

**Appendix 1** to Hou J-M, Zhao M, Zhang W, et al. Resting-state functional connectivity abnormalities in patients with obsessive-compulsive disorder and their healthy first-degree relatives. *J Psychiatry Neurosci* 2014

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### Head motion calculation

After the head motion correction procedure, the magnitude of head motion at each time point for 6 parameters (3 for translation and 3 for rotation) was obtained for each participant. The averaged head motion parameter for translation and rotation was then calculated as follows:

$$M_t = \sum(|tX_i - tX_{i-1}| + |tY_i - tY_{i-1}| + |tZ_i - tZ_{i-1}|) / 229$$

$$M_r = \sum(|rY_i - rY_{i-1}| + |rP_i - rP_{i-1}| + |rR_i - rR_{i-1}|) / 229$$

$M_t$  and  $M_r$  denote the averaged head motion parameter of translation and rotation, respectively;  $i$  denotes the time point of the time series, ranging from 2 to 230;  $tX$ ,  $tY$  and  $tZ$  denote the magnitude of translation in direction X, Y and Z, respectively; and  $rY$ ,  $rP$  and  $rR$  denote the magnitude of rotation in yaw, pitch and roll, respectively. Participants were excluded if the translation exceeded 2 mm or if rotation exceeded 2°. Using this criterion, 1 woman with OCD was excluded because of excessive head motion (> 2 mm in translation) during MR scanning.

### Seed-based interregional functional connectivity analysis

To investigate more detailed connectivity alteration patterns associated with the identified hubs, we further performed seed-based interregional correlation analysis. The regions with abnormal functional connectivity strength (FCS) values both in patients with OCD and their first-degree relatives were selected as regions of interest (ROI). According to the morphometric analysis results, 4 brain regions that showed abnormal FCS values both in patients with OCD and their first-degree relatives were selected as seed regions for functional connectivity analysis on resting-state fMRI data, specifically the bilateral caudate, left orbitofrontal cortex (OFC) and left middle temporal gyrus. Functional connectivity was analyzed using the REST software package (<http://www.restfmri.net>). Several possible spurious sources of variances, including the estimated head motion parameters, global brain average signals and average signals from the cerebrospinal fluid and white matter, were removed from the data through linear regression. After bandpass filtering (0.01-0.08 Hz) and linear trend removal, a reference time series for each seed was extracted by averaging the time series of voxels within each ROI. A correlation analysis was conducted between the seed ROI and the remaining voxels in the whole brain. The resulting  $r$  values were converted using Fisher  $r$ -to- $z$  transformation to improve the Gaussianity of their distribution.

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**Table S1: Whole brain functional connectivity strength differences among the study groups**

Brain region	Side	MNI coordinates			Cluster size	Peak t value
		x	y	z		
OCD > control						
OFC (BA 10,11,45,47)	Left	-18	15	-15	76	5.48
OFC (BA 10,32)	Right	6	43	-10	45	5.16
ACC (BA 24,32)	Left/right	1	33	19	53	5.21
Putamen	Left	-18	15	6	39	4.72
Putamen	Right	21	10	5	25	4.09
Caudate	Left	-13	12	8	20	4.39
Caudate	Right	13	14	8	20	4.06
Insula (BA 5)	Right	33	22	5	23	4.54
Middle frontal gyrus (BA 9)	Left	-40	22	30	45	4.39
Middle frontal gyrus (BA 9)	Right	35	42	27	55	4.68
Middle cingulate gyrus (BA 32)	Left	-3	41	42	25	4.13
Middle temporal gyrus (BA 20,21)	Left	-60	-50	2	30	5.13
Middle temporal gyrus (BA 21)	Right	52	-32	1	20	4.19
Inferior parietal lobule (BA 40)	Right	60	-38	36	25	4.07
OCD < control						
Occipital lobe (BA 18)	Left	-8	-89	-10	20	-4.15
Occipital lobe (BA 19)	Right	35	-89	-9	31	-4.21
Cerebellum (BA 37)	Left/right	3	-51	1	27	-3.89
Superior temporal gyrus (BA 38)	Right	36	-15	24	30	-4.61
Relatives > control						
OFC (BA 11,47)	Left	-18	12	-15	33	4.95
Caudate	Left	-11	12	11	20	4.83
Caudate	Right	12	12	9	23	5.01
Middle temporal gyrus (BA 20,21)	Left	-57	-30	-12	26	5.91
Precentral gyrus (BA 4,6)	Left	-51	-9	30	53	5.79
Precentral gyrus (BA 4,6,43)	Right	45	-9	42	39	4.33
OCD > relatives						
Middle frontal gyrus (BA 10)	Right	45	36	6	30	4.38
OCD < relatives						
Precentral gyrus (BA 4,6)	Left	-51	-9	33	40	-3.85
Precentral gyrus (BA 4,6,43)	Right	51	-9	51	32	-4.19

