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Authors
Petkus, Andrew J
Lenze, Eric J
Butters, Meryl A
et al.

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Childhood Trauma is Associated with Poorer Cognitive Performance in Older Adults

Andrew J. Petkus, Ph.D.[1], **Eric J. Lenze, M.D.**[2], **Meryl A. Butters, Ph.D.**[3], **Elizabeth W. Twamley, Ph.D.**[4,5], **Julie Loebach Wetherell, Ph.D.**[5,6]

[1]Department of Psychology, University of Southern California

[2]Healthy Mind Lab, Department of Psychiatry, Washington University in St. Louis

[3]Department of Psychiatry, University of Pittsburgh

[4]Center of Excellence for Stress and Mental Health, VA San Diego Healthcare System

[5]Department of Psychiatry, University of California, San Diego

[6]VA San Diego Healthcare System

Abstract

Objective: Childhood trauma is common and associated with both worse cognitive performance and disruption to the hypothalamic-pituitary-adrenal axis in younger adults. The extent to which these associations persist into older adulthood remains unknown. The aim of this current study was to investigate self-reported childhood trauma in relation to cognitive performance, and the extent to which cortisol explained this association, in two independent samples of older adults.

Method: In this cross-sectional study, participants in the discovery sample (N=76) consisted of older adults with a DSM-IV diagnosis of Generalized Anxiety Disorder (N=57) and age-equated psychiatrically healthy comparison subjects (N=19) who were referred largely through primary care clinics between 2004-2006. The replication sample (N=48) consisted of older adults with a DSM-IV anxiety or depressive disorder in 2011. Participants were administered the Early Trauma Inventory Self Report-Short Form and a neuropsychological assessment (primary outcome).

Results: Across both samples, childhood trauma was significantly associated with worse performance on measures of processing speed, attention, and executive functioning. The effect of trauma exposure was stronger when specifically examining general, physical, and sexual traumatic events (all $p < 0.05$). Childhood trauma was not associated with cortisol levels, and cortisol did not explain the association between trauma and cognitive functioning.

Conclusions: Self-reported traumatic events experienced in childhood are associated with poorer cognitive performance in anxious and depressed older adults. Findings demonstrate a deleterious impact of childhood trauma on brain health in old age.

Corresponding Author: Andrew J. Petkus, Ph.D., University of Southern California, Department of Neurology, 1520 San Pablo St., Suite 3000, Los Angeles, CA 90033, Phone: 323-442-8050, petkus@usc.edu.

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Keywords

Older adults; childhood trauma; cognition; anxiety; depression; cortisol

Introduction

Experiencing a traumatic event (e.g. death of a parent, friend, or family member, physical, emotional, or sexual abuse) during childhood is common[1] and a significant public health problem[2]. Additionally, the population of the United States is growing older, with the number of adults age 65 or older estimated to more than double to just under 100 million by the year 2060[3]. As many as 47% of older adults report experiencing a childhood trauma, with some evidence to suggest this prevalence is higher in recent cohorts[4]. Despite this, the long-term effects of childhood trauma on health outcomes in older adulthood remains understudied. With older adults comprising the fastest growing segment of the population, understanding the associations between childhood trauma and later-life health outcomes will only grow in importance as adult survivors of childhood trauma continue to age.

Childhood trauma has been associated with poor brain health. Younger adults who have experienced childhood trauma are at increased risk of poor physical health and psychiatric distress, such as Generalized Anxiety Disorder (GAD), Posttraumatic Stress Disorder (PTSD), and mood disorders[1, 5, 6]. Early life traumatic events may also negatively affect cognitive functioning[7, 8], particularly slower information processing speed and worse attention, memory, and executive functioning in children and younger adults[9-11]. Many of these studies find that general (e.g., unexpected death of a family member, witnessing physical violence), physical, and sexual traumas are particularly harmful to cognitive functioning[12-14]. Additionally, experiencing one childhood traumatic event is a risk factor for experiencing subsequent traumas, and multiple traumatic events in childhood are associated with worse outcomes than a single traumatic event[15].

