

# Network localization of tics: Evidence from coordinate and lesion network mapping



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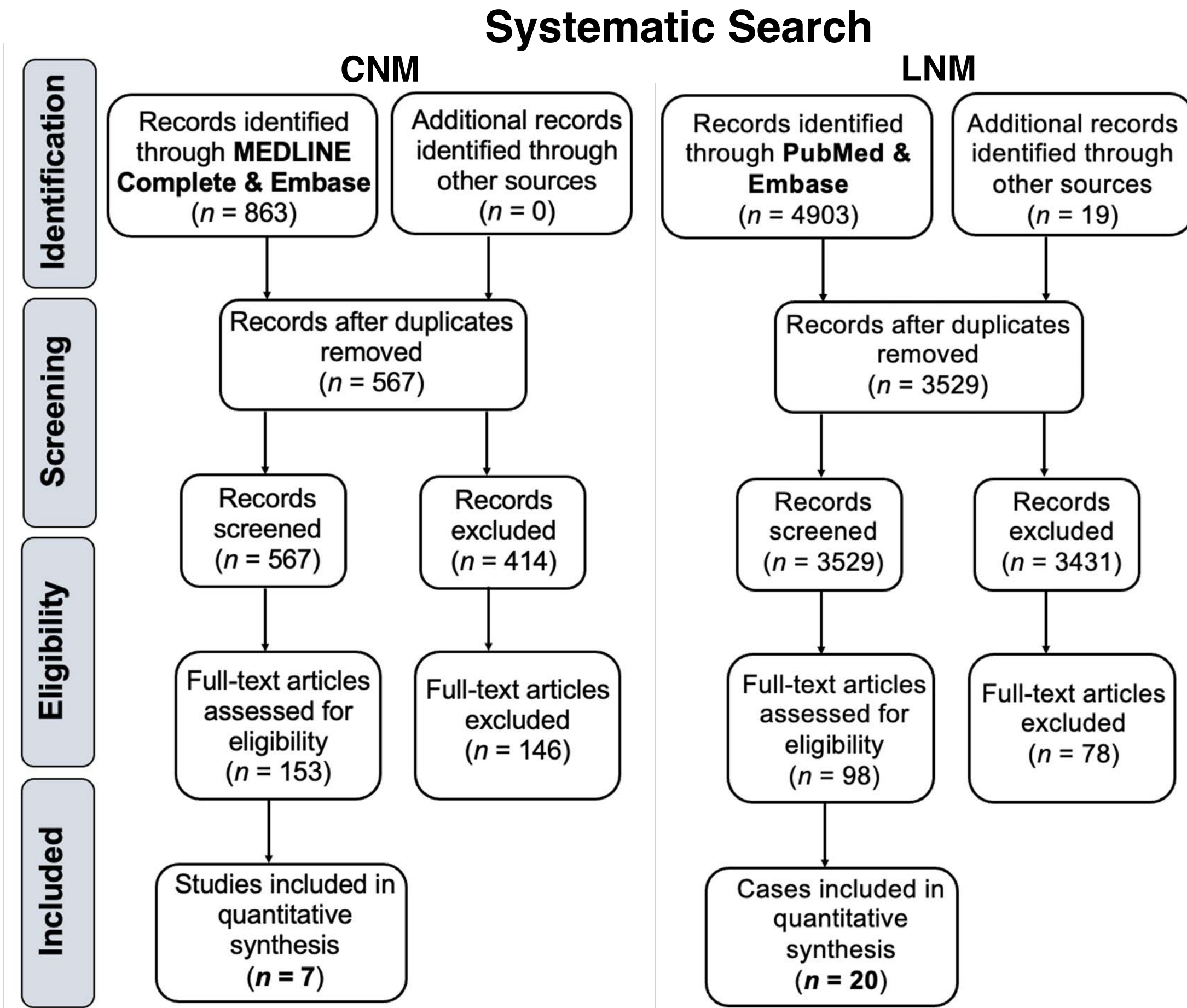
## INTRODUCTION

