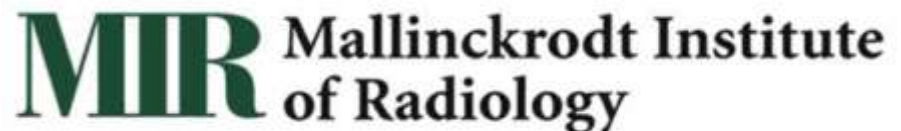


The Effect of Hyperbaric Oxygen Treatment on Resting State Networks

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Conflicts of Interest / Declarations

- NO commercial relationships to disclose
- All imaging sequences are FDA approved fMRI sequences

Introduction

- Cerebral Small Vessel Disease (CSVD) is caused by damage to blood vessels in the brain
- This damage can impair blood flow, and lead to vascular dementia
- CSVD is related to other risk factors such as hypertension and elevated cholesterol
- Treatment for CSVD involves early detection and management of risk factors

Hyperbaric Oxygen Treatment

- In studies of animals with acute ischemia, Hyperbaric Oxygen Therapy (HBO) has shown positive results
- No similar result exists for humans

HBO Therapy pressure chamber: used to expose patients to 100% oxygen in a pressurized environment.

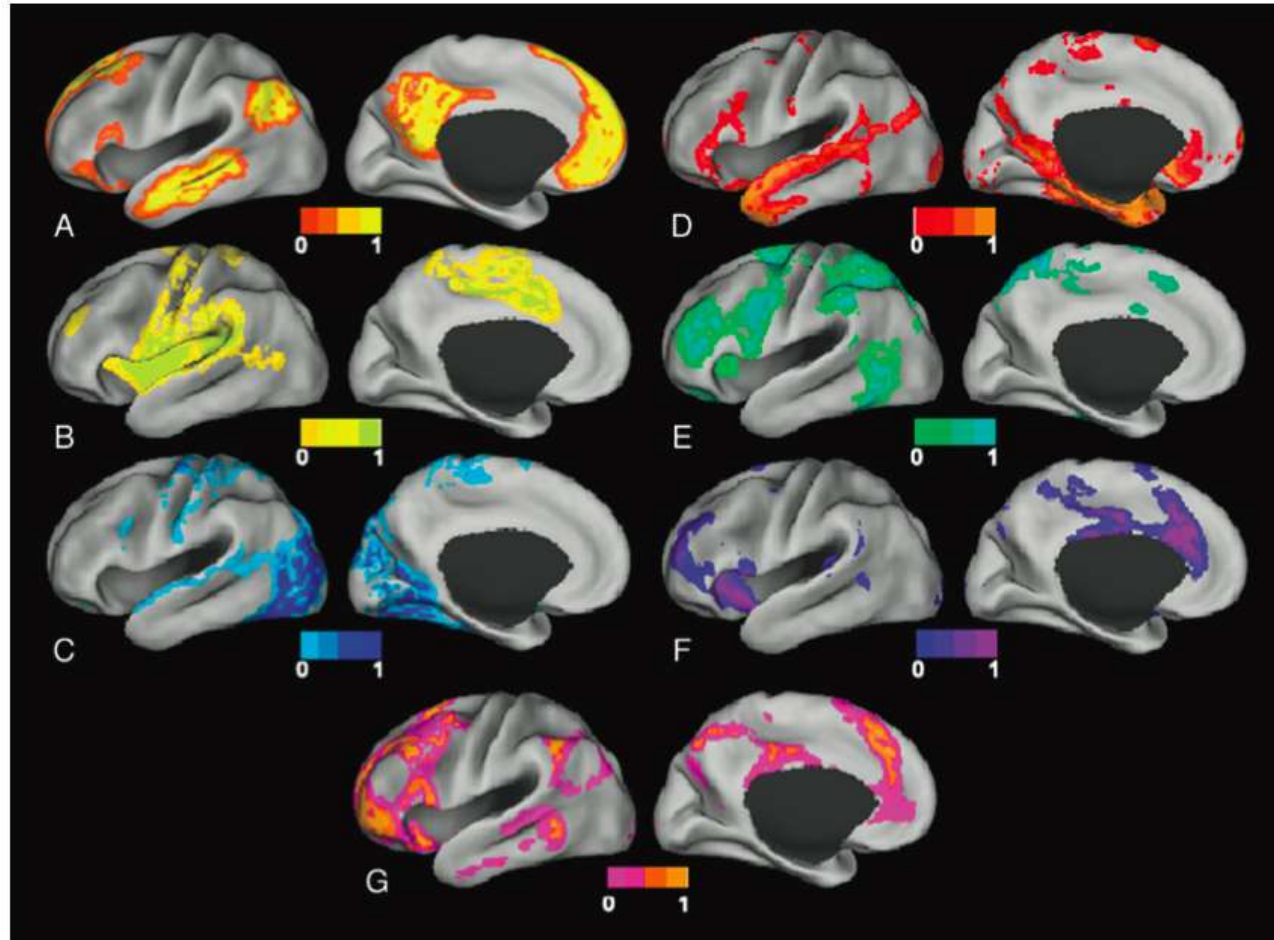


Purpose of Study

To compare the connectivity of the Resting State Networks (RSN) on patients with (CSVD) before and after Hyperbaric Oxygen (HBO) treatment

Resting State Functional MRI

- rsfMRI is used to identify correlated regions in the brain
- Correlation values calculated from the Blood Oxygen Level Dependent (BOLD) signal
- The values are analyzed and categorized into networks