Despite the strong implications of increased incidence of cognitive decline and disorders in later life, the extent to which childhood trauma is associated with cognitive performance in older adults is largely understudied. Childhood adversity comorbid with depression was associated with greater declines in processing speed in 1,312 older adults in the Longitudinal Aging Study Amsterdam[16]. Longitudinal research with 846 community-dwelling older adults found that repeated early life sexual assault was associated with greater declines in verbal fluency and Trails-B performance in older adulthood [17]. Studies have been mixed, however, with some studies reporting no association between childhood trauma and worse cognitive performance in later life[18] and other studies reporting childhood adversity was protective against decline on a cognitive performance composite score over time[19]. No research has examined the association between cognitive performance and childhood trauma in clinical samples of older adults with anxiety disorders, despite the fact that anxious older adults typically report higher rates of childhood trauma compared to psychiatrically healthy older adults[20].

Neurobiological mechanisms involving chronic inflammation[21], decreased neuroplasticity[22], and epigenetic modification of stress-related pathways[23] may explain the possible association between early life trauma and poorer cognitive performance in later life. The hypothalamus-pituitary-adrenal (HPA) axis is thought to play a particularly important role in this association. The HPA axis activates under stress, resulting in elevated levels of the cortisol hormone and certain severe and/or chronic stressors, particularly if experienced early in life, may permanently alter HPA axis function[24]. Studying this association is important, as chronically elevated cortisol levels have been associated with worse neuropsychological performance in later life[25, 26].

The purpose of this study was to investigate the association between childhood trauma, cortisol, and cognitive performance in two samples of older adults. The discovery cohort consisted of a case-comparison sample of older adults with GAD and age-equated psychiatrically healthy comparison subjects, and the replication sample consisted of older adults with a major depressive disorder or an anxiety disorder. We hypothesized that childhood trauma would be associated with worse processing speed, attention, memory, and executive functioning. We also hypothesized that childhood trauma would be associated with higher cortisol levels and cortisol would mediate the relationship between childhood trauma and cognitive performance.

Methods

Samples

Discovery Sample—Participants in the discovery sample consisted of 57 older adults with GAD and 19 psychiatrically healthy age-equated comparison participants. A detailed description of the discovery sample can be found elsewhere[27, 28]. The discovery sample was recruited at the University of Pittsburgh. Participants in the discovery sample were community-dwelling adults who were at least 60 years old, did not have a diagnosis of dementia, and had a score of 24 or higher on the Mini-Mental Status Examination (MMSE)[29]. The participants with GAD were diagnosed via the Structured Clinical Interview for DSM-IV Axis I disorders[30] and were taking part in a clinical trial investigating the efficacy of escitalopram for late-life GAD[27]. Data presented in the current report were drawn from the pre-treatment baseline assessment of this trial. The 19 comparison participants had no history of DSM-IV diagnosis and were equated to the clinical sample on demographic characteristics.

Replication sample—We also examined the associations between childhood trauma and cognitive performance in a replication sample of 48 older adults experiencing a DSM-IV depressive or anxiety disorder and cognitive complaints who were recruited for a clinical trial examining Mindfulness-Based Stress Reduction (MBSR) at the University of California, San Diego. Participants in the replication sample were aged 65 or older, had a score of 22 or higher on the abbreviated-Penn State Worry Questionnaire[31], and reported that they were experiencing problems with their memory or concentration as ascertained by an affirmative response to the question “Have you noticed any changes in your memory or thinking (as you have gotten older)?”. Individuals with dementia, as assessed by committing ten or more errors on the Short Blessed Test[32], a medical chart diagnosis of dementia, or prescription of cognitive enhancing medication, were excluded from the study. Other exclusion criteria across both studies included a lifetime diagnosis of a psychotic disorder, active alcohol or substance abuse, or an unstable medical condition.

The Institutional Review Boards at both sites approved all study procedures and all participants provided written informed consent.

