Data Supplement for Russman Block et al., Resting-State Connectivity and Response to Psychotherapy Treatment in Adolescents and Adults with OCD: A Randomized Clinical Trial, American Journal of Psychiatry (doi: 10.1176/appi.ajp.21111173).

Resting-State Connectivity and Response to Psychotherapy Treatment in Adolescents and Adults with OCD: A Randomized Clinical Trial

Supplementary Material

Participants

63 adolescents with Obsessive Compulsive Disorder (OCD) (12-17 years old), 74 adults with OCD (24-45 years old) and 70 healthy control (HC) participants (35 adolescents and 35 adults) were enrolled in the present study. Participants were required to be in one of the two age-groups to participate with age brackets selected to represent more plastic (adolescent) relative to more stable (adult) periods of brain development. Participants in the OCD group were required to have symptom onset prior to 16 years of age, and to be currently experiencing at least a moderate level of symptoms at baseline (≥16 on the Yale-Brown Obsessive Compulsive Scale (Child version, as appropriate; Y-BOCS) (1, 2). Exclusionary criteria for the OCD group included lifetime diagnoses of bipolar disorder, psychosis or mental retardation, or other Axis 1 disorders (except social phobia, generalized anxiety disorder, specific phobia, tic disorders, separation anxiety disorder, OC spectrum disorders (body dysmorphic disorder, trichotillomania) if < 5 years in remission or major depressive episode if < 2 months in remission), a serious medical, neurological illness, a closed head injury, fMRI contraindications, vision < 20/30 (± correction); substance abuse disorder in the past 6 months or a history of substance dependence in the past 24 months, suicidal intentions or behaviors in the previous 6 months, or having hoarding as a primary and/or only manifestation of an obsessive-compulsive related disorder. Patients were also excluded for taking antipsychotic medications, anticonvulsants, lithium, or stimulants, but were permitted to take selective serotonin reuptake inhibitors if on a stable

dosage for more than 4 weeks. Patients were excluded if they had experienced a failed course of Cognitive Behavioral Therapy with Exposure and Response Prevention (ERP) for OCD.

Participants in the OCD and healthy groups were matched on age and gender. Exclusionary criteria for the healthy control group included current or lifetime history of any psychiatric disorder except simple phobias, current use of medications with psychotropic effects, family history of OCD or tic disorders, a serious medical, neurological illness, a closed head injury, fMRI contraindications, and vision < 20/30 (± correction). A total of N=116 patients and 63 healthy volunteers with usable resting-state fMRI and OCD symptom assessment data were included in the present analyses. Data for included patients was collected March 2015 to January 2020. To be included in analyses examining the association between resting-state functional connectivity and symptom decline, patients with OCD were required to have a resting-state scan as well as a Y-BOCS assessment at least two of the three timepoints. A total of 133 patients with OCD attended the fMRI session, of which 129 had a usable resting state scan. Scans from 2 patients were not usable due to image artifacts, 1 patient did not have an anatomical scan, and 1 patient withdrew from the scanning session due to discomfort. Of the 129 patients who had a resting-state scan, 4 patients with OCD withdrew prior to randomization and 9 patients with OCD withdrew prior to the mid-treatment evaluation, leaving a final N of 116 (see Figure S1). A total 68 healthy volunteers attended the fMRI session, of which 63 had a usable resting-state scan. Scans from 2 HC were not usable due to image artifacts, 1 HC did not complete the resting-state sequence, 2 HC had incidental findings, and data from 1 HC could not be preprocessed due to insufficient voxels in the CSF mask, leaving a final N of 63 (see Figure S1).

Study Design

Participants with OCD were randomized to 12 weekly individual sessions of ERP or SMT to take place at the University of Michigan Health System, Michigan, USA. This study was designed to detect neural correlates of ERP effect relative to an active control therapy. It was not intended to test the superiority of ERP to SMT. SMT was included to control for potential non-specific effects of time and weekly meetings with a therapist on neural correlates of symptom change.

All participants were consented and screened by a trained study coordinator, and prospective patient participants were reviewed at weekly team meetings, attended by both principal investigators, to confirm a diagnosis of obsessive-compulsive disorder. An in-house computer program was used to generate allocation sequences, in randomized blocks of 4, stratified by gender, age and medication status. While it was not possible to conceal the treatment assignment from patients and all of the study staff, steps were taken to ensure that the symptom raters were blinded to treatment assignment, such as blocking file access that would reveal treatment assignment status to blinded raters, segregating team meetings into blinded and unblinded sessions and instructing participants to not reveal clues as to their treatment assignment when undergoing ratings. The blinded raters were also not apprised of the size of the randomization blocks. Weekly supervision by an expert clinician (Dr. Himle) ensured fidelity to structured ERP and SMT manuals on a weekly basis, supplemented by reviews of session audio recordings. OCD severity was rated at baseline, mid-treatment, and end of therapy by an independent evaluator, blinded to condition, using the Y-BOCS (1, 2). Patients were also assessed using the Hamilton Anxiety Rating Scale (HAM-A) (3), the Quick Inventory of Depressive Symptomatology (QIDS) (4) and the Clinical Global Impression – Severity scale (CGI-S) (5). Therapy providers and independent evaluators were masters-level clinicians

supervised by expert clinicians (Dr. Himle for therapy; Dr. Fitzgerald for Y-BOCS). Each week, therapy providers rated treatment adherence (Treatment Adherence Rating Scale (TARS)) - "How frequently did the patient do the assigned homework?" and "How well did the patient follow ERP/stress management principles when working on assigned homework?" – on a 0 (No Attempts/Did not follow principles) to 8 (Assigned Frequency/Excellent adherence to Principles) scale. Therapy providers were trained to deliver both ERP and SMT. Both conditions were standardized using written manuals on which therapists were trained and supervised (available on request).

Importantly, the instruments used to measure OCD severity in adults and adolescents, the Y-BOCS and CY-BOCS respectively, are highly comparable. The 10 items on these instruments are identical in wording, with variation only on the question about OCD-related interference referencing school (rather than work) on the CY-BOCS. The group of investigators that developed the Y-BOCS and CY-BOCS deliberately employed identical format/wording to enable use of these instruments for the study of OCD over the lifespan (1, 2). Consistent with this intent, the Y-BOCS and CY-BOCS have similarly high validity and reliability for adults compared to adolescents, as demonstrated by internal consistency (Cronbach's alpha coefficient: Y-BOCS 0.89, CY-BOCS 0.87) and intraclass correlation coefficients across raters (Y-BOCS .98, CY-BOCS 0.92) (1, 2). Independent evaluators generally interviewed adolescent patients and one parent using the CY-BOCS. Adult patients were typically interviewed alone but were encouraged to invite a partner and/or close adult friend if collateral information was deemed to be needed for accurate ratings by the patient and/or evaluator.

Cognitive Behavioral Therapy with Exposure and Response Prevention

The protocol for ERP followed methods previously developed by co-author Dr. Himle and is consistent with established procedures in the field for treating OCD in adolescents (6) and adults (7). It included 12 sessions, on a weekly basis over 3 months. In vivo and imaginal exposures were conducted, during which patients face their fears for a prolonged period of time without ritualizing. Patients were asked to stop ritualizing after the first exposure session. The rationale provided to patients was that by experiencing exposure without rituals, anxiety decreases with time alone ("habituation") and through the realization that feared consequences do not occur. Although formal cognitive therapy procedures were not used, dysfunctional cognitions were discussed within the context of exposure (e.g., asking the patient, "Did you notice that your anxiety decreased without your ritualizing and nothing bad happened?"). As homework, patients were asked to record any rituals and spend at least 1 hour per day conducting self-guided exposures.

Stress Management Therapy

Stress management therapy followed procedures used by Lindsay et al. 1997 (8), including 12 weekly sessions over 3 months in which patients were taught stress management skills such as deep breathing, progressive muscle relaxation, positive imagery, assertiveness training, and problem solving. The rationale provided to patients was that life stressors can trigger OCD symptoms and that these stress management skills reduce stress and thereby reduce OCD symptoms. As homework, patients were asked to monitor daily stressors and practice the stress management skills for at least 1 hour each day.

In both conditions, family members were included at baseline, mid-treatment, and the end of therapy to help them understand the components of treatment and to support patients in treatment participation.

MRI Image Acquisition

Imaging data were collected on a 3.0 T General Electric (GE) 750 scanner at the fMRI Laboratory, University of Michigan. For functional data acquisition, a T2* weighted image with gradient echo reverse spiral acquisition was acquired for each of four runs of the incentive flanker task and the single run of the resting-state task (FOV=22cm, 43 slices, slice thickness=3.0 mm, TRs=239, TR length=2000 msec, TE=30msec, Matrix=64x64). A T1-weighted image (FOV=22cm, 43 slices, slice thickness=3.0 mm, Matrix=256x256) was acquired in the same prescription as the functional images to facilitate co-registration. A high-resolution T1 spoiled gradient recalled echo (SPGR) scan was obtained for anatomic normalization (FOV=25.6 cm, 156 slices, slice thickness=1.0 mm, Matrix=256x256).

Region of Interest (ROI) Selection

Resting-state functional connectivity seeds regions for the cingulo-opercular, frontoparietal, and default mode networks were based on peaks or sub-peaks of activation elicited during an incentive flanker task (IFT) performed by N=128 patients with OCD and N=64 non-patients. This task has been demonstrated to activate cingulo-opercular and frontoparietal regions and to deactivate default mode regions. We have previously reported how brain activation from the IFT predicts treatment response in a subset of the current sample (9). For generating these ROIs, task-based fMRI data from the IFT was collapsed across all participants, and a one-sample t-test was used to elicit the main effect of cognitive interference, correcting for family-wise error (FWE) at $p < 0.05$ for the voxelwise height and cluster thresholds (see Norman et al., 2021 (9) for task details). ROIs in the cingulo-opercular (i.e., supplementary motor area, dorsal anterior cingulate cortex, bilateral anterior insula) and frontoparietal (i.e., bilateral dorsolateral prefrontal cortex, left inferior parietal lobule, right postcentral gyrus) networks

emerged, based on peaks and subpeaks that elicited positive activations. Regions in the default mode network (ventromedial prefrontal cortex and posterior cingulate cortex) were based on peaks and subpeaks that elicited negative activation using a family-wise error (FWE) correction of $p < 0.05$ at the cluster level and a voxelwise height threshold of either $p < 0.05$ FWE corrected (ventromedial prefrontal cortex) or $p < 0.001$ uncorrected (posterior cingulate cortex).

Peaks/sub-peaks were not available for all striato-thalamic ROIs. Therefore striato-thalamic ROIs were based on coordinates from Di Martino et al., 2008 and Fitzgerald et al., 2011 (10, 11). A full list of regions and their corresponding coordinates are given in Table S3.

Resting-state Task

During the resting-state task, participants viewed a black screen with a central white cross hair. Participants were instructed to lie quietly and keep their eyes focused on the crosshairs without falling asleep. Resting state data were collected during a single 8-minute run.

Processing

Standard preprocessing steps were performed in SPM 12 (http://www.fil.ion.ucl.ac.uk/spm; Wellcome Trust Centre for Neuroimaging, University College London, UK), the Computational Anatomy Toolbox 12 (http://www.neuro.uni-jena.de/cat/index.html, Jena University Hospital, Jena, Germany) and using custom code. The raw data were slice-time corrected and rigidly realigned to the first image acquired. After realignment, the low-resolution T1 structural image was co-registered with the mean functional image. Following this, the high-resolution SPGR was co-registered to the (now co-registered to the functional image) low-resolution T1. The co-registered high-resolution SPGR was then segmented using the Computational Anatomy Toolbox 12 and normalized to Montreal Neurological Institute (MNI) space using high dimensional Diffeomorphic Anatomical

Registration through Exponentiated Lie algebra. The resulting warp field was then applied to the functional data to bring all subjects into common stereotactic space. Data were smoothed with a 6mm FWHM Gaussian kernel, and the removal of artifacts arising from head motion was performed on the smoothed functional time series using ICA-AROMA.

Following this, data underwent linear and quadratic detrending, regression of 24 parameter motion expansion (original 6 plus their derivatives, plus quadratics of each), CompCor (12, 13) to identify and remove the first 5 principal components of white matter and the first 5 of CSF, bandpass filtering from 0.1-0.01Hz, and motion scrubbing of frames that exceeded a framewise displacement of 0.5 mm using a framewise displacement lever arm of 50 mm. We included an over scrubbing threshold of 62% (14) (i.e., three minutes of usable data; mean number of minutes = 7.29, *SD* = 1.05, range 3.03 – 7.97). Adolescent participants had greater motion (mean framewise displacement = 0.17, *SD* = 0.10) than adult participants (mean framewise displacement = 0.14, *SD* = 0.07) collapsed across diagnostic groups, $t(177) = 2.399$, $p = 0.02$. There was no difference in motion between participants in the OCD (mean framewise displacement = 0.16, *SD* = 0.09) and healthy groups (mean framewise displacement = 0.15, *SD* = 0.08), $t(177) = 1.242$, $p = 0.22$.

Statistical Analyses

Assumptions for linear mixed effect models were checked using the 'predictmeans' package in R (15). No datapoints had a large Cook's distance (e.g., larger than the 50th percentile of an F distribution) (16).

Clinical Outcomes

Treatment response was examined using repeated measures linear mixed effects models with restricted maximum likelihood in the nlme package for R (17) All models included a

random intercept for participant to account for the nonindependence of observations at the subject level.

To compare treatment response between the ERP and SMT groups, we implemented the following syntax:

$Y\text{-}BOCS_{ij} \sim \mathbf{Tx_i*week_j}+age\text{-}group_i+medication_i+Sex_i+Tx_i+treatment\text{-}adherence_i+week_j$, (1 |subject)

The i subscript denotes subject, the j subscript denotes time-point, Tx denotes treatment group and models were adjusted for age group (adolescents, adults), medication status (on versus off medication), gender (male, female) and treatment adherence (mean of homework frequency and therapy principles across the 12 weeks of treatment). Subscripts were added here to aid interpretation of the reader. Week was included as a continuous variable. We aimed to predict change in OCD symptoms based on fMRI data collected prior to treatment. Individuals had 3 assessment points that were targeted to occur at baseline (week 1), mid-treatment (week 6) and end of treatment (week 12). While on average, assessments did occur for most people during these exact treatment weeks, as in all studies, there was some variability, which we were able to account for by coding time as the exact treatment week during week each assessment occurred for each person, instead of assuming that they occurred at the exact same time for all participants, as one would have to do with a repeated measures ANOVA. In other words, participant A may have completed the three assessments during weeks 1, 5, and 12, while participant B completed the assessments during weeks 1, 6, and 13. One of benefits of multilevel/linear-mixed models over ANOVAs is that they allow and account for this variability between individuals. The "1 | subject" term denotes the random intercept for subject. The interaction of interest is in **bold**.

To examine treatment response within each psychotherapy group separately, we used following model in ERP and SMT sub-group analyses where the focus was on week as a predictor of symptoms.

$Y\text{-}BOCS_{ij} \sim \mathbf{week_j}+age\text{-}group_i+medication_i+Sex_i+Tx_i+treatment\text{-}adherence_i+week_j$, (1 |subject)

To compare treatment response between the adolescent and adult sub-groups, we implemented the following syntax:

$Y\text{-}BOCS_{ij} \sim \mathbf{week_j*age\text{-}group_i}+medication_i+Sex_i+Tx_i+treatment\text{-}adherence_i+age\text{-}group_i+week_j$, (1 |subject)

To examine the effect of age on treatment response within each psychotherapy group separately, we used the following model in ERP and SMT sub-group analyses where the focus was on age group as a predictor of symptoms.

$Y\text{-}BOCS_{ij} \sim week_j+\mathbf{age\text{-}group_i}+medication_i+Sex_i+Tx_i+treatment\text{-}adherence_i+week_j$, (1 |subject)

fMRI Analyses

We were primarily interested in whether the relationship between treatment response and baseline resting-state connectivity changed according to psychotherapy type (ERP, SMT), as well as whether there were any associations common across treatment groups. We were secondarily interested in the effects of age. All analyses were performed using repeated measures linear mixed effects models which included a random intercept for patient to account for the nonindependence of observations. Each statistical model was performed for each row of the ROI-to-ROI connectivity matrix. Corrections for multiple comparisons were performed for the number of ROI-to-ROI connections (N=190) using the Benjamini-Hochberg false discovery rate (FDR) correction method.

Model one – Effects of baseline connectivity and psychotherapy group on Y-BOCS.

To examine whether any ROI-ROI connections were associated with treatment response as a function of psychotherapy group, we used the following nlme model:

$Y\text{-}BOCS_{ij} \sim \mathbf{week_j * baseline\text{-}connectivity_i * Tx_i} + age\text{-}group_i + motion_i + medication_i + Sex_i + Tx_i + treatment\text{-}adherence_i + baseline\text{-}connectivity_i + week_j, (1 | subject)$

The i subscript denotes subject, the j subscript denotes time-point, Tx denotes treatment group (ERP/SMT) and models were adjusted for age group (adolescents/adults), medication status (on/off medication), sex (male/female), motion (mean framewise displacement) and treatment adherence. Y-BOCS scores were treated as a repeated measures outcome, collected at the beginning, middle and end of treatment. Week was included as a continuous variable. The "1 | subject" term denotes the random intercept for subject. Plots were created using the sjplot package for R (18).

To establish which group was driving significant $\mathbf{week_j * baseline\text{-}connectivity_i * Tx_i}$ interactions, we examined the interaction of $\mathbf{week_j * baseline\text{-}connectivity_i}$ in the ERP and SMT sub-groups separately using the following model:

$Y\text{-}BOCS_{ij} \sim \mathbf{week_j * baseline\text{-}connectivity_i} + age\text{-}group_i + medication_i + sex_i + motion_i + treatment\text{-}adherence_i + baseline\text{-}connectivity_i + week_j, (1 | subject)$

If there was a significant $\mathbf{week_j * baseline\text{-}connectivity_i}$ interaction in either the ERP or SMT subgroups, we conducted simple slopes analyses to examine directionality. To this end, the effect of $\mathbf{week_j}$ on $Y\text{-}BOCS_{ij}$ was examined and "high" and "low" (+/- 1 SD above and below the mean) of $\mathbf{baseline\text{-}connectivity_i}$.