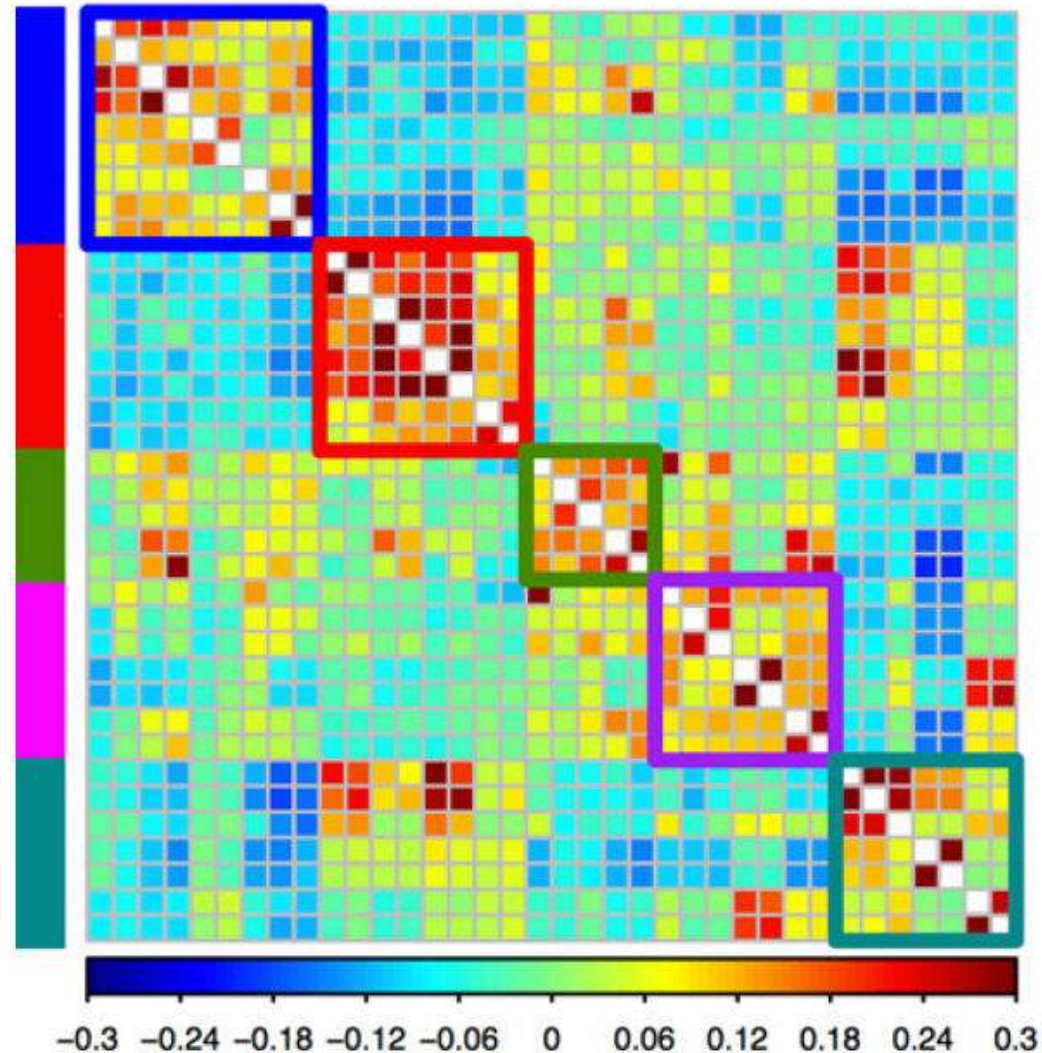


Methods: Subjects

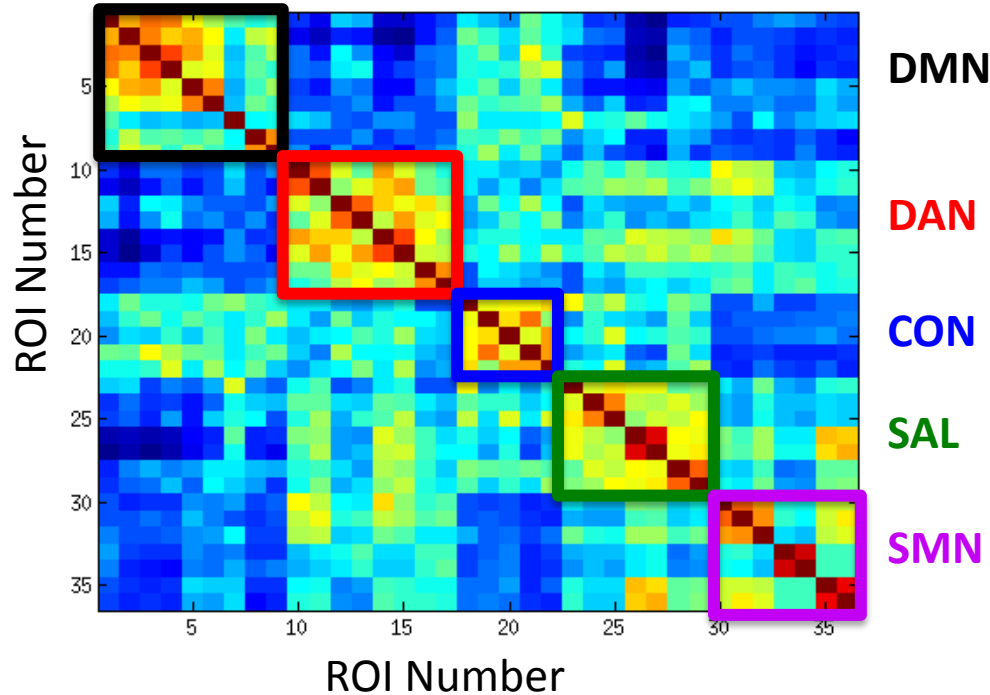
- 25 Patients >50 yo with CSVD were recruited from the community
- Patients had a neurological exam and MRI before and 4 weeks after HBO treatment
- 10 HBO treatments over a span of 2 weeks
- Four groups included in this study
 - 17 Young, healthy controls
 - 20 Elderly, healthy controls (age-matched with CSVD patients)
 - 20 Patients with CSVD, before treatment
