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A Voxel-wise Meta-analysis of Task-based fMRI Studies on Impaired Gain and Loss Processing in Adults with Addiction

Supplementary Contents

Appendix 1 to Qiu Z, Wang J. A voxel-wise meta-analysis of task-based functional MRI studies on impaired gain and loss processing in adults with addiction. J Psychiatry Neurosci 2020.

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between participants with all addictions and HCs during loss anticipation, excluding the studies of Martin et al. (2014) and Yip et al. (2016).

Figure S1. A simplified diagram illustrating an example of the Monetary Incentive Delay Task

Supplementary References. Articles included in the meta-analyses.

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Table S1. Quality assessment checklist.

Items (score 0/0.5/1 per item; total score out of 9)
Category I: Participants
1. Patients were evaluated prospectively, specific diagnostic criteria were applied, and demographic data were reported.
2. Healthy comparison participants were evaluated prospectively, psychiatric and medical illness were excluded.
3. Important variables (e.g., age, sex, illness duration, onset, medication status, comorbidity, severity of illness) were checked either by stratification or statistically.
Category II: Methods for image acquisition and analysis
4. Whole brain analysis was automated with no a prior regional selection.
5. Coordinates reported in a standard space.
6. The imaging technique used was clearly described so that it could be reproduced.
7. Measurements were clearly described so that they could be reproduced.
Category III: Results and conclusions
8. Statistical parameters for significant and important nonsignificant differences were provided.
9. Conclusions were consistent with the results obtained and the limitations were discussed.

Note: When criteria were partially met, 0.5 points were awarded.

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Table S2. Experimental paradigm, reward type, phase and contrasts of the included studies (for both primary and supplementary analyses).

Dataset	Experimental Paradigm	Reward Type	Phase and Contrasts
Luo et al., 2011	MID	monetary	anticipation (gain only)
Bischoff-Grethe et al., 2016	probabilistic feedback expectancy task	monetary	anticipation (overall; gain > loss), outcome (overall; gain > loss)
Cousijn et al., 2012	Iowa gambling task	monetary	outcome (gain > loss)
Jia et al., 2011	MID	monetary	anticipation (gain > neutral), outcome (gain > neutral)
Romanczuk-Seiferth et al., 2014	MID	monetary	anticipation (gain and loss), outcome (gain)
Rose et al., 2013	MID (revised)	monetary	outcome (gain > loss)
Yip et al., 2014	MID	monetary	anticipation (loss only), outcome (gain/loss > neutral)
Yi et al., 2019	MID	monetary	anticipation (gain > neutral), outcome (gain > neutral)
Bedi et al., 2018	SID and MID	social reward (i.e., smiling face) and monetary	outcome (gain only)
Becker et al., 2017	reward anticipation task	monetary	anticipation (monetary gain > verbal feedback)
Beck et al., 2009	MID	monetary	anticipation (loss > neutral)
Wrase et al., 2007	MID	monetary	anticipation (gain > neutral; loss > neutral)
Martin et al., 2014	reward prediction task	monetary	anticipation (loss > baseline), reward outcome (gain > baseline)
de Ruiter et al., 2008	probabilistic reversal learning task	monetary	outcome (gain and loss)
Choi et al., 2012	MID	monetary	anticipation (gain > neutral; loss > neutral)
Sescousse et al., 2013	incentive delay task	monetary and visual erotic rewards	anticipation (monetary gain > erotic cue), outcome (gain only)
Filbey et al., 2013	MID	monetary	anticipation (gain > loss)
Yip et al., 2016	MID	monetary	anticipation (gain and loss)
Goldstein et al., 2007	sustained monetary reward	monetary	outcome (gain > neutral)
Balodis et al., 2012	MID	monetary	anticipation (gain/loss > neutral), outcome (gain/loss > neutral)
Nestor et al., 2010	MID	monetary	anticipation (gain/loss > neutral), outcome (gain/loss > neutral)

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Van Hell et al., 2010	MID	monetary	anticipation (gain > neutral), reward outcome (gain > neutral)
Forbes et al., 2014	card guessing game	monetary	outcome (gain > loss)
Tobler et al., 2016	newly designed paradigm	non-social win outcome of music	outcome (gain > neutral)

Abbreviations: MID, monetary incentive delay; SID, social incentive delay; NA, not available.

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Table S3. Image acquisition details and quality assessment scores of task-based fMRI studies included in the meta-analyses.