Model two – Effects of baseline connectivity on Y-BOCS in all subjects. To examine whether any ROI-to-ROI connections were associated with treatment response collapsing across psychotherapy and age groups, we used the following nlme model:

$Y\text{-}BOCS_{ij} \sim \mathbf{week_j * baseline\text{-}connectivity_i} + age\text{-}group_i + medication_i + sex_i + Tx_i + motion_i + treatment\text{-}adherence_i + baseline\text{-}connectivity_j + week_j, (1 | subject)$

Models three and four – Exploratory analyses on the effects of age. To examine whether any ROI-ROI connections were associated with treatment response as a function of age group, we used the following nlme model

$Y\text{-}BOCS_{ij} \sim \mathbf{week_j * baseline\text{-}connectivity_i * age\text{-}group_i} + medication_i + sex_i + motion_i + Tx_i + treatment\text{-}adherence_i + baseline\text{-}connectivity_i + age\text{-}group_i + week_j, (1 | subject)$

To establish which group was driving significant $\mathbf{week_j * baseline\text{-}connectivity_i * age\text{-}group_i}$ interactions, we examined the interaction of $\mathbf{week_j * baseline\text{-}connectivity_i}$ in the adolescent and adult sub-groups separately using the following model

$Y\text{-}BOCS_{ij} \sim \mathbf{week_j * baseline\text{-}connectivity_i} + Tx_i + medication_i + sex_i + motion_i + treatment\text{-}adherence_i + baseline\text{-}connectivity_i + week_j, (1 | subject)$

If there was a significant $\mathbf{week_j * baseline\text{-}connectivity_i}$ interaction in either the adolescent or adult subgroups, we conducted simple slopes analyses to examine directionality. To this end, the effect of $\mathbf{week_j}$ on $Y\text{-}BOCS_{ij}$ was examined and "high" and "low" (+/- 1 SD above and below the mean) of $\mathbf{baseline\text{-}connectivity_i}$.

Finally, to examine if there were any ROI-ROI connections that were associated with treatment response as a function of both age and psychotherapy group, we used the following model

$Y\text{-}BOCS_{ij} \sim \mathbf{week_j * baseline\text{-}connectivity_i * age\text{-}group_i * Tx_i} + medication_i + sex_i + motion_i + Tx_i + age\text{-}group_i + treatment\text{-}adherence_i + baseline\text{-}connectivity_j + week_j, (1 | subject)$

Analyses with the Healthy Control Group. In order to contextualize significant treatment associations from models 1-4, we examined differences in baseline ROI-ROI connectivity as a function of diagnostic group (OCD vs healthy), as well as age in the healthy control group (HC) using linear regression in R. Corrections for multiple comparisons were performed for the number of ROI-to-ROI connections (N=19) using the Benjamini-Hochberg false discovery rate (FDR) correction method.

To test for diagnostic group differences in baseline connectivity, we implemented the following lm model:

Baseline-connectivity ~ **diagnostic-group**+age-group+sex+motion

To examine potential interactions between age and diagnostic status, we used the following model:

Baseline-connectivity ~ **diagnostic-group*age-group**+diagnostic-group+age-group sex+motion

To examine the effect of age group (adult vs youth) on baseline ROI-ROI connectivity in the HC group, we used the following model:

Baseline-connectivity ~ **age-group**+sex+motion

Post-hoc analyses of Medication Status. To determine the effect of medication status in the OCD group on resting-state-symptom change associations, we added an interaction term of medication status to models 1-3 for the 19 ROI-ROI connections that initially emerged as significant treatment predictors, as follows:

Model 1: $Y\text{-}BOCS_{ij} \sim \mathbf{week_j * baseline\text{-}connectivity_i * Tx_i * medication} + age\text{-}group_i + motion_i$

$_i + Sex_i + Tx_i + treatment\text{-}adherence_i + baseline\text{-}connectivity_i + week_j, (1 | subject)$

Model 2: Y-BOCS$_{ij}$ ~ **week$_j$*baseline-connectivity$_i$*medication**+**Tx$_i$** age-group$_i$+motion$_i$ $_i$+Sex$_i$+Tx$_i$+treatment-adherence$_i$+baseline-connectivity$_i$+week$_j$, (1 |subject)

Model 3: Model 1: Y-BOCS$_{ij}$ ~ **week$_j$*baseline-connectivity$_i$ *medication*age-group$_i$**+Tx$_i$ + motion$_i$ $_i$+Sex$_i$+Tx$_i$+treatment-adherence$_i$+baseline-connectivity$_i$+week$_j$, (1 |subject)

Finally, we examined the effects of medication status in the OCD group on baseline resting-state functional connectivity of the 19 ROI-ROI connections that were significant predictors of treatment response using the following linear model:

Baseline-connectivity ~ **Medication**+age-group+sex+motion

Supplemental References

1. Scahill L, Riddle MA, McSwiggin-Hardin M, et al.: Children's Yale-Brown Obsessive Compulsive Scale: Reliability and validity. J Am Acad Child Adolesc Psychiatry 1997; 36:844–852
2. Goodman WK, Price LH, Rasmussen SA, et al.: The Yale-Brown Obsessive Compulsive Scale: II. Validity. Arch Gen Psychiatry 1989; 46:1012–1016
3. Hamilton M: The assessment of anxiety states by rating. Br J Med Psychol 1959; 50–55
4. Rush AJ, Trivedi MH, Ibrahim HM, et al.: The 16-item Quick Inventory of Depressive Symptomatology (QIDS), clinician rating (QIDS-C), and self-report (QIDS-SR): A psychometric evaluation in patients with chronic major depression. Biol Psychiatry 2003; 54:573–583
5. Guy W, Bonato R: CGI: Clinical Global Impressions. Chevy Chase, MD, National Institute of Mental Health, 1970
6. March J, Mulle K: OCD in Children and Adolescents: A Cognitive-Behavioral Treatment Manual. New York, Guilford Press, 1998
7. Foa E, Kozak M: Mastery of obsessive-compulsive disorder: A cognitive-behavioral approach therapist guide. Oxford University Press, 2004
8. Lindsay M, Crino R, Andrews G: Controlled trial of exposure and response prevention in obsessive- compulsive disorder. Br J Psychiatry 1997; 171:135–139
9. Norman LJ, Mannella KA, Yang H, et al.: Treatment-Specific Associations Between Brain Activation and Symptom Reduction in OCD Following CBT: A Randomized fMRI Trial. Am J Psychiatry 2021; 178:39–47
10. Di Martino A, Scheres A, Margulies DS, et al.: Functional connectivity of human

striatum: A resting state fMRI study. Cereb Cortex 2008; 18:2735–2747

11. Fitzgerald KD, Welsh RC, Stern ER, et al.: Developmental alterations of frontal-striatal-thalamic connectivity in obsessive-compulsive disorder. J Am Acad Child Adolesc Psychiatry 2011; 50

12. Behzadi Y, Restom K, Liau J, et al.: A component based noise correction method (CompCor) for BOLD and perfusion based fMRI. Neuroimage 2007; 37:90–101

13. Muschelli J, Nebel MB, Caffo BS, et al.: Reduction of motion-related artifacts in resting state fMRI using aCompCor. Neuroimage 2014; 96:22–35

14. Yan CG, Cheung B, Kelly C, et al.: A comprehensive assessment of regional variation in the impact of head micromovements on functional connectomics. Neuroimage 2013; 76:183–201

15. Luo D, Ganesh S, Maintainer JK: R Package "predictmeans", version 1.0.6._2022; https://CRAN.R-project.org/package=predictmeans

16. Bollen KA, Jackman RW: Regression diagnostics: An expository treatment of outliers and influential cases. Sociol Methods Res 1985; 13:510–542

17. Pinheiro J, Bates D, DebRoy S, et al.: nlme: Linear and Nonlinear Mixed Effects Models, R package version 3.1-160._2022; https://CRAN.Rproject. org/package=nlme

18. Lüdecke D: sjPlot: Data visualization for statistics in social science. R package version 2.8.11._2018; https://strengejacke.github.io/sjPlot/

Tables

Table S1.

Additional Clinical Characteristics of OCD and Healthy Control Groups

	ERP group				SMT group				Healthy Control Group				Group Comparisons					
	Adolescents (N=27)		Adults (N=31)		Adolescents (N=27)		Adults (N=31)		Adolescents (N=32)		Adults (N=31)		ERP v SMT		OCD Adolescents v Adults		OCD v HC	
Comorbidities[a]	N	%	N	%	N	%	N	%	N	%	N	%	χ^2	df	χ^2	df		
Anxiety	15	56	12	39	17	63	16	52		-			1.24	1	2.30	1	-	
Body-Focused	6	22	4	13	5	19	6	19		-			0.81	1	0.35	1	-	
Depression	3	11	1	3	3	11	1	3		-			0.00	1	2.80†	1	-	
Eating	0	0	0	0	1	4	0	0		-			1.00	1	1.16	1	-	
Tic	2	7	5	16	1	4	2	6		-			0.18	1	0.27	1	-	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	*t*	df	*t*	df	*T*	df
QIDS Score																		
Baseline	7.84	5.29	6.73	3.83	7.58	3.85	7.69	5.50	2.84	2.60	2.77	2.14	0.41	108	-0.57	108	7.72***	188
Mid-treatment	7.15	5.11	4.97	2.74	6.85	3.37	6.79	4.81		-			1.06	109	-1.15	109	-	
End of treatment	5.80	5.32	4.52	2.60	6.12	4.19	7.23	5.69		-			1.84†	108	-0.05	108	-	
GAD-7 Score										-							-	
Baseline	10.00	5.55	9.55	5.40	9.70	5.57	9.80	5.71	1.44	1.79	0.74	1.15	0.00	112	-0.17	112	-0.50	194
Mid-treatment	7.73	5.45	6.94	4.91	8.19	5.24	8.43	5.33		-			1.05	112	-0.30	112	-	
End of treatment	5.84	6.13	6.31	4.86	7.12	5.31	8.68	5.84		-			1.79†	108	0.99	108	-	
HAM-A Score										-							-	
Baseline	13.78	10.05	10.97	7.53	11.04	7.08	12.00	5.87		-			-0.50	114	-0.64	114	-	
Mid-treatment	10.52	9.25	9.48	7.73	10.22	8.26	12.13	6.43		-			0.87	114	0.30	114	-	
End of treatment	9.37	11.82	7.90	7.01	8.12	5.91	12.32	7.55		-			1.15	112	0.88	112	-	
CGI Severity										-							-	
Baseline	4.56	0.80	4.32	0.75	4.52	0.70	4.65	0.66		-			1.15	114	-0.39	114	-	
Mid-treatment	4.11	0.93	3.74	0.89	4.37	0.74	4.35	0.71		-			2.92**	114	-1.21	114	-	
End of treatment	3.07	1.36	2.77	0.94	3.77	0.99	4.16	0.93		-			5.35***	112	0.27	112	-	
CGI Improvement										-							-	
Mid-treatment	2.93	0.87	2.77	0.99	3.63	1.01	3.71	1.04		-			4.57***	114	-0.18	114	-	
End of treatment	1.96	1.19	1.73	0.94	3.08	1.23	3.58	1.12		-			7.14***	112	0.64	109	-	
CGAS/GAF Score										-							-	
Baseline	53.19	9.11	55.74	6.34	50.74	8.13	53.06	5.94	87.41	5.36	87.94	4.95	-1.86†	114	1.76†	114	-31.34***	202
End of treatment	67.52	14.90	69.90	10.35	60.15	12.61	56.52	7.33		-			-4.93***	112	-0.34	112	-	
WASI FSIQ-2	109.89	12.67	107.63	12.55	107.96	13.76	106.76	15.18	107.06	11.74	105.10	10.49	-0.54	109	-0.69	109	0.71	191
TARS Score	12.56	3.70	14.11	2.75	13.45	3.20	12.47	4.10		-			-0.71	114	0.45	114	-	

[a]Anxiety: Anxiety Disorder NOS (N=3), Generalized Anxiety Disorder (N=40), Panic Disorder with Agoraphobia (N=2), Panic Disorder Without Agoraphobia (N=5), Separation Anxiety Disorder (N=1), Social Phobia (N=28), Specific Phobia (N=8)
Body-Focused: Body Dysmorphic Disorder (N=1), Presence of grooming behaviors (e.g., hair pulling), yes or no (N=20). Formal grooming disorders were not assessed.
Depression: Depressive Disorder NOS (N=7), Dysthymic Disorder (N=1)
Eating: Eating Disorder NOS (N=1)
Tic: Presence of tics, yes or no (N=10). Formal tic disorders were not assessed.

† $p < 0.1$, *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. ERP, exposure and response prevention; CGAS, Children's Global Assessment Scale; CGI, Clinical Global Impressions; GAD-7, Generalized Anxiety Disorder-7; GAF, Global Assessment of Functioning; HAM-A, Hamilton Anxiety Rating Scale; HC, Healthy Control; SMT, stress management therapy; QIDS, Quick Inventory of Depressive Symptomology; TARS, Treatment Adherence Rating Scale; WASI FSIQ, Wechsler Abbreviated Scale of Intelligence Full Scale Intelligence Quotient.

Table S2.

Clinical outcomes of medicated vs unmedicated OCD patients.

	ERP group						SMT group					
	Unmedicated (N=26)		Medicated (N=32)		Comparison		Unmedicated (N=30)		Medicated (N=28)		Comparison	
Y-BOCS	M	SD	M	SD	*t*	*d*	M	SD	M	SD	*t*	*d*
Baseline	25.95	5.17	26.17	5.26	-0.44	-0.12	27.48	5.18	26.96	4.48	0.57	0.16
Mid-treatment	21.46	6.99	21.39	6.37	0.30	0.08	24.40	6.49	24.20	4.39	0.26	0.07
End of treatment	17.00	9.33	17.90	9.39	-0.67	-0.19	22.16	8.79	22.79	6.81	-0.52	-0.14

d = Cohen's d; ERP, exposure and response prevention; SMT, stress management therapy; Y-BOCS, Yale-Brown Obsessive Compulsive Scale (standard or children's version).

Table S3.

Regions of Interest for Resting-State Functional Connectivity Analyses

Network	Brain region	MNI coordinates (x y z)	Brodmann area	Source
Cingulo-opercular	Pre-SMA	-6 8 50	32	IFT
	dACC	6 23 35	24	IFT
	L anterior insula	36 23 35	47	IFT
	R anterior insula	-33 17 8	47	IFT
Fronto-parietal	L dlPFC	-45 5 29	44	IFT
	R dlPFC	42 8 29	44	IFT
	L inferior lobule	-48 -37 47	40	IFT
	R postcentral gyrus	45 -31 53	2	IFT
Default-mode	vmPFC	-6 62 -7	11	IFT
	Precuneus/PCC	-15 -55 17	31	IFT
Subcortical	L nucleus accumbens	-9 9 -8	NA	Di Martino et al. (2008)
	R nucleus accumbens	9 9 -8	NA	Di Martino et al. (2008)
	L caudate head	-13 15 9	NA	Di Martino et al. (2008)
	R caudate head	13 15 9	NA	Di Martino et al. (2008)
	L dorsal caudal putamen	-28 1 3	NA	Di Martino et al. (2008)
	R dorsal caudal putamen	28 1 3	NA	Di Martino et al. (2008)
	L ventral rostral putamen	-20 12 -3	NA	Di Martino et al. (2008)
	R ventral rostral putamen	20 12 -3	NA	Di Martino et al. (2008)
	L medial dorsal thalamus	-7.5, -13.5, 7.5	NA	Fitzgerald et al. (2011)
	R medial dorsal thalamus	7.5, -13.5, 7.5	NA	Fitzgerald et al. (2011)

dACC: dorsal anterior cingulate cortex; dlPFC: dorsolateral prefrontal cortex; IFT: incentive flanker task; L: left; MNI: Montreal Neurological Institute; PCC: posterior cingulate cortex; R: right; SMA: supplementary motor area; vmPFC: ventromedial prefrontal cortex.

Table S4

Model 2. Linear mixed model examining ROI-ROI connections associated with treatment response over time in both age and psychotherapy groups.

ROI-ROI connection	Fixed Effects	*B*	SE	df	*t*	AIC interaction model	AIC main effects model
Pre-SMA – R dlPFC	Week	-0.42***	0.09	228	-4.53	2193.25	2202.35
	rsFC	2.01	2.71	108	0.74		
	Tx	5.51***	0.97	108	5.68		
	Meds	0.40	0.98	108	0.40		
	Sex	1.45	1.03	108	1.41		
	Motion	-1.11	5.41	108	-0.21		
	Age-Group	1.39	1.00	108	1.39		
	TARS	-0.52***	0.14	108	-3.61		
	Week*rsFC	**-0.82***	**0.23**	**228**	**-3.53**		
Pre-SMA – L IPL	Week	-0.41***	0.09	228	-4.73	2192.35	2203.21
	rsFC	2.75	2.54	108	1.08		
	Tx	5.62***	0.97	108	5.52		
	Meds	0.24	0.98	108	0.25		
	Sex	1.58	1.05	108	1.51		
	Motion	-0.72	5.59	108	-0.13		
	Age-Group	1.35	1.00	108	1.34		
	TARS	-0.48**	0.14	108	-3.35		
	Week*rsFC	**-0.82***	**0.22**	**228**	**-3.81**		
dACC – R aIns	Week	-0.52***	0.07	228	-7.16	2197.84	2203.89
	rsFC	1.95	2.10	108	0.93		
	Tx	5.56***	0.97	108	5.72		
	Meds	0.33	0.97	108	0.33		
	Sex	1.50	1.04	108	1.45		
	Motion	-1.69	5.38	108	-0.31		
	Age-Group	1.29	1.00	108	1.28		
	TARS	-0.50***	0.14	108	-3.54		
	Week*rsFC	**-0.57***	**0.18**	**228**	**-3.13**		
Pre-SMA – R aIns	Week	-0.65***	0.05	228	-12.30	2197.52	2204.08
	rsFC	2.85	2.34	108	1.22		
	Tx	5.64***	0.97	108	5.82		
	Meds	0.32	0.98	108	0.33		
	Sex	1.43	1.04	108	1.39		
	Motion	-1.99	5.39	108	-0.37		
	Age-Group	1.26	1.01	108	1.26		
	TARS	-0.50***	0.14	108	-3.50		
	Week*rsFC	**-0.66***	**0.21**	**228**	**-3.17**		
dACC – R dPut	Week	-0.36***	2.61	228	-3.78	2190.38	2202.77
	rsFC	3.16	0.10	108	1.12		
	Tx	5.50***	2.83	108	5.64		
	Meds	0.20	0.97	108	0.21		

	Sex	1.33	1.03	108	1.28		
	Motion	-1.34	5.42	108	-0.25		
	Age-Group	1.34	1.01	108	1.33		
	TARS	-0.47**	0.15	108	-3.25		
	Week*rsFC	**-0.95****	**0.24**	**228**	**-3.99**		
R aIns – R dPut	Week	-0.58***	0.06	228	-9.63	2191.78	2201.12
	rsFC	1.39	3.19	108	0.44		
	Tx	5.48***	0.96	108	5.59		
	Meds	0.48	0.98	108	0.49		
	Sex	1.40	1.03	108	1.36		
	Motion	0.21	5.53	108	0.04		
	Age-Group	1.26	1.00	108	1.26		
	TARS	-0.49*	0.14	108	-3.47		
	Week*rsFC	**-0.96***	**0.27**	**228**	**-3.52**		
L dlPFC – R vPut	Week	-0.52***	0.07	228	-7.67	2193.51	2203.6
	rsFC	5.12	3.27	108	1.57		
	Tx	5.64***	0.99	108	5.72		
	Meds	0.24	0.99	108	0.25		
	Sex	1.33	1.06	108	1.26		
	Motion	-1.98	5.12	108	-0.36		
	Age-Group	1.25	1.01	108	1.23		
	TARS	-0.50***	0.14	108	-3.45		
	Week*rsFC	**-0.99***	**0.27**	**228**	**-3.63**		
L vPut– L caudate	Week	-0.25*	0.12	228	-2.10	2188.61	2200.93
	rsFC	1.64	2.66	108	0.61		
	Tx	5.45***	0.96	108	5.69		
	Meds	0.10	0.97	108	0.10		
	Sex	1.58	1.03	108	1.53		
	Motion	-1.55	5.30	108	-0.29		
	Age-Group	1.29	0.14	108	1.30		
	TARS	-0.49***	0.99	108	-3.42		
	Week*rsFC	**-0.92****	**0.23**	**228**	**-3.99**		

*$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ FDR-corrected for comparison of 190 ROI-ROI connections. The Akaike information criterion (AIC) shows the improvement in model fit by adding the interaction of interest (bolded) to the model. aIns: anterior insula; dACC: dorsal anterior cingulate cortex; dlPFC: dorsolateral prefrontal cortex; dPut: dorsal caudal putamen; IPL: inferior parietal lobule; L: left; R: right; ROI: region of interest; rsFC: resting-state functional connectivity at baseline; SMA: supplementary motor area; TARS, Treatment Adherence Rating Scale; Tx: treatment; vPutamen: ventral rostral putamen.

