

Uncovering the neural similarities between Tourette syndrome and related disorders: A network mapping approach

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INTRODUCTION

- Most patients diagnosed with Tourette syndrome (TS) have ≥ 1 co-occurring neuropsychiatric disorders. ~50% present with obsessive-compulsive disorder (OCD) and/or attention-deficit-hyperactivity disorder (ADHD) (1).
- These three disorders show similar genetic links & have phenotypic similarities relating to urges & inhibition. Therefore, it is possible they have similar brain networks involved (2, 3).
- Neuroimaging research suggests potential overlapping neural network between **TS, OCD, & ADHD** (3). This is yet to be directly tested.

Aims

- Identify separate brain networks for **structural alterations** in patients with **OCD & ADHD**
- Examine convergence between these networks & our TS network (4)

METHODS

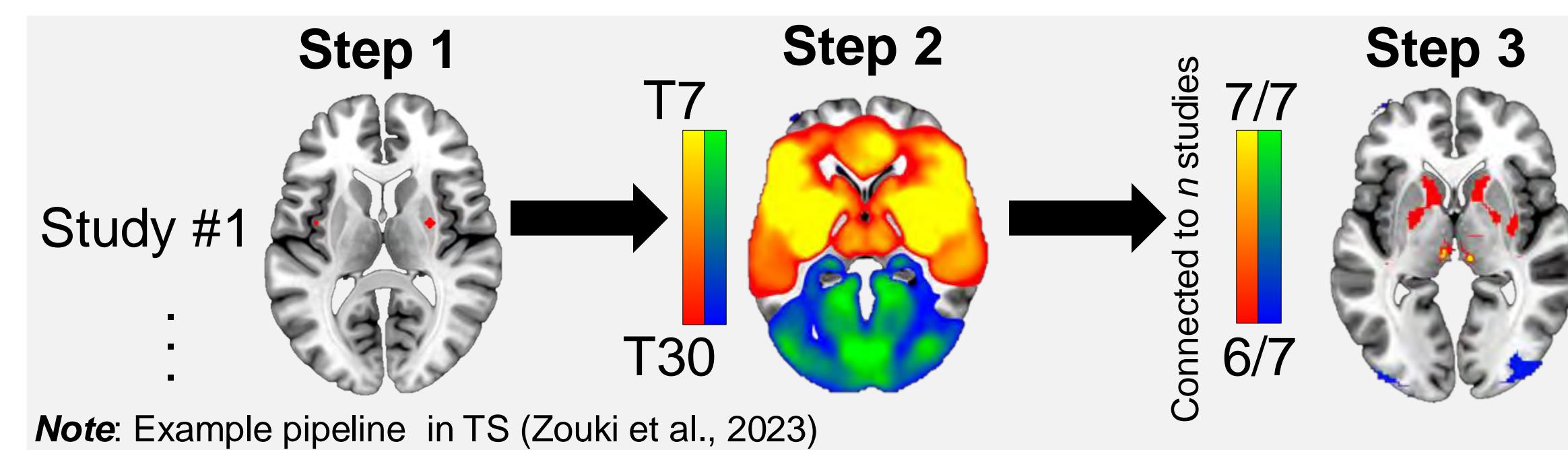
Coordinate selection

- Whole-brain voxel-based (MRI) structural differences relative to controls e.g., ADHD vs healthy control

Data extraction

- Coordinates were extracted from studies reporting findings in OCD ($N = 31$) & ADHD ($N = 38$)

Coordinate network mapping (CNM) in OCD & ADHD



Primary analyses

- Visual inspection of network similarity between TS, OCD, & ADHD
- Specificity analyses (4) for OCD & ADHD