Dataset	Data Analysis			Image Acquisition			Source of Coordinates Included	Quality Assessment
	Correction for Multiple Comparisons	Threshold (Voxel-level)	Threshold (Cluster-level)	Scanner	Software	Coordinate Space		Total Scores/9
Luo et al., 2011	corrected	Z = 2.3	p = .05	3T	FSL	MNI	Table 1. Group difference: immediate–delayed; smokers > nonsmokers	9
Bischoff-Grethe et al., 2016	corrected	p < .05	p < .05	3T	FSL	MNI	Table 5. Group and Anticipation Main Effects; Table 6. Group and Outcome Main Effects; HCs > METH+	9
Cousijn et al., 2012	corrected	Z > 2.3	p < .05	3T	FSL	MNI	Table 2. Heavy cannabis users > controls	8
Jia et al., 2011	uncorrected	p < .001 or p < .005	NA	3T	SPM	MNI	Table S3 in Supplement 1. CD > HC	9
Romanczuk-Seiferth et al., 2014	uncorrected	p < .01	NA	3T	SPM	MNI	Supplementary table 14-17 and 20-23	8.5
Rose et al., 2013	corrected	NA	p < .05	3T	Other	TAL	Table 2. Controls > Smokers+NIC Group*Outcome (successful > Unsuccessful)	9
Yip et al., 2014	FWE corrected	NA	p < .01	3T	FSL	MNI	Supplementary Table 1.	8.5
Yi et al., 2019	corrected	Z > 2.3	p < .05	7T	FSL	MNI	Table 3. AID; Table 4. AID > MID	8.5
Bedi et al., 2018	corrected	p < .001	NA	3T	FSL	MNI	Table S2 in Supplement, SID and MID	9
Becker et al., 2017	uncorrected	NA	p < .001	3T	SPM	MNI	Table 3. AD versus Depressed patients and healthy controls	8.5
Beck et al., 2009	uncorrected	NA	p < .001	1.5T	SPM	MNI	Page 8 of Supplement 1.	9
Wrase et al., 2007	uncorrected	NA	p < .001	1.5T	SPM	MNI	Table 2. and Table 3.	9
Martin et al., 2014	corrected	p < .005	p < .05	3T	Other	TAL	Results - Smokers versus nonsmokers (in-text)	9

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de Ruiter et al., 2008	corrected	NA	$p < .001$	3T	SPM	MNI	Table 2.	8.5
Choi et al., 2012	uncorrected	NA	$p < .001$	1.5T	SPM	MNI	Table 2. and Table 3.	9
Sescousse et al., 2013	uncorrected	$p < .001$	NA	1.5T	SPM	MNI	Supplementary Table 1., reward outcome phase (in-text)	8.5
Filbey et al., 2013	corrected	NA	$p < .05$	3T	FSL	MNI	Table 3. Marijuana users > controls	9
Yip et al., 2016	corrected	$p < .001$	$p < .05$ (FWE corrected)	3T	SPM	MNI	Table 3.	9
Goldstein et al., 2007	uncorrected	NA	$p < .05$	4T	SPM	TAL	Table 1. B. Non-boldface	9
Balodis et al., 2012	corrected	NA	$p < .05$	3T	SPM	MNI	Table 2. A1 and outcome	8.5
Nestor et al., 2010	corrected	$p < .005$	$p <= .05$	3T	Other	TAL	Table 2. and Table 3.	9
Van Hell et al., 2010	corrected	$p < .05$	NA	1.5T	SPM	TAL	Table 2. and Table 4.	8.5
Forbes et al., 2014	corrected	$p < .001$	NA	3T	SPM	TAL	Table S1.	9
Tobler et al., 2016	uncorrected	$p < .001$	NA	3T	SPM	MNI	Table 2.	9

Abbreviations: FWE, family-wise error; FSL, FMRIB's Software Library; SPM, Statistical Parametric Mapping; MNI, Montreal Neurological Institute; TAL, Talairach space; METH+, methamphetamine dependence; HCs, healthy controls; CD, cocaine dependence; NIC, nicotine use; AID, activity incentive delay; MID, monetary incentive delay; SID, social incentive delay; AD, alcohol dependence; NA, not available.

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Table S4. Meta-analyses results regarding regional differences of task-evoked activation between participants with addiction and HCs during gain anticipation (including gain-loss contrasts).

Local Maximum				Cluster		Egger's test	Jackknife	Heterogeneity
Region	Peak MNI coordinate (x, y, z)	SDM-Z value	*p* value	No. of voxels	Breakdown (No. of voxels)	(*p* value)	sensitivity	
All addictions > HCs								
L angular gyrus, BA 39	-52,-56,30	1.464	8.93e-4	160	L angular gyrus, BA 39 (92) L middle temporal gyrus, BA 21 (18) L angular gyrus, BA 22 (15) L supramarginal gyrus, BA 22 (10) L middle temporal gyrus, BA 22 (6) L supramarginal gyrus, BA 40 (6) L inferior parietal (excluding supramarginal and angular) gyri, BA 39 (6) L angular gyrus, BA 40 (3) L middle temporal gyrus, BA 39 (3) L supramarginal gyrus, BA 39 (1)	0.116	13/15	No
Corpus callosum	26,-76,28	1.539	5.63e-4	154	Corpus callosum (109) R middle occipital gyrus, BA 19 (23) R superior occipital gyrus, BA 19 (22)	0.761	13/15	No
L middle occipital gyrus, BA 39	-40,-84,24	1.518	6.40e-4	137	L middle occipital gyrus, BA 39 (76)	0.220	14/15	No

