Supplemental Material

Previously Published Neuroimaging Papers with the PGS-E Sample

There are two previous publications that use neuroimaging data from the Pittsburgh Girls Study – Emotions substudy (PGS-E).[1,2] Analyses for the two previous publications and the current manuscript were conducted independently to test three different *a priori* hypotheses. Methodological differences between the current manuscript and previous publications are detailed below. The methodology in the current manuscript reflects current best practices in fMRI data analysis and incorporates the most recent data from this ongoing longitudinal study.

Casement et al.[1] evaluated the relationship between parental warmth and peer victimization during early adolescence and later reward-related neural response and depressive symptoms. The methodology in the current manuscript differs from the methodology in Casement et al.[1] in the following ways:

1) temporal censoring[3] with Artifact Detection Toolbox was used to remove motion artifact rather than excluding participants with average movement greater than 2 mm or 2°;
2) AlphaSim was used to determine the minimum functional cluster size necessary to maintain a corrected $P < 0.05$ across the composite mask of all four ROIs rather than calculating a cluster extent threshold for each ROI individually; and,
3) depression scores were calculated from two waves of data collection (Wave 6 at age 16 and Wave 7 at age 17) rather than using Wave 6 data alone because data collection for Wave 7 was completed recently before the start of data analyses for the current study.

Romens et al.[2] evaluated the relationship between childhood poverty, reward-related neural response, and depressive symptoms. The methodology in the current manuscript differs from the methodology in Romens in the following ways:

1) the reward anticipation interval was 8 s in duration rather than 6 s in duration to capture a larger portion of the reward anticipation-related hemodynamic response;

2) AlphaSim cluster extent thresholds were calculated across composite functional masks for the PGS-E sample rather than across composite anatomical masks defined in PickAtlas;
3) depression scores were calculated from two waves of data collection (Wave 6 at age 16 and Wave 7 at age 17) rather than Wave 6 data alone.

Results

Association between insomnia symptoms in early adolescence and reward-related BOLD response in late adolescence, adjusting for insomnia symptoms in late adolescence. In a regression with NIS and NRS scores entered as separate predictors, higher NRS scores were associated with greater reward-related BOLD response in two dmPFC clusters (BA 8/9/10/24/32 cluster size = 1242, $t_{117} = 4.67$, $P_{corrected} < 0.05$, MNI coordinates of maximum voxel: 4, 18, 26; BA 10 cluster size = 386, $t_{117} = 3.33$, $P_{corrected} < 0.05$, MNI coordinates of maximum voxel: -10, 60, 16) and in the caudate bilaterally (left caudate cluster size = 301, $t_{117} = 3.50$, $P_{corrected} < 0.05$, MNI coordinates of maximum voxel: -12, 2, 2; right caudate cluster size = 275, $t_{117} = 3.29$, $P_{corrected} < 0.05$, MNI coordinates of maximum voxel: 12, 0, -4); see Figure S1. NIS was not significantly associated with reward-related BOLD response.

Association between reward-related BOLD response and depressive symptoms in late adolescence, adjusting for insomnia symptoms in late adolescence. Conjunction analyses indicated that higher depression scores during late adolescence were associated greater reward-related BOLD response in the dmPFC subregion that was associated with NRS (BA 32 cluster size = 156, $t_{118} = 2.63$, $P_{corrected} < 0.05$, MNI coordinates of maximum voxel: 6, 32, 18); see Figure S2. Depression scores during late adolescence were not significantly associated with reward-related BOLD response in caudate subregions that were associated with NRS.

Mediation of NRS-depression association by reward-related BOLD response, adjusting for insomnia symptoms in late adolescence. NRS scores during early adolescence had a marginally significant positive relationship with depression scores in later adolescence after adjusting for NIS and NRS in late adolescence (B = 0.29, $R^2_{Adjusted} = 0.22$, $p = 0.08$). Bootstrap tests of mediation indicated that greater dmPFC response during reward anticipation significantly mediated the relationship between early adolescent NRS and later adolescent non-sleep depressive symptoms after adjusting for age 9 depressive symptoms and late adolescent NIS and NRS (B = 0.12, 95% CI: 0.01, 0.30, P < 0.05). NRS did not have a

direct effect on depressive symptoms after adjusting for reward anticipation response in the dmPFC (B = -0.05, 95% CI: -0.40, 0.29, P > 0.05), indicating full mediation.

