Impulsive-Antisocial Dimension of Psychopathy Linked to Enlargement and Abnormal Functional Connectivity of the Striatum

Supplemental Information

Supplemental Results

Regional Volume Regressions in FreeSurfer and SPM

Note: All relationships reported as significant in the full model are also significant in a zero-order correlation unless otherwise specified.

Total PCL-R (covarying for substance abuse severity, intracranial volume, age, race)

Right nucleus accumbens volume had a significant positive association with total PCL-R score in SPM (p=0.027, B=0.205) and a trending association in the same direction in FreeSurfer (p=0.057, B=0.176). Left nucleus accumbens volume had a significant positive association with total PCL-R score in both FreeSurfer (p=0.012, B=0.231) and SPM (p=0.047, B=0.180).

Factor 1 (covarying for Factor 2, substance abuse severity, intracranial volume, age, race)

Right putamen volume had a significant negative association with Factor 1 score in SPM (p=0.042, B=-0.207); however, the association was not significant in FreeSurfer (p=0.385, B=-0.091), and the zero-order correlation between the volume of this region and Factor 1 score was not significant. This association was also not significant when Factor 2 score was removed as a covariate from the model.

Factor 2 (covarying for Factor 1, substance use severity, intracranial volume, age, race)

Right nucleus accumbens volume had a significant positive association with Factor 2 score in SPM (p=0.001, B=0.380) and a non-significant association in the same direction in FreeSurfer (p=0.119, B=0.184). Likewise, left nucleus accumbens volume had a significant positive association with Factor 2 score in SPM (p=0.038, B=0.239) and a non-significant association in

the same direction in FreeSurfer (p=0.189, B=0.153). Right putamen volume had a significant positive association with Factor 2 score in SPM (p=0.001, B=0.368) and in FreeSurfer (p=0.038, B=0.234). Left putamen volume had a significant positive association with Factor 2 score in FreeSurfer (p=0.036, B=0.234); however, this association was not significant in SPM (p=0.243, B=0.131), and the zero-order correlation between the volume of this region and Factor 2 score was not significant. Right globus pallidus volume had a significant positive relationship with Factor 2 score in SPM (p=0.003, B=0.336) but no relationship in FreeSurfer (p=0.989, B=0.002). Right caudate volume had a significant positive relationship with Factor 2 scores in SPM (p=0.010, B=0.303); the association was not significant in FreeSurfer (p=0.299, B=-0.104). All of the significant associations, with the exception of the right caudate association, remained significant when Factor 1 score was removed as a covariate from the model.

Table S1. Correlation of regional volumes between FreeSurfer and SPM

Region	Correlation Coefficient (p-value)
Putamen (L)	.271 (p=0.002)
Putamen (R)	.366 (p<0.001)
Caudate (L)	.262 (p=0.003)
Caudate (R)	.219 (p=0.014)
Accumbens (L)	.271 (p=0.002)
Accumbens (R)	.302 (p=0.001)
Globus Pallidus (L)	.171 (p=0.058)
Globus Pallidus (R)	.028 (p=0.761)
Intracranial Volume (ICV)	.523 (p<0.001)

Table S2. Total PCL-R regional volume regressions in FreeSurfer and SPM

Region	Standardized Beta	t-value	p-value	Relationship	Zero-Order Correlation (p-value)
	FreeSurfer				
Accumbens (L)	0.231	2.558	**0.012**	Positive	0.076
Accumbens (R)	0.176	1.919	0.057	Positive	**0.032**
	SPM				
Accumbens (L)	0.180	2.007	**0.047**	Positive	0.077
Accumbens (R)	0.205	2.243	**0.027**	Positive	**0.022**

Table S3. Factor 1 (covarying for Factor 2) regional volume regressions in SPM

Region	Standardized Beta	t-value	p-value	Relationship	Zero-Order Correlation (p-value)
Putamen (R)	-0.207	-2.061	**0.042**	Negative	0.658

Table S4. Factor 2 (covarying for Factor 1) regional volume regressions in FreeSurfer and SPM

Region	Standardized Beta	t-value	p-value	Relationship	Zero-Order Correlation (p-value)
	FreeSurfer				
Putamen (L)	0.234	2.116	**0.036**	Positive	0.176
Putamen (R)	0.234	2.098	**0.038**	Positive	0.192
	SPM				
Putamen (R)	0.368	3.422	**0.001**	Positive	**0.015**
Caudate (R)	0.303	2.617	**0.010**	Positive	**0.035**
Accumbens (L)	0.239	2.095	**0.038**	Positive	**0.044**
Accumbens (R)	0.380	3.351	**0.001**	Positive	**0.002**
Globus Pallidus (R)	0.336	3.090	**0.003**	Positive	**0.049**

