

# Mindfulness-Based Stress Reduction alters neural responses associated with asthma outcomes

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## BACKGROUND

### Asthma, Psychological Distress, and the Brain

- Psychological distress negatively impacts airway inflammation, asthma control, and treatment efficacy<sup>1</sup>
- Neural networks involved in emotion-processing and responding have been linked to immune modulation<sup>2</sup>, including asthma-related inflammation<sup>3,4</sup>
- Regions in these networks—including the prefrontal cortex (PFC), amygdala (AMYG), insula, and anterior cingulate cortex (ACC)—regulate attention and integrate cognitive-affective appraisals of salient cues<sup>5,6</sup>
- Interventions targeting emotion regulation, such as Mindfulness-Based Stress Reduction (MBSR), can reduce stress-related inflammation<sup>7</sup>, improve asthma control<sup>8</sup>, and alter neural activity within these regions<sup>9</sup>
- What neural mechanisms underlie the impacts of MBSR on asthma?

## Hypotheses

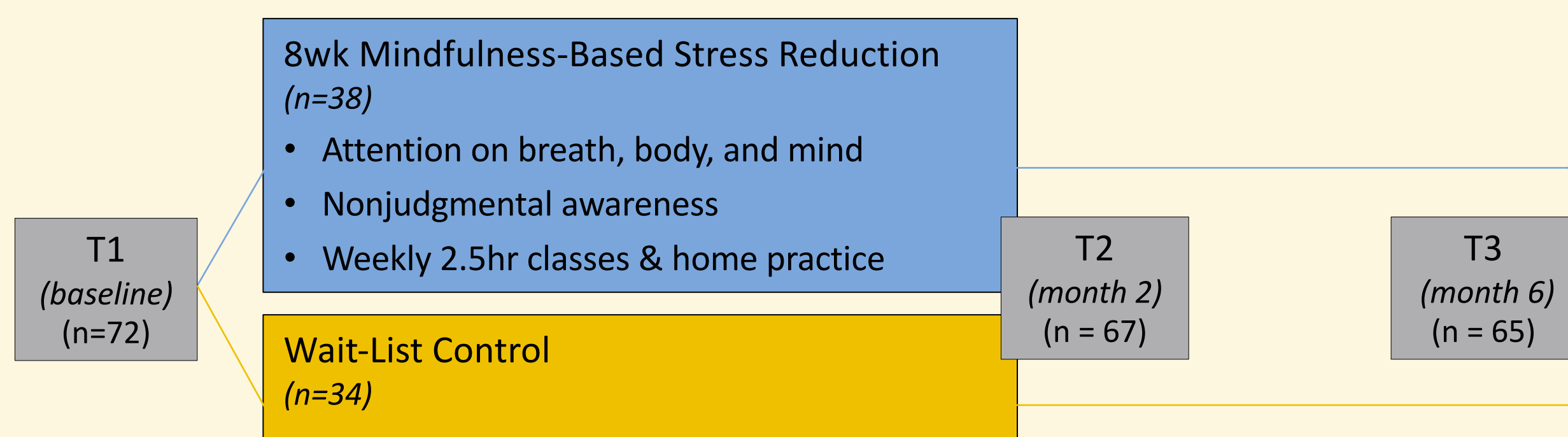
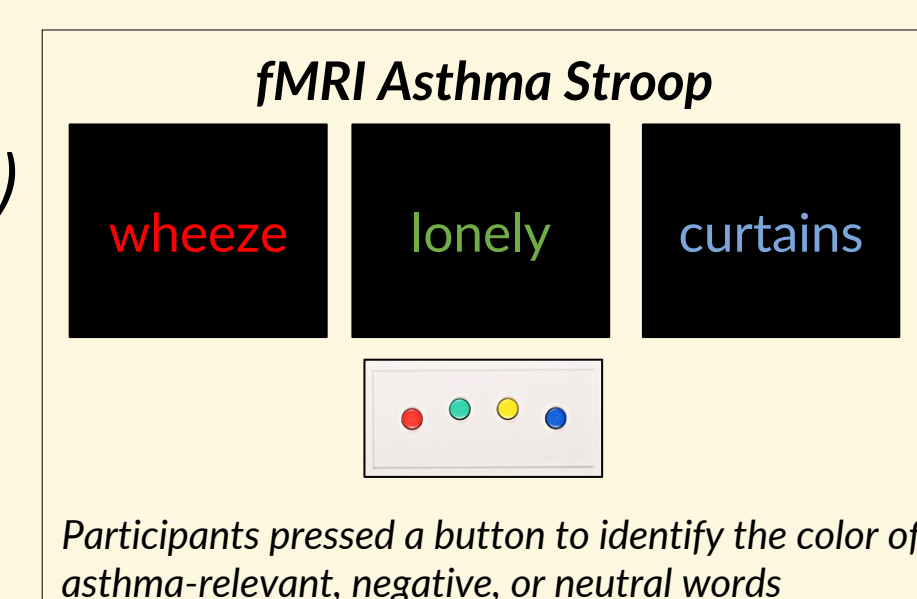
- MBSR will reduce activity in regions within emotion-relevant neural networks, in response to aversive cues
- MBSR training-related neural changes will correlate with improved inflammation and psychological symptoms