RESULTS

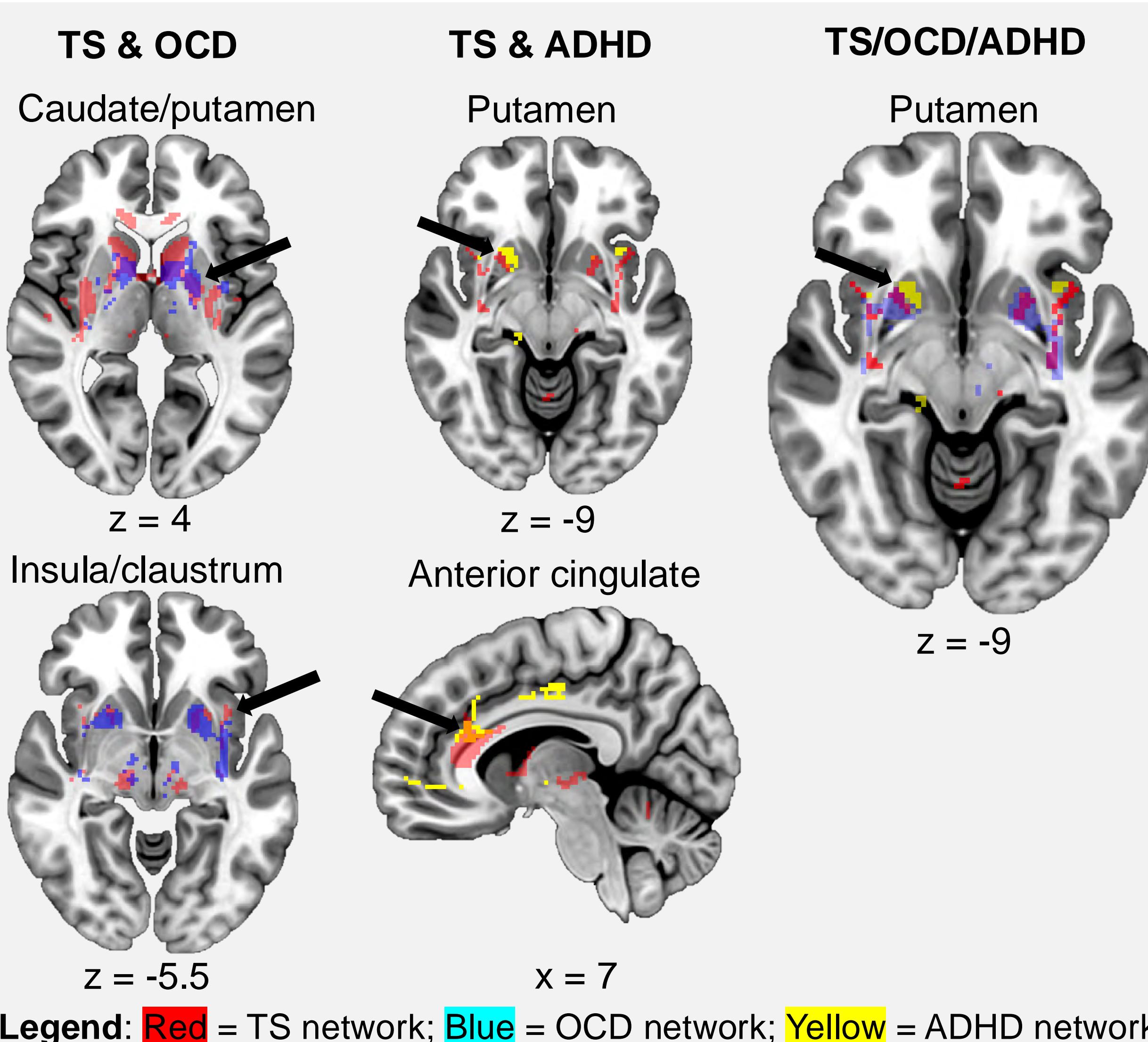
Clinical characteristics

- 3/31 OCD studies explicitly noted comorbid tics/ADHD, 3/38 ADHD studies reported co-occurring tics/OCD & 4/7 TS studies noted comorbid OCD/ADHD

CNM in OCD & ADHD

- Alterations in OCD mapped to bilateral caudate, putamen, claustrum, thalamus, left insula (positive connectivity)
- Neuroimaging findings in ADHD localized to bilateral precentral gyrus, mid-/anterior cingulate, corpus callosum, thalamus, putamen, insula (positive connectivity)
- Both disorders primarily showed negative connectivity to the occipital cortex

Network similarity between TS, OCD, & ADHD



- Network similarity between TS & OCD primarily in the caudate, putamen & insula/claustrum
- Network similarity between TS & ADHD primarily in the anterior cingulate & putamen

(Cont.)

- Network similarity between TS/OCD/ADHD primarily in putamen

Specificity analyses

- Including all studies, no regions were more specifically connected to OCD or ADHD, relative to each other or TS (TFCE $p < .05$)

DISCUSSION

- We provide first application of CNM to OCD, findings largely consistent with recent LNM (5)
- Findings show consistency with recent CNM findings reported in ADHD by Wall et al. (6)
- Network similarity between TS & OCD may reflect the shared sensory phenomena associated with tics & compulsions, respectively.
- Network similarity between TS & ADHD may be associated with shared sensory & impulsivity symptoms.
- No specificity compared to the other disorders. May be due to common co-occurrence convoluting results. Requires additional validation of networks in patient data.

FUTURE DIRECTIONS

- Validation of networks in patient rs-fMRI data
- Examination between functional correlates & OCD/ADHD symptoms in upcoming TS dataset (**U-TIC TS Study 2025-2027**)
- Future structural & functional neuroimaging studies should provide summary stats. based on comorbidities & symptom dimensions (e.g., sMRI for OCD subtypes)
- Longitudinal analyses to examine compensatory processes in TS, OCD, & ADHD

References

(1) Mathews & Grados (2011). JAACAP; (2) Amat et al. (2006). Am. J. Psychiatry; (3) Sheppard et al. (1999). Clin. Psychol. Rev.; (4) Zouki, Silk, Corp et al. (2023). Brain Comms.; (5) Cotovio et al. (2025). MedRxiv; (6) Wall et al. (2025). ACNS



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