Table S5. Total PCL-R focal volume voxel-wise regressions in SPM

Region	pFWE	MNI Peak Coordinates	Relationship	Cluster Size
Putamen (L)	**0.022**	(-20, 15, 3)	Positive	27
	0.035	(-14, 12, -6)	Positive	7
	0.042	(-16, 15, -4)	Positive	2
Globus Pallidus (R)	**0.017**	(20, -4, 6)	Positive	3
	0.035	(16, -2, 2)	Positive	2
Globus Pallidus (L)	**0.021**	(-12, 8, -6)	Positive	17
Accumbens (R)	**0.021**	(14, 12, -8)	Positive	21
Accumbens (L)	**0.011**	(-12, 8, -8)	Positive	26

Table S6. Factor 1 (covarying for Factor 2) focal volume voxel-wise regressions in SPM

Region	pFWE	MNI Peak Coordinates	Relationship	Cluster Size
Putamen (R)	**0.028**	(24, -10, 14)	Positive	3

Table S7. Factor 2 (covarying for Factor 1) focal volume voxel-wise regressions in SPM

Region	pFWE	MNI Peak Coordinates	Relationship	Cluster Size
Caudate (L)	**0.006**	(-2, 8, -9)	Positive	20
	0.006	(-18, 18, 3)	Positive	32
	0.030	(-21, 15, 14)	Positive	
Accumbens (L)	**0.018**	(-8, 8, -12)	Positive	44
Accumbens (R)	**0.001**	(6, 10, -10)	Positive	145
	0.001	(16, 14, -12)	Positive	
Globus Pallidus (R)	**0.016**	(16, 10, -4)	Positive	260
	0.016	(26, -10, 2)	Positive	
	0.020	(20, -3, 4)	Positive	
Putamen (L)	**<0.001**	(-20, 18, -2)	Positive	135
	0.001	(-21, 14, 8)	Positive	
Putamen (R)	**0.004**	(18, 14, -10)	Positive	172
	0.028	(21, 10, 3)	Positive	
	0.036	(27, -10, 0)	Positive	34

Table S8. Total PCL-R RSFC regressions

Focal Seed	Seed Origin Coordinates	RSFC Relationship with:	MNI Peak Coordinates	Cluster Size	t-value
Putamen (L)	(-20, 15, 3)	Superior Lateral Occipital Cortex (R)	(-32.5, 59.5, 33.5)	146	-5.18
Globus Pallidus (R)	(16, -2, 2)	Cuneal Cortex (R)	(-5.5, 86.5, 39.5)	366	-5.13

Negative t-value indicates negative relationship.

Table S9. Factor 2 (covarying for Factor 1) RSFC regressions

Focal Seed	Seed Origin Coordinates	RSFC Relationship with:	MNI Peak Coordinates	Cluster Size	t-value
Caudate (L)	(-18, 18, 3)	Putamen (L)	(18.5, -6.5, 3.5)	124	4.00
Accumbens (R)	(6, 10, -10)	Dorsolateral Prefrontal Cortex (R)	(-38.5, -30.5, 39.5)	188	4.26
	(16, 14, -12)	Postcentral Gyrus (L)	(24.5, 32.5, 54.5)	202	-5.31
Globus Pallidus (R)	(16, 10, -4)	Precentral Gyrus (L)	(12.5, 8.5, 63.5)	561	-4.41
		Postcentral Gyrus (L)	(24.5, 32.5, 54.5)	188	-4.77
Putamen (L)	(-20, 18, -2)	Ventral Midbrain	(3.5, 17.5, -23.5)	149	4.09
		Superior Lateral Occipital Cortex (R)	(-38.5, 83.5, 27.5)	113	-3.79
		Globus Pallidus (L)	(18.5, 11.5, -5.5)	106	3.85
Putamen (R)	(18, 14, -10)	Postcentral Gyrus (L)	(24.5, 32.5, 51.5)	209	-5.67
	(21, 10, 3)	Putamen (L)	(27.5, -6.5, -5.5)	123	4.70

Negative t-value indicates negative relationship.