 - 20 Patients with CSVD, after HBO treatment

Methods: rsfMRI

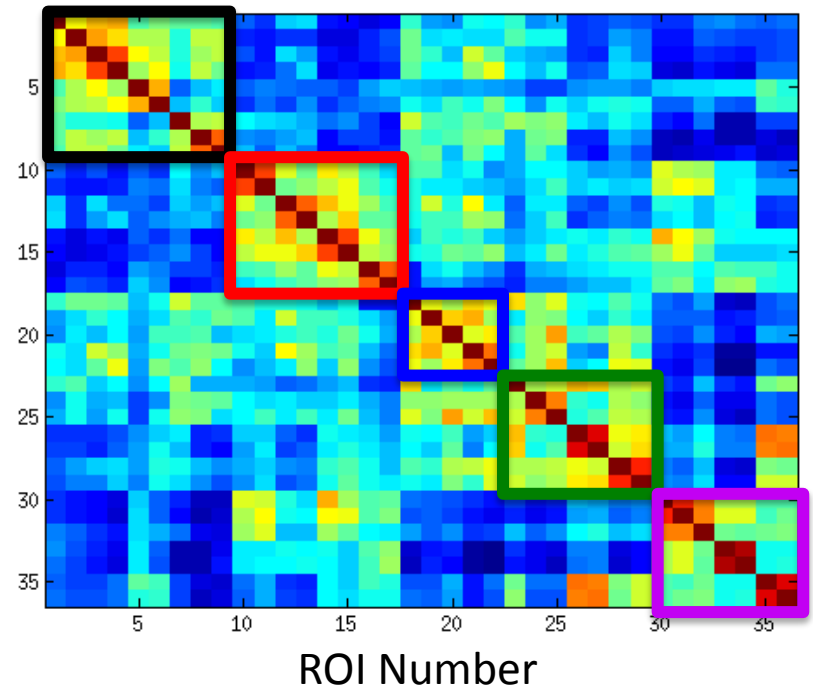
- 36 Regions of Interest were divided into five Resting State Networks:
 - Default Mode Network (DMN)
 - Dorsal Attention Network (DAN)
 - Control Network (CON)
 - Salience Network (SAL)
 - Sensory-Motor Network (SMN)
- These correlation values were averaged over the networks to obtain avg. connectivity values
- Similarly, connectivity values were calculated between the different networks



