Aging and Positive Mood: Longitudinal Neurobiological and Cognitive Correlates

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BACKGROUND

- Aging is associated with more losses than gains
  - Declines in cognitive and physical health
  - Social tragedies (death of spouses and friends)
- Conversely, the literature supports the notion that older adults possess remarkably preserved emotional regulation
  - The idea that older adults attend to positive over negative stimuli has been called "the positivity effect" (Mather & Carstensen, 2005)
  - The presence of "the positivity effect" in older adults has been linked to better mood outcomes (Mather & Carstensen, 2005)

AIM: *To determine the longitudinal neural and cognitive correlates of preserved emotional regulation trajectories in older adults.*

METHODS

Participants

Table 1. Baseline Study Participant Demographic and Clinical Characterization

n	716
Average # of visits (Range)	2.5 (1, 13)
n with structural DTI imaging	365
Average # of imaging visits (Range)	1.6 (1, 5)
Baseline age (Range)	67.9 (40.5, 99.4)
Sex, % female	59.2%
Education (Range)	17.4 (7, 20)
MMSE (Range)	29 (25, 30)
CDR	0
GDS (Range)	3 (0, 24)

Measure of Mood Symptoms

Geriatric Depression Scale (GDS)

Neuropsychological Measures

Executive function
Memory
Processing speed

Imaging

3T Siemens MRI scanner

Sequences:

- T1
- T2
- DTI

Statistical Analysis

Linear mixed-effects regression models

- Controlling for:
  - Gender
  - Education
  - Total intracranial volume (where applicable)

CONCLUSIONS

- In our cohort, mood improved with age and was moderated by executive function, processing speed, and white matter microstructure integrity independently, in analogous interactions
  - Mood continued to improve with age in subjects with stable executive function and processing speed, but worsened in those with declining executive function and processing speed
  - Mood continued to improve with age in subjects with stable FA values, but worsened in those with declining FA values
- Previous studies have shown that positivity is linked to better cognitive control and leads to improved mood in older adults (Mather & Knight, 2005)
  - Our results are consistent with this finding, demonstrating a significant association between the cognitive domains of executive function and processing speed with depressive symptoms over time
- Our results highlight a potential neurobiological pathway underlying this relationship. We demonstrated an interaction between within-person changes in white matter microstructure with age to predict mood outcomes
- Future research should aim to clarify the underlying mechanism, further exploring biological substrates driving psychological processes

RESULTS

Longitudinal Changes in Mood

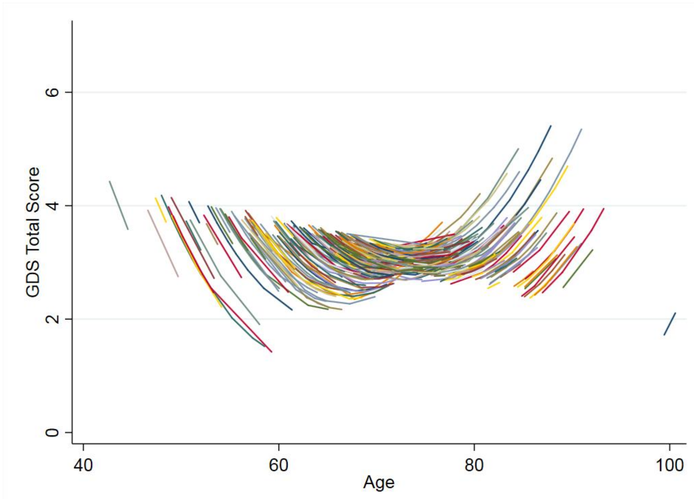

Figure 1. Longitudinal relationship between aging and Geriatric Depression Scale (GDS) scores. GDS is scored on a scale of 0 – 30, with higher scores indicating more depressive symptoms.

- As age increased over time, GDS scores improved
  b = - 0.03, p < 0.06
- Significant age by time interaction (See Figure 1)
  age*time: **b = 0.01, p < 0.001**
- The beneficial effect of older age on GDS attenuated and reversed after age 77

Cognitive Correlates

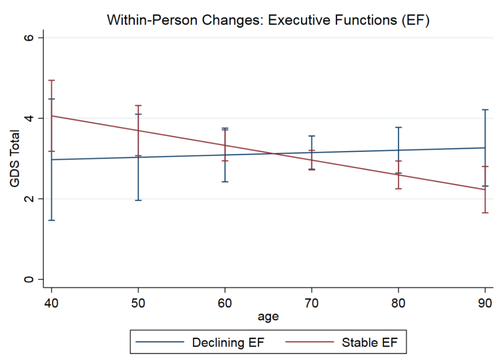

Figure 2. Executive function (EF) interacted with age to predict changes in GDS over time. In those with stable EF, mood symptoms continued to improve over time. Mood symptoms worsened in those with declining EF.