Table S5.

Model 3. Linear mixed model examining ROI-ROI connections associated with treatment response over time as a function of Age-Group.

ROI-ROI connection	Group	Fixed Effects	*B*	SE	df	*t*	AIC full model	AIC 2-way interaction model
R dlPFC – R NAc		Week	-0.66***	0.07	226	-9.68	2191.81	2202.99
		rsFC	-2.52	5.17	107	-0.49		
		Age-Group	2.21	1.19	107	1.86		
		Tx	6.00***	0.96	107	5.86		
		Meds	0.21	0.99	107	0.21		
		Sex	1.59	1.04	107	1.53		
		Motion	-3.71	5.42	107	-068		
		TARS	-0.49**	0.14	107	-3.44		
		Week*rsFC	1.34†	0.46	226	2.95		
		Week*Age-Group	-0.11	0.10	226	-1.13		
		rsFC*Age-Group	11.43	7.49	107	1.53		
		Week*rsFC*Age-Group	**-2.37***	**0.67**	**226**	**-3.52**		
	Adolescents	Week*rsFC	-1.04[m]	0.52	105	-1.98		
		1 SD above rsFC	-0.92[c]	0.11	105	-8.18		
		1 SD below rsFC	-0.62[c]	0.11	105	-5.80		
	Adults	Week*rsFC	1.34[b]	0.43	121	3.08		
		1 SD above rsFC	-0.49[c]	0.08	232	-6.07		
		1 SD below rsFC	-0.87[c]	0.10	121	-8.83		
L IPL – R NAc		Week	-0.70***	0.07	226	-9.78	2193.75	2205.62
		rsFC	-7.46	4.66	107	-1.60		
		Age-Group	1.69	1.21	107	1.40		
		Tx	5.66***	0.96	107	5.86		
		Meds	0.31	0.99	107	0.31		
		Sex	1.36	1.04	107	1.31		
		Motion	-2.33	5.36	107	-0.44		
		TARS	-0.51**	0.15	107	-3.46		

		Week*rsFC	1.12†	0.41	226	2.75		
		Week*Age-Group	-0.08	0.10	226	-0.78		
		rsFC*Age-Group	12.84	7.12	107	1.80		
		Week*rsFC*Age-Group	**-2.29***	**0.63**	**226**	**-3.64**		
	Adolescents	Week*rsFC	-1.16[a]	0.50	105	-2.32		
		1 SD above rsFC	-0.96[c]	0.12	105	-8.16		
		1 SD below rsFC	-0.62[c]	0.10	105	-6.28		
	Adults	Week*rsFC	1.12[b]	0.39	121	2.87		
		1 SD above rsFC	-0.51[c]	0.08	121	-6.52		
		1 SD below rsFC	-0.86[c]	0.10	121	-8.48		
R postcentral gyrus – L NAc		Week	-0.68***	0.07	226	-9.93	2201.31	2188.92
		rsFC	-3.51	5.17	107	-0.68		
		Age-Group	2.14	1.20	107	1.79		
		Tx	5.76***	0.97	107	5.93		
		Meds	0.01	0.99	107	0.01		
		Sex	1.66	1.04	107	1.59		
		Motion	-3.13	5.37	107	-0.58		
		TARS	-0.51**	0.15	107	-3.48		
		Week*rsFC	1.64*	0.45	226	3.64		
		Week*Age-Group	-0.10	0.10	226	-0.95		
		rsFC*Age-Group	8.06	7.72	107	1.04		
		Week*rsFC*Age-Group	**-2.42***	**0.67**	**226**	**-3.60**		
	Adolescents	Week*rsFC	-0.78	0.53	105	-1.46		
	Adults	Week*rsFC	1.64[c]	0.42	121	3.88		
		1 SD above rsFC	-0.52[c]	0.07	121	-7.38		
		1 SD below rsFC	-0.93[c]	0.10	121	-9.46		
R postcentral gyrus – R NAc	Main model	Week	-0.68***	0.07	226	-10.07	2182.93	2203.87
		rsFC	-6.30	5.07	107	-1.24		
		Age-Group	2.18	1.20	107	1.82		
		Tx	5.65***	0.96	107	5.88		
		Meds	0.11	1.02	107	0.11		
		Sex	1.48	1.04	107	1.42		
		Motion	-3.09	5.43	107	-0.56		

		TARS	-0.50**	0.15	107	-3.39		
		Week*rsFC	1.55*	0.42	226	3.66		
		Week*Age-Group	-1.13	0.10	226	-1.26		
		rsFC*Age-Group	16.66	8.24	107	2.02		
		Week*rsFC*Age-Group	**-3.31*** **	**0.69**	**226**	**-4.78**		
	Adolescents	Week*rsFC	-1.76[b]	0.58	105	-3.05		
		1 SD above rsFC	-1.04[c]	0.12	105	-8.66		
		1 SD below rsFC	-0.57[c]	0.10	105	-5.79		
	Adults	Week*rsFC	1.55[c]	0.40	121	3.83		
		1 SD above rsFC	-0.44[c]	0.08	121	-5.31		
		1 SD below rsFC	-0.92[c]	0.10	121	-9.48		
R postcentral gyrus – L IPL	Main model	Week	-0.71	0.07	226	-10.28	2181.68	2196.31
		rsFC	1.89	2.87	107	0.66		
		Age-Group	1.82	1.15	107	1.58		
		Tx	5.74***	0.92	107	6.26		
		Meds	0.32	0.95	107	0.34		
		Sex	1.72	1.00	107	1.72		
		Motion	-4.84	5.37	107	-0.90		
		TARS	-0.47**	0.14	107	-3.38		
		Week*rsFC	-1.11**	0.26	226	-4.24		
		Week*Age-Group	-0.08**	0.10	226	-0.80		
		rsFC*Age-Group	1.13	4.38	107	0.26		
		Week*rsFC*Age-Group	**1.65****	**0.40**	**226**	**4.13**		
	Adolescents	Week*rsFC	0.54	0.32	105	1.67		
	Adults	Week*rsFC	-1.11[c]	0.24	121	-4.56		
		1 SD above rsFC	-1.00[c]	0.10	121	-9.96		
		1 SD below rsFC	-0.42[c]	0.08	121	-5.29		
L IPL - R dPut		Week	-0.64***	0.07	226	-9.41	2194.41	2202.59
		rsFC	6.86	4.46	107	1.54		
		Age-Group	1.98	1.18	107	1.68		
		Tx	5.88***	0.98	107	6.01		
		Meds	0.41	0.98	107	0.42		
		Sex	1.35	1.05	107	1.29		

		Motion	-3.05	5.52	107	-0.55		
		TARS	-0.49**	0.14	107	-3.44		
		Week*rsFC	-1.21*	0.38	226	-3.21		
		Week*Age-Group	-0.12	0.10	226	-1.15		
		rsFC*Age-Group	-5.09	6.45	107	-0.79		
		Week*rsFC*Age-Group	**1.76***	**0.57**	**226**	**3.10**		
	Adolescents	Week*rsFC	0.55	0.45	105	1.23		
	Adults	Week*rsFC	-1.21[c]	0.35	121	-3.40		
		1 SD above rsFC	-0.65[c]	0.06	121	-10.09		
		1 SD below rsFC	-0.43[c]	0.09	121	-4.75		
L aIns - L Caudate		Week	-0.61***	0.07	226	-8.91	2197.74	2207.33
		rsFC	-6.51	3.77	107	-1.73		
		Age-Group	2.04	1.19	107	1.72		
		Tx	5.73***	0.97	107	5.93		
		Meds	0.32	0.99	107	0.32		
		Sex	1.36	1.04	107	1.31		
		Motion	-1.70	5.68	107	-0.30		
		TARS	-0.50**	0.15	107	-3.36		
		Week*rsFC	0.87	0.34	226	2.53		
		Week*Age-Group	-0.12	0.10	226	-1.20		
		rsFC*Age-Group	10.30	5.37	107	1.92		
		Week*rsFC*Age-Group	**-1.60***	**0.47**	**226**	**-3.38**		
	Adolescents	Week*rsFC	-0.73[a]	0.34	105	-2.14		
		1 SD above rsFC	-0.73[c]	0.08	105	-9.38		
		1 SD below rsFC	-0.56[c]	0.12	105	-4.83		
	Adults	Week*rsFC	0.86[b]	0.33	121	2.64		
		1 SD above rsFC	-0.63[c]	0.06	121	-9.69		
		1 SD below rsFC	-0.79[c]	0.09	121	-9.03		
L aIns – R Caudate		Week	-0.61**	2.63	226	-8.75	2194.67	2203.53
		rsFC	-6.35	4.02	107	-1.58		
		Age-Group	2.14	1.19	107	1.80		
		Tx	5.75***	0.98	107	5.89		
		Meds	0.22	1.00	107	0.22		

		Sex	1.39	1.04	107	1.34		
		Motion	-1.90	5.52	107	-0.34		
		TARS	-0.50**	0.15	107	-3.38		
		Week*rsFC	1.26	0.35	226	3.56		
		Week*Age-Group	-0.14	0.10	226	-1.41		
		rsFC*Age-Group	7.87	6.05	107	1.30		
		Week*rsFC*Age-Group	**-1.68***	**0.52**	**226**	**-3.24**		
	Adolescents	Week*rsFC	-0.42	0.41	105	-1.04		
	Adults	Week*rsFC	1.26[c]	0.33	121	3.80		
		1 SD above rsFC	-0.63[c]	0.06	121	-9.99		
		1 SD below rsFC	-0.85[c]	0.08	121	-10.10		
L caudate - R caudate		Week	-0.63**	0.07	226	-9.44	2190.60	2198.93
		rsFC	1.32	3.79	107	0.35		
		Age-Group	2.03	1.16	107	1.75		
		Tx	5.83***	0.95	107	3.13		
		Meds	0.32	0.97	107	0.33		
		Sex	1.44	1.02	107	1.40		
		Motion	-1.17	5.31	107	-0.22		
		TARS	-0.50**	0.14	107	-3.51		
		Week*rsFC	0.30	0.33	226	0.90		
		Week*Age-Group	-0.13	0.10	226	-1.32		
		rsFC*Age-Group	0.13	5.08	107	0.02		
		Week*rsFC*Age-Group	**-1.45***	**0.45**	**226**	**-3.20**		
	Adolescents	Week*rsFC	-1.15[c]	0.31	105	-3.70		
		1 SD above rsFC	-1.05[c]	0.11	105	-9.67		
		1 SD below rsFC	-0.49[c]	0.10	105	-4.83		
	Adults	Week*rsFC	0.30	0.33	121	0.92		

† $p < 0.1$, *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ FDR-corrected for comparison of 190 ROI-ROI connections. [m]$p < 0.10$, [a]$p < 0.05$, [b]$p < 0.01$, [c]$p < 0.001$ uncorrected for multiple comparisons. The Akaike information criterion (AIC) shows the improvement in model fit by adding the interaction of interest (bolded) to the model. For significant three-way interactions of week by baseline rsFC by age group, post-hoc analyses (shaded, not FDR-corrected for multiple comparisons) are presented of the interaction of week by baseline rsFC in each age group separately, as well as the simple slopes for +/- 1 SD from the mean of baseline rsFC. aIns: anterior insula; dlPFC: dorsolateral prefrontal cortex; dPut: dorsal caudal putamen; IPL: inferior parietal lobule; L: left; NAc, nucleus accumbens; R:

right; ROI: region of interest; rsFC: resting-state functional connectivity at baseline; TARS: Treatment Adherence Rating Scale; Tx: treatment.

Table S6.

Differences in baseline connectivity between the OCD and Healthy Control Group

Post-hoc test for linear mixed model	ROI-ROI connection	Fixed Effects	*B*	SE	*t*
Model 1 *Tx-Group*Week*rsFC*	vmPFC – L caudate	Diagnosis Age-Group Sex Motion Diagnosis*Age-group	-0.03 -0.05 0.03 0.30 0.03	0.04 0.05 0.03 0.16 0.06	-0.96 -1.09 1.23 1.87 0.54
Model 1 *Tx-Group*Week*rsFC*	vmPFC – L mdThal	Diagnosis Age-Group Sex Motion Diagnosis*Age-group	0.10† 0.01 -0.01 0.05 -0.08	0.04 0.05 0.03 0.17 0.06	2.30 0.22 -0.21 0.31 -1.34
Model 2 *Week*rsFC*	Pre-SMA – R dlPFC	Diagnosis Age-Group Sex Motion Diagnosis*Age-group	-0.04 -0.06 0.01 0.42† 0.09	0.05 0.05 0.03 0.19 0.06	-0.88 -1.03 0.42 2.22 1.41
Model 2 *Week*rsFC*	Pre-SMA – L IPL	Diagnosis Age-Group Sex Motion Diagnosis*Age-group	-0.004 -0.03 0.002 0.74** 0.04	0.05 0.06 0.03 0.20 0.07	-0.09 -0.55 0.07 3.79 0.54
Model 2 *Week*rsFC*	dACC – R insula	Diagnosis Age-Group Sex Motion Diagnosis*Age-group	-0.04 0.02 0.04 0.27 -0.01	0.06 0.07 0.04 0.25 0.09	-0.59 0.22 0.95 1.08 -0.06
Model 2 *Week*rsFC*	Pre-SMA – R aIns	Diagnosis Age-Group Sex Motion Diagnosis*Age-group	0.04 0.06 -0.01 0.37 -0.08	0.05 0.06 0.04 0.21 0.07	0.75 1.01 -0.19 1.64 -1.00
Model 2 *Week*rsFC*	dACC – R dPut	Diagnosis Age-Group Sex Motion	0.03 0.02 -0.06 0.31	0.04 0.05 0.03 0.17	0.78 0.48 -1.98 1.86

		Diagnosis*Age-group	-0.01	0.06	-0.11
Model 2 *Week*rsFC*	R aIns – R dPut	Diagnosis	0.01	0.04	0.16
		Age-Group	0.08	0.05	1.76
		Sex	-0.01	0.03	-0.62
		Motion	0.47*	0.16	3.01
		Diagnosis*Age-group	-0.08	0.06	-1.42
Model 2 *Week*rsFC*	L dlPFC – R vPut	Diagnosis	-0.01	0.04	-0.22
		Age-Group	-0.01	0.05	-0.21
		Sex	-0.04	0.03	-1.40
		Motion	0.42*	0.16	2.66
		Diagnosis*Age-group	-0.02	0.06	-0.35
Model 2 *Week*rsFC*	L vPut– L caudate	Diagnosis	-0.002	0.05	-0.5
		Age-Group	0.02	0.05	0.32
		Sex	0.03	0.03	0.80
		Motion	0.30	0.18	1.64
		Diagnosis*Age-group	-0.03	0.06	-0.49
Model 3 *Age-Group*Week*rsFC*	R dlPFC – R NAc	Diagnosis	0.03	0.04	0.65
		Age-Group	-0.04	0.04	-1.02
		Sex	-0.02	0.02	-0.82
		Motion	-0.10	0.14	0.71
		Diagnosis*Age-group	0.0002	0.05	0.004
Model 3 *Age-Group*Week*rsFC*	L IPL – R NAc	Diagnosis	0.01	0.04	0.18
		Age-Group	-0.02	0.04	-0.59
		Sex	-0.02	0.03	-0.80
		Motion	-0.06	0.15	-0.43
		Diagnosis*Age-group	-0.04	0.05	-086
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus – L NAc	Diagnosis	0.02	0.03	0.70
		Age-Group	0.03	0.04	0.86
		Sex	-0.02	0.02	-0.87
		Motion	0.18	0.14	1.33
		Diagnosis*Age-group	-0.09	0.05	-1.79
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus - R NAc	Diagnosis	0.01	0.03	0.33
		Age-Group	0.02	0.04	0.51
		Sex	-0.01	0.02	-0.24
		Motion	0.22	0.13	1.65
		Diagnosis*Age-group	-0.08	0.05	-1.70
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus –	Diagnosis	-0.02	0.06	-0.41
		Age-Group	0.05	0.07	0.77

	L IPL	Sex	-0.03	0.04	-0.73
		Motion	0.69	0.022	1.70
		Diagnosis*Age-group	0.04	0.08	0.53
Model 3 *Age-Group*Week*rsFC*	L IPL – R dPut	Diagnosis	0.04	0.04	0.95
		Age-Group	0.04	0.04	0.88
		Sex	-0.04	0.03	-1.42
		Motion	0.62***	0.15	4.16
		Diagnosis*Age-group	-0.06	0.05	-1.20
Model 3 *Age-Group*Week*rsFC*	L aIns – L caudate	Diagnosis	-0.02	0.05	-0.53
		Age-Group	-0.04	0.05	-0.77
		Sex	0.01	0.03	0.18
		Motion	0.50*	0.18	2.73
		Diagnosis*Age-group	0.08	0.07	1.30
Model 3 *Age-Group*Week*rsFC*	L aIns – R caudate	Diagnosis	-0.02	0.04	-0.54
		Age-Group	-0.01	0.05	-0.20
		Sex	0.01	0.03	0.36
		Motion	0.17	0.17	1.02
		Diagnosis*Age-group	0.07	0.07	1.14
Model 3 *Age-Group*Week*rsFC*	L caudate – R caudate	Diagnosis	-0.04	0.05	-0.86
		Age-Group	0.06	0.05	0.11
		Sex	-0.04	0.03	-1.13
		Motion	0.31	0.19	1.64
		Diagnosis*Age-group	-0.03	0.07	-0.50

† $p < 0.1$, *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ FDR-corrected for comparison of 19 ROI-ROI connections which were significant predictors of treatment response in OCD patients. All models had 173 degrees of freedom. dACC, dorsal anterior cingulate cortex; dlPFC, dorsolateral prefrontal cortex; dPut; dorsal caudal putamen; Ins, anterior insula; IPL: inferior parietal lobule; L, left; md Thal, medial dorsal thalamus; NAc; nucleus accubens; R, right; ROI, region of interest; rsFC: resting-state functional connectivity; SMA, supplementary motor area; Tx, treatment; vmPFC, ventromedial prefrontal cortex; vPut, ventral rostral putamen

Table S7.

