Extreme stress or trauma report is associated with poorer age-related fluid intelligence scores across the adult lifespan

Vivian C. Marcano, Giuseppe G. Miranda, Karen M. Rodrigue, Kristen M. Kennedy

Center for Vital Longevity, School of Behavioral and Brain Sciences, The University of Texas at Dallas

Introduction

- Fluid intelligence grants us the ability to solve new problems without relying on prior experience or knowledge accumulated over a lifetime, by conceptualizing abstract information in real time. These fluid abilities diminish as we age.
- In addition to the impact of aging, accumulated real life stress experience has been associated with decline in fluid intelligence in individuals (Friedel et al., 2014).
- Frontal lobe decline has been associated with a decline in fluid intelligence in an age-related manner (Bugg et al., 2006).
- Stress influences cognition independent of age due to stressors fluctuating, whereas stress has been shown to act in an age-dependent fashion when examining the immune system (Graham et al., 2006).
- The current study investigated (a) whether there is a significant association between self-reported extreme stress or trauma encountered across the lifespan and fluid intelligence performance, and (b) whether this self-reported extreme stress or trauma impacts an individual’s longitudinal change in fluid intelligence over four years.
- We hypothesize that individuals who experience higher levels of stress will have significantly lower fluid intelligence compared to their less-stressed counterparts. We expect that these findings will not be dependent on age.
- These hypotheses were based on prior knowledge of traumatic experiences’ effect on other cognitive processes, e.g., episodic memory (Bower & Sivers, 1998).

Methods

Participants

- 192 cognitively healthy and normal adults with no history of substance abuse, cardiovascular, neurological, psychiatric or metabolic conditions.

Demographics

<table>
<thead>
<tr>
<th>N</th>
<th>Sex</th>
<th>M/F</th>
<th>Age Range</th>
<th>Mean Age (SD)</th>
<th>Education (SD)</th>
<th>MMSE (SD)</th>
<th>CTS_Total Mean (SD)</th>
<th>c Fluid Intel Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>214</td>
<td>89/125</td>
<td>20-94</td>
<td>53.860 (28.791)</td>
<td>15.582 (2.426)</td>
<td>28.953 (0.952)</td>
<td>52.972 (33.272)</td>
<td>0 (0.719)</td>
<td></td>
</tr>
</tbody>
</table>

Culture Fair Intelligence Test (CFIT)

- The Culture Fair Intelligence Test is a nonverbal intelligence test designed to measure reasoning ability through figural patterns and geometric forms.
- Several studies have found this examination to be a fair and adequate measure of fluid intelligence (Cattell and Cattell, 1959).

Cumulative Trauma Scale (CTS)

- Cumulative trauma scale is a scale composed of 61 items that assess cumulative trauma. The items detail lifetime stress, internal stressors, man-made events and socially made events. The participant reports the frequency of the traumatic event and the extent of the emotional effect (positive or negative) on him or her.

Data Analysis

- An ANCOVA was conducted in JASP V 0.14.1 with a fluid intelligence construct as the dependent variable, predicted by age (continuous, centered), sex, cumulative trauma scale construct, and age x cumulative trauma scale interaction. Any non-significant interaction terms (p < 0.12) were removed and the models re-run to conserve statistical power.

Inclusionary Criteria

All participants who had complete data for fluid intelligence and cumulative stress trauma scores.

Results

- As expected, we found the typical strong, negative effect of age on fluid intelligence.
- Importantly, we further identified that greater cumulative life trauma and stressors was associated with lower fluid intelligence. Note: 95% CI displayed in shaded gray.
- CTS scores did not differ by age. No age by cumulative trauma scale on fluid IQ association was identified. Note: 95% CI displayed shaded around the regression line.
- CTS scores did not differ by age. No age by cumulative trauma scale on fluid IQ association was identified. Note: 95% CI displayed shaded around the regression line.

Discussion

- As expected, we found the typical strong, negative association of increasing age on decreasing fluid intelligence.
- Importantly, we further identified that greater cumulative life trauma and stressors was associated with poorer fluid intelligence above and beyond the effects of aging.
- Notably, this association was not age-dependent (i.e., no CTS x Age interaction), suggesting that experience of extreme stress or trauma burden is detrimental to fluid processing even in younger and middle-aged adults. Further CTS scores were unrelated to age.
- These findings lend evidence to studies on the impact of stress on other domains of cognitive performance, (Friedal et al., 2014) which suggest that stress-induced increase of cortisol levels can negatively impact performance (McCraty et al., 1998).
- Four-year change in fluid intelligence was not predicted by CTS scores. Future longitudinal analyses will examine the effects of cumulative stress on within-person change in fluid intelligence over longer duration of time (i.e., 8 years).