The Effect of Hippocampal Integrity and Volume on Recall Memory in Healthy Aging

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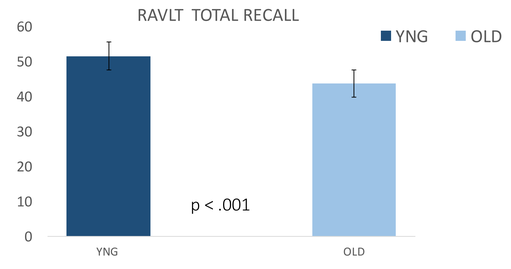
Introduction

- Recall memory is the ability to subsequently recollect information that has been encountered. It is known to decline with age (e.g., Schoenberg, et al., 2006).
- Previous neuroimaging studies have described white matter integrity as a predictor of recall memory (e.g., Bennett, et al., 2016)
- Studies have also shown that hippocampal integrity and volume decline as one ages (e.g., Fjell, et al., 2009; Miller, et al., 2005) and that these measures of brain structure separately relate to recall memory (e.g., Chen, et al., 2009; Bruno, et al., 2016).
- Structural Equation Modelling (SEM) can be used to assess the mediational influences and distinct individual effects of latent measures on certain observed variables (e.g., Taylor, et al., 2008).
- The current study is the first to use SEM to examine the joint contributions of hippocampal gray matter integrity and volume to age group differences in recall memory.

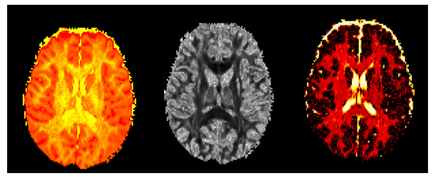
Recall Memory Declines With Age

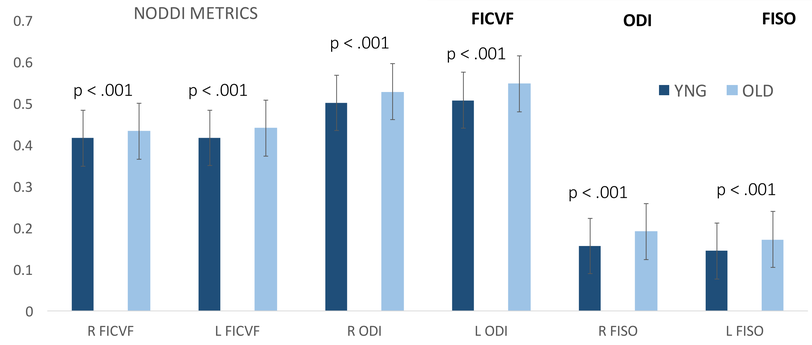
- 44 healthy young (YNG, 17 female, 19.85 ± 1.04) and 44 healthy old (OLD, 29 female, 73.87 ± 5.42) adults completed the Rey Auditory Verbal Learning Task (RAVLT).
- Age group differences in Total Recall scores (TOT RCL) were assessed using between-group t-tests.
- As expected, recall memory was significantly lower in older adults relative to younger adults.



Hippocampal Integrity Declines With Age

- Neurite Orientation and Dispersion Density Imaging (NODDI) was used to measure integrity within bilateral anatomical masks of hippocampal gray matter (Zhang, et al., 2012).
- Age group differences in the following integrity metrics were assessed using between-group t-tests:
  - ❖ Intracellular diffusion (FICVF)
  - ❖ Extracellular diffusion (ODI)
  - ❖ Free-water diffusion (FISO)

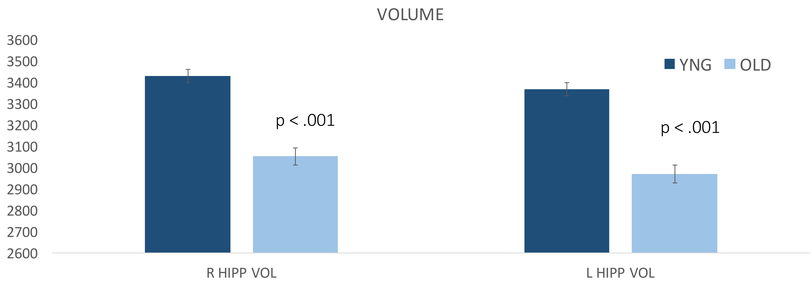




- As expected, all measures of hippocampal diffusion were significantly higher in older adults relative to younger adults, depicting declines in integrity with age.

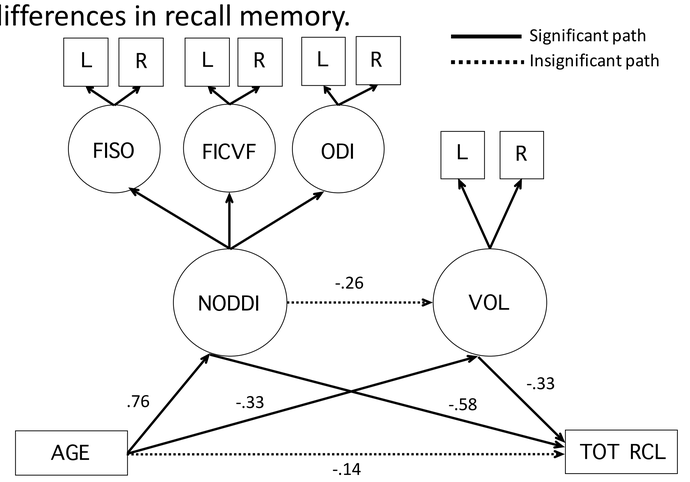
Hippocampal Volume Declines With Age

- Age group differences in volume of the bilateral anatomical masks of hippocampus were assessed with an age group (YNG, OLD) x hemisphere (L HIPP, R HIPP) ANOVA.
- As expected, bilateral hippocampal volume was significantly lower in older adults compared to younger adults.



Meditating Roles of Integrity and Volume

- SEM was used to test the mediating role of latent measures of hippocampal gray matter integrity and volume on age differences in recall memory.



Chi-Squared (p-value)	51.310 (p=.005)
RMSEA (90% CI)	.098 (.054,.140)
GFI	.910
CFI	.962
SRMR	.0544
Total Effect (95% CI) p-value	-.406 (-.564, -.221) p<.001
Total Indirect Effect (95% CI) p-value	-.263 (-.631,.066) p=.105
NODDI Indirect Effect (95% CI) p-value	-.438 (-.909, -.143) p=.004
Volume Indirect Effect (95% CI) p-value	.109 (.010,.263) p=.035
NODDI to Volume Indirect Effect (95% CI) p-value	.066 (-.012,.375) p=.104
Direct Effect of Age on Total Recall (95% CI) p-value	-.143 (-.470, -.289) p=.488

- Significant indirect effects separately for hippocampal gray matter integrity and volume, but not for total indirect effects, suggests that these measures individually mediate the effect of age on recall memory.

Summary & Discussion

- We replicated previous work showing age group differences in recall memory, hippocampal gray matter integrity, and hippocampal volume.
- Our novel SEM analysis revealed separate, rather than joint, contributions of hippocampal integrity and volume on recall memory in aging.

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