

Similarities and differences of the neural correlates in various sleep disorders and sleep deprivation across 231 neuroimaging studies

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INTRODUCTION

Patients with various chronic sleep disorders and/or healthy individuals with experimental total/partial sleep deprivation report diverse nocturnal/daytime symptoms. Still, some of those symptoms, their comorbidities, and their genetic underpinning are similar^{1,2}, suggesting common neurobiological substrates that are not well-characterized yet.

AIM

This large-scale pre-registered multimodal neuroimaging meta-analysis investigated the specific/shared neural correlates across various sleep disorders and total/partial sleep deprivation using a multimodal coordinate-based meta-analysis (CBMA) following the best-practice guidelines^{3,4}. Subsequently, we aimed to identify the function and connectivity map of those regions.

METHOD

Data Sources: PubMed, Web of Science, Embase, Scopus search in January 2024

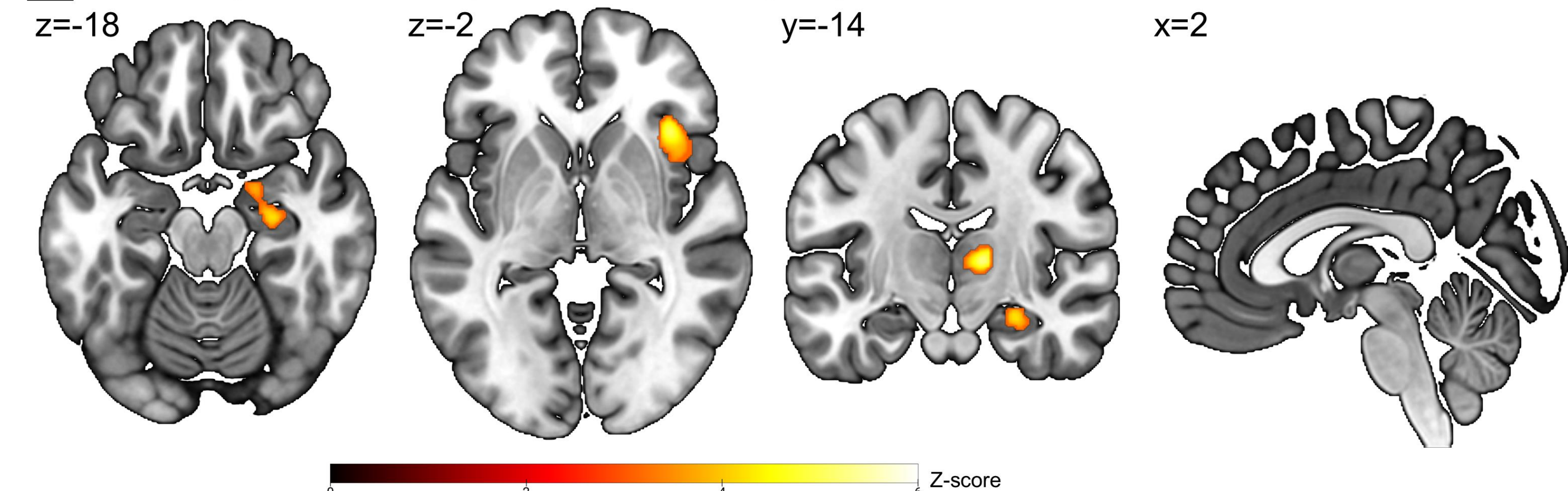
Study Selection: Whole-brain structural (voxel-based morphometry) and functional (task- & resting-state fMRI) differences between various sleep disorders or total/partial sleep deprivation and normal sleep conditions.

Main analyses:

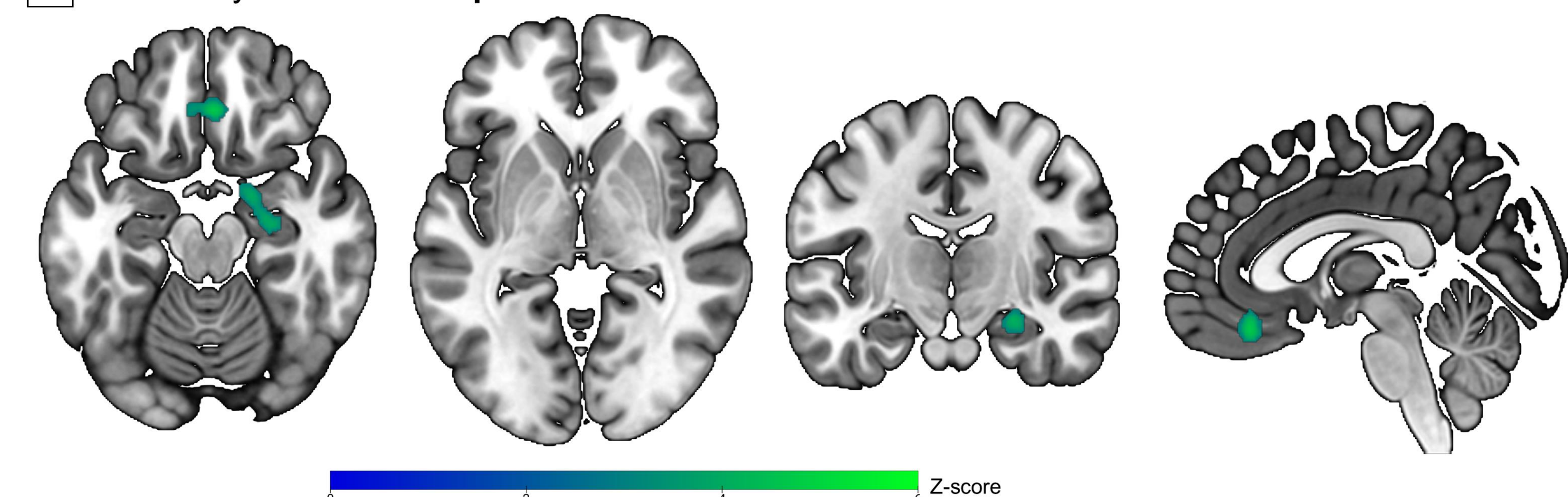
- Several activation likelihood estimation (ALE)⁵ analyses across various sleep disorders/deprivation conditions.
- Functional decoding and task-based connectivity analyses of the identified convergent regions using the BrainMap⁶ dataset.
- Task-free connectivity analysis of the convergent regions using the eNKI dataset.
- Conjunction between task-based and task-free functional connectivity maps.

RESULTS

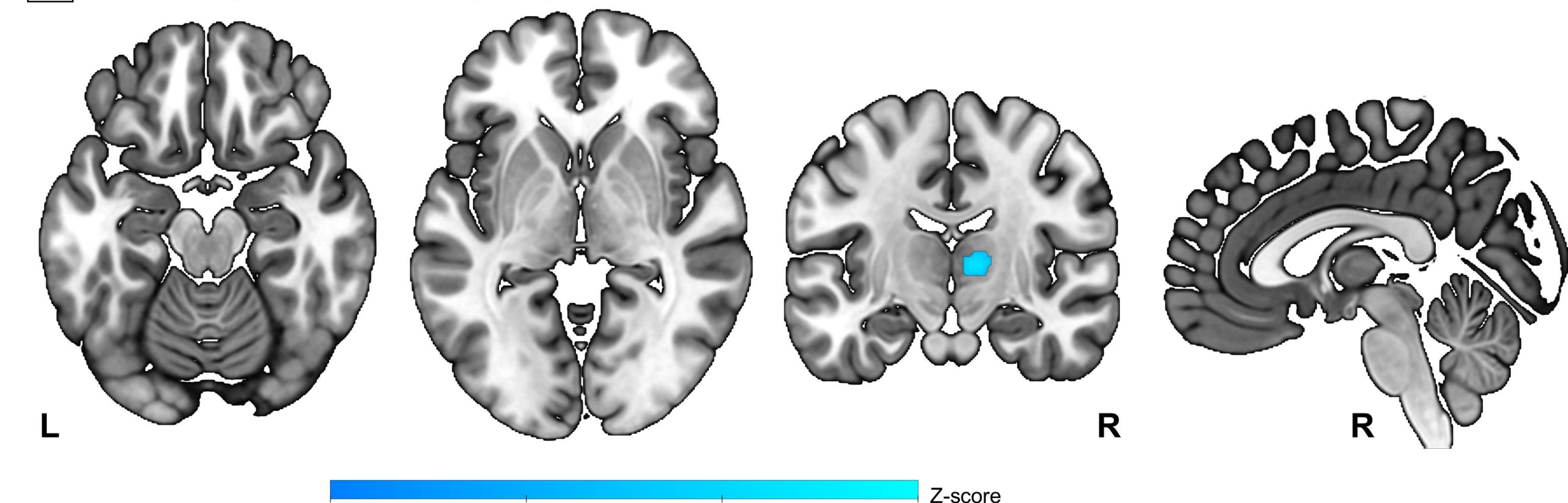
A) ALE analysis across sleep disorders & sleep deprivation