## METHODS

- **72 adults ages 18-65** ( $M = 38.1$ ; 43 F) with asthma, with elevated airway inflammation ( $FeNO \geq 30ppb$  or blood eosinophils (EOS)  $\geq 150$  cells/ $\mu L$  or sputum EOS  $\geq 2\%$  total leukocytes)

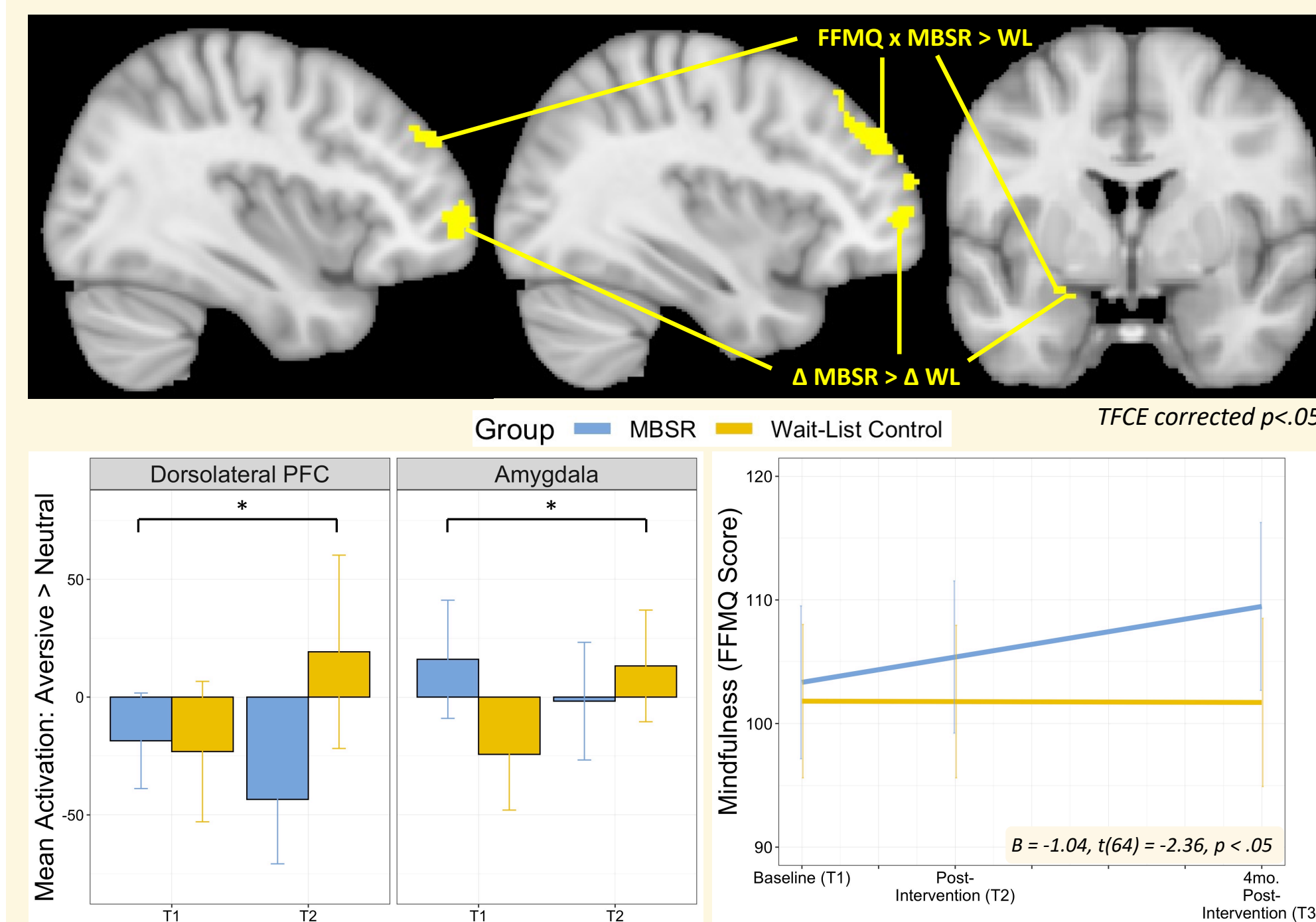
- Assessments (T1, T2, T3):