Measures

Childhood trauma—Childhood trauma was self-reported using the Early Trauma Inventory-Self Report Short Form (ETISR-SF)[33], a reliable and well-validated measure of childhood trauma. The ETISR-SF consists of 28 items capturing four types of early childhood traumatic events, including general trauma (12 items), physical abuse (5 items), emotional abuse (5 items), and sexual abuse (6 items). Scores represent the total number of events experienced before the age 18, with scores in this sample ranging from 0-17. Because research documents links between general, physical, and sexual abuse and poorer cognitive functioning[34, 35], we exclusively examined the ETISR-SF composite of these subscales. The ETISR-SF was administered in both the discovery and replication samples.

Cognitive functioning—For both samples, a neuropsychological battery was administered that assessed multiple domains of functioning. In the discovery sample, the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) [36] was administered. The RBANS consists of subscales measuring attention, immediate memory, visuospatial construction, language, and delayed memory abilities. To examine psychomotor speed and attention, the RBANS Coding and Digit Span subtests were also examined separately. Raw scores were transformed into age-adjusted standard scores using normative data from the RBANS manual. Working memory was assessed using the Letter-Number Sequencing age-adjusted standard score from the Wechsler Adult Intelligence Scale-III[37]. Executive function inhibition ability was measured using the Stroop Neuropsychological Screening Test[38]. Number of correct responses was transformed to standard scores using normative data provided in the manual. Executive function problem-solving ability was also measured using the total number of correct sorts transformed to an age-adjusted standard score from the Delis-Kaplan Executive Function System (D-KEFS)[39] Sorting Test. All normed scores were transformed to standard scores with a mean of 100 and SD of 15 in order to be consistent across all outcomes.

The neuropsychological battery administered in the replication study assessed the same general domains of cognitive functioning. Attentional abilities were measured using the Digit Vigilance Test (DVT)[40] and the Digit Span subtest from the RBANS. Demographically corrected T-scores[41] were obtained for DVT total time and total errors. Age-adjusted z-scores were derived for Digit Span performance. Immediate and delayed memory was assessed by a list learning task and contextual memory. A 16-word list learning task[42], similar to the Rey Auditory Verbal Learning test, was administered to assess immediate and delayed list recall. Contextual recall was also assessed by reading participants two paragraphs containing 44 pieces of information and having them immediately recall the information in the paragraphs[43]. Delayed contextual memory was assessed by asking participants to repeat the contextual information after a 30-minute delay. Because age-corrected normative data were not available for both the list learning and contextual memory tasks, we analyzed the raw test scores. The Color-Word Interference and Verbal Fluency subtests from the D-KEFS[39] were administered to assess executive functioning. The age-corrected scaled score was computed for the time based color naming with interference condition (condition 3) of the Color-Word Interference test, and the age-corrected scaled score of the Verbal Fluency subtest was utilized. Similar to the discovery sample, all normed scores were transformed to standard scores in order to put all neuropsychological outcomes on the same scale.

Salivary cortisol—For two consecutive days before the baseline assessment, participants collected cortisol. In the discovery sample, cortisol was taken six times over the course of the day, whereas for the replication sample, cortisol was collected three times over the course of the day (upon waking, 30 minutes after waking, and at bedtime). Data were averaged across the two days. Cortisol was log-transformed and normalized. Two cortisol outcomes were examined: peak daily cortisol and the area under the curve (AUC). A total of 19 participants in the discovery sample were missing cortisol data; therefore, all analyses with the discovery sample cortisol included 57 people. A more detailed description of cortisol data collection is presented elsewhere[28].