- Tics can be idiopathic, presenting as focal symptoms of Tourette Syndrome (TS), or secondary to neural pathologies e.g., focal brain lesions<sup>1</sup>
- Neuroimaging studies implicate widespread cortical and subcortical abnormalities in TS. However, due to neuroanatomical heterogeneity, it remains unclear which brain regions are **key** to TS symptomatology
- Likewise, tic-inducing lesions can occur throughout the brain, suggesting that tic symptoms may better localize to a neural network rather than a single brain region
- 'Coordinate network mapping' (CNM) and 'lesion network mapping' (LNM) can be used to localize neuroimaging findings and symptom inducing brain lesions to a common brain network, respectively

### AIMS

- To localize heterogeneous structural neuroimaging findings in TS to a network of brain regions
- Identify a common network for tics based on idiopathic and secondary tic symptoms

## COORDINATE & CASE SELECTION



### INCLUSION CRITERIA

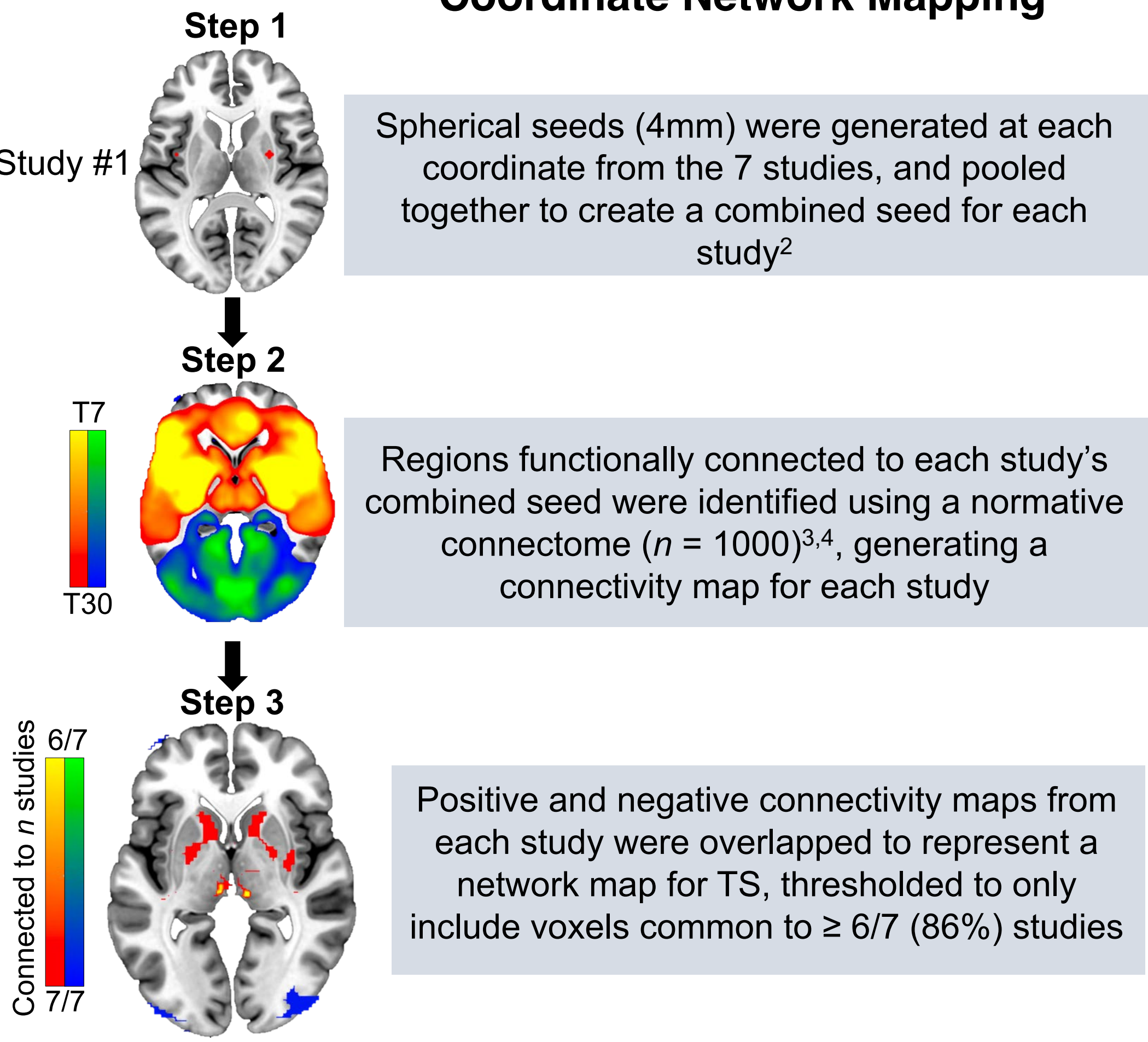
- Coordinates of neuroimaging abnormalities (PET, SPECT, MRI) i.e., TS vs. HC
- Cases documenting tic-inducing brain lesions

