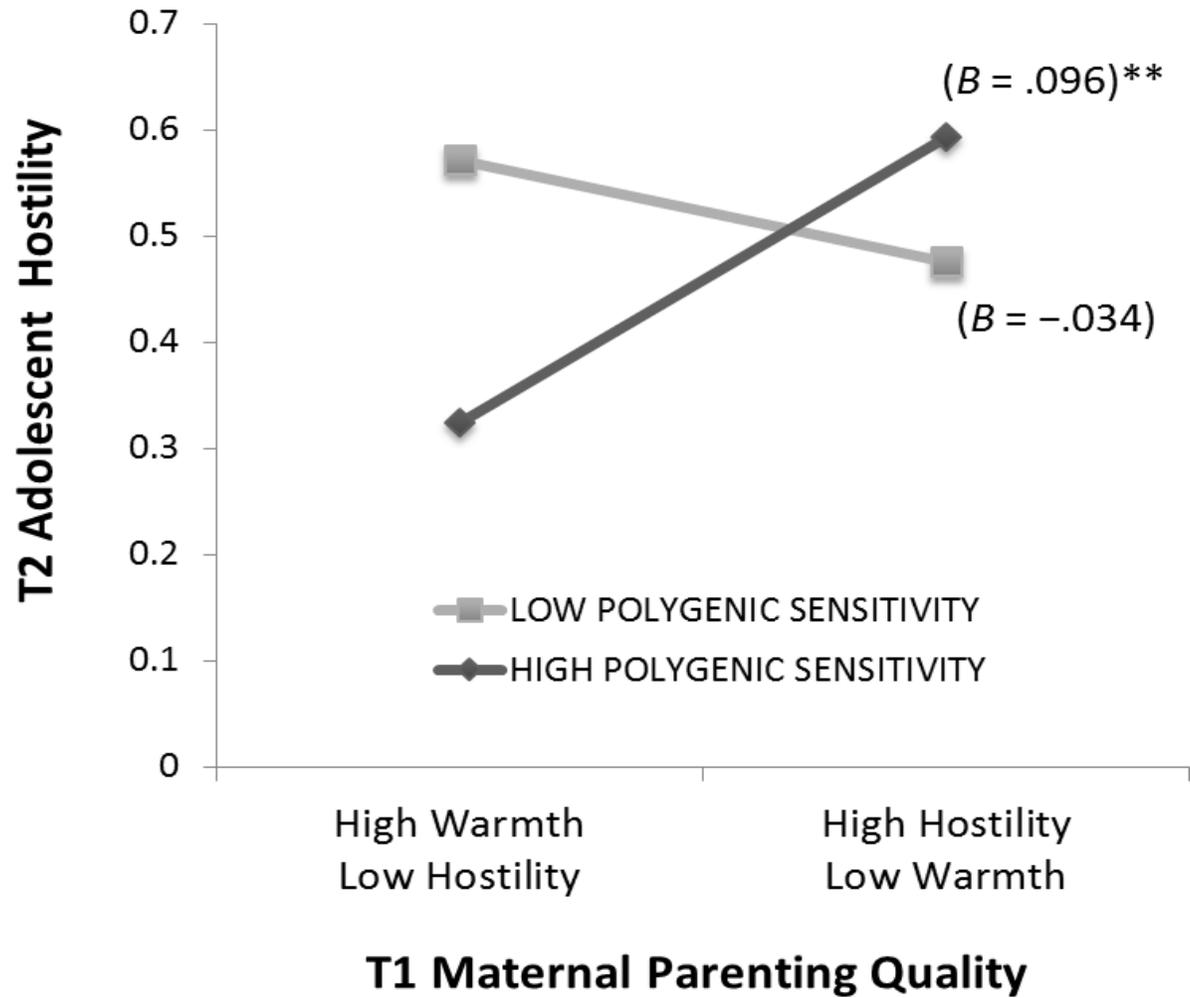
All continuous independent variables were grand mean centered prior to conducting moderation analyses.

