Mindfulness-Based Intervention Effects on DMN Cross-Network Resting FC Associated with Symptom Improvement

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Background

- Psychosis is associated with disrupted functional connectivity (FC) of the default mode network (DMN), a brain network activated at rest and suppressed during extrinsic cognition, as well as increased stress sensitivity.
- There is also evidence of widespread resting-state FC abnormalities of the DMN, salience network (SN), and central executive network (CEN) in psychosis.
- Multiple psychiatric disorders are characterized by failure to suppress DMN activity during tasks.
- We examine the effect of mindfulness-based cognitive therapy (MBCT), an intervention that improves emotion regulation and decreases stress sensitivity, on DMN connectivity with frontal cortex in three independent studies (two shown here) of MBCT in PTSD.
- PTSD is a chronic debilitating disorder with clinical and FC features also associated with high levels of distress and impairments in social and occupational functioning.

Methods

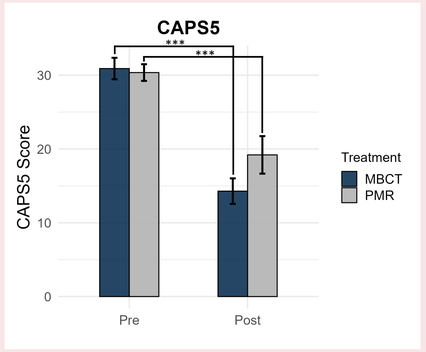
- A randomized controlled trial (RCT) with PTSD patients comparing MBCT to an active mind-body comparison intervention, Progressive Muscle Relaxation (PMR) and a single-arm pilot study with PTSD patients doing MBCT.
- Clinician administered assessments (CAPS-5) and self-report measures (PCL-5 and PHQ-9) were collected.
- 3T fMRI scans were collected during resting state. Participants focused on a fixation "plus sign" and were asked to let their minds wander freely for 8 minutes.
- Seed-based subject level rsFC (Fisher r-to-Z transformed) T-maps were generated CONN toolbox using PCC seeds [-5, -56, 26].
- First level T-maps were entered into second-level (group) random effects models – paired t-tests in SPM12.
- Second-level maps were thresholded p<.005 uncorrected and small volume correction.

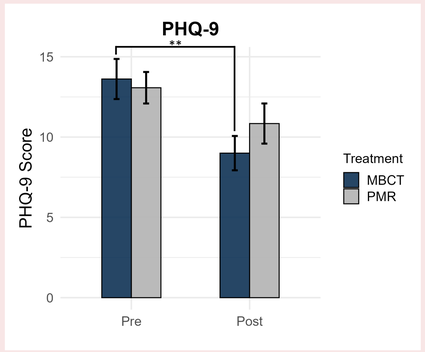
Results

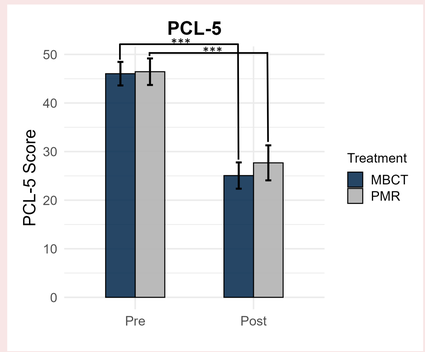
- MBCT reduced PTSD pre-post in both studies, independently.
- In Study 1, MBCT showed a trend (p = 0.12) of greater reduction in PTSD symptoms (CAPS-5 Cohen's d = 0.53 compared to PMR).
- MBCT increased PCC seed rsFC with bilateral DLPFC BA10.
- Increased PCC-DLPFC rsFC may be a therapeutic mechanism that is unique to Mindfulness-Based Interventions.
- Increased PCC-DLPFC rsFC may be linked to increased volitional meta-cognitive attention, increased emotional regulation of spontaneous distressing thoughts, and increased stress reduction – which may potentially also provide clinical benefits for psychosis.
- We are currently aggregating scan data from 5 studies (N=164 participants) for mega-analyses with multiple PCC-seeds and search areas / ROIs in BA46 and BA10 to elucidate the effects of MBCT and Rumination-Focused Cognitive Behavioral Therapy psychotherapies on DMN function.