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					L middle occipital gyrus, BA 19 (45) L middle occipital gyrus (12) L angular gyrus, BA 39 (1)			
R precuneus	4,-52,44	1.267	2.90e-3	53	R precuneus (51) Corpus callosum (2)	0.737	11/15	No
L precentral gyrus, BA 6	-24,-18,72	1.286	2.59e-3	33		0.561	13/15	No
R precuneus	10,-64,64	1.396	1.31e-3	29	R precuneus, BA 7 (26) R precuneus, BA 5 (1) R superior parietal gyrus, BA 7 (1) R precuneus (1)	0.076	13/15	No
R superior longitudinal fasciculus III	38,34,0	1.376	1.52e-3	27	R superior longitudinal fasciculus III (17) R inferior frontal gyrus, triangular part, BA 47 (6) R inferior frontal gyrus, orbital part, BA 47 (2) R insula, BA 47 (1)	0.537	13/15	No
Corpus callosum	10,-82,30	1.265	2.91e-3	12		0.602	10/15	No
All addictions < HCs								
L superior frontal gyrus, medial, BA 32	0,48,18	-1.589	4.39e-4	633	L superior frontal gyrus, medial, BA 32 (172) L anterior cingulate / paracingulate gyri, BA 32 (169) R anterior cingulate / paracingulate gyri,	0.068	13/15	No

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					BA 32 (153) L superior frontal gyrus, medial, BA 10 (25) L superior frontal gyrus, medial (22) L anterior cingulate / paracingulate gyri (20) R superior frontal gyrus, medial, BA 10 (14) L anterior cingulate / paracingulate gyri, BA 24 (14) Corpus callosum (11) R superior frontal gyrus, medial, BA 32 (9) L median network, cingulum (9) R anterior cingulate / paracingulate gyri (8) R anterior cingulate / paracingulate gyri, BA 24 (4) R superior frontal gyrus, medial (3)			
R temporal pole, superior temporal gyrus, BA 38	30,14,-26	-1.438	1.15e-3	241	R temporal pole, superior temporal gyrus, BA 38 (90) R temporal pole, superior temporal gyrus (35)	0.046	13/15	No

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					R inferior frontal gyrus, orbital part, BA 38 (26) R inferior frontal gyrus, orbital part (19) R insula, BA 38 (14) R temporal pole, superior temporal gyrus, BA 20 (7) R parahippocampal gyrus, BA 38 (7) R parahippocampal gyrus, BA 28 (7) R insula (2) R temporal pole, superior temporal gyrus, BA 28 (2) R parahippocampal gyrus, BA 36 (1)			
L superior longitudinal fasciculus III	-46,28,8	-1.639	3.51e-4	209	L inferior frontal gyrus, triangular part, BA 45 (108) L superior longitudinal fasciculus III (43) Corpus callosum (37) L inferior frontal gyrus, triangular part, BA 48 (5) L inferior network, inferior fronto-occipital fasciculus (5) L inferior frontal gyrus, triangular part, BA 47 (5) L anterior thalamic projections (4)	0.630	13/15	No

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L striatum	-16,14,-16	-1.46	9.96e-4	135	L striatum (2) L striatum (43) L inferior network, uncinate fasciculus (16) L olfactory cortex, BA 25 (14) L superior frontal gyrus, orbital part, BA 11 (14) L inferior frontal gyrus, orbital part, BA 11 (12) L olfactory cortex, BA 11 (9) L gyrus rectus, BA 11 (8) L superior frontal gyrus, orbital part, BA 25 (4) Corpus callosum (3) L lenticular nucleus, putamen, BA 25 (2) L gyrus rectus, BA 25 (2) L caudate nucleus, BA 11 (1) L caudate nucleus, BA 25 (1)	0.027	12/15	Yes
L inferior network, inferior longitudinal fasciculus	-36,-50,-10	-1.502	7.69e-4	100	L inferior network, inferior longitudinal fasciculus (75) L fusiform gyrus, BA 37 (19) L inferior temporal gyrus, BA 37 (6)	0.088	13/15	No
R inferior network, inferior	38,-16,-8	-1.562	4.75e-4	71	R inferior network, inferior	0.143	13/15	No

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fronto-occipital fasciculus					fronto-occipital fasciculus (22) R lenticular nucleus, putamen, BA 48 (12) Corpus callosum (7) R insula, BA 48 (3) R inferior network, inferior longitudinal fasciculus (3)			
R supplementary motor area, BA 6	2,18,62	-1.418	1.31e-3	68	L supplementary motor area, BA 6 (32) R supplementary motor area, BA 6 (13) R supplementary motor area, BA 8 (7) R supplementary motor area (4) L supplementary motor area (4) R superior frontal gyrus, medial, BA 8 (1) L supplementary motor area, BA 8 (1)	0.156	13/15	No
Corpus callosum	-24,-52,50	-1.379	1.72e-3	36	Corpus callosum (24) L inferior parietal (excluding supramarginal and angular) gyri, BA 7 (7) L superior parietal gyrus, BA 7 (5)	0.340	13/15	No
R inferior network, inferior longitudinal fasciculus	30,-22,-8	-1.403	1.47e-3	10	R inferior network, inferior longitudinal fasciculus (3) Corpus callosum (3) R hippocampus, BA 20 (2)	0.167	9/15	No