### DATA EXTRACTION

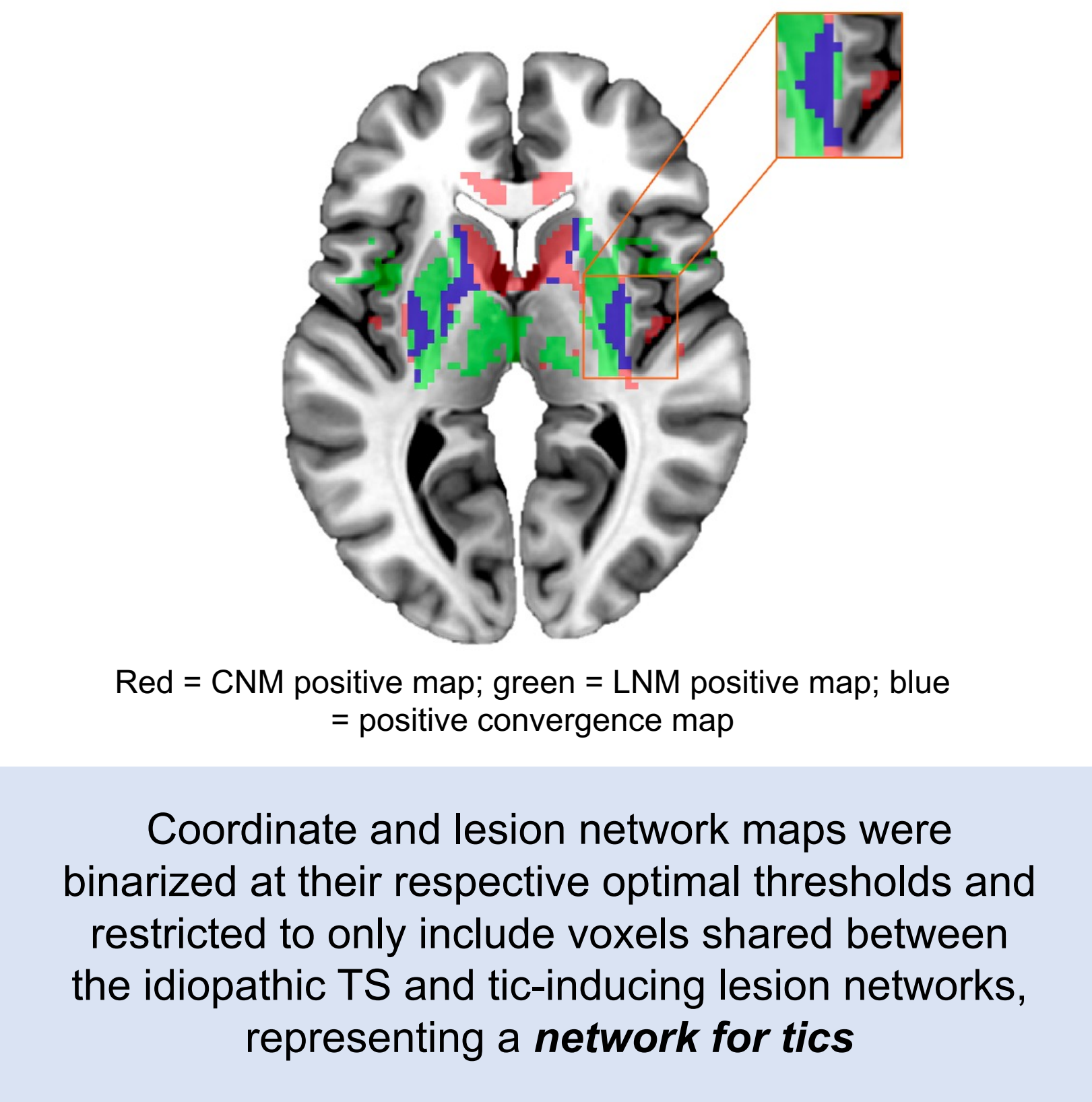
- MNI coordinates were extracted from the studies (n = 7)
- Lesion images, etiology and clinical characteristics were extracted from the case reports (n = 20)