$R^2\Delta$  were used to assess the significance of moderation effects.

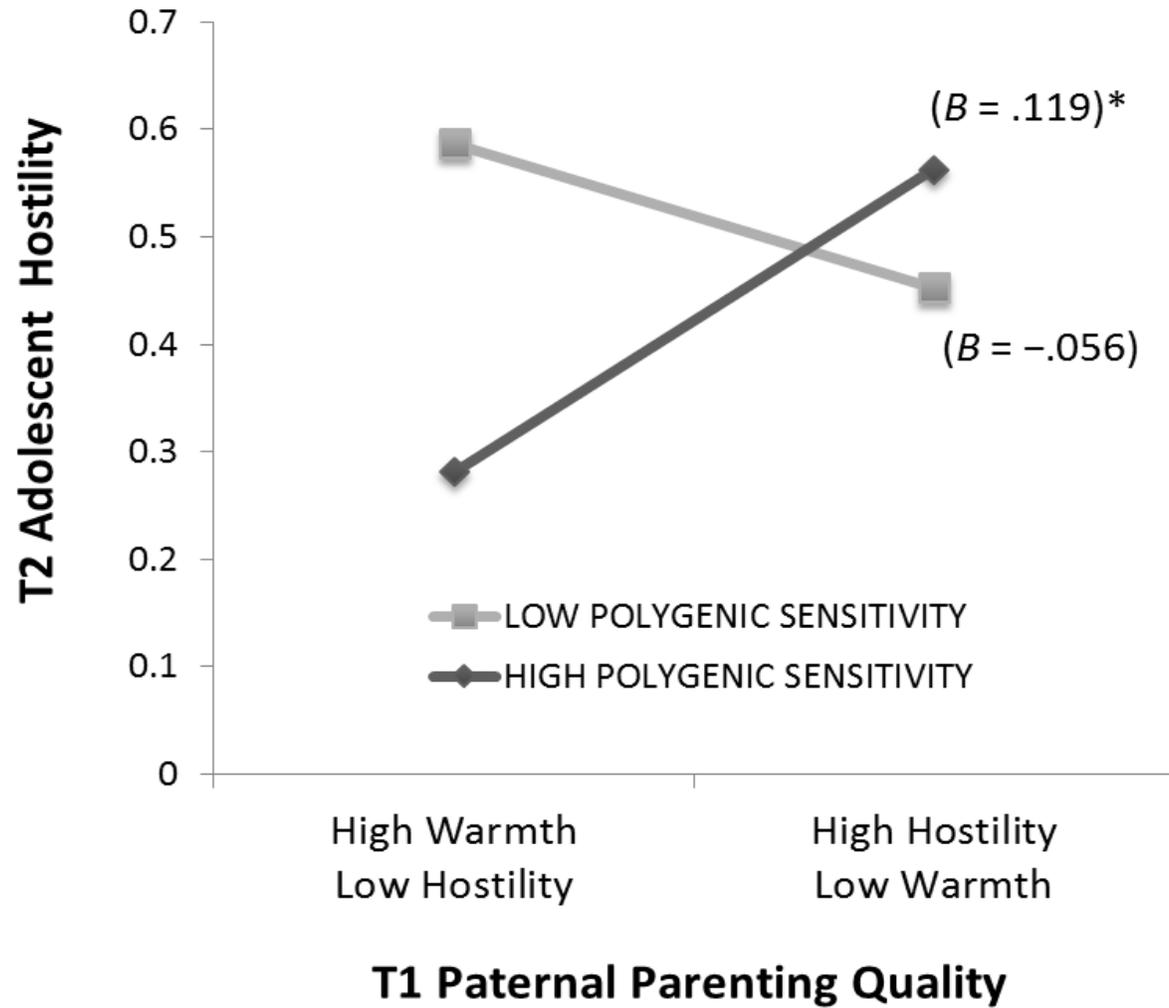


Effect of parenting on adolescent adjustment as moderated by adolescent polygenic sensitivity.  $B$  = unstandardized regression coefficient.