Differences in baseline connectivity between adult and adolescent healthy control participants

Post-hoc test for linear model	ROI-ROI connection	Fixed Effect	*B*	SE	*t*
Model 3 *Age-Group*Week*rsFC*	R dlPFC – R NAc	Age-Group	-0.03	0.04	-0.74
		Sex	0.01	0.04	0.33
		Motion	-0.32	0.28	-1.14
Model 3 *Age-Group*Week*rsFC*	L IPL – R NAc	Age-Group	-0.19	0.04	-0.45
		Sex	-0.02	0.04	-0.39
		Motion	-0.29	0.28	-1.03
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus – L NAc	Age-Group	-0.02	-0.04	0.53
		Sex	0.04	0.04	0.88
		Motion	-0.32	0.28	1.23
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus – R NAc	Age-Group	0.02	0.04	0.40
		Sex	0.04	0.04	0.90
		Motion	0.32	0.27	1.12
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus – L IPL	Age-Group	0.07	0.07	0.96
		Sex	-0.04	0.07	-0.50
		Motion	-0.26	0.45	-0.56
Model 3 *Age-Group*Week*rsFC*	L IPL – R dPut	Age-Group	0.03	0.04	0.77
		Sex	-0.04	0.05	-0.83
		Motion	0.79	0.29	2.74
Model 3 *Age-Group*Week*rsFC*	L aIns – L caudate	Age-Group	-0.03	0.05	-0.55
		Sex	0.02	0.05	0.47
		Motion	-0.02	0.33	-0.05
Model 3 *Age-Group*Week*rsFC*	L aIns – R caudate	Age-Group	0.01	0.05	-0.15
		Sex	0.04	0.05	0.81
		Motion	0.05	(0.32	0.17
Model 3 *Age-Group*Week*rsFC*	L caudate – R caudate	Age-Group	-0.002	0.05	-0.04
		Sex	-0.02	0.05	-0.29
		Motion	-0.61	0.34	1.78

† $p < 0.1$, *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ FDR-corrected for comparison of 9 ROI-ROI connections which had significant interactions with age in analyses of OCD treatment response. All models had 59 degrees of freedom. dACC, dorsal anterior cingulate cortex; dlPFC, dorsolateral prefrontal cortex; dPut; dorsal caudal putamen; Ins, anterior insula; IPL: inferior parietal lobule; L, left; NAc; nucleus accubens; R, right; rsFC: resting-state functional connectivity; ROI, region of interest.

Table S8.

Differences in neural predictors of symptom change as a function of medication status

Post-hoc test for linear mixed model	ROI-ROI connection	Group	Fixed Effects	*B*	SE	df	*t*	AIC original model	AIC meds interaction model
Model 1	vmPFC –		Week	-1.22***	0.12	222	-9.91	2143.79	2149.41
*Tx-Group*Week*rsFC*	L caudate		rsFC	-0.77	5.25	104	-0.15		
			Tx	0.39	2.27	104	0.18		
			Meds	1.73	2.26	104	0.77		
			Sex	1.88†	1.07	104	1.76		
			Motion	-3.59	5.54	104	-0.65		
			Age-Group	1.33	1.01	104	1.31		
			TARS	-0.50***	0.14	104	-3.45		
			Week*rsFC	0.94*	0.43	222	2.16		
			Week*Tx	1.17***	0.18	222	6.54		
			rsFC*Tx	8.42	8.00	104	1.05		
			Week*Meds	0.13*	0.18	222	0.72		
			rsFC*Meds	-7.40	8.20	104	-0.91		
			Tx*Meds	0.32	3.21	104	1.00		
			Week*rsFC*Tx	-2.71***	0.65	222	-4.16		
			Week*rsFC*Meds	-0.44	0.67	222	-0.67		
			Week*Tx*Meds	-0.37	0.26	222	-1.42		
			rsFC*Tx*Meds	-5.92	11.88	104	-0.50		
			Week*rsFC*Tx*Meds	**1.85†**	**0.96**	**122**	**1.91**		
		Meds N	Week*rsFC*Tx	-6.13[c]	5.06	107	-1.21		
		ERP	Week*rsFC	0.94[a]	0.39	49	2.43		
			1 SD above rsFC	-1.01[c]	0.09	49	-11.80		
			1 SD below rsFC	-1.43[c]	0.18	49	-8.10		
		SMT	Week*rsFC	-1.77[b]	0.54	57	-3.67		
			1 SD above rsFC	-0.36[c]	0.10	57	-3.59		
			1 SD below rsFC	0.28	0.23	57	1.22		

		Meds Y	Week*rsFC*Tx	-0.86	0.71	116	-1.22		
Model 1	vmPFC –		Week	-1.14***	0.12	222	-9.76	2140.86	2147.62
*Tx-Group*Week*rsFC*	L mdThal		rsFC	1.29	4.91	104	0.26		
			Tx	0.92	2.12	104	0.43		
			Meds	1.25	2.38	104	0.52		
			Sex	1.60	1.11	104	1.44		
			Motion	-1.92	5.54	104	-0.35		
			Age-Group	1.15	1.05	104	1.09		
			TARS	-0.47**	0.14	104	-3.13		
			Week*rsFC	0.48	0.39	222	1.23		
			Week*Tx	1.11***	0.17	222	6.52		
			rsFC*Tx	5.03	6.90	104	0.73		
			Week*Meds	-0.15	0.19	222	-0.78		
			rsFC*Meds	-4.83	8.83	104	-0.55		
			Tx*Meds	0.72	3.31	104	0.22		
			Week*rsFC*Tx	-2.13***	0.56	222	-3.83		
			Week*rsFC*Meds	0.84	0.68	222	1.23		
			Week*Tx*Meds	-0.16	0.30	222	-0.61		
			rsFC*Tx*Meds	-6.53	11.77	104	-0.56		
			Week*rsFC*Tx*Meds	0.87	0.95	122	0.91		
Model 2	Pre-SMA –		Week	-0.46***	0.12	226	-3.66	2193.25	2196.27
*Week*rsFC*	R dlPFC		rsFC	2.69	3.77	107	0.71		
			Meds	0.44	2.14	107	0.20		
			Tx	5.47***	0.98	107	5.59		
			Sex	1.49	1.04	107	1.43		
			Motion	-1.30	5.46	107	-0.24		
			TARS	1.35***	1.01	107	1.34		
			Age-Group	-0.51	0.14	107	-3.58		
			Week*rsFC	-0.80*	0.33	226	-2.43		
			Week*Meds	0.09	0.19	226	0.47		
			rsFC*Meds	-1.24	5.39	107	-0.23		
			Week*rsFC*Meds	-0.08	0.47	226	-0.16		
Model 2	Pre-SMA –		Week	-0.50***	0.12	226	-4.11	2192.35	2193.32

*Week*rsFC*	L IPL	rsFC	3.37	3.22	107	1.05		
		Meds	0.72	2.01	107	0.36		
		Tx	5.49***	0.97	107	5.66		
		Sex	1.57	1.04	107	1.51		
		Motion	-1.15	5.58	107	-0.21		
		TARS	1.30**	1.00	107	1.29		
		Age-Group	-0.47	0.14	107	-3.28		
		Week*rsFC	-0.60*	0.28	226	-2.14		
		Week*Meds	0.19	0.18	226	1.06		
		rsFC*Meds	-1.48	4.96	107	-0.30		
		Week*rsFC*Meds	-0.55	0.44	226	-1.25		
Model 2	dACC –	Week	-0.59***	0.11	226	-5.44	2197.84	2201.55
*Week*rsFC*	R aIns	rsFC	0.63	3.28	107	0.19		
		Meds	-0.52	1.69	107	-0.31		
		Tx	5.56***	0.98	107	5.70		
		Sex	1.51	1.04	107	1.45		
		Motion	-1.57	5.49	107	-0.29		
		TARS	1.28***	1.01	107	1.27		
		Age-Group	-0.50	0.15	107	-3.41		
		Week*rsFC	-0.40	0.28	226	-1.41		
		Week*Meds	0.12	0.15	226	0.80		
		rsFC*Meds	2.27	4.28	107	0.53		
		Week*rsFC*Meds	-0.30	0.37	226	-0.81		
Model 2	Pre-SMA –	Week	-0.65***	0.08	226	-8.69	2197.52	2200.87
*Week*rsFC*	R aIns	rsFC	3.60	3.54	107	1.02		
		Meds	0.21	1.20	107	0.17		
		Tx	5.64***	0.97	107	5.78		
		Sex	1.45	1.05	107	1.39		
		Motion	-1.97	5.42	107	-0.36		
		TARS	1.25***	1.01	107	1.24		
		Age-Group	-0.50	0.15	107	-3.40		
		Week*rsFC	-0.83*	0.31	226	-2.71		
		Week*Meds	0.01	0.11	226	0.12		

		rsFC*Meds	-1.38	4.73	107	-0.29		
		Week*rsFC*Meds	0.32	0.42	226	0.76		
Model 2	dACC –	Week	-0.41**	0.14	226	-3.03	2190.38	2193.43
*Week*rsFC*	R dPut	rsFC	2.35	3.71	107	0.63		
		Meds	-0.42	2.25	107	-0.19		
		Tx	5.50***	0.98	107	5.60		
		Sex	1.33	1.04	107	1.27		
		Motion	-1.35	5.47	107	-0.25		
		TARS	1.34**	1.02	107	1.32		
		Age-Group	-0.47	0.15	107	-3.23		
		Week*rsFC	-0.81*	0.32	226	-2.58		
		Week*Meds	0.10	0.19	226	0.54		
		rsFC*Meds	1.90	5.50	107	0.35		
		Week*rsFC*Meds	-0.32	0.48	226	-0.66		
Model 2	R aIns –	Week	-0.64***	0.08	226	-7.70	2191.78	2192.28
*Week*rsFC*	R dPut	rsFC	-0.03	4.56	107	-0.01		
		Meds	-0.14	1.36	107	-0.10		
		Tx	5.47***	0.97	107	5.67		
		Sex	1.37	1.03	107	1.33		
		Motion	0.07	5.57	107	0.01		
		TARS	1.28***	1.01	107	1.27		
		Age-Group	-0.50	0.14	107	-3.49		
		Week*rsFC	-0.56	0.39	226	-1.42		
		Week*Meds	0.14	0.12	226	1.18		
		rsFC*Meds	2.87	6.21	107	0.46		
		Week*rsFC*Meds	-0.80	0.55	226	-1.46		
Model 2	L dlPFC –	Week	-0.45***	0.11	226	-4.29	2193.51	2194.17
*Week*rsFC*	R vPut	rsFC	9.81	4.54	107	2.16		
		Meds	2.02	1.59	107	1.27		
		Tx	5.70***	0.99	107	5.78		
		Sex	1.24	1.06	107	1.17		
		Motion	-2.21	5.51	107	-0.40		
		TARS	1.14***	1.02	107	1.13		

		Age-Group	-0.51	0.15	107	-3.54		
		Week*rsFC	-1.27**	0.39	226	-3.24		
		Week*Meds	-0.12	0.14	226	-0.87		
		rsFC*Meds	-9.13	6.25	107	-1.46		
		Week*rsFC*Meds	0.52	0.56	226	0.93		
Model 2	L vPut–	Week	-0.20***	0.17	226	-1.18	2188.61	2189.33
*Week*rsFC*	L caudate	rsFC	5.47	3.57	107	1.53		
		Meds	4.17	2.74	107	1.52		
		Tx	5.41***	0.95	107	5.69		
		Sex	1.67	1.02	107	1.63		
		Motion	-2.47	5.29	107	-0.47		
		TARS	1.29***	0.98	107	1.31		
		Age-Group	-0.50	0.14	107	-3.53		
		Week*rsFC	-1.01**	0.32	226	-3.17		
		Week*Meds	-0.10	0.24	226	-0.41		
		rsFC*Meds	-8.47	5.26	107	-1.61		
		Week*rsFC*Meds	0.19	0.47	226	0.40		
Model 3	R dlPFC –	Week	-0.67***	0.09	222	-7.42	2191.81	2178.05
*Week*rsFC*Age*	R NAc	rsFC	-4.71	6.77	104	-0.70		
		Age-Group	0.94	1.75	104	0.54		
		Meds	-0.57	1.64	104	-0.35		
		Tx	5.73***	0.96	104	5.96		
		Sex	2.04	1.09	104	1.87		
		Motion	-1.96	5.54	104	-0.35		
		TARS	-0.44**	0.15	104	-2.95		
		Week*rsFC	2.40***	0.59	222	4.06		
		Week*Age-Group	-0.16	0.15	222	-1.07		
		rsFC*Age-Group	19.35	11.72	104	1.65		
		Week*Meds	0.00	0.14	222	-0.03		
		rsFC*Meds	5.91	10.80	104	0.55		
		Age-Group*Meds	1.79	2.39	104	0.75		
		Week*rsFC*Age-Group	-3.39*	1.07	222	-3.17		
		Week*rsFC*Meds	-2.48†	0.92	222	-2.68		

		Week*Age-Group*Meds	0.14	0.21	222	0.65		
		rsFC*Age-Group*Meds	-13.74	15.87	104	-0.87		
		Week*rsFC*Age-Group*Meds	2.56	1.42	222	1.80		
Model 3 *Week*rsFC*Age*	L IPL – R NAc	Week	-0.66	0.09	222	-7.17	2193.75	2183.55
		rsFC	-7.63	5.64	104	-1.35		
		Age-Group	1.34	1.68	104	0.80		
		Meds	0.01	1.71	104	0.01		
		Tx	5.79	0.95	104	6.06		
		Sex	1.62	1.04	104	1.56		
		Motion	-1.40	5.31	104	-0.26		
		TARS	-0.46**	0.15	104	-3.12		
		Week*rsFC	1.52**	0.50	222	3.04		
		Week*Age-Group	-0.22	0.15	222	-1.42		
		rsFC*Age-Group	20.29	8.82	104	2.30		
		Week*Meds	-0.06	0.15	222	-0.40		
		rsFC*Meds	1.47	9.99	104	0.15		
		Age-Group*Meds	0.32	2.42	104	0.13		
		Week*rsFC*Age-Group	-2.55**	0.81	222	-3.16		
		Week*rsFC*Meds	-1.07	0.89	222	-1.20		
		Week*Age-Group*Meds	0.21	0.22	222	0.97		
		rsFC*Age-Group*Meds	-19.59	14.60	104	-1.34		
		Week*rsFC*Age-Group*Meds	0.97	1.32	222	0.73		
Model 3 *Week*rsFC*Age*	R postcentral gyrus – L NAc	Week	-0.70	0.09	222	-7.44	2188.92	2179.85
		rsFC	-0.24	6.47	104	-0.04		
		Age-Group	1.45	1.73	104	0.84		
		Meds	0.79	1.92	104	0.41		
		Tx	5.97	0.97	104	6.14		
		Sex	1.76	1.06	104	1.65		
		Motion	-3.02	5.36	104	-0.56		
		TARS	-0.49**	0.15	104	-3.35		
		Week*rsFC	1.82**	0.58	222	3.14		

		Week*Age-Group	-0.16	0.15	222	-1.01		
		rsFC*Age-Group	10.36	11.24	104	0.92		
		Week*Meds	-0.20	0.17	222	-1.16		
		rsFC*Meds	-9.09	10.93	104	-0.83		
		Age-Group*Meds	-0.18	2.59	104	-0.07		
		Week*rsFC*Age-Group	-2.61*	1.01	222	-2.58		
		Week*rsFC*Meds	-0.04	0.97	222	-0.05		
		Week*Age-Group*Meds	0.39	0.23	222	1.68		
		rsFC*Age-Group*Meds	-0.10	15.87	104	-0.01		
		Week*rsFC*Age-Group*Meds	0.09	1.42	222	0.06		
Model 3 *Week*rsFC*Age*	R postcentral gyrus – R NAc	Week	-0.63	0.09	222	-7.12	2182.93	2171.39
		rsFC	-4.32	5.88	104	-0.73		
		Age-Group	1.03	1.71	104	0.60		
		Meds	0.91	1.90	104	0.48		
		Tx	5.96	0.96	104	6.20		
		Sex	1.68	1.05	104	1.59		
		Motion	-3.43	5.39	104	-0.64		
		TARS	-0.46**	0.15	104	-3.09		
		Week*rsFC	1.61**	0.50	222	3.23		
		Week*Age-Group	-0.21	0.15	222	-1.38		
		rsFC*Age-Group	24.56	11.91	104	2.06		
		Week*Meds	-0.27	0.16	222	-1.65		
		rsFC*Meds	-8.56	12.30	104	-0.70		
		Age-Group*Meds	0.26	2.56	104	0.10		
		Week*rsFC*Age-Group	-2.75**	1.05	222	-2.61		
		Week*rsFC*Meds	0.59	1.07	222	0.56		
		Week*Age-Group*Meds	0.37	0.23	222	1.65		
		rsFC*Age-Group*Meds	-6.39	18.07	104	-0.35		
		Week*rsFC*Age-Group*Meds	-1.46	1.58	222	-0.92		
Model 3 *Week*rsFC*Age*	R postcentral gyrus – L IPL	Week	0.43	0.30	222	1.45	2181.68	2175.35
		rsFC	2.80	4.61	104	0.61		

		Age-Group	6.54	5.25	104	1.24		
		Meds	0.40	4.32	104	0.09		
		Tx	5.59	0.91	104	6.11		
		Sex	1.90	1.00	104	1.90		
		Motion	-2.00	5.47	104	-0.37		
		TARS	-0.44**	0.14	104	-3.22		
		Week*rsFC	-1.61***	0.44	222	-3.66		
		Week*Age-Group	-1.67**	0.49	222	-3.39		
		rsFC*Age-Group	-6.63	6.94	104	-0.96		
		Week*Meds	-0.51	0.40	222	-1.29		
		rsFC*Meds	-1.37	5.89	104	-0.23		
		Age-Group*Meds	-9.04	7.02	104	-1.29		
		Week*rsFC*Age-Group	2.06**	0.64	222	3.20		
		Week*rsFC*Meds	0.78	0.55	222	1.41		
		Week*Age-Group*Meds	0.60	0.65	222	0.93		
		rsFC*Age-Group*Meds	12.52	8.93	104	1.40		
		Week*rsFC*Age-Group*Meds	-0.65	0.83	222	-0.78		
Model 3 *Week*rsFC*Age*	L IPL - R dPut	Week	-0.38	0.13	222	-2.99	2194.41	2186.46
		rsFC	9.51	5.40	104	1.76		
		Age-Group	4.04	2.56	104	1.58		
		Meds	1.46	2.16	104	0.68		
		Tx	5.83	0.98	104	5.95		
		Sex	1.61	1.06	104	1.52		
		Motion	-1.53	5.69	104	-0.27		
		TARS	-0.44**	0.15	104	-3.01		
		Week*rsFC	-1.18*	0.46	222	-2.56		
		Week*Age-Group	-0.73	0.23	222	-3.13		
		rsFC*Age-Group	-11.79**	9.66	104	-1.22		
		Week*Meds	-0.10	0.19	222	-0.50		
		rsFC*Meds	-8.84	9.31	104	-0.95		
		Age-Group*Meds	-2.15	3.32	104	-0.65		
		Week*rsFC*Age-Group	2.25*	0.86	222	2.61		