## NETWORK MAPPING TECHNIQUES

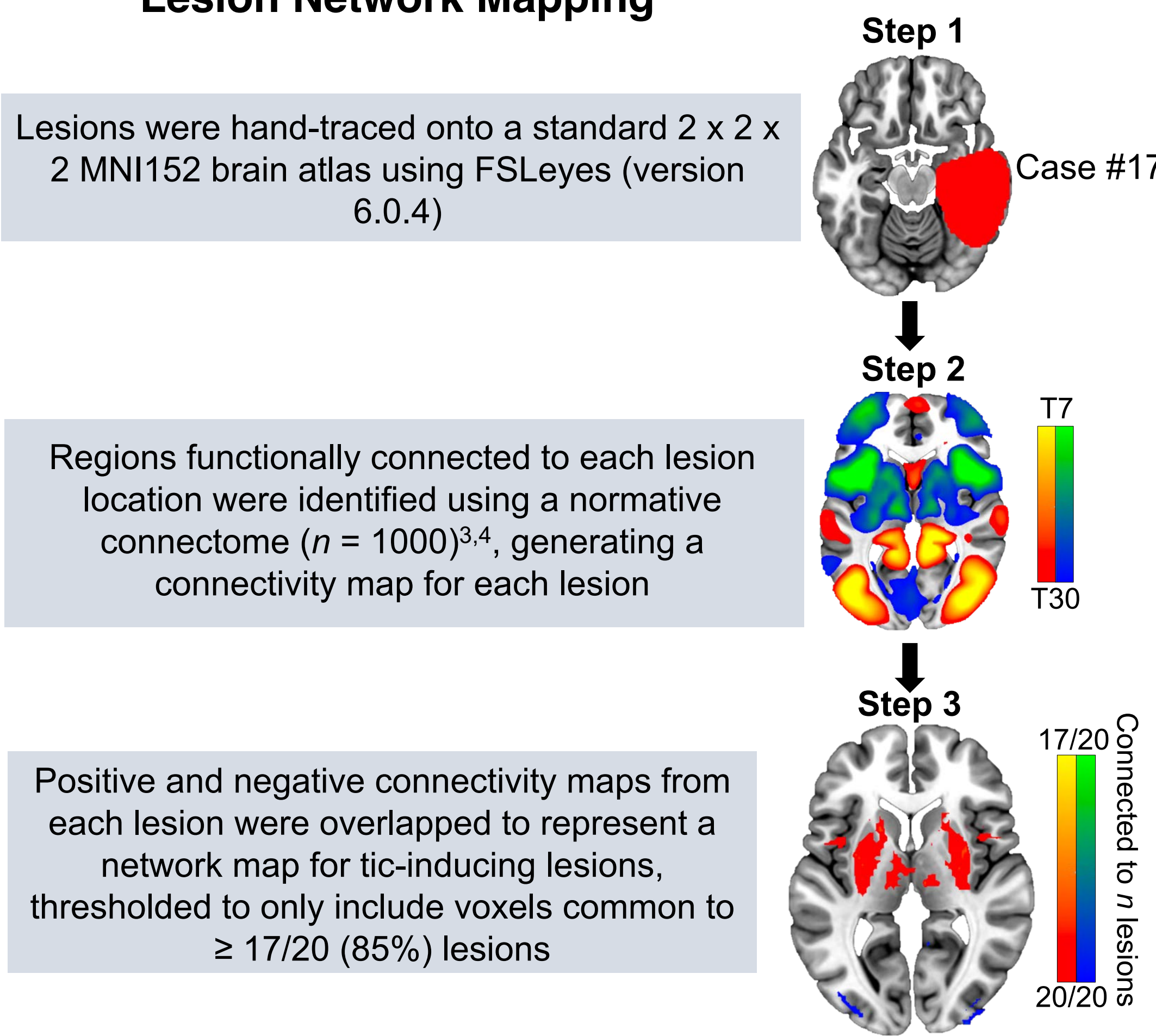
### Coordinate Network Mapping



### Convergence Network Map



### Lesion Network Mapping



## RESULTS

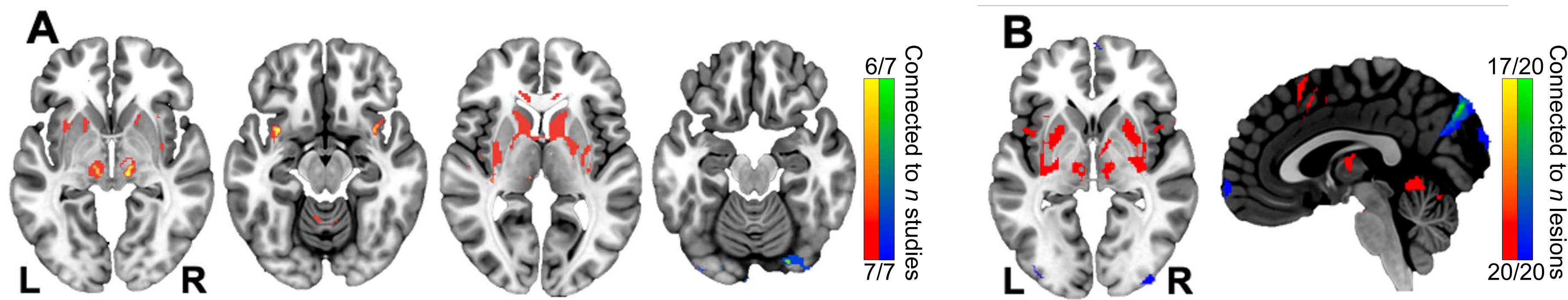
### Coordinate & Lesion Network Mapping

#### CNM

- Heterogeneous neuroimaging findings in patients with TS localized to a common network, involving structures within the cortico-basal-ganglia-thalamo-cortical circuit (see figure A)