Covariates—Physical health was quantified using the Cumulative Illness Rating Scale for Geriatrics (CIRS-G)[44]. Worry was measured using the Penn State Worry Questionnaire-Abbreviated (PSWQ-A[31]). Depressive symptoms were measured in the discovery sample using the 17 item Hamilton Rating Scale for Depression (HRSD)[45]. Depressive symptoms were measured in the replication sample using the National Institute of Health PROMIS Depression items[46]. The apolipoprotein ε4 (APOE ε4) allele is a genetic risk factor for cognitive decline and Alzheimer's disease. APOE genotyping was available for a subsample of the discovery sample (N = 39) and for all participants in the replication sample (N = 48). DNA was extracted from the blood using standard procedures for both samples.

Data Analysis

The three groups within the two samples were compared on descriptive variables that were common to both samples using one-way ANOVA and chi-square tests for categorical variables. The two clinical groups (GAD in the discovery sample and the replication sample) were also compared. Hierarchical multiple regression analyses were used to examine the associations between number of childhood traumas and each cognitive outcome. Each model was run with the ETISR-SF total composite score, as well as a composite of the general, physical, and sexual trauma subscale score. The structure of the models was as follows: Step 1- controlling for age, sex, years of education, GAD status, and CIRS-G; Step 2- depressive and worry symptoms and diagnosis of Posttraumatic Stress Disorder were added to the model; and Step 3- peak cortisol was added to the model to examine the extent to which cortisol mediated the association between trauma and cognitive performance. These analyses were duplicated in the replication sample. In the replication sample APOE genotype (no ε4 allele = 0; presence of ε4 allele = 1) was included as a covariate to the Step 2 models.

Results

Sample characteristics and frequency of childhood trauma

Table 1 provides descriptive statistics of the discovery and replication samples. Compared to the discovery sample, participants in the replication sample completed significantly more years of education. When compared to the two clinical groups, the healthy comparison participants endorsed significantly less worry and less childhood trauma. Table 2 presents the frequencies of each self-reported childhood trauma.

Association of childhood trauma with cognitive performance

Table 3 displays results from the linear regression models investigating self-reported trauma exposure in relation to cognitive performance in the discovery sample. After controlling for age, sex, education, physical health, and GAD status, childhood trauma was associated with a worse total index score on the RBANS. This score was driven by worse performance on the Attention Index. Childhood trauma was also associated with worse Coding, Digit Span, Stroop Color-Word Interference performance, and sorting abilities. After adjusting for PTSD diagnosis, depressive and worry symptoms, childhood trauma remained associated with worse attention performance, Stroop Color-Word Interference, and sorting performance. When examining these associations in the subsample for which APOE data was available the magnitude of the results did not significantly change when we adjust for APOE (see supplemental table 1). See figure 1 for graphs of the estimated test performance for individuals with no trauma, those reporting the mean number of traumatic events, and those reporting high number of traumatic events.

When examining composite of general, physical, and sexual traumas in relation to cognitive performance, a similar pattern of results emerged. The number of self-reported events was associated with a lower Total Index Score on the RBANS total and attention indices, Coding subtest, Digit Span subtest, Stroop Color-Word Interference, and Sorting. The effect size of the association between childhood trauma and worse cognitive performance was generally larger when only examining the composite of general, physical, and sexual traumatic events compared to the ETISR-SF total composite score.

In the replication sample, a similar pattern of results of childhood trauma on cognitive performance emerged (see Table 4). The number of traumatic events from the full childhood trauma inventory was associated with worse Digit Span performance. Number of traumatic events was also associated with worse verbal fluency and D-KEFS Color-Word Interference. Similar to the discovery sample, when examining only the total number of general, physical, and sexual traumas reported, the effect size of trauma approximately doubled for most outcomes.

Cortisol and childhood trauma

To examine whether cortisol levels were explaining the association between childhood trauma and worse cognitive performance, we first examined the association between childhood trauma and cortisol level. The total number of events reported from the full childhood trauma inventory was not associated with higher peak ($\beta = 0.06$, 95% CI = −0.09;

0.20, $p = 0.44$) or area under the curve ($\beta = 0.13$, 95% CI = −0.73; 0.10, $p = 0.76$) cortisol. Trauma was also not associated with either peak or AUC cortisol when examining a composite of general, physical, or sexual traumas ($p > 0.31$).