- **Type 2 Inflammation** (blood & sputum EOS,  $FeNO$ )
- **Self-Report**: Asthma Control (ACQ-6), Mindfulness (FFMQ), Distress (SCL-90R), Depression (BDI), Anxiety (BAI)
- **Task-based fMRI**: Asthma Stroop

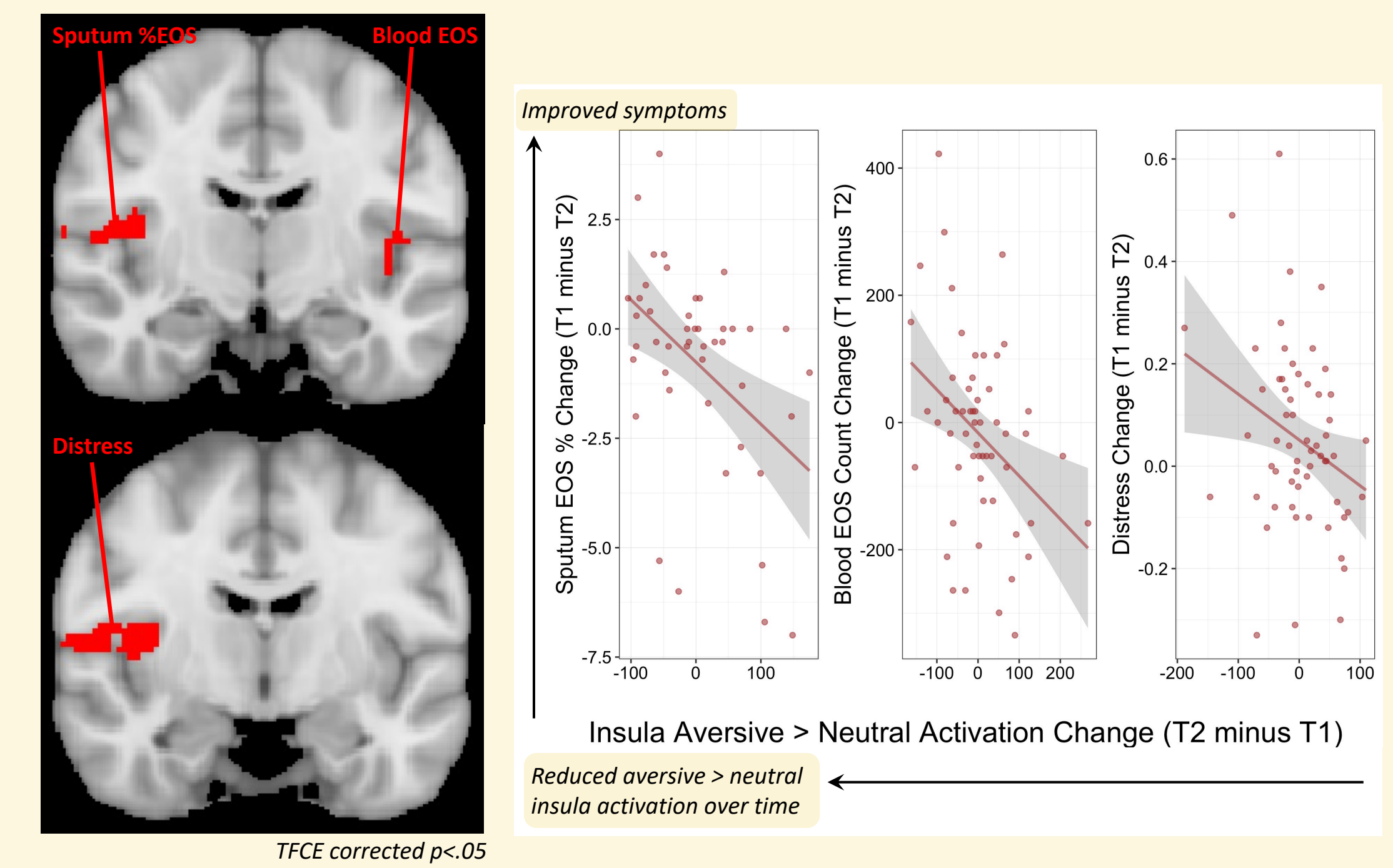


## RESULTS

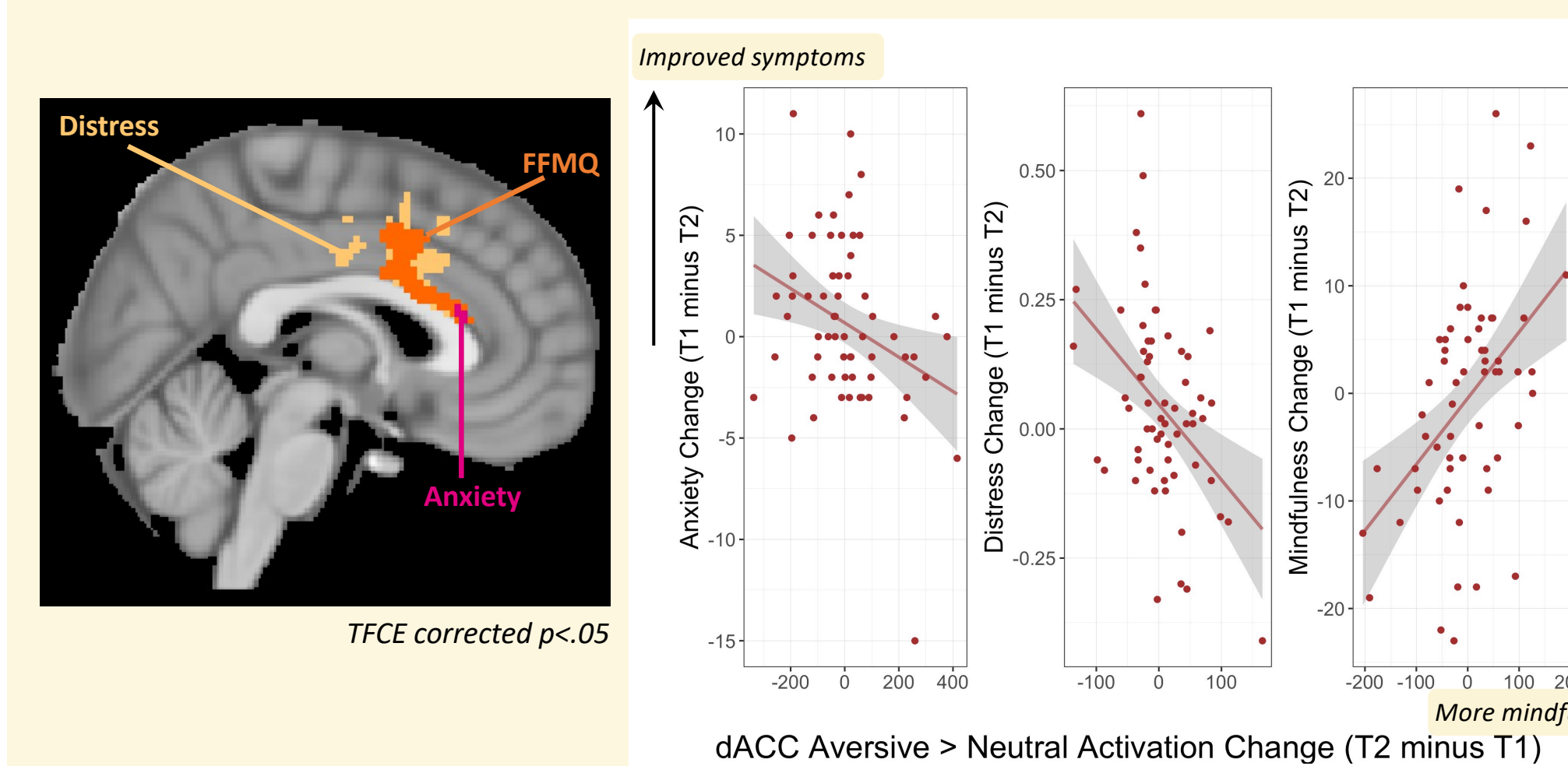
MBSR decreases **dIPFC** and **AMYG** response to aversive cues, which correlates with increased mindfulness



