Self-reported history of extreme stress or trauma associated with lower cognitive flexibility
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Introduction
- Cognitive flexibility is a core executive function that involves the ability to adapt cognitive processing to changes in the environment and correctly respond to new stimuli.
  - In contrast, cognitive inflexibility consists of cognitive rigidity and an inability to adapt to changing situations.
- Cognitive inflexibility is frequently associated with individuals with PTSD, extreme stress, or trauma due to the inability to differentiate between threatening and non-threatening stimuli (Pang, 2015).
- The prevalence of white matter hyperintensities (WMH) are common macrostructural lesions common in individuals middle-aged and older that increase with age.
- WMH are associated with cognitive impairment, especially on tasks of executive function, including cognitive flexibility (Wright et al., 2008).
- The current study investigates whether there is a significant association between self-reported extreme stress/trauma encountered across one’s lifespan and cognitive flexibility, and if so, whether WMH mediates this relationship.

Methods

Participants
- 190 cognitively healthy adults were screened against neurologic, psychiatric, metabolic, cardiovascular problems, major head trauma, and substance abuse.

<table>
<thead>
<tr>
<th>n(M/F)</th>
<th>Age Range</th>
<th>Age mean ± SD</th>
<th>Edu. mean ± SD</th>
<th>MMSE ± SD</th>
<th>CTS ± SD</th>
<th>Cog. Flexibility ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>190 (78/112)</td>
<td>20-94</td>
<td>53.66 ± 18.87</td>
<td>15.52 ± 2.47</td>
<td>26.99 ± 9.0</td>
<td>52.51 ± 32.83</td>
<td>0 ± 0.72</td>
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Cognitive Flexibility Construct
- Trail Making B, Stroop, Verbal Fluency, and Wisconsin Card Sorting Test were combined from the D-KEFS (Delis-Kaplan Executive Function System) cognitive battery (Delis et al., 2001).
- Variables were z-scored and averaged to yield a CF ability for each participant.

White Matter Hyperintensities
- Volumes (mm$^3$) were computed for 3 lobar regions (Frontal, Temporal, and Parietal) and then averaged to obtain a total lesion volume

Cumulative Trauma Scale (CTS)
- CTS a self-reported scale composed of 61 items that assess cumulative trauma pertaining to life-stressors. Each item details a stressful event, an effect scale, and an occurrence rate.

Results

Statistical analysis
- General linear models were conducted in JASP V 0.14.1 with a cognitive flexibility construct as the dependent variable. Centered age, sex, CTS construct, white matter hyperintensities, and age x CTS construct were added as independent predictors.
- Non-significant interaction terms (p < 0.12) were removed and models were re-run to conserve statistical power.
- A significant main effect of CTS scores on cognitive flexibility was found, beyond the effects of age.
- There was no significant WMH mediation effect on the relationship between CTS scores and cognitive flexibility measures.

Greater cumulative of life stressors or trauma was associated with significantly poorer cognitive flexibility, regardless of one’s age.

Increasing age was strongly associated with cognitive inflexibility, as expected.

CTS scores did not differ by age.

Conclusions
- These results demonstrate that lower cognitive flexibility scores are associated with higher cumulative trauma scores beyond the effects of age. This indicates that despite not receiving a diagnosis of PTSD, participants with cumulative trauma still experience similar cognitive inflexibility. White matter hyperintensity did not appear to have any effect.
- These findings extend the current field of research studying the connection between PTSD symptoms and cognitive flexibility (Ben-Zion et al., 2018) into the study of trauma in general by confirming that the relationship is not exclusive to those only diagnosed with PTSD.
- The effect of trauma on cognitive flexibility does not seem to be altered by age.
- Further work is needed to understand the neural mediators of this effect. A longitudinal study would be particularly helpful to evaluate the within-subject effects of cumulative trauma on cognitive inflexibility over time.

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