\*\*  $p < .01$ .



Effect of maternal parenting on adolescent hostility as moderated by adolescent polygenic sensitivity.  $B$  = unstandardized regression coefficient.  
 \*\*  $p < .01$ .



Effect of paternal parenting on adolescent hostility as moderated by adolescent polygenic sensitivity.  $B$  = unstandardized regression coefficient.  
\*  $p < .05$ .

# Parenting and Adolescents' Psychological Adjustment: Longitudinal Moderation by Adolescents' Genetic Sensitivity

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Table 1

*Descriptive Statistics and Intercorrelations Among Study Variables*

	<i>M or %</i>	<i>SD</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>	<i>12</i>
Time 1: Predictors														
1. Adolescent depressive symptoms	.63	.61	—											
2. Adolescent anxiety symptoms	.51	.53	.78***	—										
3. Adolescent hostility symptoms	.61	.68	.67***	.69***	—									
4. Maternal parenting quality	3.25	1.40	.07	.10 <sup>†</sup>	.13*	—								
5. Paternal parenting quality	3.63	1.19	.08	.10 <sup>†</sup>	.15**	.47***	—							
6. Adolescent polygenic sensitivity	4.41	1.36	-.02	-.01	-.02	.01	.01	—						
7. Adolescent sex (male)	45%	—	-.13*	.02	.07	.01	-.01	.02	—					
Time 1: Family SES														
8. Maternal education	13.27	1.63	-.04	-.03	-.08	-.15**	-.19**	.03	.04	—				
9. Paternal education	13.62	2.24	-.11 <sup>†</sup>	.13*	-.08	-.09 <sup>†</sup>	-.25***	.06	-.05	.04	—			
10. Family income-to-needs ratio	2.93	2.18	.03	.13*	-.03	-.14*	-.15**	-.06	-.01	.08	.25***	—		
Time 2 Outcomes														
11. Adolescent depressive symptoms	.47	.48	.53***	.45***	.36***	.11 <sup>†</sup>	.05	.02	-.18**	-.02	.04	.02	—	
12. Adolescent anxiety symptoms	.39	.48	.42***	.44***	.37***	.13*	.07	-.05	-.04	-.10 <sup>†</sup>	-.08	-.03	.70***	—
13. Adolescent hostility symptoms	.48	.55	.38***	.44***	.51***	.13*	.10 <sup>†</sup>	-.05	.02	.03	-.01	.02	.62***	.64***

Note. ( $N = 323$ ). Psychiatric symptoms assessed using the *SCL-90-R*.

<sup>†</sup> $p < .10$ , \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$  (2-tailed tests).

Statistical models ( $y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \varepsilon_i$ )

$y_i$  = T2 adolescent outcome

$X_1$  = parenting quality

$X_2$  = adolescent polygenic sensitivity

$(X_3 = X_1 \times X_2)$  = GxE interaction

All continuous independent variables were grand mean centered prior to conducting moderation analyses.

$R^2\Delta$  were used to assess the significance of moderation effects (Cohen et al., 2003).

Table 2

*Gene by Environment Interactions Between Adolescent Cumulative Polygenic Sensitivity and Maternal Parenting Quality Predicting Change in Adolescent Adjustment*

<i>Predictors</i>	Depression				Anxiety				Hostility			
	<i>B</i>	<i>SE B</i>	$\beta$	$\Delta R^2$	<i>B</i>	<i>SE B</i>	$\beta$	$\Delta R^2$	<i>B</i>	<i>SE B</i>	$\beta$	$\Delta R^2$
<b>Main Effects</b>												
Adolescent sex <sup>a</sup>	-.12	.05	-.12*		-.04	.05	-.05		-.02	.05	-.02	
Previous adolescent symptoms	.40	.04	.51***		.39	.05	.43***		.41	.04	.51***	
Maternal parenting quality	.03	.02	.07		.03	.02	.08		.03	.02	.08	
Adolescent polygenic sensitivity	.01	.02	.03		-.01	.02	-.04		-.02	.02	-.05	
<i>R</i> <sup>2</sup>		.296***				.212***				.274***		
<b>Interaction Effects</b>												
Maternal Parenting $\times$ Polygenic Sensitivity	.03	.01	.11*	.011*	.04	.01	.15**	.021**	.05	.01	.17**	.027**