Young Healthy Controls

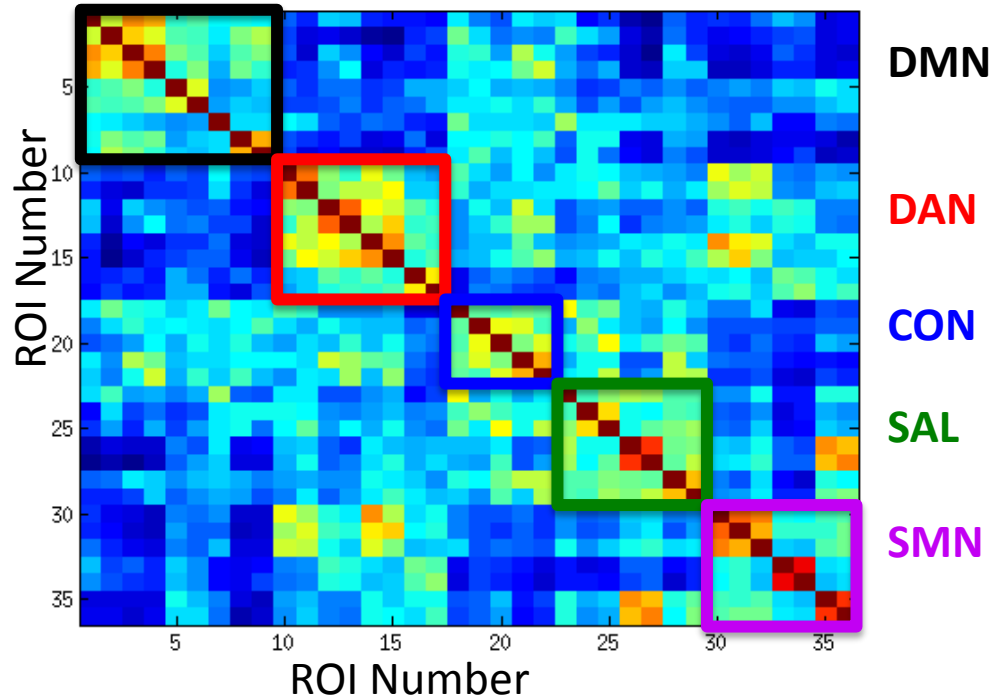


Elderly Healthy Controls

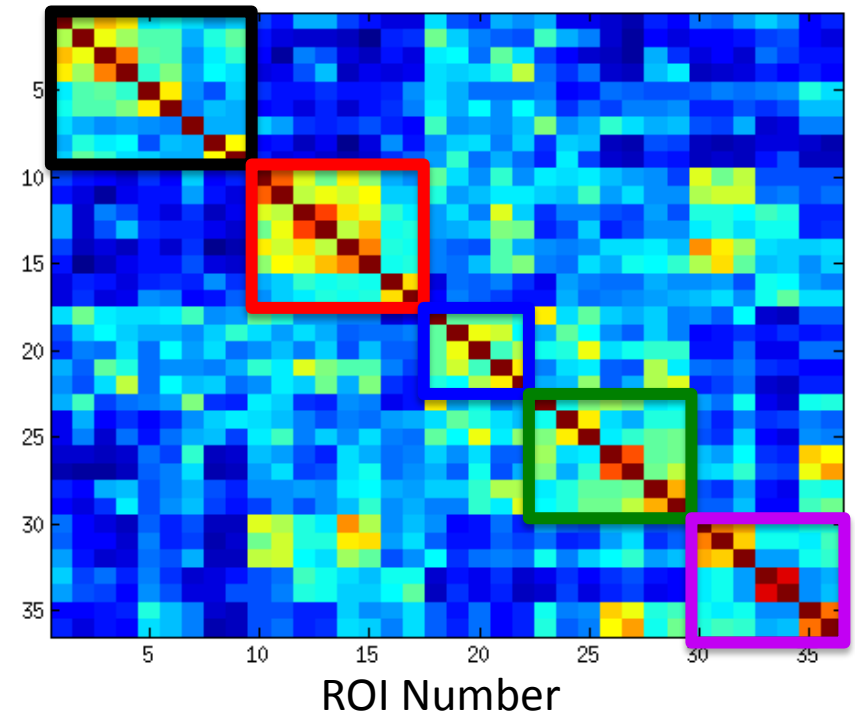


- Visually, the brighter colors within networks on young, healthy controls indicate higher connectivity for those subjects
- Similarly the darker colors between networks