		Week*rsFC*Meds	-0.26	0.82	222	-0.32		
		Week*Age-Group*Meds	0.45	0.30	222	1.52		
		rsFC*Age-Group*Meds	14.86	13.86	104	1.07		
		Week*rsFC*Age-Group*Meds	-0.34	1.22	222	-0.28		
Model 3 *Week*rsFC*Age*	L aIns - L Caudate	Week	-0.87	0.13	222	-6.79	2197.74	2189.00
		rsFC	-3.35	4.95	104	-0.68		
		Age-Group	-0.38	2.45	104	-0.16		
		Meds	1.16	2.17	104	0.53		
		Tx	5.81	0.95	104	6.08		
		Sex	1.57	1.04	104	1.51		
		Motion	-4.95	6.11	104	-0.81		
		TARS	-0.49**	0.15	104	-3.31		
		Week*rsFC	1.30**	0.46	222	2.85		
		Week*Age-Group	0.11	0.22	222	0.51		
		rsFC*Age-Group	8.27	6.83	104	1.21		
		Week*Meds	0.12	0.20	222	0.60		
		rsFC*Meds	-6.93	7.58	104	-0.91		
		Age-Group*Meds	-0.02	3.47	104	-0.01		
		Week*rsFC*Age-Group	-1.69*	0.62	222	-2.73		
		Week*rsFC*Meds	-0.96	0.69	222	-1.39		
		Week*Age-Group*Meds	0.21	0.31	222	0.67		
		rsFC*Age-Group*Meds	5.40	11.14	104	0.48		
		Week*rsFC*Age-Group*Meds	0.16	0.99	222	0.16		
Model 3 *Week*rsFC*Age*	L aIns – R Caudate	Week	-0.90	0.12	222	-7.68	2194.67	2181.82
		rsFC	-2.62	5.56	104	-0.47		
		Age-Group	0.62	2.35	104	0.26		
		Meds	1.92	2.27	104	0.84		
		Tx	6.05	0.96	104	6.28		
		Sex	1.39	1.03	104	1.35		
		Motion	-3.66	5.55	104	-0.66		
		TARS	-0.50**	0.15	104	-3.44		

Week*rsFC	1.92***	0.50	222	3.86
Week*Age-Group	0.08	0.21	222	0.37
rsFC*Age-Group	5.28	7.52	104	0.70
Week*Meds	0.04	0.20	222	0.21
rsFC*Meds	-8.00	8.12	104	-0.99
Age-Group*Meds	-0.66	3.71	104	-0.18
Week*rsFC*Age-Group	-2.10**	0.67	222	-3.15
Week*rsFC*Meds	-1.16	0.72	222	-1.60
Week*Age-Group*Meds	0.29	0.33	222	0.86
rsFC*Age-Group*Meds	4.51	12.65	104	0.36
Week*rsFC*Age-Group*Meds	0.51	1.15	222	0.45

† $p < 0.1$, *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ FDR-corrected for comparison of number of ROI-ROI connections in original model that significant predictors of treatment response in OCD patients. [a]$p < 0.05$, [b]$p < 0.01$, [c]$p < 0.001$ uncorrected for multiple comparisons. dACC, dorsal anterior cingulate cortex; dlPFC, dorsolateral prefrontal cortex; dPut; dorsal caudal putamen; Ins, anterior insula; IPL: inferior parietal lobule; L, left; md Thal, medial dorsal thalamus; Meds: Medications; NAc; nucleus accubens; R, right; ROI, region of interest; rsFC: resting-state functional connectivity; SMA, supplementary motor area; Tx, treatment; vmPFC, ventromedial prefrontal cortex; vPut, ventral rostral putamen

Table S9.

Results of models 1, 2, and 3 in participants not on medications

Post-hoc test for linear mixed model	ROI-ROI connection	Fixed Effects	*B*	SE	df	*t*
Model 1 *Tx-Group*Week*rsFC*	vmPFC – L caudate	Week	-1.23***	0.13	106	-9.77
		rsFC	-0.22	5.22	48	-0.04
		Tx	0.76	2.27	48	0.33
		Sex	2.69	1.43	48	1.89
		Motion	-5.57	7.00	48	-0.80
		Age-Group	0.15	1.45	48	0.11
		TARS	-0.41†	0.21	48	-2.01
		Week*rsFC	0.95	0.44	106	2.15
		Week*Tx	1.19***	0.18	106	6.44
		rsFC*Tx	7.26	8.03	48	0.90
		Week*rsFC*Tx	**-2.72*** **	**0.66**	**106**	**-4.10**
Model 1 *Tx-Group*Week*rsFC*	vmPFC – L mdThal	Week	-1.14***	0.12	106	-9.54
		rsFC	2.48	4.93	106	0.50
		Tx	1.35	2.13	48	0.63
		Sex	2.93	1.48	48	1.98
		Motion	-5.95	6.83	48	-0.87
		Age-Group	0.22	1.48	48	0.15
		TARS	-0.37†	0.21	48	-1.81
		Week*rsFC	0.48***	0.40	48	1.20
		Week*Tx	1.11	0.17	106	6.36
		rsFC*Tx	3.12	6.88	106	0.45
		Week*rsFC*Tx	**-2.13***	**0.57**	**48**	**-3.74**
Model 2 *Week*rsFC*	Pre-SMA– R dlPFC	Week	-0.46***	0.13	108	7.43
		rsFC	4.07	3.90	108	-3.50
		Tx	6.08***	1.39	49	1.04
		Sex	2.22	1.41	49	4.36
		Motion	-4.97	6.98	49	1.58
		Age-Group	0.36	1.47	49	-0.71
		TARS	-0.44†	0.21	49	0.24
		Week*rsFC	**-0.80***	**0.35**	**49**	**-2.13**
Model 2 *Week*rsFC*	Pre-SMA– L IPL	Week	-0.50	0.13	108	-3.90
		rsFC	4.21	3.34	49	1.26
		Tx	6.14	1.39	49	4.41
		Sex	2.24	1.42	49	1.57
		Motion	-5.99	7.21	49	-0.83
		Age-Group	0.30	1.44	49	0.21
		TARS	-0.43	0.21	49	-2.08
		Week*rsFC	**-0.59†**	**0.30**	**108**	**-2.00**
Model 2 *Week*rsFC*	dACC – R insula	Week	-0.59***	0.12	108	-5.12
		rsFC	0.48	3.37	49	0.14
		Tx	5.93***	1.39	49	4.28

		Sex	2.40	1.40	49	1.71
		Motion	-4.03	6.98	49	-0.58
		Age-Group	0.15	1.43	49	0.10
		TARS	-0.40†	0.21	49	-1.96
		Week*rsFC	-0.40	0.30	108	-1.35
Model 2	Pre-SMA–	Week	-0.65***	0.08	108	-8.39
*Week*rsFC*	R aIns	rsFC	3.21	3.57	49	0.90
		Tx	5.99***	1.39	49	4.31
		Sex	2.40	1.40	49	1.71
		Motion	-4.95	6.80	49	-0.73
		Age-Group	0.17	1.44	49	0.12
		TARS	-0.40†	0.21	49	-1.94
		Week*rsFC	**-0.83***	**0.32**	**108**	**-2.62**
Model 2	dACC –	Week	-0.41***	0.14	108	-2.88
*Week*rsFC*	R dPut	rsFC	3.50	3.83	49	0.91
		Tx	6.00***	1.39	49	4.30
		Sex	2.21	1.40	49	1.58
		Motion	-4.71	6.94	49	-0.68
		Age-Group	0.42	1.46	49	0.29
		TARS	-0.42†	0.21	49	-2.03
		Week*rsFC	**-0.81***	**0.33**	**108**	**-2.45**
Model 2	R aIns –	Week	-0.65***	0.09	108	-7.21
*Week*rsFC*	R dPut	rsFC	0.44	4.73	49	0.09
		Tx	5.96***	1.39	49	4.29
		Sex	2.28	1.39	49	1.64
		Motion	-3.68	7.16	49	-0.51
		Age-Group	0.15	1.44	49	0.11
		TARS	-0.41†	0.21	49	-1.97
		Week*rsFC	-0.56	0.42	108	-1.32
Model 2	L dlPFC –	Week	-0.45***	0.11	108	-4.17
*Week*rsFC*	R vPut	rsFC	11.49	4.66	49	2.46
		Tx	6.45***	1.43	49	4.51
		Sex	2.43	1.41	49	1.72
		Motion	-6.98	6.92	49	-1.01
		Age-Group	0.22	1.43	49	0.16
		TARS	-0.46†	0.21	49	-2.24
		Week*rsFC	**-1.27*** **	**0.40**	**108**	**-3.14**
Model 2	L vPut–	Week	-0.21***	0.18	108	-1.14
*Week*rsFC*	L caudate	rsFC	5.86	3.66	49	1.60
		Tx	6.09***	1.39	49	4.38
		Sex	2.21	1.39	49	1.58
		Motion	-5.26	6.84	49	-0.77
		Age-Group	0.29	1.43	49	0.20
		TARS	-0.44†	0.20	49	-2.12
		Week*rsFC	-1.01***	0.33	108	-3.05
Model 3	R dlPFC –	Week	-0.67***	0.09	106	-7.37

*Age-Group*Week*rsFC*	R NAc	rsFC	-2.83	6.66	48	-0.42
		Age-Group	1.16	1.70	48	0.68
		Tx	6.08***	1.32	48	4.60
		Sex	3.16	1.41	48	2.25
		Motion	-5.41	6.46	48	-0.84
		TARS	-0.32†	0.20	48	-1.60
		Week*rsFC	2.39***	0.59	106	4.03
		Week*Age-Group	-0.17	0.16	106	-1.06
		rsFC*Age-Group	17.19	11.41	48	1.51
		Week*rsFC*Age-Group	**-3.38*** **	**1.08**	**106**	**-3.14**
Model 3 *Age-Group*Week*rsFC*	L IPL – R NAc	Week	-0.66***	0.09	106	-7.02
		rsFC	-7.40	5.62	48	-1.32
		Age-Group	1.53	1.69	48	0.91
		Tx	6.28***	1.37	48	4.59
		Sex	2.32	1.39	48	1.67
		Motion	-5.02	6.67	48	-0.75
		TARS	-0.46†	0.20	48	-2.26
		Week*rsFC	1.52***	0.51	106	2.98
		Week*Age-Group	-0.22	0.15	106	-1.40
		rsFC*Age-Group	20.38	8.78	48	2.32
		Week*rsFC*Age-Group	**-2.55*** **	**0.83**	**106**	**-3.09**
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus – L NAc	Week	-0.70***	0.10	106	-7.20
		rsFC	0.83	6.32	48	0.13
		Age-Group	1.75	1.69	48	1.04
		Tx	6.25***	1.31	48	4.77
		Sex	2.65	1.34	48	1.98
		Motion	-7.58	6.46	48	-1.17
		TARS	-0.49†	0.20	48	-2.50
		Week*rsFC	1.82***	0.60	106	3.06
		Week*Age-Group	-0.16	0.16	106	-0.99
		rsFC*Age-Group	9.43	10.94	48	0.86
		Week*rsFC*Age-Group	**-2.62***	**1.04**	**106**	**-2.50**
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus - R NAc	Week	-0.63***	0.09	106	-6.81
		rsFC	-3.14	5.83	48	-0.54
		Age-Group	1.25	1.69	48	0.74
		Tx	6.43***	1.34	48	4.80
		Sex	2.56	1.38	48	1.85
		Motion	-7.87	6.60	48	-1.19
		TARS	-0.44†	0.20	48	-2.27
		Week*rsFC	1.61***	0.52	106	3.09
		Week*Age-Group	-0.21	0.16	106	-1.34
		rsFC*Age-Group	24.13	11.76	48	2.05
		Week*rsFC*Age-Group	**-2.75***	**1.10**	**106**	**-2.50**
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus –	Week	0.43	0.31	106	1.41
		rsFC	2.71	4.69	48	0.58
		Age-Group	5.70	5.41	48	1.05

	L IPL	Tx	5.85***	1.36	48	4.32
		Sex	2.42	1.36	48	1.78
		Motion	-5.45	7.35	48	-0.74
		TARS	-0.46†	0.20	48	-2.34
		Week*rsFC	-1.62**	0.46	106	-3.55
		Week*Age-Group	-1.67***	0.51	106	-3.30
		rsFC*Age-Group	-5.30	7.19	48	-0.74
		Week*rsFC*Age-Group	**2.07*** **	**0.66**	**106**	**3.11**
Model 3	L IPL –	Week	-0.38***	0.13	106	-2.88
Age-	R dPut	rsFC	10.71	5.43	48	1.97
*Group*Week*rsFC*		Age-Group	4.09	2.59	48	1.58
		Tx	6.33***	1.39	48	4.56
		Sex	2.20	1.42	48	1.55
		Motion	-8.73	7.30	48	-1.20
		TARS	-0.40†	0.20	48	-1.93
		Week*rsFC	-1.19*	0.48	106	-2.48
		Week*Age-Group	-0.73	0.24	106	-3.04
		rsFC*Age-Group	-10.30	9.88	48	-1.04
		Week*rsFC*Age-Group	**2.26***	**0.89**	**106**	**2.54**
Model 3	L aIns –	Week	-0.87***	0.13	106	-6.58
Age-	L caudate	rsFC	-2.46	4.96	48	-0.50
*Group*Week*rsFC*		Age-Group	-0.54	2.45	48	-0.22
		Tx	6.01***	1.36	48	4.43
		Sex	2.20	1.37	48	1.61
		Motion	-11.80	8.35	48	-1.41
		TARS	-0.50	0.21	48	-2.35
		Week*rsFC	1.31*	0.47	106	2.77
		Week*Age-Group	0.11	0.23	106	0.50
		rsFC*Age-Group	9.50	6.95	48	1.37
		Week*rsFC*Age-Group	**-1.69***	**0.64**	**106**	**-2.65**
Model 3	L aIns –	Week	-0.90***	0.12	106	-7.56
Age-	R caudate	rsFC	-2.39	5.45	48	-0.44
*Group*Week*rsFC*		Age-Group	0.71	2.30	48	0.31
		Tx	6.31***	1.35	48	4.68
		Sex	2.10	1.34	48	1.56
		Motion	-7.18	6.94	48	-1.04
		TARS	-0.42†	0.20	48	-2.10
		Week*rsFC	1.92***	0.51	106	3.80
		Week*Age-Group	0.08	0.22	106	0.36
		rsFC*Age-Group	5.46	7.48	48	0.73
		Week*rsFC*Age-Group	**-2.10***	**0.68**	**106**	**-3.10**
Model 3	L caudate–	Week	-0.99*	0.38	106	-2.61
Age-	R caudate	rsFC	3.04	4.70	48	0.65
*Group*Week*rsFC*		Age-Group	2.95	6.17	48	0.48
		Tx	6.42***	1.36	48	4.73
		Sex	2.16	1.36	48	1.58

Motion	-3.45	6.83	48	-0.51
TARS	-0.42†	0.20	48	-2.11
Week*rsFC	0.45	0.43	106	1.04
Week*Age-Group	1.03	0.58	106	1.79
rsFC*Age-Group	-1.29	7.13	48	-0.18
Week*rsFC*Age-Group	**-1.56***	**0.66**	**106**	**-2.35**

† $p < 0.1$, *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ FDR-corrected for comparison of ROI-ROI connections within each model which were significant predictors of treatment response in OCD patients. dACC, dorsal anterior cingulate cortex; dlPFC, dorsolateral prefrontal cortex; dPut; dorsal caudal putamen; Ins, anterior insula; IPL: inferior parietal lobule; L, left; md Thal, medial dorsal thalamus; NAc; nucleus accubens; R, right; ROI, region of interest; rsFC: resting-state functional connectivity; SMA, supplementary motor area; Tx, treatment; vmPFC, ventromedial prefrontal cortex; vPut, ventral rostral putamen.

Table S10.

Results of models 1, 2, and 3 in participants on medications.

Post-hoc test for linear mixed model	ROI-ROI connection	Fixed Effects	*B*	SE	df	*t*
Model 1 *Tx-Group*Week*rsFC*	vmPFC – L caudate	Week	-1.09***	0.14	116	-7.98
		rsFC	-6.95	6.55	52	-1.06
		Tx	1.11	2.38	52	0.47
		Sex	1.15	1.71	52	0.67
		Motion	0.78	9.28	52	0.08
		Age-Group	2.08	1.50	52	1.38
		TARS	-0.56*	0.22	52	-2.54
		Week*rsFC	0.50	0.50	116	1.00
		Week*Tx	0.82***	0.18	116	4.44
		rsFC*Tx	1.58	8.95	52	0.18
		Week*rsFC*Tx	-0.86	0.71	116	-1.22
Model 1 *Tx-Group*Week*rsFC*	vmPFC – L mdThal	Week	-1.29***	0.15	116	-8.52
		rsFC	-0.97	7.52	52	-0.13
		Tx	2.25	2.68	52	0.84
		Sex	0.21	1.73	52	0.12
		Motion	5.77	9.37	52	0.62
		Age-Group	1.57	1.54	52	1.02
		TARS	-0.53*	0.22	52	-2.38
		Week*rsFC	1.32*	0.55	116	2.42
		Week*Tx	0.95***	0.20	116	4.64
		rsFC*Tx	-2.71	9.86	52	-0.28
		Week*rsFC*Tx	-1.27	0.75	116	-1.68
Model 2 *Week*rsFC*	Pre-SMA– R dlPFC	Week	-0.37**	0.13	118	-2.80
		rsFC	1.25	4.05	53	0.31
		Tx	5.20***	1.45	53	3.60
		Sex	1.03	1.68	53	0.61
		Motion	3.88	8.98	53	0.43
		Age-Group	1.92	1.50	53	1.28
		TARS	-0.53*	0.22	53	-2.39
		Week*rsFC	**-0.88***	**0.32**	**118**	**-2.75**
Model 2 *Week*rsFC*	Pre-SMA– L IPL	Week	-0.31*	0.12	118	-2.50
		rsFC	0.91	4.10	53	0.22
		Tx	5.10***	1.41	53	3.61
		Sex	1.21	1.66	53	0.73
		Motion	6.54	9.04	53	0.72
		Age-Group	2.01	1.48	53	1.36
		TARS	-0.44†	0.23	53	-1.96
		Week*rsFC	**-1.15****	**0.32**	**118**	**-3.57**
Model 2 *Week*rsFC*	dACC – R insula	Week	-0.47***	0.09	118	-5.00
		rsFC	2.72	2.83	53	0.96