*Notes.* ( $N = 323$ ). Predictors were measured at Time 1. Psychiatric symptoms assessed using the *SCL-90-R*. All main effect predictor variables were entered simultaneously in Step 1. Socioeconomic indicators including parent education and family income-to-needs ratio were included as statistical controls; however, none were statistically significant and are not presented here due to space considerations.

<sup>a</sup>(0 = female, 1 = male).

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$  (2-tailed tests).

Table 3

*Gene by Environment Interactions Between Adolescent Cumulative Polygenic Sensitivity and Paternal Parenting Quality Predicting Change in Adolescent Adjustment*

<i>Predictors</i>	Depression				Anxiety				Hostility			
	<i>B</i>	<i>SE B</i>	$\beta$	$\Delta R^2$	<i>B</i>	<i>SE B</i>	$\beta$	$\Delta R^2$	<i>B</i>	<i>SE B</i>	$\beta$	$\Delta R^2$
Main Effects												
Adolescent sex <sup>a</sup>	-.11	.05	-.12*		-.05	.05	-.05		-.01	.05	-.01	
Previous adolescent symptoms	.40	.04	.51***		.39	.05	.44***		.41	.04	.51***	
Paternal parenting quality	.01	.02	.02		.01	.02	.02		.02	.02	.03	
Adolescent polygenic sensitivity	.01	.02	.03		-.02	.02	-.04		-.02	.02	-.04	
$R^2$			.294***				.201***				.265***	
Interaction Effects												
Paternal Parenting $\times$ Polygenic Sensitivity	.02	.01	.06	.004	.03	.02	.11*	.012*	.04	.02	.10*	.011*

*Notes.* ( $N = 323$ ). Predictors were measured at Time 1. Psychiatric symptoms assessed using the *SCL-90-R*. All main effect predictor variables were entered simultaneously in Step 1. Socioeconomic indicators including parent education and family income-to-needs ratio were included as statistical controls; however, none were statistically significant and are not presented here due to space considerations.

<sup>a</sup>(0 = female, 1 = male).

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$  (2-tailed tests).