References

1. Casement MD, Guyer AE, Hipwell AE, et al. Girls' challenging social experiences in early adolescence predict neural response to rewards and depressive symptoms. Dev Cogn Neurosci 2014;8:18-27.
2. Romens SE, Casement MD, McAloon RL, et al. Adolescent girls' neural response to reward mediates the relation between childhood financial disadvantage and depression. J Child Psychol Psychiat 2015.
3. Siegel JS, Power JD, Dubis JW, et al. Statistical improvements in functional magnetic resonance imaging analyses produced by censoring high-motion data points. Hum Brain Mapp 2013:1981-96.

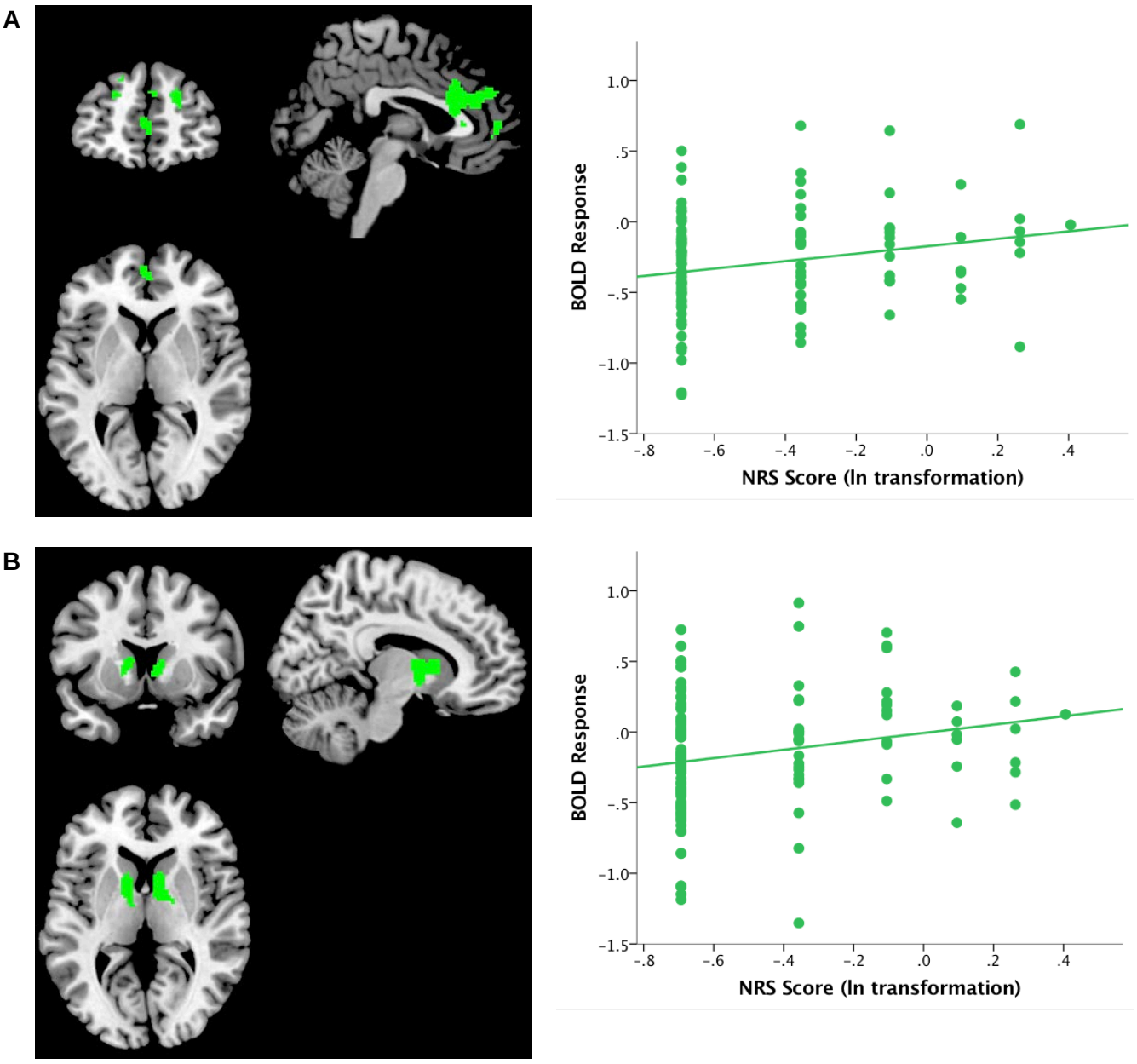

Figure S1. Positive association between NRS scores during early adolescence and reward-related BOLD response in the mPFC (A) and bilateral caudate (B) during late adolescence, adjusting for NRS and NIS scores in late adolescence.