Discussion

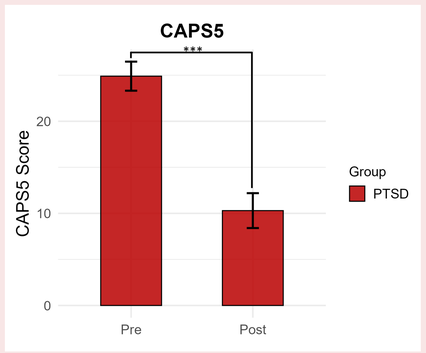
Study 1: University of Michigan

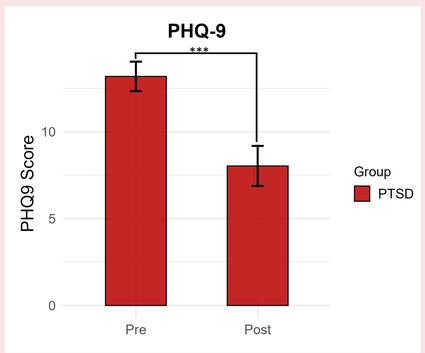


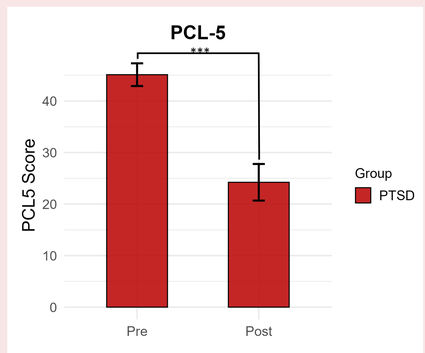




Study 2: The Ohio State University

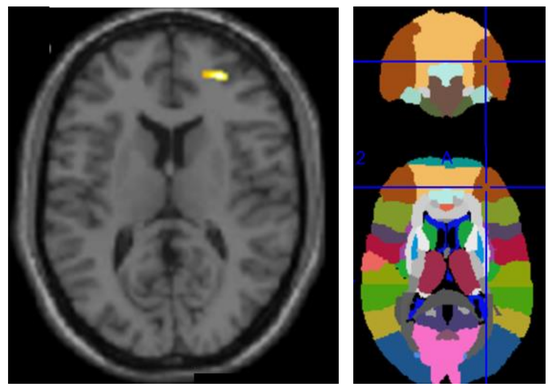






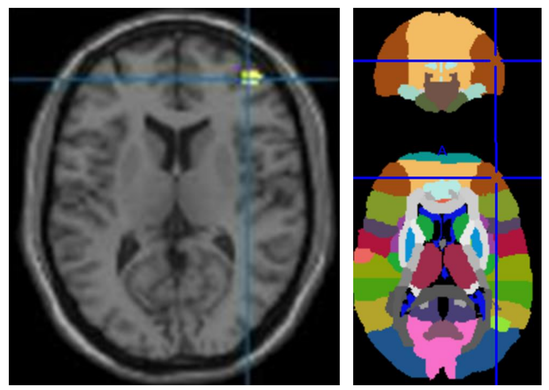
Independent Replication Across Two Sites: Increased Resting State Functional Connectivity between PCC seed (Default Mode Network) and DLPFC (Central Executive Network)

(38,44,12) BA10



Study 1 MBCT Community PTSD
- King et al., 2022
- Ann Arbor / Detroit (Univ Michigan)
- Age 21-67 85% female, community
- MBCT N=21 vs. PMR N=20
- MBCT and PMR reduced PTSD (CAPS d=1.9, d=1.2)
- 3T GE MR750
- PCC seed MNI (0, –56, 26)

(40,50,10) BA10



Study 2 MBCT Community PTSD
- King et al., 2024
- Columbus (The Ohio State Univ)
- Age 21-62 84% female, community
- MBCT N=37 single arm pilot
- MBCT reduced PTSD (CAPS d=1.2)
- 3T Siemens Prisma
- PCC seed MNI (0, –56, 26)