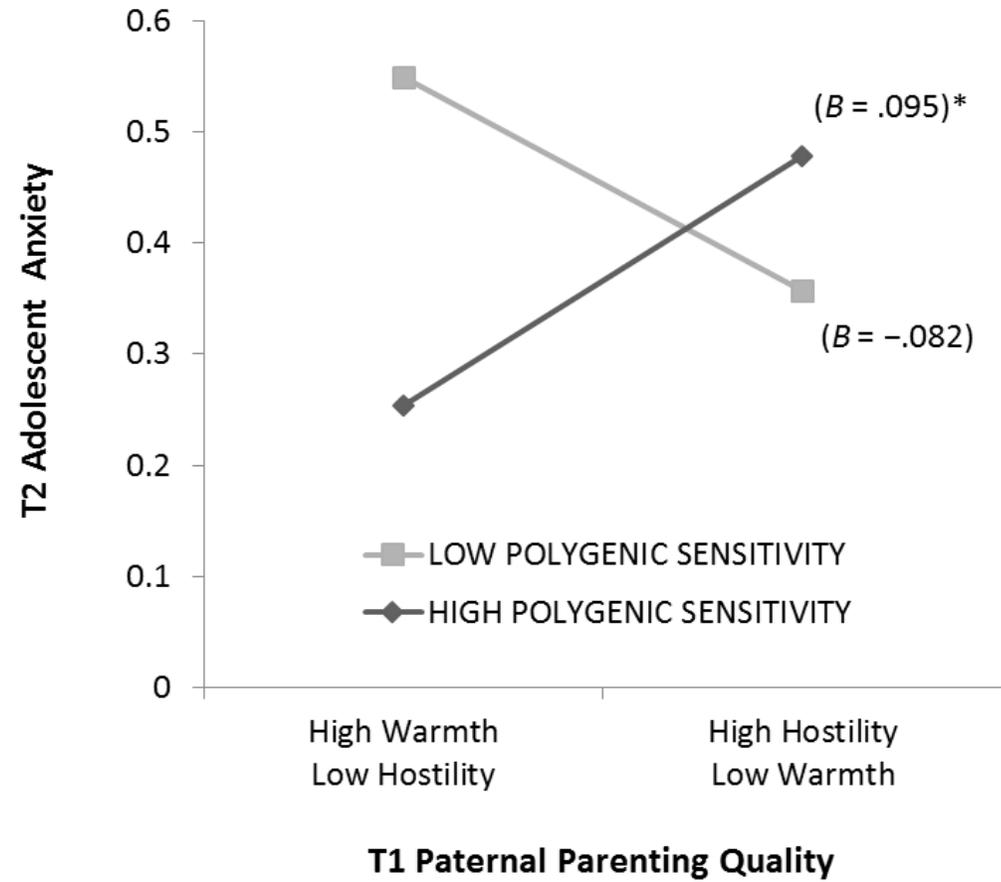


Figure 4. The prospective association between observed paternal parenting quality and adolescent *SCL-90-R* Anxiety at high (+2 SD) and low (-2 SD) levels of adolescent polygenic sensitivity.  $B$  = unstandardized regression coefficient. \* $p < .05$ .

