

Sex-specific topological structure associated with dementia identified via latent space network analysis



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Introduction

- Statistical network analysis has transformed neuroimaging research in recent years by enabling flexible and intuitive integration of multiple data types and preserving the topological brain connectivity structure while uncovering mechanism of degenerative aging.
- In this study, we apply a novel latent space joint network model to perform a case-control comparison using
 - the functional connectivity data
 - region-specific cortical volume, cortical thickness, surface area
 - PET information.
- We hypothesize that by preserving complex network structures during imaging biomarker detection, we find sex-specific topological structures associated with dementia.

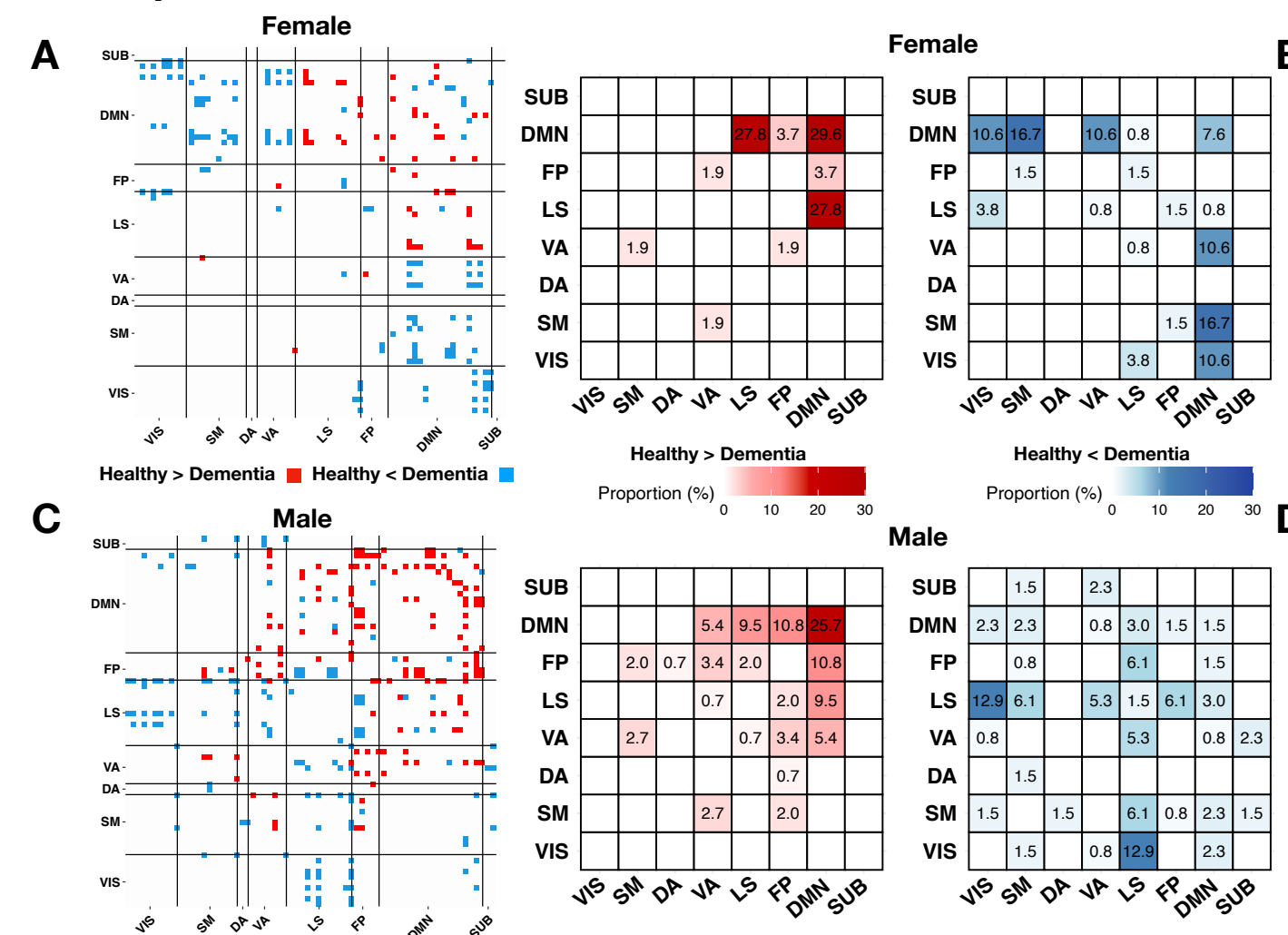
Methods

	Healthy	Mild Cognitive Impairment (MCI)	Dementia
Male	94	84	33
Female	102	73	24

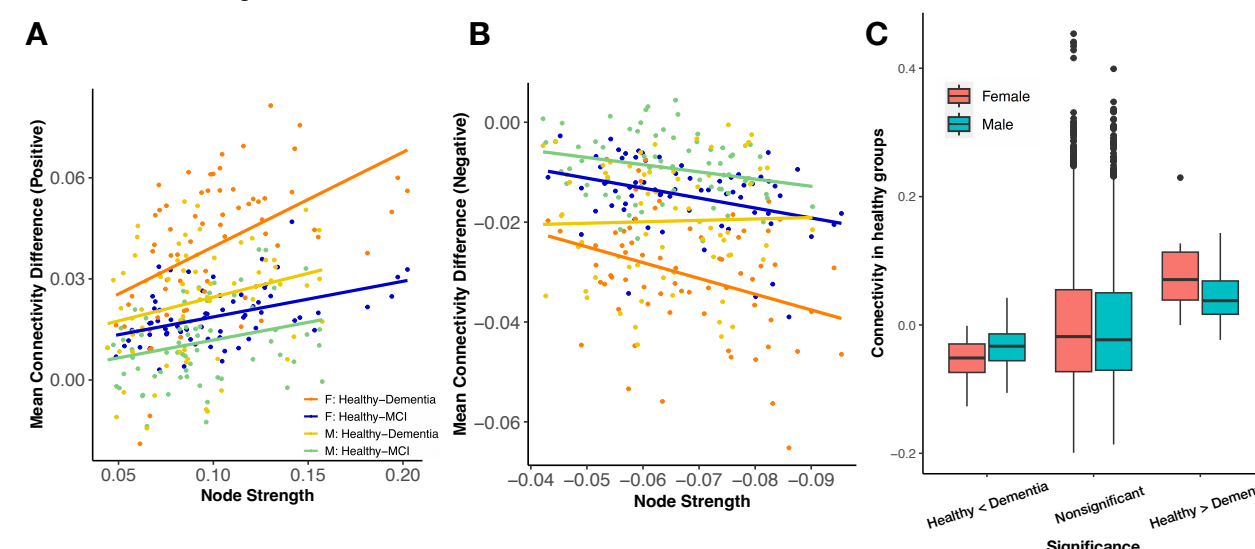
- This study applies a probabilistic approach for latent space estimation that extends current multiplex network modeling approaches and captures the higher-order dependence in functional connectomes by preserving transitivity and modularity structures.
- We used resting state fMRI, PET and MRI imaging.

Results

- Females show more default mode network (DMN)-centered hyperactivity whereas males showing more limbic system (LS)-centered hyperactivity while both show DMN-centered hypoactivity.



- Centrality plays an important role in dementia-related dysfunction with stronger association between connectivity changes and regional centrality in females than in males.



Conclusions

- We provide a comprehensive picture of dementia-related neurodegeneration linking centrality, network segregation and DMN-centered changes in functional connectomes, and how these components of neurodegeneration differ between the sexes.
- An imbalance between excitatory or inhibitory mechanism leads to whole-brain destabilization in dementia patients.
- DMN plays a critical role in typical AD dementia.
- Sex differences in topological changes in the brain, e.g., network segregation are critical.
- Our results highlight the disparity between males and females in AD dementia.

Additional Information

- An extension of this abstract is written as a manuscript available here: <https://osf.io/preprints/psyarxiv/r675z>
- More information about the latent space estimation is available here: <https://arxiv.org/abs/2304.01345>

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