		Tx	5.50***	1.43	53	3.86
		Sex	0.76	1.67	53	0.45
		Motion	3.00	9.04	53	0.33
		Age-Group	1.98	1.52	53	1.30
		TARS	-0.57*	0.23	53	-2.52
		Week*rsFC	**-0.70****	**0.23**	**118**	**-3.09**
Model 2	Pre-SMA–	Week	-0.64***	0.07	118	-8.98
*Week*rsFC*	R aIns	rsFC	1.76	3.22	53	0.55
		Tx	5.58***	1.42	53	3.94
		Sex	0.61	1.67	53	0.36
		Motion	3.51	9.07	53	0.39
		Age-Group	1.88	1.51	53	1.24
		TARS	-0.56*	0.23	53	-2.51
		Week*rsFC	**-0.51†**	**0.27**	**118**	**-1.87**
Model 2	dACC –	Week	27.13*	4.23	118	6.42
*Week*rsFC*	R dPut	rsFC	-0.31	0.13	118	-2.30
		Tx	3.93***	4.46	53	0.88
		Sex	5.32	1.47	53	3.63
		Motion	0.57	1.67	53	0.34
		Age-Group	3.51	9.06	53	0.39
		TARS	1.78*	1.52	53	1.18
		Week*rsFC	**-0.51****	**0.23**	**53**	**-2.22**
Model 2	R aIns –	Week	-0.50***	0.08	118	-6.28
*Week*rsFC*	R dPut	rsFC	1.63	4.44	53	0.37
		Tx	5.33***	1.39	53	3.84
		Sex	0.60	1.63	53	0.37
		Motion	6.68	9.04	53	0.74
		Age-Group	2.03	1.48	53	1.37
		TARS	-0.56*	0.22	53	-2.58
		Week*rsFC	**-1.36****	**0.36**	**118**	**-3.82**
Model 2	L dlPFC –	Week	-0.57***	0.09	118	-6.58
*Week*rsFC*	R vPut	rsFC	-0.53	4.73	53	-0.11
		Tx	5.38***	1.41	53	3.82
		Sex	0.14	1.71	53	0.08
		Motion	5.31	9.13	53	0.58
		Age-Group	1.51	1.53	53	0.99
		TARS	-0.54*	0.22	53	-2.46
		Week*rsFC	**-0.75†**	**0.38**	**118**	**-1.96**
Model 2	L vPut–	Week	-0.30†	0.17	118	-1.83
*Week*rsFC*	L caudate	rsFC	-2.95	3.98	53	-0.74
		Tx	5.06***	1.37	53	3.70
		Sex	1.37	1.62	53	0.84
		Motion	2.25	8.66	53	0.26
		Age-Group	2.03	1.45	53	1.40
		TARS	-0.51*	0.21	53	-2.36
		Week*rsFC	**-0.83***	**0.33**	**118**	**-2.50**

Model 3 *Age-Group*Week*rsFC*	R dlPFC – R NAc	Week	-0.67***	0.11	116	-6.06
		rsFC	0.81	9.16	52	0.09
		Age-Group	2.06	1.87	52	1.10
		Tx	5.61***	1.43	52	3.92
		Sex	0.68	1.73	52	0.39
		Motion	2.82	10.16	52	0.28
		TARS	-0.55†	0.23	52	-2.39
		Week*rsFC	-0.08	0.71	116	-0.11
		Week*Age-Group	-0.03	0.15	116	-0.18
		rsFC*Age-Group	5.29	11.35	52	0.47
		Week*rsFC*Age-Group	-0.83	0.93	116	-0.89
Model 3 *Age-Group*Week*rsFC*	L IPL – R NAc	Week	-0.72***	0.12	116	-6.06
		rsFC	-6.47	8.52	52	-0.76
		Age-Group	1.23	1.90	52	0.65
		Tx	5.41***	1.39	52	3.88
		Sex	0.88	1.65	52	0.54
		Motion	4.23	8.91	52	0.48
		TARS	-0.44†	0.23	52	-1.91
		Week*rsFC	0.45	0.72	116	0.62
		Week*Age-Group	0.00	0.15	116	-0.02
		rsFC*Age-Group	0.40	12.34	52	0.03
		Week*rsFC*Age-Group	-1.58	1.02	116	-1.55
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus – L NAc	Week	-0.89***	0.14	116	-6.59
		rsFC	-10.75	9.46	52	-1.14
		Age-Group	0.58	2.18	52	0.26
		Tx	5.88***	1.48	52	3.98
		Sex	0.66	1.77	52	0.37
		Motion	3.75	9.22	52	0.41
		TARS	-0.51†	0.24	52	-2.16
		Week*rsFC	1.77†	0.76	116	2.34
		Week*Age-Group	0.23	0.16	116	1.40
		rsFC*Age-Group	11.27	12.24	52	0.92
		Week*rsFC*Age-Group	**-2.52***	**0.97**	**116**	**-2.59**
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus - R NAc	Week	-0.90***	0.13	116	-6.79
		rsFC	-13.16	11.31	52	-1.16
		Age-Group	0.78	2.10	52	0.37
		Tx	5.67***	1.43	52	3.98
		Sex	0.72	1.68	52	0.43
		Motion	2.80	9.12	52	0.31
		TARS	-0.48†	0.24	52	-1.99
		Week*rsFC	2.20	0.90	116	2.44
		Week*Age-Group	0.16	0.16	116	1.02
		rsFC*Age-Group	18.55	14.51	52	1.28
		Week*rsFC*Age-Group	**-4.20****	**1.13**	**116**	**-3.72**
Model 3 *Age-*	R postcentral	Week	-0.08	0.25	116	-0.31
		rsFC	1.07	3.72	52	0.29

*Group*Week*rsFC*	gyrus – L IPL	Age-Group	-2.82	4.66	52	-0.60
		Tx	5.44***	1.31	52	4.15
		Sex	1.38	1.56	52	0.88
		Motion	2.22	8.57	52	0.26
		TARS	-0.42†	0.21	52	-2.00
		Week*rsFC	-0.83†	0.32	116	-2.60
		Week*Age-Group	-1.06†	0.41	116	-2.61
		rsFC*Age-Group	6.00	5.71	52	1.05
		Week*rsFC*Age-Group	**1.41***	**0.50**	**116**	**2.82**
Model 3 *Age-Group*Week*rsFC*	L IPL – R dPut	Week	-0.47***	0.14	116	-3.47
		rsFC	-2.45	8.25	52	-0.30
		Age-Group	0.94	2.28	52	0.41
		Tx	5.54***	1.44	52	3.84
		Sex	0.87	1.64	52	0.53
		Motion	8.71	9.35	52	0.93
		TARS	-0.42†	0.23	52	-1.82
		Week*rsFC	-1.44†	0.65	116	-2.21
		Week*Age-Group	-0.27	0.18	116	-1.51
		rsFC*Age-Group	6.17	10.30	52	0.60
		Week*rsFC*Age-Group	**1.91†**	**0.84**	**116**	**2.29**
Model 3 *Age-Group*Week*rsFC*	L aIns – L caudate	Week	-0.75***	0.14	116	-5.19
		rsFC	-10.25	5.87	52	-1.75
		Age-Group	-1.20	2.65	52	-0.45
		Tx	5.70***	1.39	52	4.09
		Sex	0.73	1.68	52	0.44
		Motion	2.22	9.11	52	0.24
		TARS	-0.52†	0.22	52	-2.32
		Week*rsFC	0.34	0.50	116	0.67
		Week*Age-Group	0.32	0.21	116	1.56
		rsFC*Age-Group	15.17	9.09	52	1.67
		Week*rsFC*Age-Group	**-1.54†**	**0.75**	**116**	**-2.05**
Model 3 *Age-Group*Week*rsFC*	L aIns – R caudate	Week	-0.86***	0.16	116	-5.34
		rsFC	-10.66	6.24	52	-1.71
		Age-Group	-0.69	3.10	52	-0.22
		Tx	5.97***	1.43	52	4.17
		Sex	0.39	1.68	52	0.23
		Motion	0.94	9.17	52	0.10
		TARS	-0.59†	0.23	52	-2.60
		Week*rsFC	0.75†	0.52	116	1.45
		Week*Age-Group	0.37	0.25	116	1.45
		rsFC*Age-Group	10.49	10.81	52	0.97
		Week*rsFC*Age-Group	-1.59	0.92	116	-1.72
Model 3 *Age-Group*Week*rsFC*	L caudate– R caudate	Week	-0.66	0.46	116	-1.43
		rsFC	-2.33	6.66	52	-0.35
		Age-Group	-1.29	6.88	52	-0.19
		Tx	5.50***	1.41	52	3.91

Sex	0.49	1.70	52	0.29
Motion	2.00	9.03	52	0.22
TARS	-0.56†	0.22	52	-2.50
Week*rsFC	-0.03	0.55	116	-0.05
Week*Age-Group	0.90	0.56	116	1.59
rsFC*Age-Group	3.96	8.06	52	0.49
Week*rsFC*Age-Group	-1.12	0.67	116	-1.66

† $p < 0.1$, *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ FDR-corrected for comparison of ROI-ROI connections within each model which were significant predictors of treatment response in OCD patients. dACC, dorsal anterior cingulate cortex; dlPFC, dorsolateral prefrontal cortex; dPut; dorsal caudal putamen; Ins, anterior insula; IPL: inferior parietal lobule; L, left; md Thal, medial dorsal thalamus; NAc; nucleus accubens; R, right; ROI, region of interest; rsFC: resting-state functional connectivity; SMA, supplementary motor area; Tx, treatment; vmPFC, ventromedial prefrontal cortex; vPut, ventral rostral putamen.

Table S11.

Differences in baseline resting-state functional connectivity as a function of medication status

Post-hoc test for linear mixed model	ROI-ROI connection	Fixed Effects	*B*	*SE*	*t*
Model 1 *Tx-Group*Week*rsFC*	vmPFC – L caudate	Meds	-0.02	0.04	-0.46
		Sex	0.07	0.04	1.643
		Motion	0.06	0.25	0.238
		Age-group	-0.02	0.04	-0.473
Model 1 *Tx-Group*Week*rsFC*	vmPFC – L mdThal	Meds	0.22	0.06	3.576
		Sex	0.04	0.04	0.824
		Motion	-0.02	0.05	-0.433
		Age-group	0.15†	0.28	0.533
Model 2 *Week*rsFC*	Pre-SMA – R dlPFC	Meds	0.04	0.04	1.018
		Sex	0.04	0.04	0.858
		Motion	0.27	0.28	0.985
		Age-group	0.02	0.05	0.539
Model 2 *Week*rsFC*	Pre-SMA – L IPL	Meds	-0.01	0.05	-0.251
		Sex	0.07	0.05	1.517
		Motion	0.68	0.30	2.289
		Age-group	-0.03	0.05	-0.663
Model 2 *Week*rsFC*	dACC – R insula	Meds	-0.06	0.05	-1.003
		Sex	0.07	0.06	1.196
		Motion	0.84*	0.35	2.41
		Age-group	0.01	0.06	0.121
Model 2 *Week*rsFC*	Pre-SMA – R aIns	Meds	0.01	0.05	0.295
		Sex	-0.03	0.05	-0.668
		Motion	0.35	0.32	1.104
		Age-group	-0.05	0.05	-1.061
Model 2 *Week*rsFC*	dACC – R dPut	Meds	-0.03	0.04	-0.627
		Sex	-0.07	0.04	-1.736
		Motion	0.24*	0.27	0.879
		Age-group	0.00	0.04	-0.024
Model 2 *Week*rsFC*	R aIns – R dPut	Meds	0.02	0.04	0.635
		Sex	-0.03	0.04	-0.705
		Motion	0.55*	0.24	2.287
		Age-group	-0.03	0.04	-0.734
Model 2 *Week*rsFC*	L dlPFC – R vPut	Meds	-0.04	0.04	-1.12
		Sex	-0.06	0.04	-1.564
		Motion	0.55*	0.24	2.309
		Age-group	-0.04	0.04	-0.963
Model 2 *Week*rsFC*	L vPut– L caudate	Meds	-0.06	0.04	-1.386
		Sex	0.05	0.04	1.186
		Motion	0.02	0.28	0.085
		Age-group	0.00	0.05	0.09

Model 3 *Age-Group*Week*rsFC*	R dlPFC – R NAc	Meds	0.00	0.03	0.116
		Sex	-0.01	0.03	-0.219
		Motion	0.34	0.21	1.658
		Age-group	-0.01	0.03	-0.397
Model 3 *Age-Group*Week*rsFC*	L IPL – R NAc	Meds	0.01	0.04	0.183
		Sex	-0.01	0.04	-0.163
		Motion	-0.05	0.24	-0.197
		Age-group	-0.06	0.04	-1.632
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus – L NAc	Meds	0.04	0.03	1.409
		Sex	-0.04	0.03	-1.187
		Motion	0.21	0.20	1.055
		Age-group	-0.05	0.03	-1.679
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus - R NAc	Meds	0.02	0.03	0.781
		Sex	0.00	0.03	-0.123
		Motion	0.20	0.20	0.981
		Age-group	-0.05	0.03	-1.544
Model 3 *Age-Group*Week*rsFC*	R postcentral gyrus – L IPL	Meds	0.08	0.06	1.423
		Sex	-0.04	0.06	-0.657
		Motion	0.43	0.36	1.173
		Age-group	0.04	0.06	0.664
Model 3 *Age-Group*Week*rsFC*	L IPL – R dPut	Meds	-0.03	0.04	-0.779
		Sex	-0.05	0.04	-1.256
		Motion	0.33	0.23	1.441
		Age-group	-0.03	0.04	-0.796
Model 3 *Age-Group*Week*rsFC*	L aIns – L caudate	Meds	0.00	0.05	-0.017
		Sex	-0.01	0.05	-0.21
		Motion	0.26	0.30	0.87
		Age-group	0.08	0.05	1.712
Model 3 *Age-Group*Week*rsFC*	L aIns – R caudate	Meds	0.05	0.04	1.345
		Sex	-0.01	0.04	-0.147
		Motion	-0.06	0.26	-0.216
		Age-group	0.06	0.04	1.546
Model 3 *Age-Group*Week*rsFC*	L caudate – R caudate	Meds	-0.03	0.05	-0.719
		Sex	-0.04	0.05	-0.805
		Motion	0.01	0.31	0.044
		Age-group	-0.02	0.05	-0.326

† $p < 0.1$, *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ FDR-corrected for comparison of number of ROI-ROI connections in original model that significant predictors of treatment response in OCD patients. All models had 86 degrees of freedom. dACC, dorsal anterior cingulate cortex; dlPFC, dorsolateral prefrontal cortex; dPut; dorsal caudal putamen; Ins, anterior insula; IPL: inferior parietal lobule; L, left; md Thal, medial dorsal thalamus; Meds: Medications; NAc; nucleus accubens; R, right; ROI, region of interest; rsFC: resting-state functional connectivity; SMA, supplementary motor area; Tx, treatment; vmPFC, ventromedial prefrontal cortex; vPut, ventral rostral putamen

Figure S1.

CONSORT diagram displaying the progress of all participants through the study.

IFT, incentive flanker task; OCD, Obsessive Compulsive Disorder; ROI, region of interest; rsfcMRI: resting-state functional connectivity magnetic resonance imaging; Tx, treatment

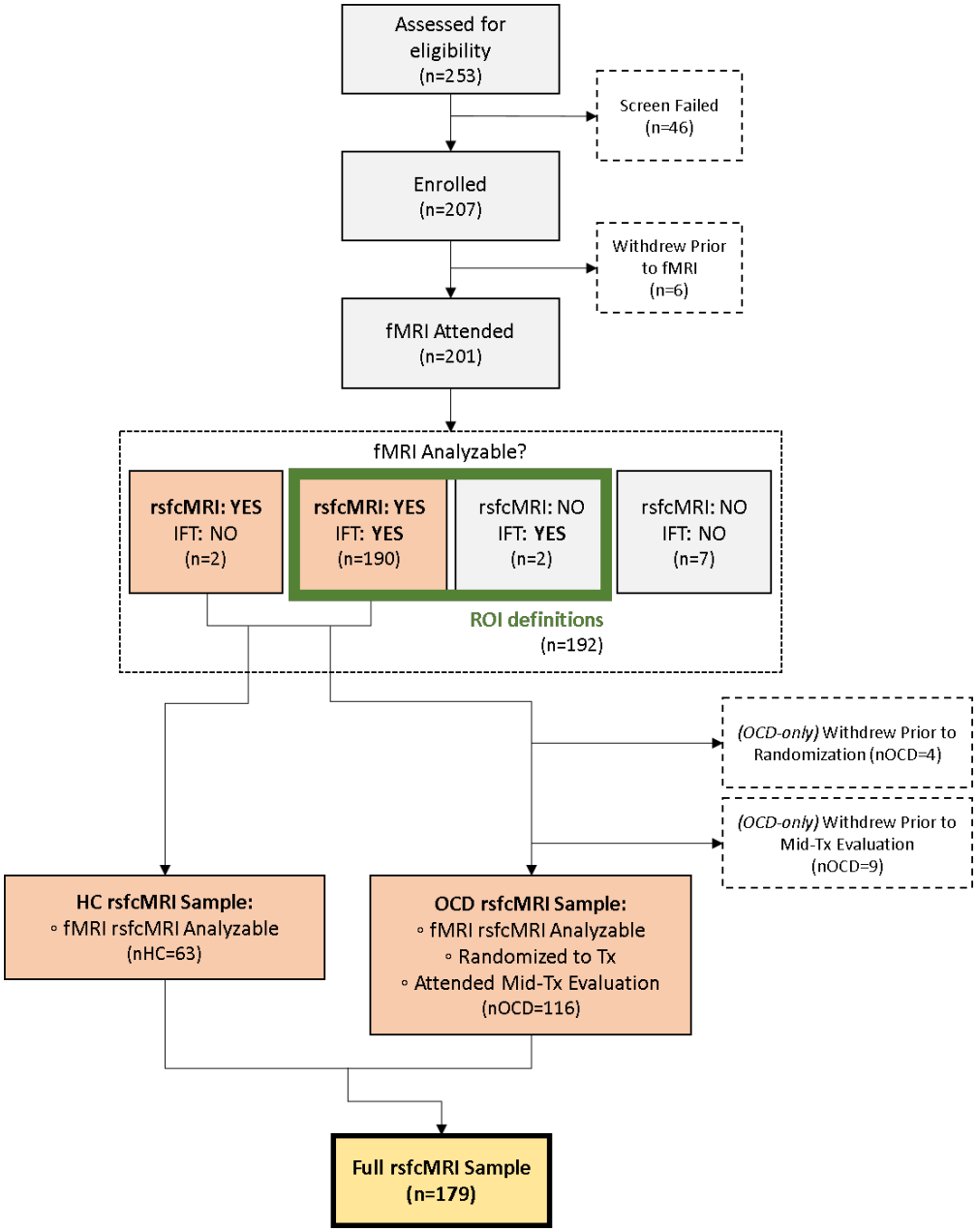


Figure S2.

*Simple slopes showing significant time*connectivity*treatment interactions in model 1.*

For each connection, the slope of predicted symptom change is shown at mean (green dashed line), high (+ 1 SD, blue dotted line) and low (- 1 SD, red solid line) connectivity. ERP, exposure and response prevention; Y-BOCS, Yale-Brown Obsessive Compulsive Scale child or adult version; SMT, stress management therapy.