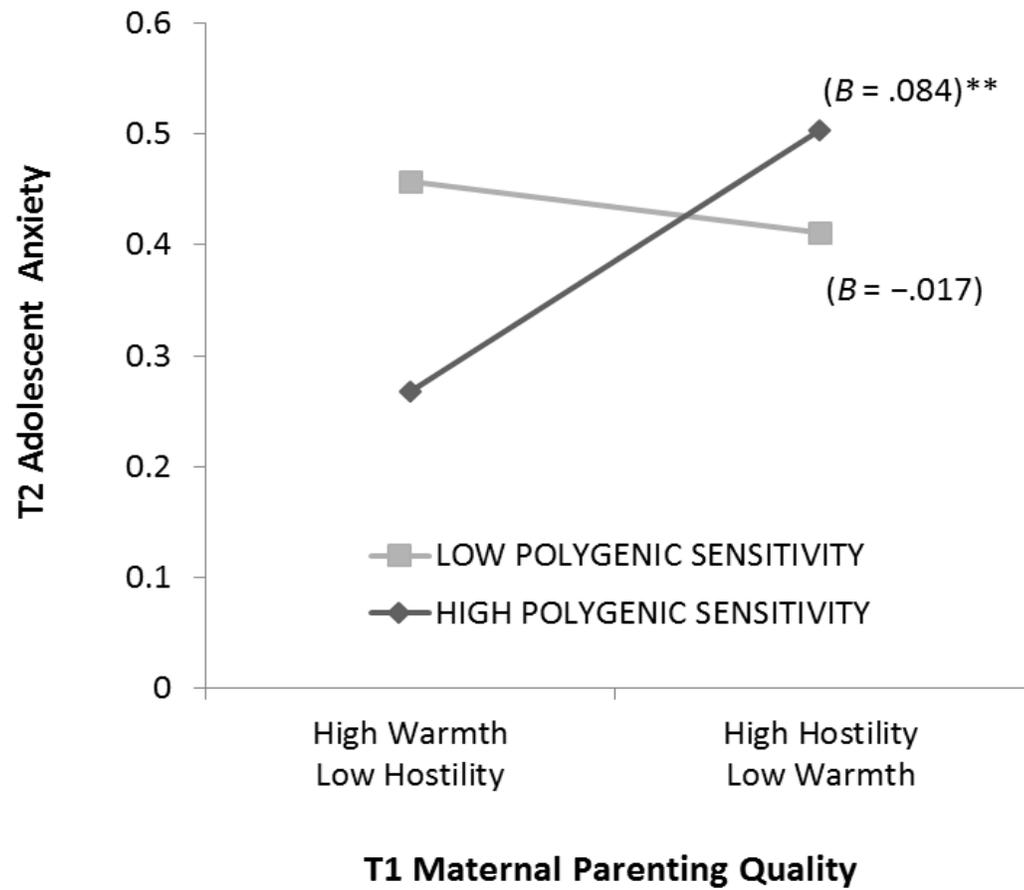
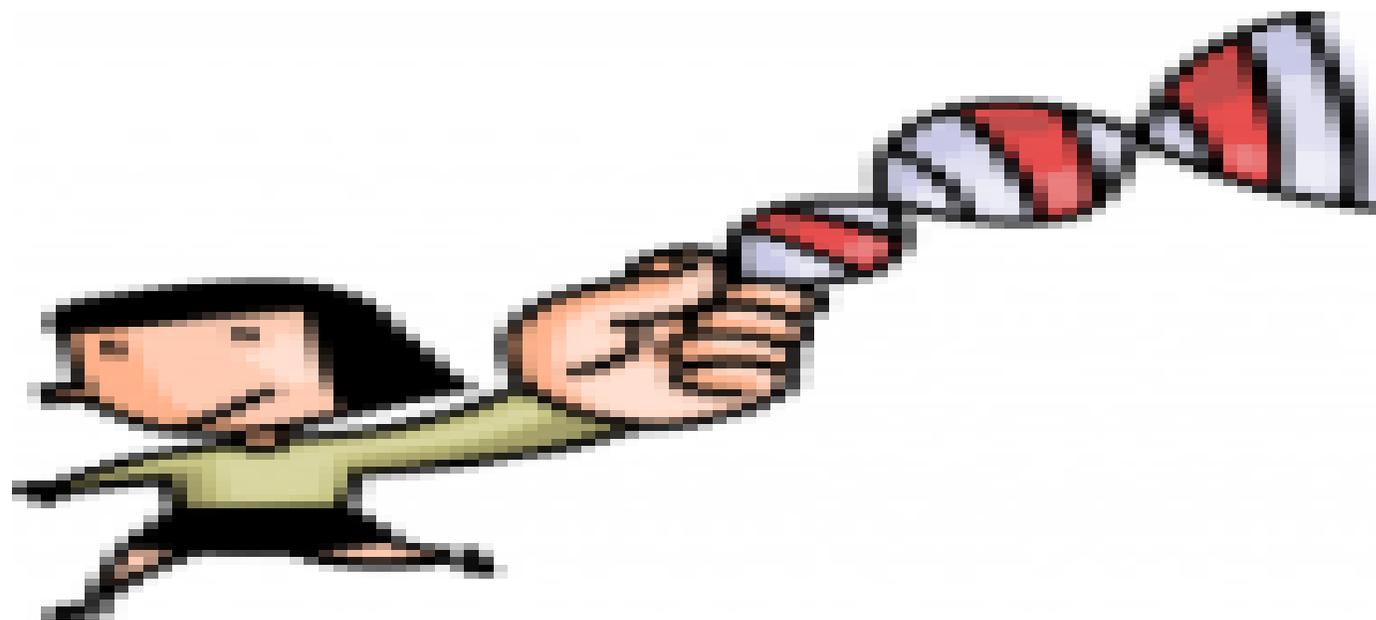


Figure 2. The prospective association between observed maternal parenting quality and adolescent *SCL-90-R* Anxiety at high (+1 *SD*) and low (−1 *SD*) levels of adolescent polygenic sensitivity. *B* = unstandardized regression coefficient. \*\*  $p < .01$ .

# Genes Influence Adolescent Adjustment



# Parenting and Adolescent Adjustment

Warm / supportive  
parenting



Adolescent  
Positive  
Adjustment

Hostile  
parenting



Adolescent  
Negative  
Adjustment