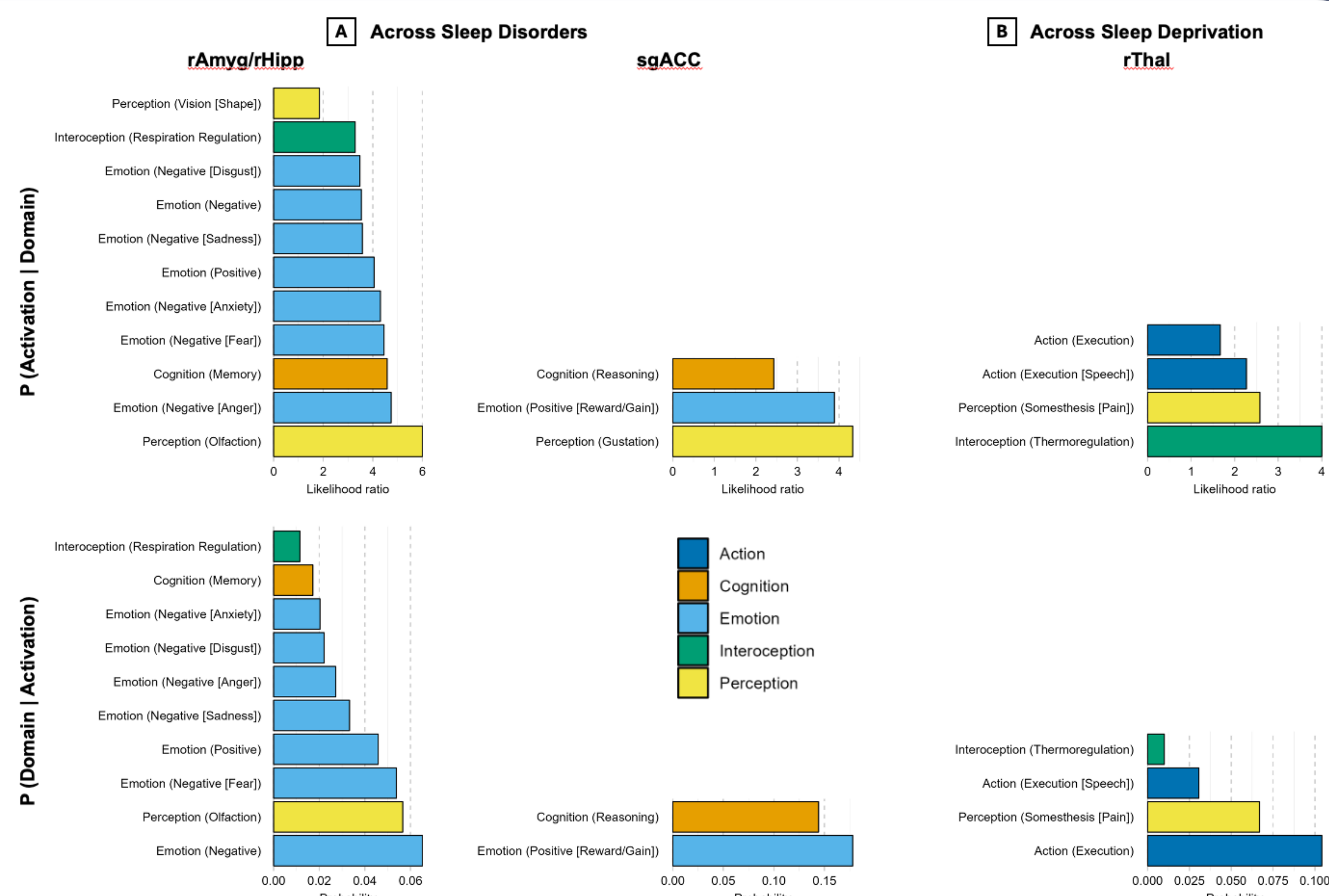
B) ALE analysis across sleep disorders



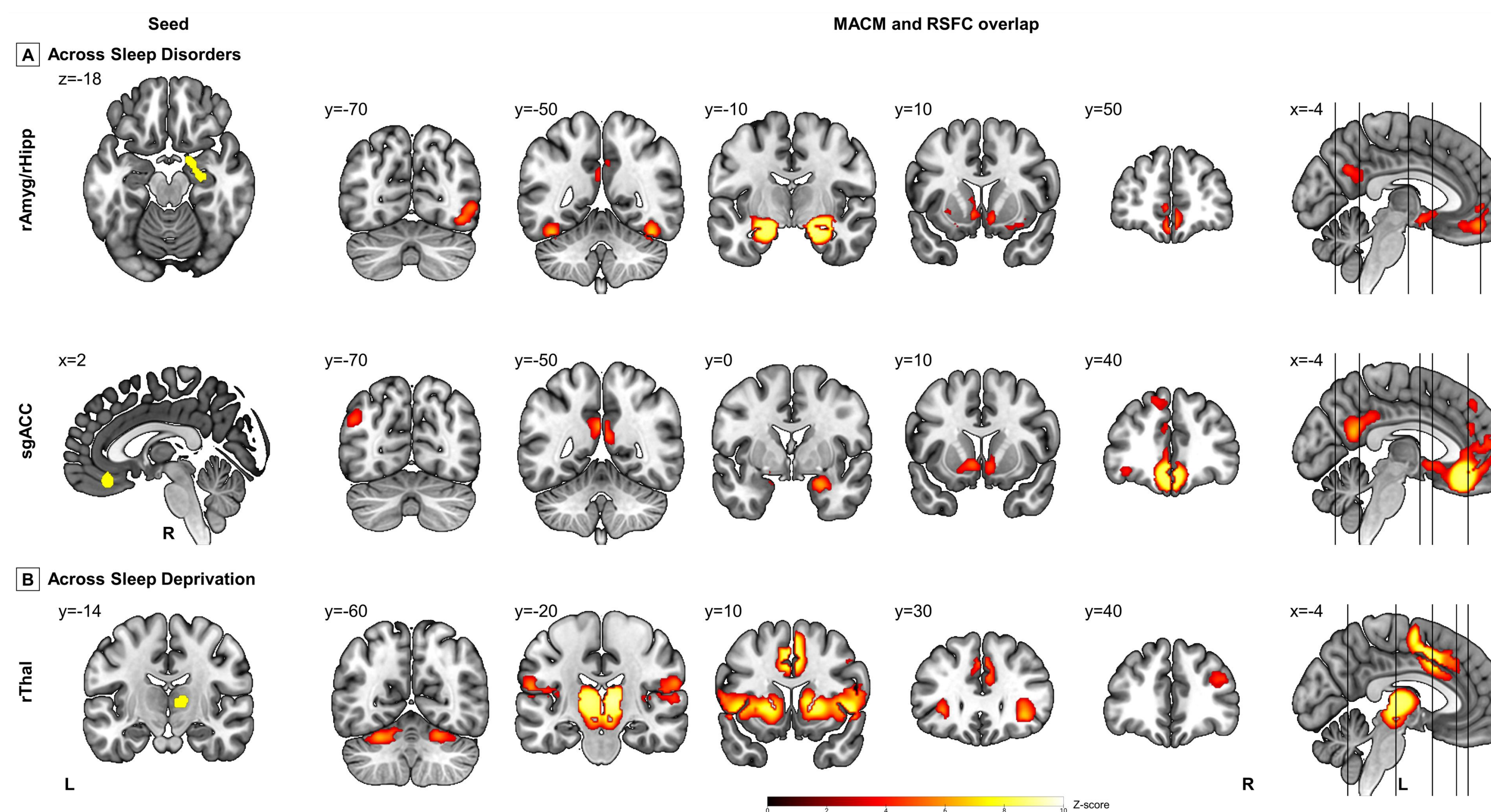
C) ALE analysis across sleep deprivation



- A) The ALE analysis across **ALL studies** (n=231) revealed three clusters in the right insular/frontal operculum, right thalamus (rThal), and right amygdala/hippocampus (rAmyg/rHipp).
- B) The ALE analysis across **various sleep disorders** (n=158) identified the rAmyg/rHipp cluster and subgenual anterior cingulate cortex (sgACC).
- C) The rThal was consistently found in ALE analysis of **sleep deprivation** (n=73) studies.



Functional decoding of the rAmyg/rHipp & sgACC clusters found in the ALE analyses across various sleep disorders (A) and the rThal cluster identified across sleep deprivation (B)



The conjunction of both task-based and task-free functional connectivity of the clusters identified in the ALE analyses across various sleep disorders (A) and sleep deprivation (B)

CONCLUSIONS

- ❖ Convergent abnormality among various sleep disorders in the **rAmyg/rHipp** and **sgACC**. They are associated with emotion/cognition/perception and connected to the regions in the default mode network. These clusters and corresponding networks are probably related to some of their similar symptomatology.
- ❖ Consistent dysfunction in the **rThal** cluster across total/partial sleep deprivation. The rThal is involved in executive functions/perception/interoception and showed connectivity with the subcortical/motor regions.
- ❖ There are no overlapping brain alterations when comparing patients with sleep disorders to those experiencing acute sleep deprivation, suggesting **unique neural correlates for short- and long-term sleep disturbances**.

REFERENCES

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