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					R optic radiations (1) R inferior network, inferior fronto-occipital fasciculus (1)			
SDs > HCs								
L middle occipital gyrus, BA 39	-40,-80,22	1.818	5.16e-5	934	L angular gyrus, BA 39 (243) L middle occipital gyrus, BA 19 (230) L middle occipital gyrus, BA 39 (190) L middle temporal gyrus, BA 39 (53) L middle temporal gyrus, BA 21 (42) L middle occipital gyrus (27) L inferior network, inferior longitudinal fasciculus (25) L angular gyrus, BA 22 (14) L angular gyrus, BA 19 (12) L middle temporal gyrus, BA 22 (12) Corpus callosum (11) L supramarginal gyrus, BA 22 (9) L middle temporal gyrus, BA 37 (4) L inferior parietal (excluding supramarginal and angular) gyri, BA 39 (3) L superior longitudinal fasciculus II (3)	0.721	11/11	No

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					L middle occipital gyrus, BA 37 (2) L supramarginal gyrus, BA 39 (2) L angular gyrus (2)			
Corpus callosum	24,-76,24	1.536	3.04e-4	476	Corpus callosum (272)	0.840	10/11	No
					R middle occipital gyrus, BA 19 (91) R superior occipital gyrus, BA 19 (77) R cuneus cortex, BA 18 (16) R cuneus cortex, BA 19 (10) R inferior network, inferior longitudinal fasciculus (3) R cuneus cortex (2) L cuneus cortex, BA 18 (1) L cuneus cortex (1) R superior occipital gyrus, BA 18 (1) R superior occipital gyrus, BA 7 (1) R middle occipital gyrus, BA 39 (1)			
Right precuneus, BA 7	10,-62,68	1.319	1.25e-3	57	R precuneus, BA 7 (43) R precuneus, BA 5 (8) R superior parietal gyrus, BA 7 (4) R superior parietal gyrus (1) R precuneus (1)	0.081	10/11	No
L hippocampus, BA 37	-26,-34,-4	1.253	1.80e-3	48	L hippocampus, BA 37 (21) L optic radiations (13)	0.136	10/11	No

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					Corpus callosum (9) L hippocampus, BA 27 (4) L hippocampus (1)			
L precuneus, BA 23	0,-58,24	1.195	2.51e-3	27	L precuneus, BA 23 (11) R precuneus, BA 23 (9) L precuneus (5) R posterior cingulate gyrus (1) R precuneus (1)	0.174	10/11	No
L calcarine fissure / surrounding cortex, BA 17	2,-96,8	1.268	1.62e-3	20	L calcarine fissure / surrounding cortex, BA 17 (9) L cuneus cortex, BA 18 (4) L calcarine fissure / surrounding cortex (4) L calcarine fissure / surrounding cortex, BA 18 (2) L cuneus cortex, BA 17 (1)	0.142	10/11	No
SDs < HCs								
R anterior cingulate / paracingulate gyri, BA 32	6,42,16	-1.473	8.46e-4	779	L anterior cingulate / paracingulate gyri, BA 32 (207) R anterior cingulate / paracingulate gyri, BA 32 (195) L superior frontal gyrus, medial, BA 32 (106)	0.110	9/11	No

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L anterior cingulate / paracingulate gyri, BA 24 (104)
L anterior cingulate / paracingulate gyri (50)
R anterior cingulate / paracingulate gyri, BA 24 (45)
R median cingulate / paracingulate gyri, BA 24 (23)
R median cingulate / paracingulate gyri, BA 32 (14)
L superior frontal gyrus, medial (13)
R anterior cingulate / paracingulate gyri (5)
Corpus callosum (4)
L median cingulate / paracingulate gyri, BA 24 (4)
R superior frontal gyrus, medial, BA 32 (3)
L median cingulate / paracingulate gyri (2)
R median network, cingulum (2)
R superior frontal gyrus, medial, BA 10 (1)

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					R superior frontal gyrus, medial (1)			
L superior longitudinal fasciculus III	-44,26,8	-1.513	5.63e-4	350	L inferior frontal gyrus, triangular part, BA 45 (114) L superior longitudinal fasciculus III (51) Corpus callosum (48) L inferior frontal gyrus, opercular part, BA 48 (42) L inferior frontal gyrus, opercular part, BA 44 (42) L inferior frontal gyrus, triangular part, BA 48 (35) L inferior frontal gyrus, triangular part, BA 47 (6) L inferior frontal gyrus, triangular part (3) L anterior thalamic projections (3) L frontal aslant tract (2) L insula, BA 48 (1) L inferior network, inferior fronto-occipital fasciculus (1) L frontal inferior longitudinal fasciculus (1) L striatum (1)	0.631	9/11	No
L striatum	-16,14,-16	-1.575	3.41e-4	223	L striatum (61)	0.023	9/11	Yes