ACC = anterior cingulate cortex; BA = Brodmann area; MNI = Montreal Neurological Institute; OCD = obsessive-compulsive disorder; OFC = orbitofrontal cortex.  
 $p < 0.05$ , corrected with multiple comparisons.

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**Table 2: Seed ROI-based functional connectivity analysis among the three groups**

Seed ROI; connected region	MNI coordinates			Voxel size	Peak <i>t</i> value
	x	y	z		
<b>OCD &gt; control</b>					
Left caudate					
Left OFC	-16	30	-15	55	4.95
Right OFC	7	41	-10	45	4.83
Right caudate	13	13	9	35	5.83
Left putamen	-23	7	13	30	5.19
Left thalamus	-6	-7	9	25	4.59
Right caudate					
Left OFC	-17	12	-17	43	4.92
Right OFC	6	42	-12	29	4.55
Left caudate	-15	12	3	36	4.13
Right putamen	22	10	6	27	3.91
Left/right ACC	-1	36	1	50	4.26
Left OFC					
Left caudate	-17	16	6	32	4.69
Left putamen	-23	9	7	25	4.32
Right caudate	12	14	6	31	3.95
Left/right ACC	-2	41	12	35	3.57
Left MTG					
Left PCC	-4	-45	19	26	3.93
Right MTG	47	-32	1	25	4.53
<b>OCD &lt; control</b>					
Left OFC					
Left occipital cortex	-23	-87	-12	25	-4.15
Right occipital cortex	38	-84	-13	31	-4.71
Cerebellum	3	-40	-12	28	-3.77
<b>Relatives &gt; control</b>					
Left caudate					
Left OFC	-16	30	-12	33	4.76
Right caudate	13	13	14	28	4.52
Right caudate					
Left caudate	-13	9	15	23	5.06
Right OFC	10	30	-12	25	3.89
Left OFC					
Left caudate	-12	8	11	29	4.51
Left precentral gyrus	-50	-9	31	35	4.95
Right precentral gyrus	45	-9	41	28	4.72

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	x	y	z		
Left MTG					
Left PCC	-4	-45	26	33	4.26
<b>OCD &gt; relatives</b>					
Left caudate					
Left ACC	-9	53	1	26	3.98
Left thalamus	15	-17	11	25	4.21
Right caudate					
Left/right ACC	2	40	3	30	4.35
Right putamen	-26	10	6	37	3.58
Inferior frontal gyrus	-29	55	11	24	4.26
<b>OCD &lt; relatives</b>					
Left OFC					
Left precentral gyrus	-51	-7	37	30	-4.52
Right precentral gyrus	49	-5	41	25	-4.57

ACC = anterior cingulate cortex; BA = Brodmann area; MNI = Montreal Neurological Institute; MTG = middle temporal gyrus; OCD = obsessive-compulsive disorder; OFC = orbitofrontal cortex.  
*p* < 0.05, family-wise error-corrected).