Discussion

This cross-sectional study investigated the number of self-reported traumatic events experienced in childhood in relation to cognitive functioning in two samples of older adults. Childhood traumatic events were associated with worse attention and poorer executive functioning. These associations were independent of physical health, demographic variables, APOE ε4 genotype, and depressive and worry symptom severity. Furthermore, the effect of trauma on cognitive performance was larger for those reporting general, physical, or sexual trauma, compared to emotional abuse. This association was present in three different groups of older adults: older adults with GAD, psychiatrically healthy older adults, and older adults with anxiety or depressive disorders. These findings supported our initial hypothesis and were present in both the discovery and replication samples. Our second hypothesis was not supported, as the number of traumatic events in childhood was not associated with cortisol levels, and cortisol levels did not explain the association between childhood trauma and cognitive performance.

Early childhood trauma was not associated with current cortisol levels and cortisol did not explain the association between childhood trauma and worse cognitive performance, highlighting the potential importance of other physiological mechanisms. Prior research has also documented associations between childhood trauma and increased inflammation in older adulthood and documented functional and structural changes to the hippocampus and frontal cortex in younger adults[47]. Childhood trauma may affect neurotrophic factors such as Brain Derived Neurotrophic Factor[48]. As a result, upon entering older adulthood and experiencing age-related cognitive decline, individuals with childhood trauma may be at risk for greater declines in cognitive performance due to lower brain and/or cognitive reserve stemming from the potential adverse effects of childhood trauma on brain development.

Future studies need to examine the association between childhood trauma and physiological biomarkers further. The extent to which childhood trauma is associated with structural and functional neuroanatomy, inflammation, and neurotrophic factors in older adulthood are important unanswered questions. It is well established that depression is associated with worse cognitive performance in later life[49], and a growing body of literature is demonstrating the association between anxiety and worse cognitive performance[50, 51]. Future research should also examine the extent to which childhood trauma mediates the association between anxiety and cognitive performance in later life. The extent to which childhood trauma is associated with structural and functional neuroanatomy in older adulthood is an important unanswered question that needs to be studied further. Lastly, future research needs to examine the role of resilience factors, such as coping style and cognitive hardiness[52], in moderating this association.

This study has several limitations. Childhood trauma was measured with retrospective recall. It is possible that individuals who are particularly distressed, or more cognitively impaired, may exhibit a recall bias and be more likely to endorse traumatic events. Measures of biomarkers other than cortisol, such as inflammatory cytokines, neurotrophic factors, and neuroimaging, were not available, limiting the ability to examine other potential biological mechanisms. Third, although we controlled for diagnosis of PTSD, we did not have a measure of PTSD symptoms. Fourth, the cognitive and clinical measures were not uniform across both studies, although they assessed similar domains with similar tests. Fifth, we were unable to examine the modifying role of ethnicity, and past research has found that the role of early life adversity and cognitive performance in later life may be different for different racial groups[12]. Lastly, the cross-sectional design does not allow us to make conclusions of causality.