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					L inferior frontal gyrus, orbital part, BA 11 (28) L olfactory cortex, BA 25 (25) L inferior network, uncinate fasciculus (21) L superior frontal gyrus, orbital part, BA 11 (21) L gyrus rectus, BA 11 (11) L olfactory cortex, BA 11 (10) Corpus callosum (10) L lenticular nucleus, putamen, BA 25 (8) L gyrus rectus, BA 25 (6) L superior frontal gyrus, orbital part, BA 25 (5) L caudate nucleus, BA 25 (3) L caudate nucleus, BA 11 (2) L lenticular nucleus, putamen, BA 48 (1) L olfactory cortex, BA 48 (1)			
Corpus callosum	-24,-52,50	-1.436	1.11e-3	54	Corpus callosum (32) L inferior parietal (excluding supramarginal and angular) gyri, BA 7 (13) L superior parietal gyrus, BA 7 (8)	0.264	9/11	No

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					L inferior parietal (excluding supramarginal and angular) gyri, BA 40 (1)			
R inferior network, inferior fronto-occipital fasciculus	34,-18,-4	-1.382	1.75e-3	33	R inferior network, inferior fronto-occipital fasciculus (12) Corpus callosum (7) R lenticular nucleus, putamen, BA 48 (6) R striatum (1)	0.135	9/11	No
L inferior network, inferior longitudinal fasciculus	-36,-50,-12	-1.287	3.67e-3	25	L inferior network, inferior longitudinal fasciculus (22) L fusiform gyrus, BA 37 (3)	0.113	9/11	No

Abbreviations: HCs, healthy controls; SDs, substance dependence; BA, Brodmann area; R, right; L, left.

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Table S5. Meta-analyses results regarding regional differences of task-evoked activation between participants with addiction and HCs during gain outcome (including gain-loss contrasts).

Local Maximum				Cluster		Egger's test	Jackknife	Heterogeneity
Region	Peak MNI coordinate (x, y, z)	SDM-Z value	*p* value	No. of voxels	Breakdown (No. of voxels)	(*p* value)	sensitivity	
All addictions > HCs								
R middle occipital gyrus, BA 19	30,-78,36	1.131	9.08e-4	266	R middle occipital gyrus, BA 19 (137) R superior occipital gyrus, BA 19 (48) R superior occipital gyrus, BA 7 (30) Corpus callosum (23) R middle occipital gyrus, BA 7 (18) R middle occipital gyrus, BA 39 (9) R middle occipital gyrus (1)	0.327	18/20	No
R temporal pole, superior temporal gyrus, BA 20	42,8,-30	1.048	1.59e-3	154	R inferior network, inferior longitudinal fasciculus (59) R temporal pole, middle temporal gyrus, BA 20 (35) R temporal pole, superior temporal gyrus, BA 38 (15) R temporal pole, superior temporal gyrus, BA 20 (12) R temporal pole, middle temporal gyrus,	0.131	18/20	No

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					BA 21 (9) R temporal pole, middle temporal gyrus, BA 38 (8) R middle temporal gyrus, BA 20 (7) R inferior network, uncinate fasciculus (4) R middle temporal gyrus, BA 21 (4)			
All addictions < HCs								
R median cingulate / paracingulate gyri, BA 23	2,-18,36	-2.06	2.06e-5	1352	R median cingulate / paracingulate gyri, BA 23 (267) L median cingulate / paracingulate gyri, BA 23 (259) L median cingulate / paracingulate gyri, BA 24 (133) R median cingulate / paracingulate gyri, BA 24 (122) R median network, cingulum (119) L median network, cingulum (95) R median cingulate / paracingulate gyri (85) Corpus callosum (74) L median cingulate / paracingulate gyri (59)	0.848	20/20	No

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					L anterior cingulate / paracingulate gyri (13) L posterior cingulate gyrus, BA 23 (11) L anterior cingulate / paracingulate gyri, BA 24 (9) L superior frontal gyrus, medial (7) R median cingulate / paracingulate gyri, BA 32 (7) L superior frontal gyrus, medial, BA 32 (7) L superior frontal gyrus, medial, BA 24 (3) R posterior cingulate gyrus, BA 23 (1) R superior frontal gyrus, medial, BA 32 (1) R supplementary motor area (1) L posterior cingulate gyrus (1)			
R inferior parietal (excluding supramarginal and angular) gyri, BA 40	52,-54,44	-1.393	2.64e-3	145	R inferior parietal (excluding supramarginal and angular) gyri, BA 40 (79) R inferior parietal (excluding supramarginal and angular) gyri, BA 39 (35)	0.488	18/20	Yes