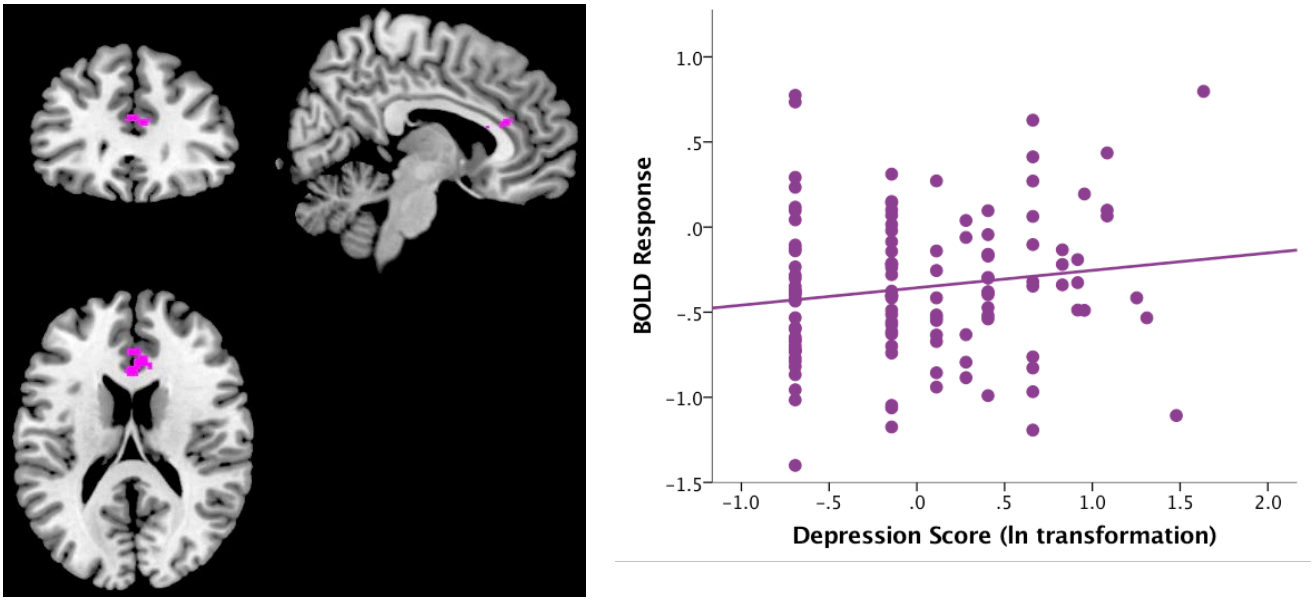

Figure S2. Positive association between late adolescent depression scores and reward-related BOLD response in the mPFC region that was also associated with early adolescent NRS scores, adjusting for NRS and NIS scores in late adolescence.

Table S1

Within-group Reward-Related BOLD Response during Reward Anticipation in Region of Interest Analyses

Condition	MNI Coordinates of Maximum Voxel			Cluster Size	*t* (*df* = 122)	$P_{FWE\text{-}corr}$
	x	y	z			
Left orbitofrontal cortex (BA 13, 45, 47)	-52	24	2	283	9.79	0.986
dmPFC (BA 8, 9), pregenual ACC (BA 24 and 32)	-2	38	44	3877	8.97	0.000*
Right orbitofrontal cortex (BA 13, 45, 47)	38	36	-14	215	8.05	0.997
Caudate head, bilaterally	8	16	8	533	5.97	0.773

Note. Alpha Sim corrected $P < 0.05$ for the composite mask with four ROIs (cluster extent threshold: 175). BA, Brodmann Area; BOLD, blood-oxygen-level-dependent; *Significant at $P < 0.05$ when corrected for family-wise error at the cluster-level.

Table S2

Within-group Reward-Related BOLD Response during Reward Anticipation in Whole Brain Analyses

Condition	MNI Coordinates			Cluster Size	*t* (*df* = 122)	$P_{FWE-corr}$
	x	y	z			
Prefrontal cortex (BA 9) extending bilaterally through much of the frontal lobe (BAs 6, 8, 10, 11, 45, 47; insula), caudate head and body, temporal lobe (BAs 21, 22, 37, 38; amygdala, hippocampus), occipital lobe (BAs 18, 19, 37), and parietal lobe (BAs 7, 39)	-44	-60	48	41982	12.44	<0.001*

Note. Alpha Sim corrected P < 0.05 for whole brain analysis (cluster extent threshold: 579). BA, Brodmann Area; BOLD, blood-oxygen-level-dependent; *Significant at P < 0.05 when corrected for family-wise error at the cluster-level.