EF*age: **b = -0.43, p < 0.04**

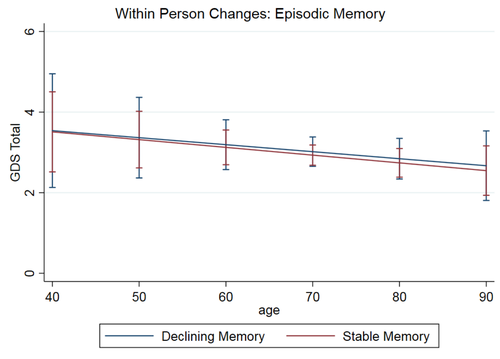

Figure 4. No significant associations between memory, age, and mood.

*memory*age:* b = -0.002, p > 0.90

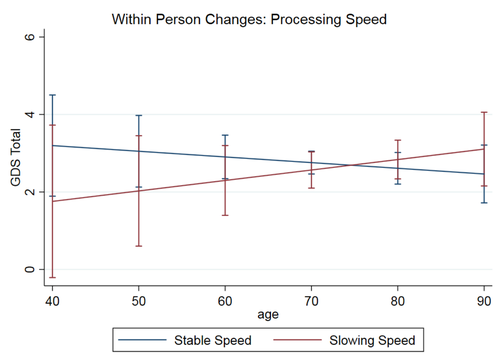

Figure 3: Processing speed interacted with age to predict changes in GDS over time. In those with stable speed, mood symptoms continued to improve over time. Mood symptoms worsened in those with slowing speed.

speed*age: **b = 0.04, p < 0.05**

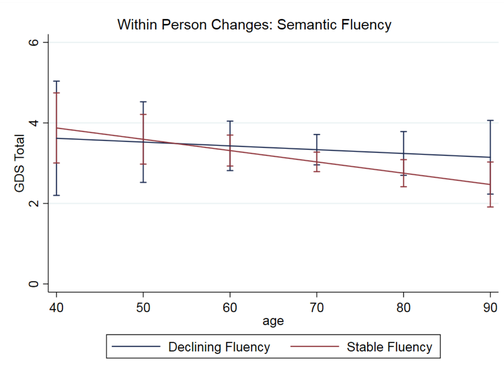

Figure 5. No significant associations between semantic fluency, age, and mood.

*fluency*age:* b = -0.002, p > 0.20

Neuroimaging Correlates

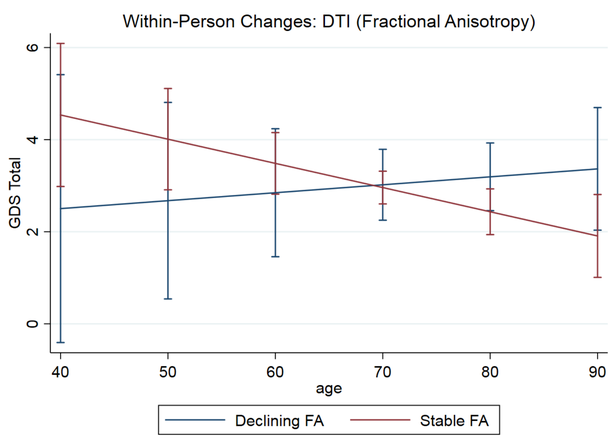

Figure 6: FA interacted with age to predict changes in GDS over time. In those with stable FA values, mood symptoms continued to improve over time. Mood symptoms worsened in those with declining FA values.

FA*age: **b = -2.33, p < 0.04**

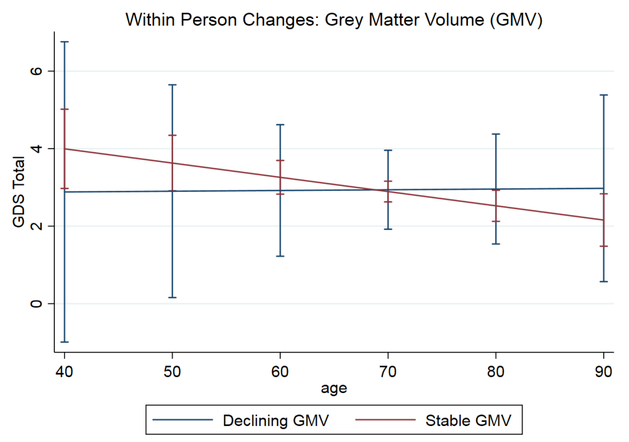

Figure 7. No significant associations between grey matter regions of interest, age, and mood. GM ROIs included medial temporal lobes, dorsolateral prefrontal cortex, amygdala, subcortical network, salience network, and executive network.

p's > 0.05

Acknowledgements

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References:

Mather M., & Carstensen L. (2005). Aging and motivated cognition: the positivity effect in attention and memory. *Trends Cogn Sci*, *9*(10), 496-502.

Mather M. & Knight M. (2005). Goal-directed memory: the role of cognitive control in older adults' emotional memory. *Psychol Aging*, 20(4), 554-70.