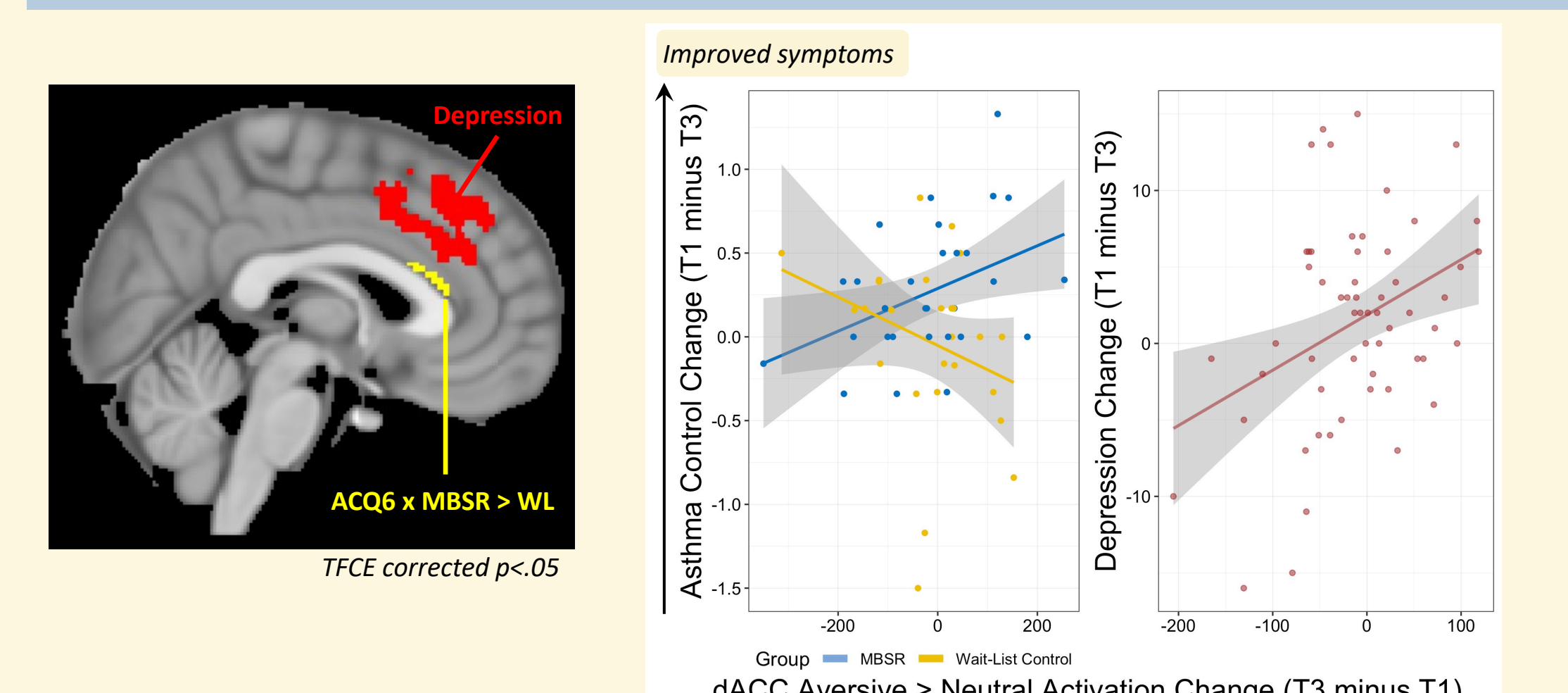
Decreased inflammation and distress over time correlate with reduced **insula** response to aversive cues



Increased mindfulness and decreased distress correlate with reduced **dACC** response to aversive cues at T2



MBSR-related improved asthma control and overall decreased depression correlate with **increased dACC** response to aversive cues at T3



## CONCLUSIONS

- MBSR training alters neural processing of aversive words, which suggests a decreased need for effortful cognitive-affective regulation and reduced reactivity to salient cues, and predicts increased mindfulness
- Across groups, decreased neural reactivity in regions involved in salience appraisal is associated with improved disease-related outcomes following mindfulness training
- Given the role of the dACC in both emotion reactivity and attention regulation, its contribution to associations between mindfulness, emotion, and asthma may shift toward effortful regulation over time
- These results highlight the importance of considering mind-body relationships in asthma treatment



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