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					R angular gyrus, BA 39 (25) R angular gyrus, BA 40 (5) R inferior parietal (excluding supramarginal and angular) gyri (1)			
L middle frontal gyrus, BA 46	-34,40,32	-1.361	3.07e-3	37	L middle frontal gyrus, BA 46 (28) L middle frontal gyrus, BA 9 (9)	0.181	18/20	No
SDs > HCs								
(None)								
SDs < HCs								
R median cingulate / paracingulate gyri, BA 23	2,-26,36	-2.095	4.13e-5	1519	R median cingulate / paracingulate gyri, BA 23 (279) L median cingulate / paracingulate gyri, BA 23 (276) L median cingulate / paracingulate gyri, BA 24 (135) R median network, cingulum (134) R median cingulate / paracingulate gyri, BA 24 (127) R median cingulate / paracingulate gyri (123) L median network, cingulum (115) Corpus callosum (87)	0.767	16/16	No

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L median cingulate / paracingulate gyri (75)
L anterior cingulate / paracingulate gyri (17)
L superior frontal gyrus, medial, BA 32 (16)
R median cingulate / paracingulate gyri, BA 32 (13)
L posterior cingulate gyrus, BA 23 (13)
L superior frontal gyrus, medial (6)
L anterior cingulate / paracingulate gyri, BA 24 (3)
R posterior cingulate gyrus, BA 23 (3)
L superior frontal gyrus, medial, BA 24 (2)
L median cingulate / paracingulate gyri, BA 32 (2)
R superior frontal gyrus, medial, BA 32 (2)
L supplementary motor area, BA 32 (2)
L supplementary motor area (2)
R supplementary motor area (1)
L posterior cingulate gyrus (1)

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R inferior parietal (excluding supramarginal and angular) gyri, BA 40	52,-54,44	-1.417	2.58e-3	170	R inferior parietal (excluding supramarginal and angular) gyri, BA 40 (62) R angular gyrus, BA 39 (53) R inferior parietal (excluding supramarginal and angular) gyri, BA 39 (34) R angular gyrus, BA 22 (11) R angular gyrus, BA 40 (6) R inferior parietal (excluding supramarginal and angular) gyri (3) R superior temporal gyrus, BA 22 (1)	0.423	14/16	Yes

Abbreviations: HCs, healthy controls; SDs, substance dependence; BA, Brodmann area; R, right; L, left.

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Table S6. Meta-analyses results regarding regional differences of task-evoked activation between participants with all addictions and HCs during gain anticipation, excluding the studies of Martin et al. (2014) and Yip et al. (2016).

Local Maximum				Cluster		Egger's test	Jackknife	Heterogeneity
Region	Peak MNI coordinate (x, y, z)	SDM-Z value	*p* value	No. of voxels	Breakdown (No. of voxels)	(*p* value)	sensitivity	
All addictions > HCs								
L angular gyrus, BA 39	-52,-56,32	1.852	1.65e-4	456	L angular gyrus, BA 39 (159) L middle temporal gyrus, BA 21 (50) L supramarginal gyrus, BA 40 (47) L middle temporal gyrus, BA 22 (37) L supramarginal gyrus, BA 22 (31) L supramarginal gyrus, BA 48 (23) L inferior parietal (excluding supramarginal and angular) gyri, BA 39 (23) L angular gyrus, BA 22 (21) L inferior parietal (excluding supramarginal and angular) gyri, BA 40 (13) L middle temporal gyrus, BA 39 (11) L supramarginal gyrus, BA 42 (8) L angular gyrus, BA 40 (7)	0.464	11/11	No

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					L superior temporal gyrus, BA 42 (7) L superior temporal gyrus, BA 22 (5) L arcuate network, posterior segment (4) L supramarginal gyrus, BA 39 (4) L middle temporal gyrus, BA 42 (3) L middle temporal gyrus, BA 37 (2) L angular gyrus, BA 48 (1)			
L precentral gyrus, BA 6	-24,-16,74	1.503	1.21e-3	59		0.314	9/11	No
R precuneus	10,-54,46	1.357	3.00e-3	27	R precuneus (26) Corpus callosum (1)	0.900	8/11	No
All addictions < HCs								
R temporal pole, superior temporal gyrus, BA 38	30,14,-26	-1.608	1.00e-3	377	R temporal pole, superior temporal gyrus, BA 38 (135) R temporal pole, superior temporal gyrus (41) R inferior frontal gyrus, orbital part, BA 38 (38) R insula, BA 38 (24) R parahippocampal gyrus, BA 28 (24) R inferior frontal gyrus, orbital part (20) R parahippocampal gyrus, BA 38 (13) R temporal pole, superior temporal gyrus, BA 20 (12)	0.016	10/11	No

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					R temporal pole, superior temporal gyrus, BA 34 (8) R temporal pole, superior temporal gyrus, BA 28 (3) R insula, BA 48 (3) R parahippocampal gyrus, BA 36 (3) R insula (2) R inferior network, inferior longitudinal fasciculus (2) R parahippocampal gyrus (1) R olfactory cortex (1)			
L supplementary motor area, BA 6	0,16,62	-1.788	2.58e-4	215	L supplementary motor area, BA 6 (94) R supplementary motor area, BA 6 (44) R supplementary motor area, BA 8 (24) L supplementary motor area (22) R supplementary motor area (9) L supplementary motor area, BA 8 (8) R superior frontal gyrus, medial, BA 8 (3)	0.016	10/11	No
L striatum	-16,16,-12	-1.626	9.08e-4	219	L striatum (63) L olfactory cortex, BA 25 (29) L inferior network, uncinate fasciculus (23) L superior frontal gyrus, orbital part, BA	0.008	8/11	Yes