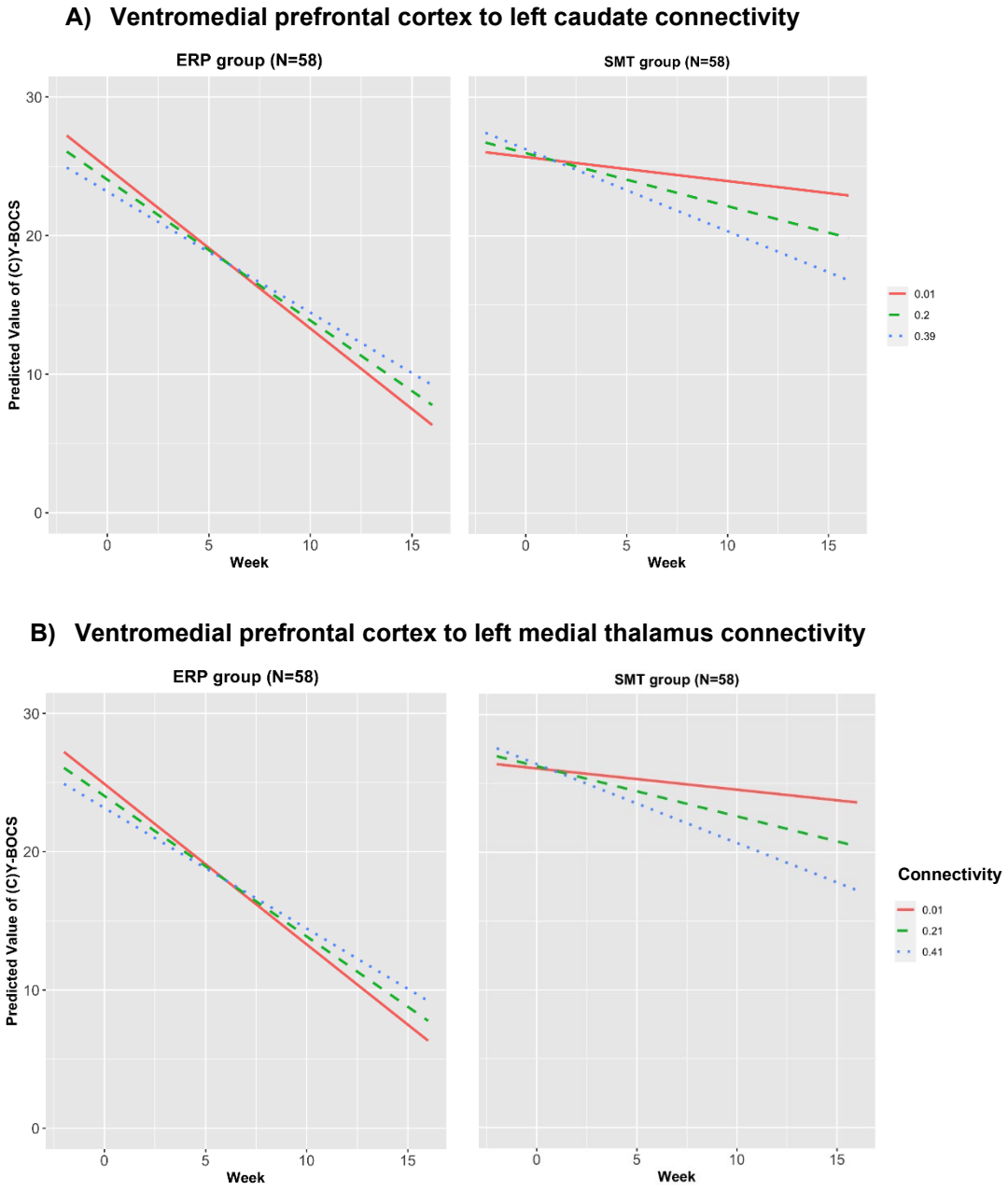
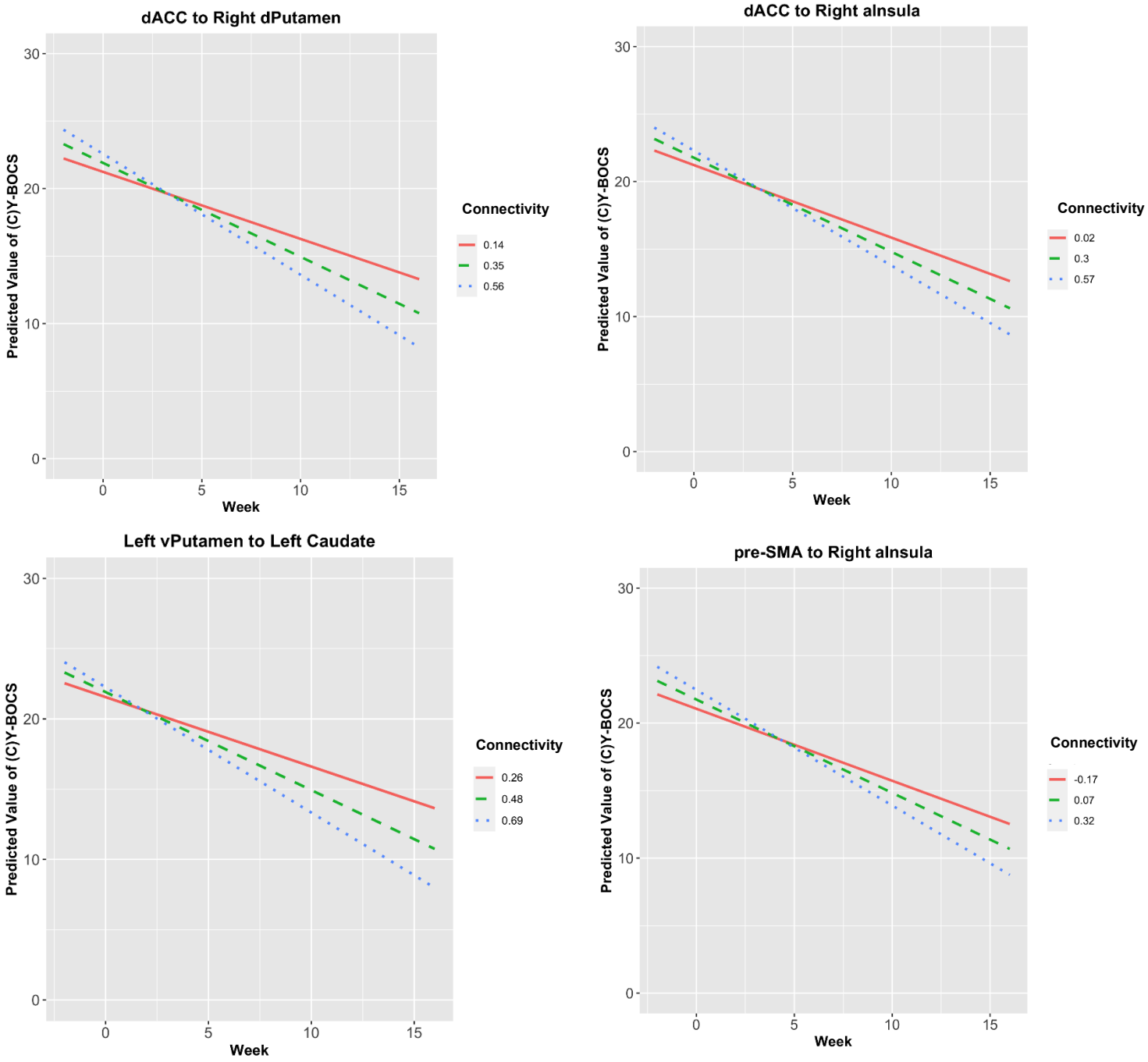
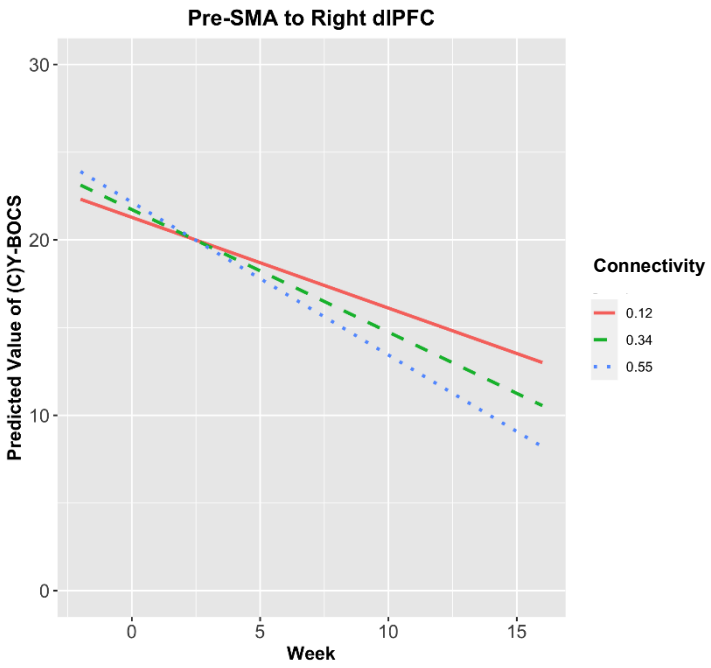


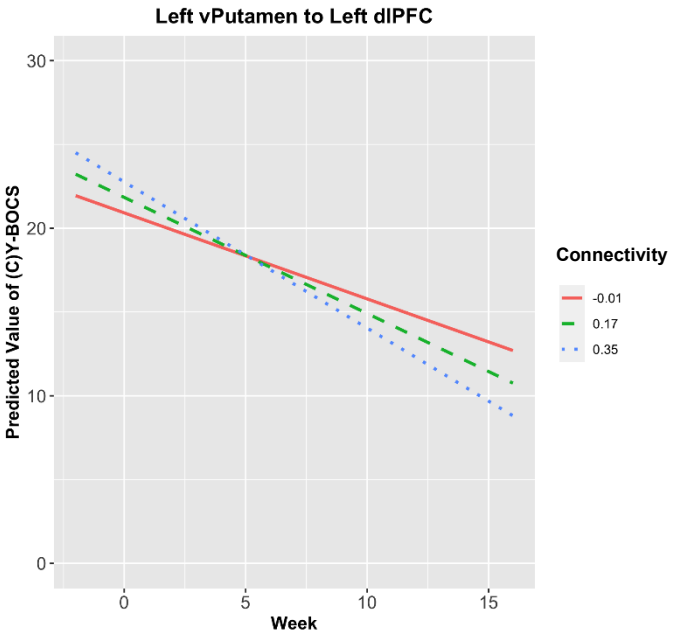
Figure S3.

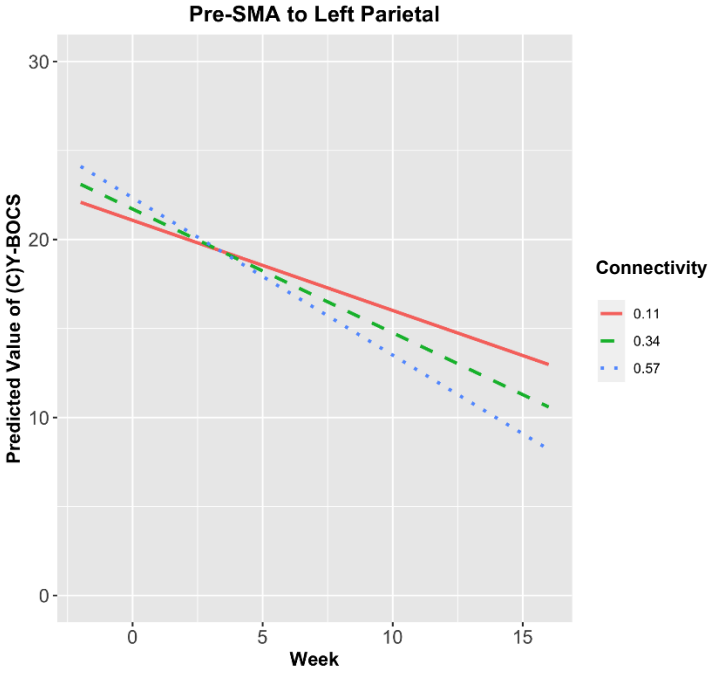
*Simple slopes for significant time*connectivity interactions on OCD symptoms in model 2.*

For each connection, the slope of predicted symptom change is shown at mean (green dashed line), high (+ 1 SD, blue dotted line) and low (- 1 SD, red solid line) connectivity. Y-BOCS, Yale-Brown Obsessive Compulsive Scale child or adult version; a, anterior; d, dorsal; dACC, anterior cingulate cortex; dlPFC, dorsolateral prefrontal cortex; SMA, supplementary motor area; v, ventral




Pre-SMA to Right dlPFC
Predicted Value of (C)Y-BOCS
Week
Connectivity
0.12
0.34
0.55


Left vPutamen to Left dlPFC
Predicted Value of (C)Y-BOCS
Week
Connectivity
-0.01
0.17
0.35


Pre-SMA to Left Parietal
Predicted Value of (C)Y-BOCS
Week
Connectivity
0.11
0.34
0.57

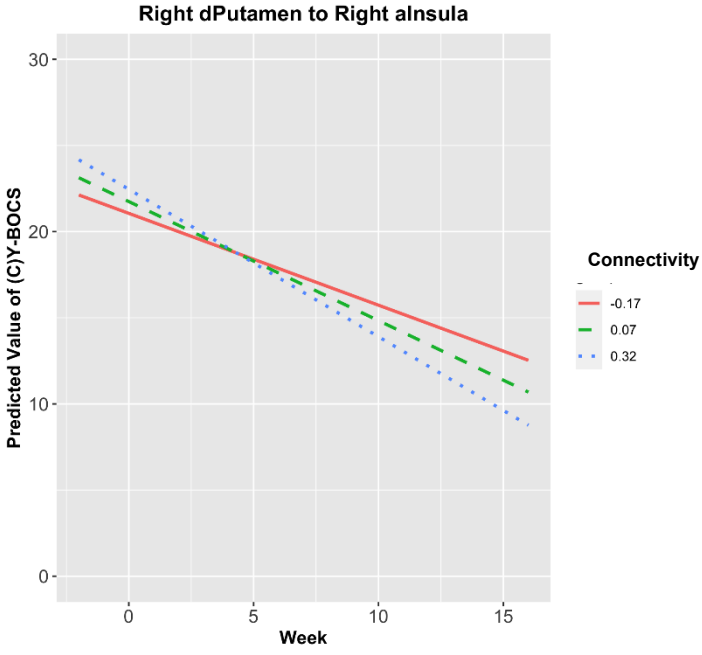
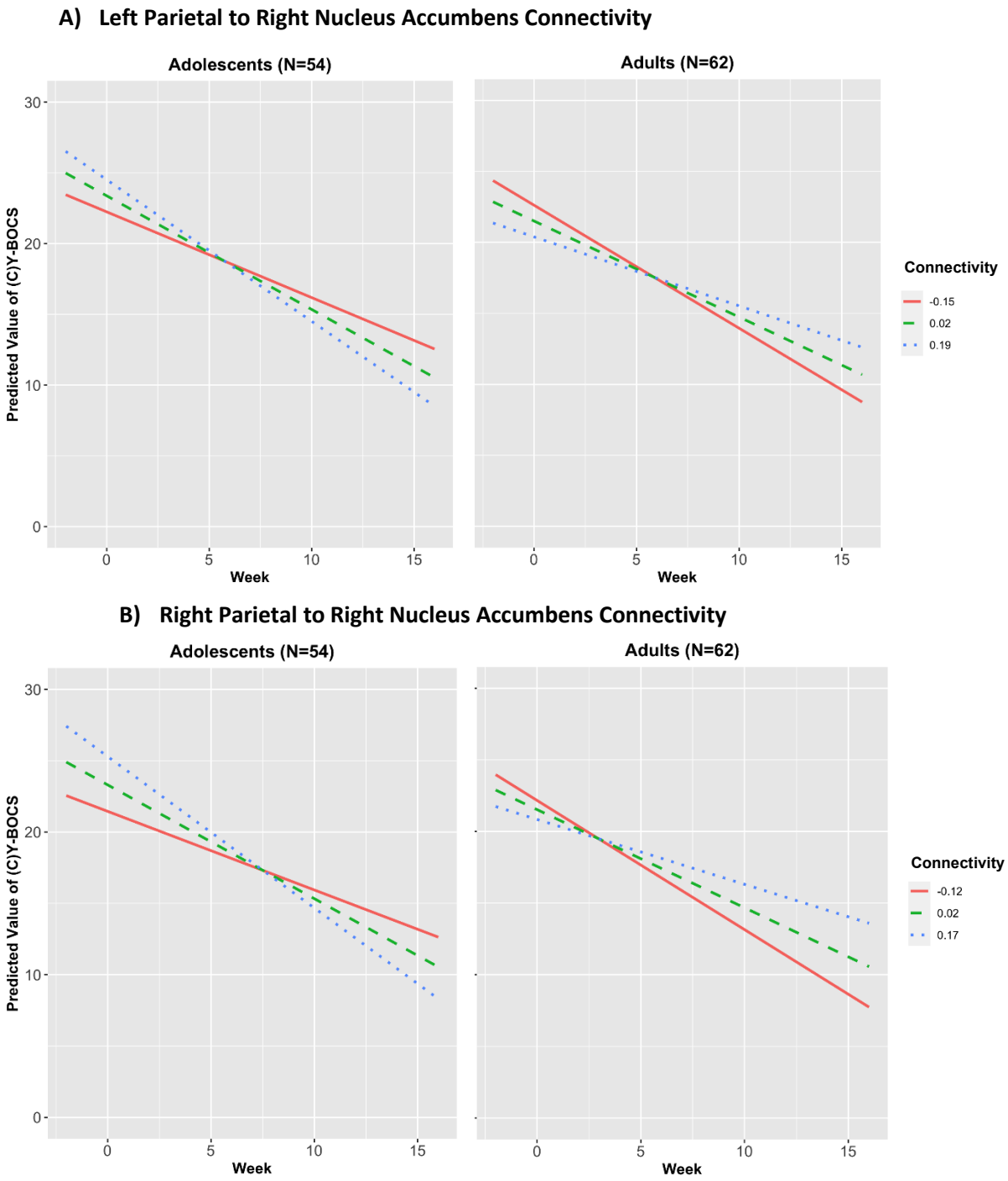

Right dPutamen to Right aInsula
Predicted Value of (C)Y-BOCS
Week
Connectivity
-0.17
0.07
0.32

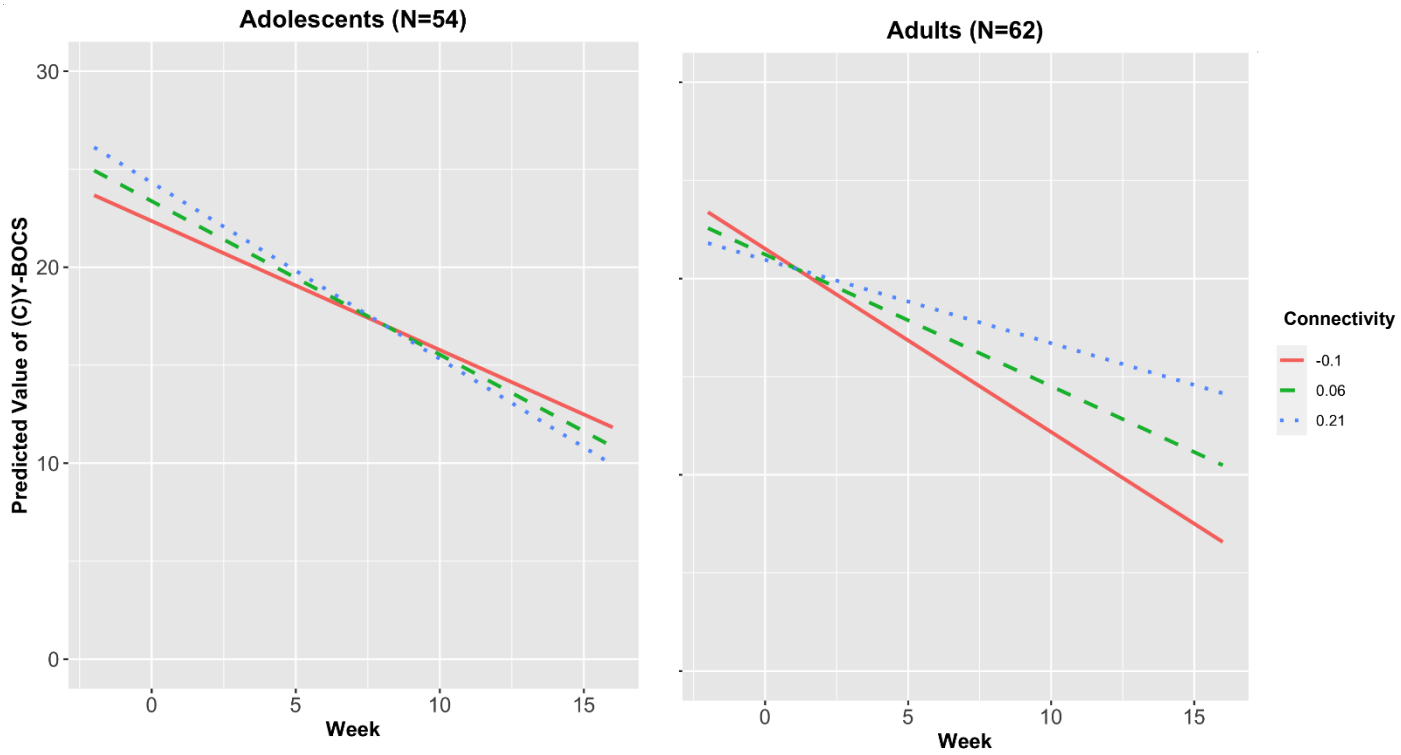
Figure S4.