In conclusion, findings demonstrate the public health importance of preventing childhood trauma and developing interventions to help younger and older individuals with history of childhood trauma. Additionally, cortisol levels were not associated with childhood trauma, highlighting the importance of other possible physiological mechanisms.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Copeland WE, Keeler G, Angold A, Costello EJ. Traumatic events and posttraumatic stress in childhood. Arch Gen Psychiatry. 2007;64(5):577–584. [PubMed: 17485609]
2. Children and trauma: American Psychological Association; 2008.
3. A profile of older americans. Washington D.C.: Administration on Aging: U.S. Department of Health and Human Services; 2012.
4. Dube SR, Felitti VJ, Dong M, Giles WH, Anda RF. The impact of adverse childhood experiences on health problems: evidence from four birth cohorts dating back to 1900. Prev Med. 2003;37(3):268–277. [PubMed: 12914833]
5. Sareen J, Henriksen CA, Bolton SL, Afifi TO, Stein MB, Asmundson GJ. Adverse childhood experiences in relation to mood and anxiety disorders in a population-based sample of active military personnel. Psychol Med. 2013;43(1):73–84. [PubMed: 22608015]
6. Zlotnick C, Johnson J, Kohn R, Vicente B, Rioseco P, Saldivia S. Childhood trauma, trauma in adulthood, and psychiatric diagnoses: results from a community sample. Compr Psychiatry. 2008;49(2):163–169. [PubMed: 18243889]
7. Schuitevoerder S, Rosen JW, Twamley EW, et al. A meta-analysis of cognitive functioning in older adults with PTSD. J Anxiety Disord. 2013;27(6):550–558. [PubMed: 23422492]
8. Scott JC, Matt GE, Wrocklage KM, et al. A quantitative meta-analysis of neurocognitive functioning in posttraumatic stress disorder. Psychol Bull. 2015;141(1):105–140. [PubMed: 25365762]
9. Goodman GS, Quas JA, Ogle CM. Child maltreatment and memory. Annu Rev Psychol. 2010;61:325–351. [PubMed: 19575622]

10. Pollak SD, Nelson CA, Schlaak MF, et al. Neurodevelopmental effects of early deprivation in postinstitutionalized children. Child Dev. 2010;81(1):224–236. [PubMed: 20331664]
11. Carrey NJ, Butter HJ, Persinger MA, Bialik RJ. Physiological and cognitive correlates of child abuse. J Am Acad Child Adolesc Psychiatry. 1995;34(8):1067–1075. [PubMed: 7545147]
12. Cicchetti D, Rogosch FA, Gunnar MR, Toth SL. The differential impacts of early physical and sexual abuse and internalizing problems on daytime cortisol rhythm in school-aged children. Child Dev. 2010;81(1):252–269. [PubMed: 20331666]
13. Ritchie K, Jaussent I, Stewart R, et al. Association of adverse childhood environment and 5-HTTLPR Genotype with late-life depression. J Clin Psychiatry. 2009;70(9):1281–1288. [PubMed: 19573496]
14. Ege MA, Messias E, Thapa PB, Krain LP. Adverse childhood experiences and geriatric depression: results from the 2010 BRFSS. Am J Geriatr Psychiatry. 2015;23(1):110–114. [PubMed: 25306195]
15. Turner RJ, Lloyd DA. Lifetime traumas and mental health: the significance of cumulative adversity. J Health Soc Behav. 1995;36(4):360–376. [PubMed: 8719054]