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					11 (19) L inferior frontal gyrus, orbital part, BA 11 (18) L gyrus rectus, BA 11 (13) L lenticular nucleus, putamen, BA 25 (10) Corpus callosum (10) L olfactory cortex, BA 11 (7) L gyrus rectus, BA 25 (6) L superior frontal gyrus, orbital part, BA 25 (5) L caudate nucleus, BA 25 (4) L caudate nucleus, BA 11 (2)			
L inferior network, inferior longitudinal fasciculus	-36,-50,-10	-1.827	1.81e-4	193	L inferior network, inferior longitudinal fasciculus (116) L fusiform gyrus, BA 37 (50) L inferior temporal gyrus, BA 37 (24) L inferior temporal gyrus, BA 20 (2)	0.124	9/11	No
L middle frontal gyrus	-24,46,30	-1.465	2.55e-3	24	L middle frontal gyrus, BA 46 (11) L middle frontal gyrus, BA 9 (9) L middle frontal gyrus (4)	0.082	9/11	No

Abbreviations: HCs, healthy controls; BA, Brodmann area; R, right; L, left.

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Table S7. Meta-analyses results regarding regional differences of task-evoked activation between participants with all addictions and HCs during loss anticipation, excluding the studies of Martin et al. (2014) and Yip et al. (2016).

Local Maximum				Cluster		Egger's test	Jackknife	Heterogeneity
Region	Peak MNI coordinate (x, y, z)	SDM-Z value	*p* value	No. of voxels	Breakdown (No. of voxels)	(*p* value)	sensitivity	
All addictions > HCs								
L postcentral gyrus, BA 4	-50,-20,46	1.485	3.25e-4	581	L postcentral gyrus, BA 4 (232) L postcentral gyrus, BA 3 (141) L postcentral gyrus, BA 6 (97) L inferior parietal (excluding supramarginal and angular) gyri, BA 3 (55) L precentral gyrus, BA 6 (18) L postcentral gyrus (12) L supramarginal gyrus, BA 3 (11) L precentral gyrus, BA 4 (9) L inferior parietal (excluding supramarginal and angular) gyri, BA 2 (3) L hand inferior U tract (2) L postcentral gyrus, BA 43 (1)	0.552	6/8	No
Corpus callosum	14,-14,66	1.306	1.91e-3	358	R precentral gyrus, BA 6 (156)	0.395	6/8	No

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					Corpus callosum (60) R precentral gyrus, BA 4 (43) R postcentral gyrus, BA 4 (29) R superior frontal gyrus, dorsolateral, BA 6 (26) R supplementary motor area, BA 6 (23) R cortico-spinal projections (9) R postcentral gyrus, BA 3 (8) R precentral gyrus (2) R precentral gyrus, BA 3 (1) R postcentral gyrus (1)			
L middle frontal gyrus, BA 10	-30,56,6	1.401	1.08e-3	193	L middle frontal gyrus, BA 10 (107) L superior frontal gyrus, dorsolateral, BA 10 (34) L middle frontal gyrus (10) L middle frontal gyrus, BA 11 (8) L superior frontal gyrus, dorsolateral, BA 11 (7) L middle frontal gyrus, BA 46 (6) Corpus callosum (5) L middle frontal gyrus, BA 47 (4) L superior frontal gyrus, orbital part, BA 11 (3)	0.321	6/8	No

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					L anterior thalamic projections (3) L middle frontal gyrus, orbital part, BA 47 (3) L middle frontal gyrus, orbital part, BA 10 (1) L superior frontal gyrus, orbital part, BA 47 (1) L superior frontal gyrus, dorsolateral, BA 47 (1)			
R striatum	24,12,4	1.451	5.63e-4	152	R striatum (101) R lenticular nucleus, putamen, BA 48 (31) R superior longitudinal fasciculus III (10) R lenticular nucleus, putamen (4) R inferior network, inferior fronto-occipital fasciculus (4) R fronto-insular tract 3 (2)	0.661	6/8	No
R inferior frontal gyrus, opercular part, BA 48	52,14,6	1.133	3.91e-3	25	R inferior frontal gyrus, opercular part, BA 48 (20) R inferior frontal gyrus, triangular part, BA 45 (4) R inferior frontal gyrus, triangular part, BA 48 (1)	0.429	6/8	No