on the young subjects indicate more anti-correlation

CSVD Patients – Before Treatment



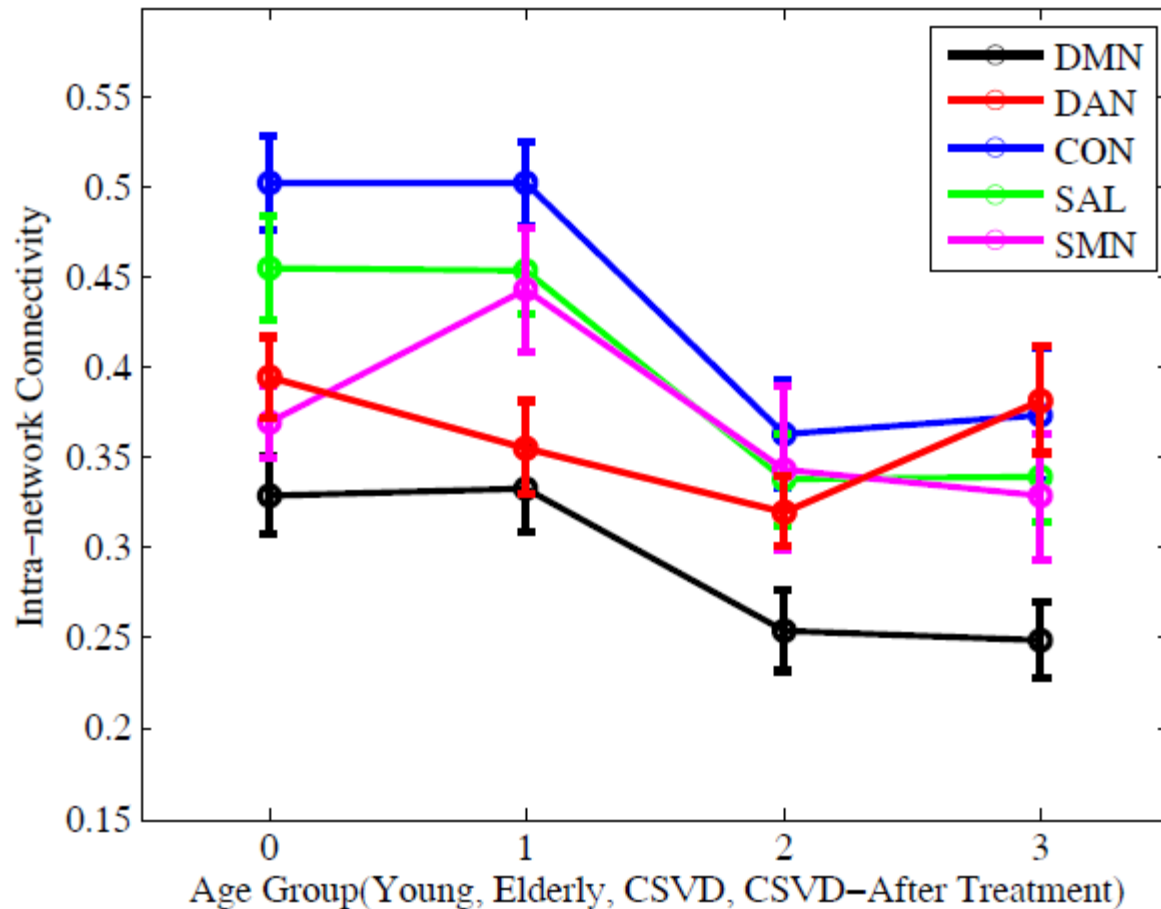
CSVD Patients – After Treatment



- The differences between the two groups are too small to be easily seen by eye
- Analysis of the connectivity values gives a clearer picture