16. Korten NC, Penninx BW, Pot AM, Deeg DJ, Comijs HC. Adverse Childhood and Recent Negative Life Events: Contrasting Associations With Cognitive Decline in Older Persons. J Geriatr Psychiatry Neurol. 2014;27(2):128–138. [PubMed: 24578461]
17. Petkus AJ, Wetherell JL, Stein MB, Liu L, Barrett-Connor E. History of sexual assault is associated with greater declines in executive functioning in older adults with APOE epsilon4. Journals of Gerontology Series B: Psychological and Social Science. 2012;67(6):653–659.
18. Feeney J, Kamiya Y, Robertson IH, Kenny RA. Cognitive function is preserved in older adults with a reported history of childhood sexual abuse. J Trauma Stress. 2013;26(6):735–743. [PubMed: 24265204]
19. Barnes LL, Wilson RS, Everson-Rose SA, Hayward MD, Evans DA, Mendes de Leon CF. Effects of early-life adversity on cognitive decline in older African Americans and whites. Neurology. 2012;79(24):2321–2327. [PubMed: 23233682]
20. Petkus AJ, Gum AM, King-Kallimanis B, Wetherell JL. Trauma history is associated with psychological distress and somatic symptoms in homebound older adults. Am J Geriatr Psychiatry. 2009;17(9):810–818. [PubMed: 19700953]
21. Rooks C, Veledar E, Goldberg J, Bremner JD, Vaccarino V. Early trauma and inflammation: role of familial factors in a study of twins. Psychosom Med. 2012;74(2):146–152. [PubMed: 22286843]
22. Tyrka AR, Burgers DE, Philip NS, Price LH, Carpenter LL. The neurobiological correlates of childhood adversity and implications for treatment. Acta Psychiatr Scand. 2013;128(6):434–447. [PubMed: 23662634]
23. Mehta D, Klengel T, Conneely KN, et al. Childhood maltreatment is associated with distinct genomic and epigenetic profiles in posttraumatic stress disorder. Proc Natl Acad Sci U S A. 2013;110(20):8302–8307. [PubMed: 23630272]
24. De Bellis MD, Zisk A. The biological effects of childhood trauma. Child Adolesc Psychiatr Clin N Am. 2014;23(2):185–222, vii. [PubMed: 24656576]
25. Comijs HC, Gerritsen L, Penninx BW, Bremmer MA, Deeg DJ, Geerlings MI. The association between serum cortisol and cognitive decline in older persons. Am J Geriatr Psychiatry. 2010;18(1):42–50. [PubMed: 20094017]
26. Franz CE, O'Brien RC, Hauger RL, et al. Cross-sectional and 35-year longitudinal assessment of salivary cortisol and cognitive functioning: the Vietnam Era twin study of aging. Psychoneuroendocrinology. 2011;36(7):1040–1052. [PubMed: 21295410]
27. Lenze EJ, Rollman BL, Shear MK, et al. Escitalopram for older adults with generalized anxiety disorder: a randomized controlled trial. JAMA. 2009 1 21;301(3):295–303. [PubMed: 19155456]
28. Mantella RC, Butters MA, Amico JA, et al. Salivary cortisol is associated with diagnosis and severity of late-life generalized anxiety disorder. Psychoneuroendocrinology. 2008;33(6):773–781. [PubMed: 18407426]
29. Folstein MF, Folstein SE, McHugh P. Mini-Mental State: A practical method for grading the cognitive state of patients for the clinician. Journal of Psychiatric Research. 1975;12:189–198. [PubMed: 1202204]