*Simple slopes showing significant time*connectivity*age-group interactions of the nucleus accubens in model 3.*

For each connection, the slope of predicted symptom change is shown at mean (green dashed line), high (+ 1 SD, blue dotted line) and low (- 1 SD, red solid line) connectivity. Y-BOCS, Yale-Brown Obsessive Compulsive Scale child or adult version.



D) Right Parietal to Left Nucleus Accumbens Connectivity



C) Right Dorsolateral Prefrontal Cortex to Right Nucleus Accumbens Connectivity

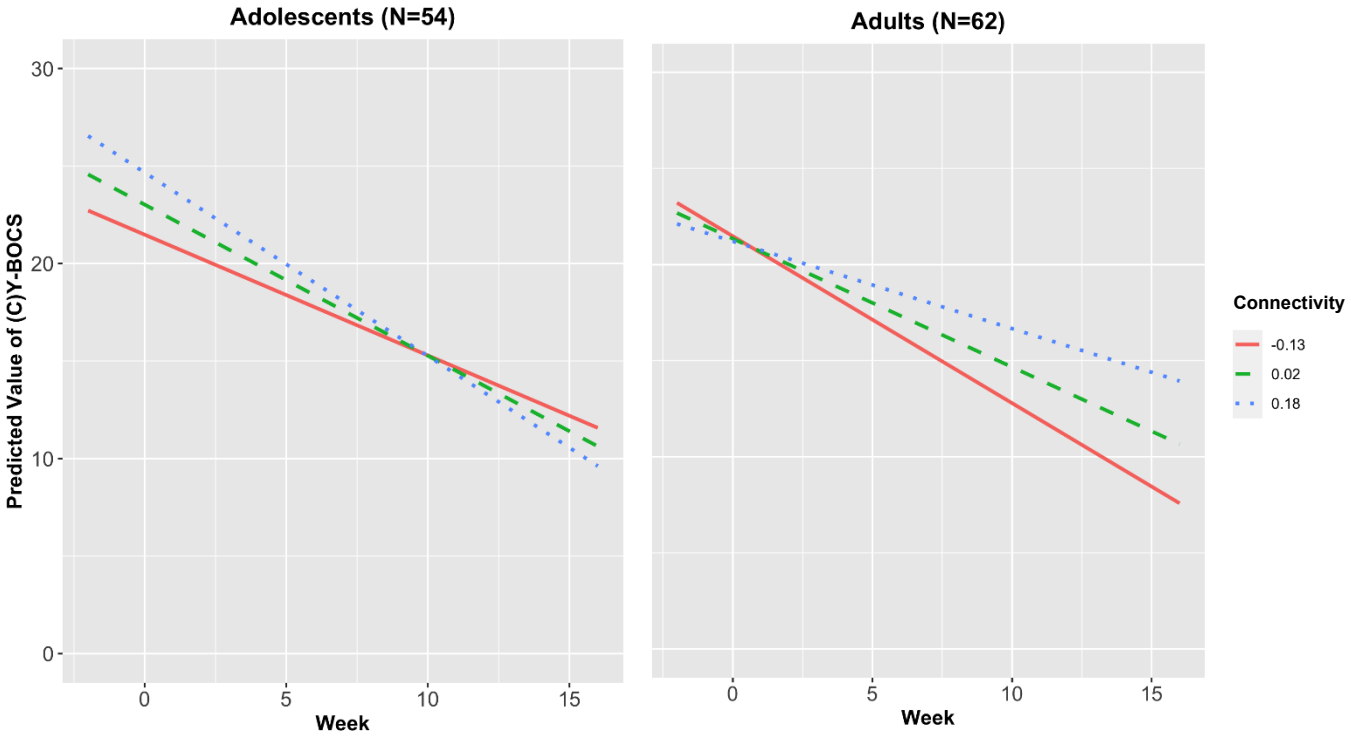


Figure S5.

Simple for the interaction of time by left inferior lobule connectivity adults and adolescents in model 3.

For each connection, the slope of predicted symptom change is shown at mean (green dashed line), high (+ 1 SD, blue dotted line) and low (- 1 SD, red solid line) connectivity. In adults, greater connectivity of the left inferior lobule predicted steeper reduction in symptoms over time. In adolescents, there was no significant interaction between connectivity and time on symptoms. Y-BOCS, Yale-Brown Obsessive Compulsive Scale child or adult version.

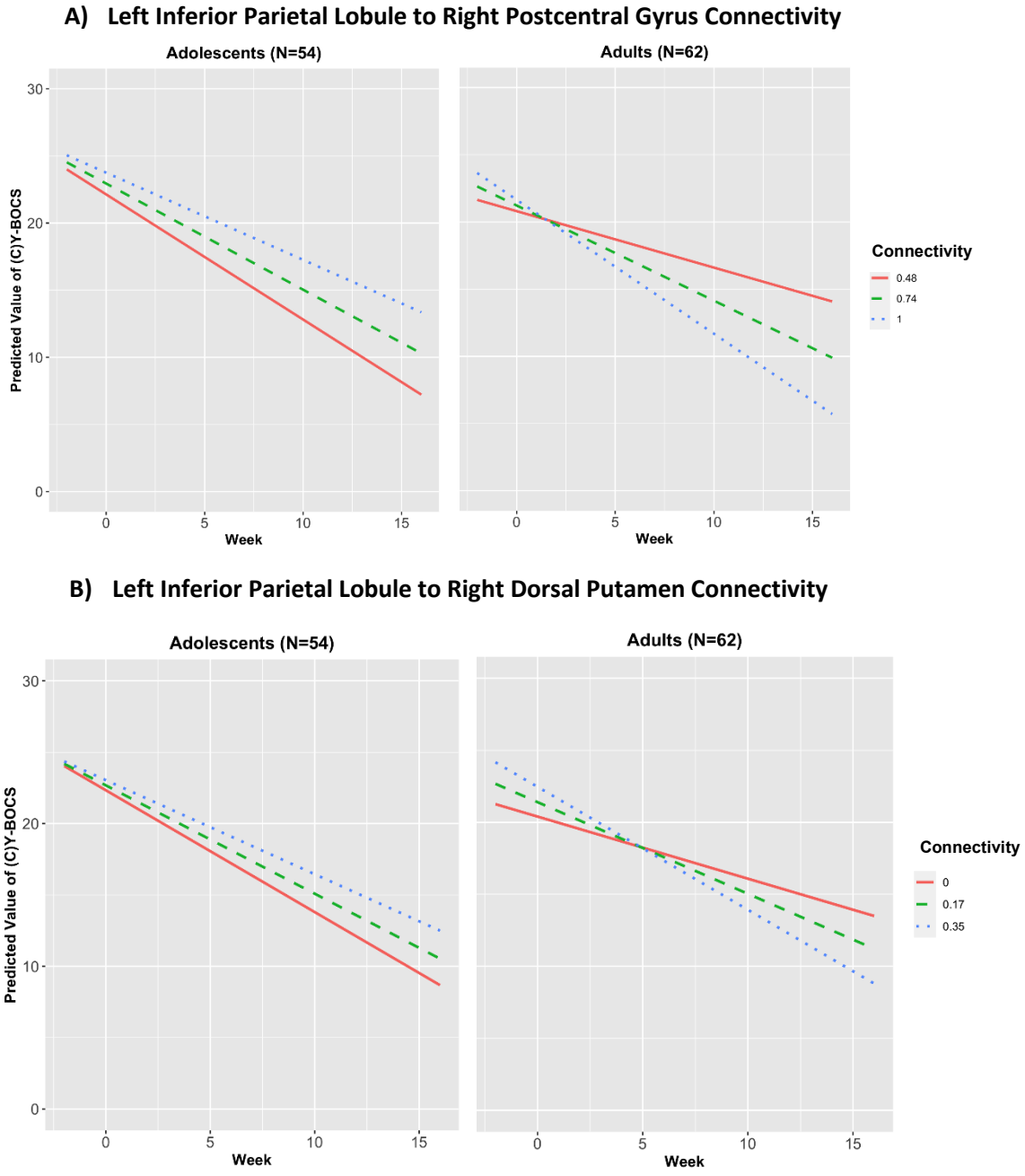
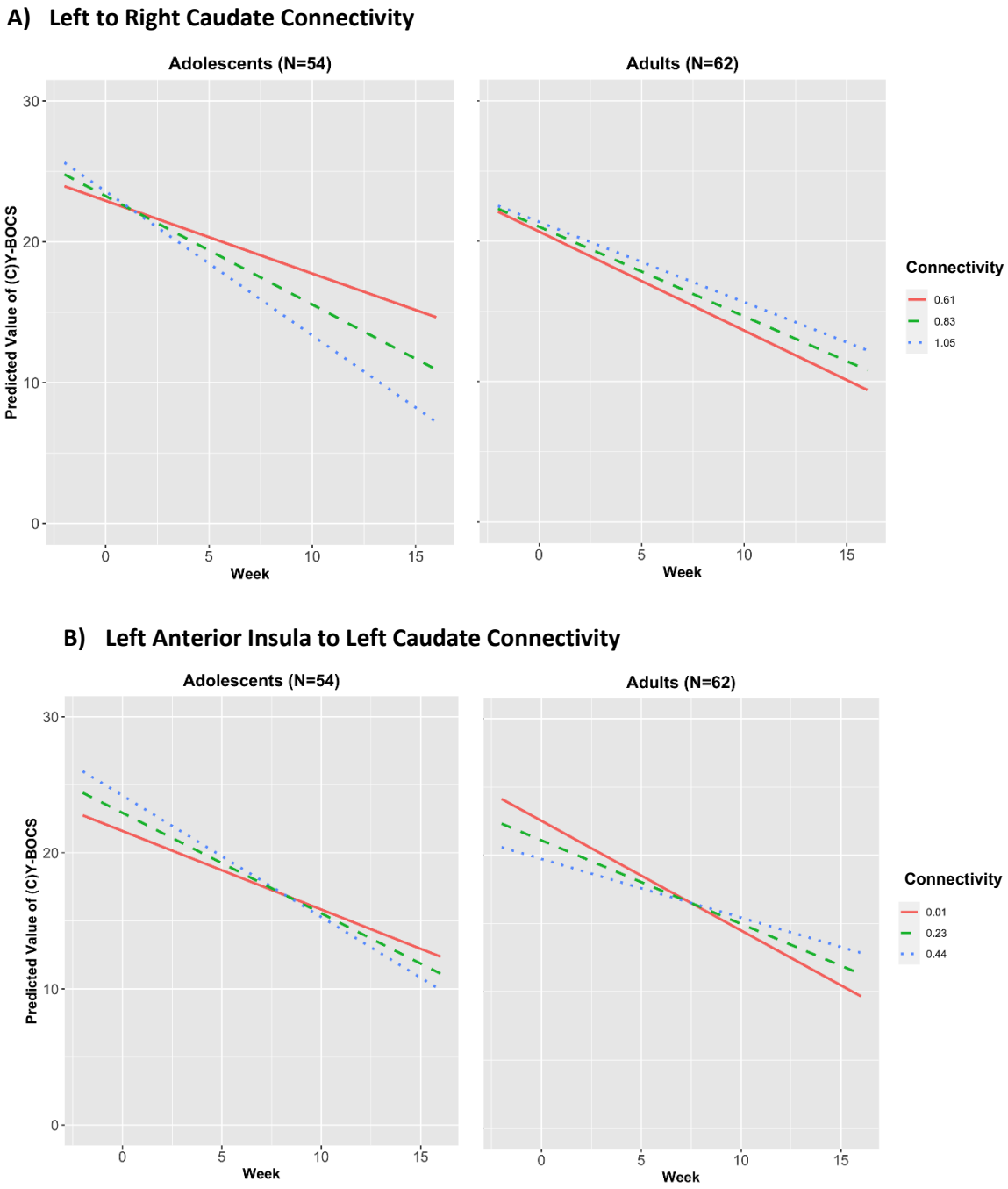


Figure S6.

*Simple slopes showing significant time*connectivity*age-group interactions within the cingulo-opercular network in model 3.*

For each connection, the slope of predicted symptom change is shown at mean (green dashed line), high (+ 1 SD, blue dotted line) and low (- 1 SD, red solid line) connectivity. A: left to right caudate. B: Left anterior insula to left caudate. C: Left anterior insula to right caudate



C) Left Anterior Insula to Right Caudate Connectivity

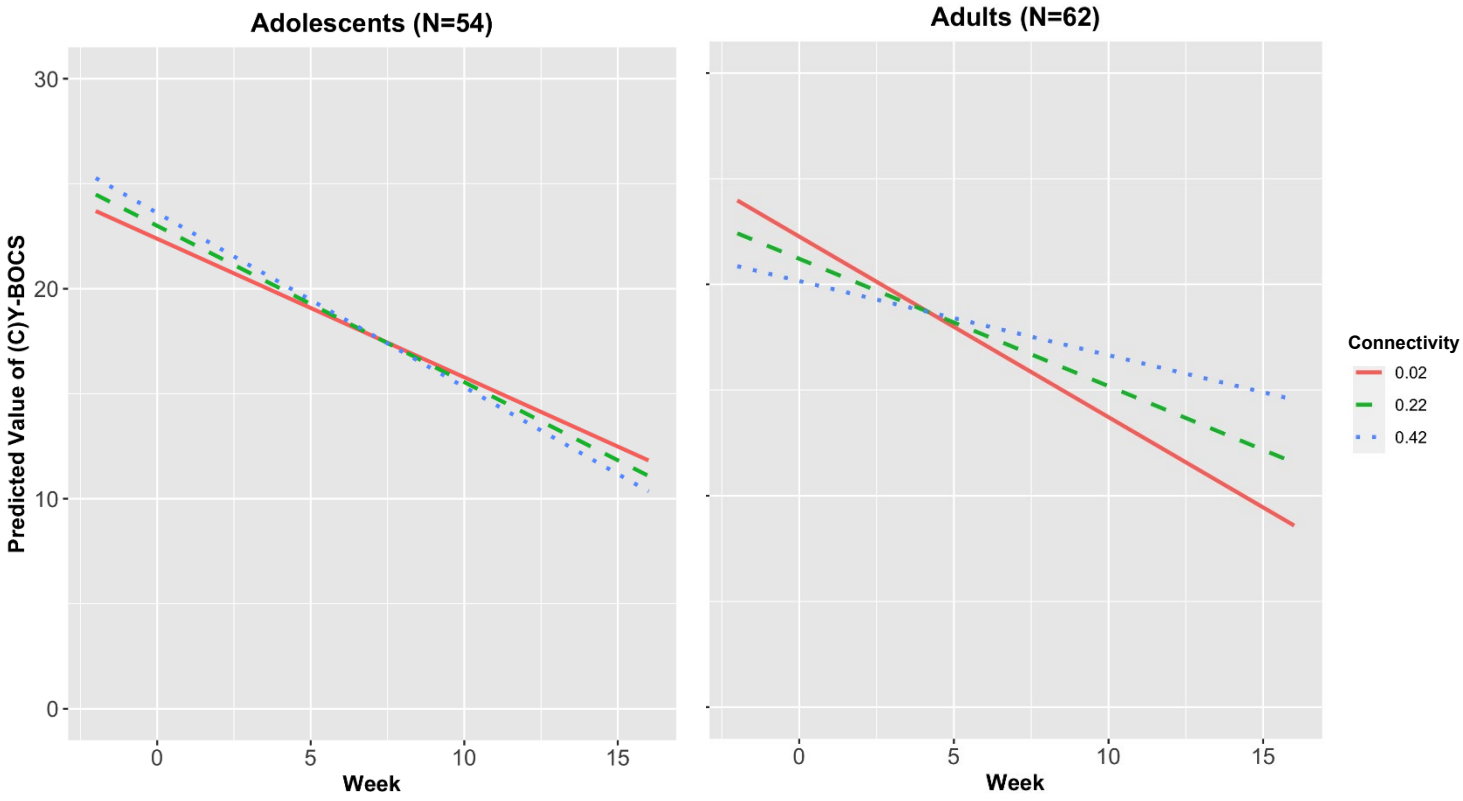


Figure S7.

ROI-ROI connections associated with symptom decline from models 1, 2, and 3 separated by medication status. Results are FDR-corrected for comparison of number of ROI-ROI connections in original model. Solid gray line indicates significant connections $p < 0.05$, and dotted gray line indicates marginal connections $p < 0.10$. dACC, dorsal anterior cingulate cortex; dlPFC, dorsolateral prefrontal cortex; dPut; dorsal caudal putamen; Ins, anterior insula; IPL: inferior parietal lobule; L, left; md Thal, medial dorsal thalamus; Meds: Medications; NAc; nucleus accubens; R, right; SMA, supplementary motor area; vmPFC, ventromedial prefrontal cortex; vPut, ventral rostral putamen