Intra-network Connectivity

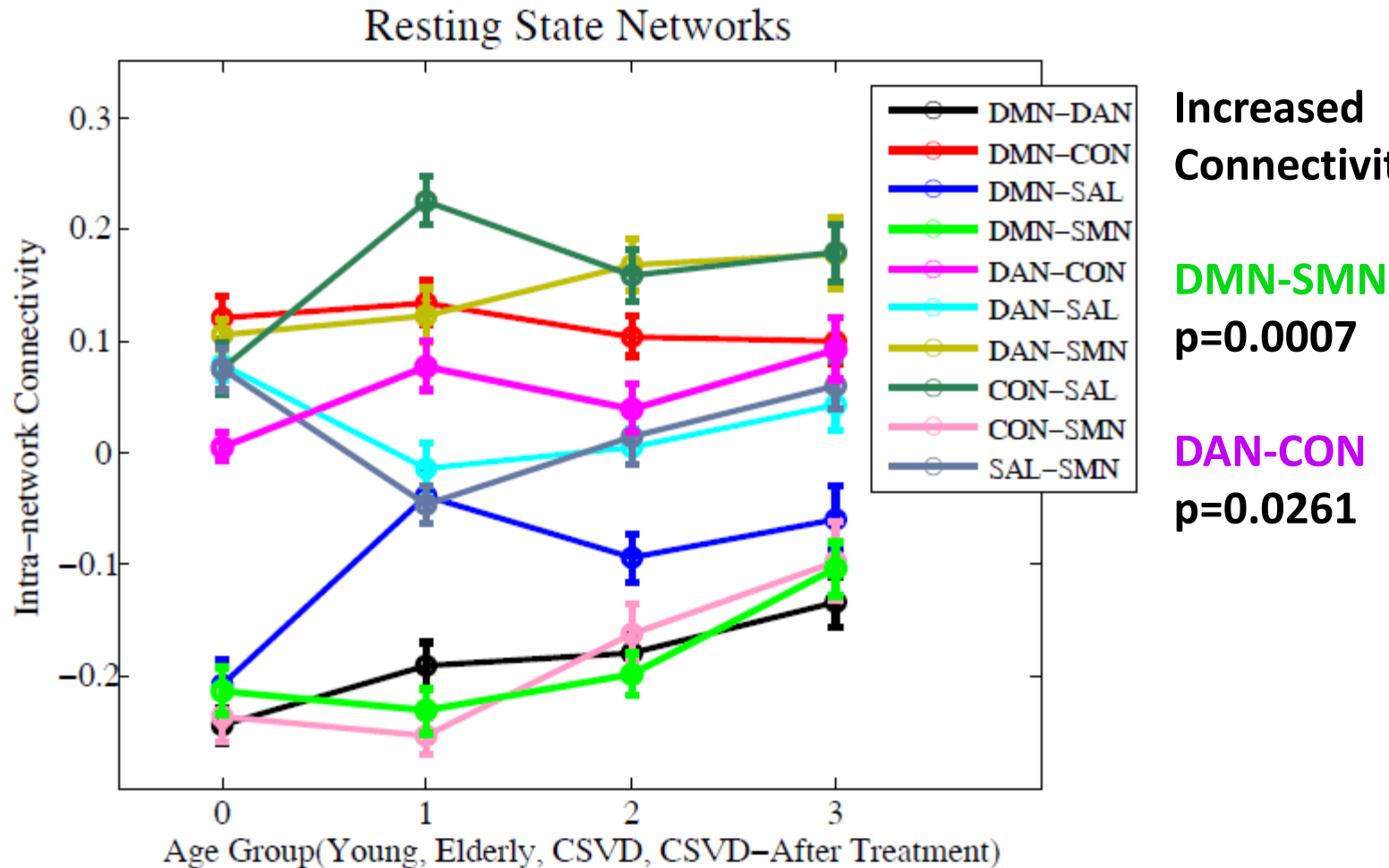
Resting State Networks



Increased Connectivity
in the **DAN** Network

$p=0.0878$

Internetwork Connectivity



Conclusion

- Treatment of CVSD with Hyperbaric Oxygen demonstrates:
 - A trend for increase in the internal connectivity of the DAN
 - Increase in cross network correlation between the DMN-SMN, and the DAN-CON
- These are critical networks for normal cognitive function
- However, further studies are needed to relate these changes to behavioral testing and improved activities of daily living