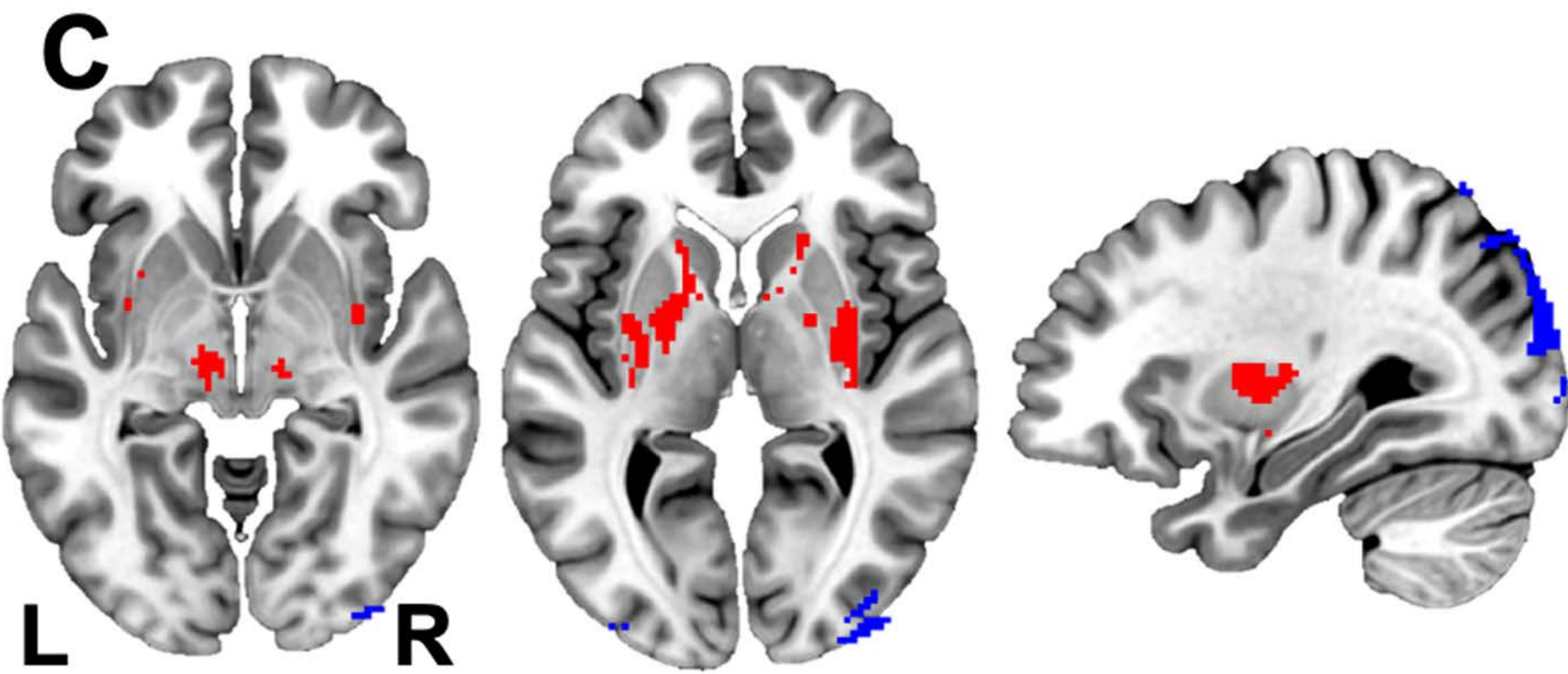
#### LNM

- Tic-inducing lesions were reported in heterogeneous locations, however, mapped to a common network (see figure B). Our findings are largely consistent with those previously published by Ganos and colleagues<sup>5</sup>



### Convergence Network Map

- Both idiopathic TS and lesion-induced tics map to a common network, involving the thalamus, caudate, putamen, external segment of the globus pallidus (GPe) and the occipital lobe (see figure C)



## CONCLUSIONS & FUTURE DIRECTIONS

- Seemingly inconsistent structural neuroimaging findings in patients with TS map to a common network involving regions previously associated with tic onset and premonitory urge<sup>6</sup>
- This network identified in TS and a network for tic-inducing lesions converge in the thalamus, caudate, putamen, GPe and occipital lobe, revealing a sub-network which may mediate tics as shared symptoms between idiopathic and acquired tics
- Brain regions involved in this sub-network are consistent with common neuromodulation targets for tics<sup>7</sup>

### NEXT STEPS

- Further examination of the relationship between intrinsic functional connectivity patterns in this network and tic symptoms severity

## REFERENCES

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