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All addictions < HCs								
L striatum	-12,16,-8	-1.785	1.03e-4	2321	L striatum (376) L temporal pole, superior temporal gyrus, BA 38 (127) L inferior network, uncinate fasciculus (121) L lenticular nucleus, putamen, BA 48 (113) L inferior network, inferior longitudinal fasciculus (105) Corpus callosum (102) R striatum (90) L olfactory cortex, BA 25 (76) L gyrus rectus, BA 11 (73) L inferior temporal gyrus, BA 20 (73) Anterior commissure (56) L caudate nucleus, BA 25 (53) L temporal pole, middle temporal gyrus, BA 20 (48) L anterior thalamic projections (47) L temporal pole, middle temporal gyrus, BA 38 (41) L amygdala, BA 34 (37)	0.069	8/8	No

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R olfactory cortex, BA 25 (33)
L temporal pole, superior temporal gyrus, BA 48 (29)
L temporal pole, superior temporal gyrus (27)
L middle temporal gyrus, BA 20 (24)
L middle temporal gyrus, BA 21 (24)
L olfactory cortex (24)
L temporal pole, middle temporal gyrus, BA 21 (20)
L olfactory cortex, BA 11 (17)
L pons (17)
L temporal pole, superior temporal gyrus, BA 20 (17)
L superior frontal gyrus, orbital part, BA 11 (16)
L inferior network, inferior fronto-occipital fasciculus (15)
L superior frontal gyrus, medial orbital, BA 11 (14)
L lenticular nucleus, putamen, BA 25 (13)
L gyrus rectus, BA 25 (12)

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R caudate nucleus, BA 25 (12)
R gyrus rectus, BA 11 (10)
L insula, BA 48 (10)
L temporal pole, superior temporal gyrus, BA 21 (8)
L lenticular nucleus, putamen, BA 11 (6)
L caudate nucleus (6)
L cortico-spinal projections (5)
L anterior cingulate / paracingulate gyri (5)
R olfactory cortex (5)
L anterior cingulate / paracingulate gyri, BA 11 (4)
L gyrus rectus (4)
R gyrus rectus, BA 25 (4)
R superior frontal gyrus, medial orbital, BA 11 (4)
L superior temporal gyrus, BA 48 (4)
R median network, cingulum (3)
R gyrus rectus (3)
R olfactory cortex, BA 11 (3)
L lenticular nucleus, putamen (3)
L anterior cingulate / paracingulate gyri,

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	BA 25 (3)
	L lenticular nucleus, putamen, BA 34 (2)
	L caudate nucleus, BA 11 (2)
	L inferior temporal gyrus (2)
	L amygdala, BA 36 (2)
	L inferior temporal gyrus, BA 36 (2)
	R superior frontal gyrus, medial orbital (2)
	L superior frontal gyrus, orbital part (1)
	R caudate nucleus (1)
	L temporal pole, superior temporal gyrus, BA 36 (1)
	L amygdala, BA 20 (1)

Abbreviations: HCs, healthy controls; BA, Brodmann area; R, right; L, left.

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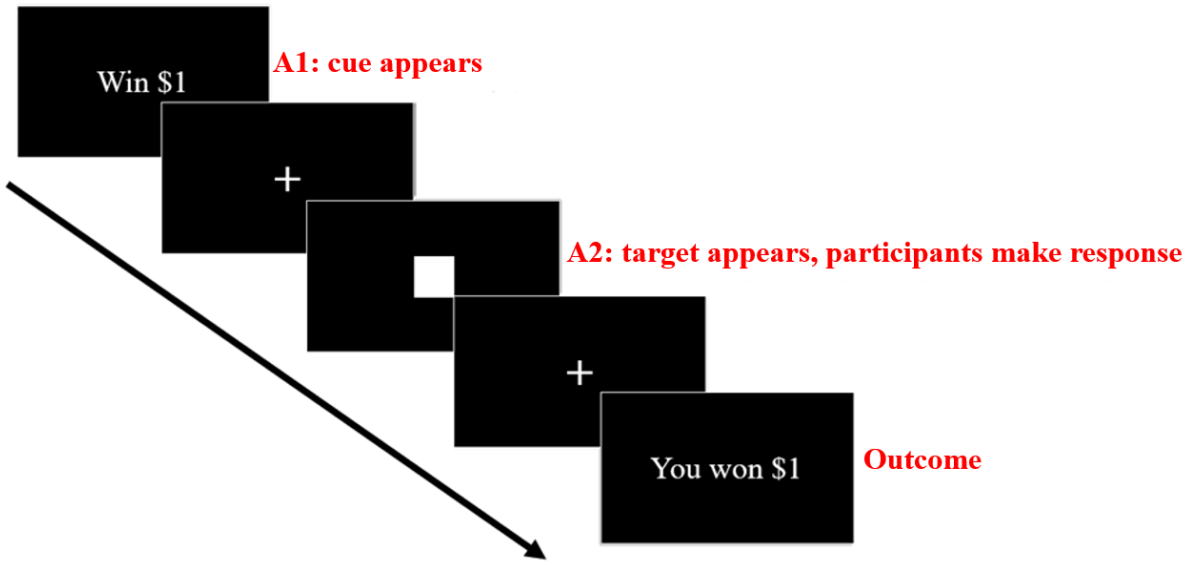

Figure S1. A simplified diagram illustrating an example of the Monetary Incentive Delay Task.

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