30. American Psychiatric Association. Diagnostic and statistical manual of mental disorders: DSM-IV. 4th ed. Washington, DC: American Psychiatric Association; 1994.
31. Hopko DR, Stanley MA, Reas DL, et al. Assessing worry in older adults: confirmatory factor analysis of the Penn State Worry Questionnaire and psychometric properties of an abbreviated model. Psychol Assess. 2003;15(2):173–183. [PubMed: 12847777]
32. Katzman R, Brown T, Fuld P: Validation of a short orientation-memory-concentration test of cognitive impairment. Am J Psychiatry 1983; 140:734–739 [PubMed: 6846631]
33. Bremner JD, Bolus R, Mayer EA. Psychometric properties of the Early Trauma Inventory-Self Report. J Nerv Ment Dis. 2007;195(3):211–218. [PubMed: 17468680]
34. Bremner JD, Randall P, Scott TM, et al. Deficits in short-term memory in adult survivors of childhood abuse. Psychiatry Res. 1995;59(1-2):97–107. [PubMed: 8771224]
35. Ritchie K, Jaussent I, Stewart R, et al. Adverse childhood environment and late-life cognitive functioning. Int J Geriatr Psychiatry. 2011;26(5):503–510. [PubMed: 21445999]
36. Randolph C, Tierney MC, Mohr E, Chase TN. The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS): preliminary clinical validity. J Clin Exp Neuropsychol. 1998;20(3):310–319. [PubMed: 9845158]
37. Wechsler D WAIS-III administration and scoring manual. San Antonio, TX: The Psychological Corportation; 1997.
38. Trenerry M, Crosson B, DeBoe J, Leber WR. Stroop Neuropsychological Screening Test Manual. Odessa, FL: Psychological Assessment Resources; 1989.
39. Dellis D, Kaplan E, Kramer J. Delis-Kaplan executive function system (D-KES). San Antonio, TX: The Psychological Corporation; 2001.
40. Kelland DZ, Lewis RF. The Digit Vigilance Test: Reliability, validity, and sensitivity to diazepam. Archives of Clinical Neuropsychology. 1996;11:339–344. [PubMed: 14588938]
41. Heaton RK, Grant I, Matthews CG. Comprehensive norms for an expanded Halstead-Reitan Battery: Demographic corrections, research findings, and clinical applications. Odessa, FL: Psychological Assessment Resources; 1991.
42. Storandt M, Balota DA, Aschenbrenner AJ, Morris JC. Clinical and psychological characteristics of the initial cohort of the Dominantly Inherited Alzheimer Network (DIAN). Neuropsychology. 2014;28(1):19–29. [PubMed: 24219606]
43. Newcomer JW, Selke G, Melson AK, et al. Decreased memory performance in healthy humans induced by stress-level cortisol treatment. Arch Gen Psychiatry. 1999;56(6):527–533. [PubMed: 10359467]
44. Miller MD, Paradis CF, Houck PR, et al. Rating chronic medical illness burden in geropsychiatric practice and research: application of the Cumulative Illness Rating Scale. Psychiatry Res. 1992;41(3):237–248. [PubMed: 1594710]
45. Hamilton M A rating scale for depression. Journal of Neurology, Neurosurgery, and Psychiatry. 1960;23:56–62.
46. Gershon RC, Cella D, Fox NA, Havlik RJ, Hendrie HC, Wagster MV. Assessment of neurological and behavioural function: the NIH Toolbox. Lancet Neurol. 2010;9(2):138–139. [PubMed: 20129161]
47. Grassi-Oliveira R, Ashy M, Stein LM. Psychobiology of childhood maltreatment: effects of allostatic load? Rev Bras Psiquiatr. 2008;30(1):60–68. [PubMed: 18373020]
48. van Velzen LS, Schmaal L, Jansen R, et al. Effect of childhood maltreatment and brain-derived neurotrophic factor on brain morphology. Soc Cogn Affect Neurosci. 2016;11(11):1841–1852. [PubMed: 27405617]
49. Koenig AM, Bhalla RK, Butters MA. Cognitive functioning and late-life depression. J Int Neuropsychol Soc. 2014;20(5):461–467. [PubMed: 24685173]
50. Beaudreau SA, O’Hara R. Late-life anxiety and cognitive impairment: a review. American Journal of Geriatric Psychiatry. 2008;16(10):790–803. [PubMed: 18827225]
51. Petkus AJ, Reynolds CA, Wetherell JL, Kremen WS, Pedersen NL, Gatz M. Anxiety is associated with increased risk of dementia in older Swedish twins. Alzheimers Dement. 2016; 12; 399–406. [PubMed: 26549599]

52. Beasley M, Thompson T, Davidson J. Resilience in response to life stress: the effects of coping style and cognitive hardiness. Personality and Individual Differences; 2003; 34; 77–95.

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Clinical points

Childhood trauma is common and associated with poorer brain health, but the association between childhood trauma and cognitive performance in older adulthood is relatively unknown. Findings suggest that older patients with anxiety who have a history of childhood trauma may have worse processing speed, attention, and executive functioning than those without childhood trauma.

Podcast:

In this study, sponsored by the National Institute of Mental Health and the National Center for Complementary and Integrative Health, researchers found that number of retrospectively recalled number of traumatic events experienced in childhood was associated with worse cognitive performance in three groups of older adults: older adults with generalized anxiety disorder, psychiatrically healthy older adults, and older adults with anxiety or depressive disorders. Specifically, the cognitive domains most associated with childhood traumatic events were slower processing speed, worse atttention, and poorer executive functioning. Cortisol, a hormone associated with stress, was not explaining this association signifying the potential importance of other physiological factors. These results highlight the public health significance of childhood trauma and importance of developing interventions to prevent and treat the effects childhood trauma.

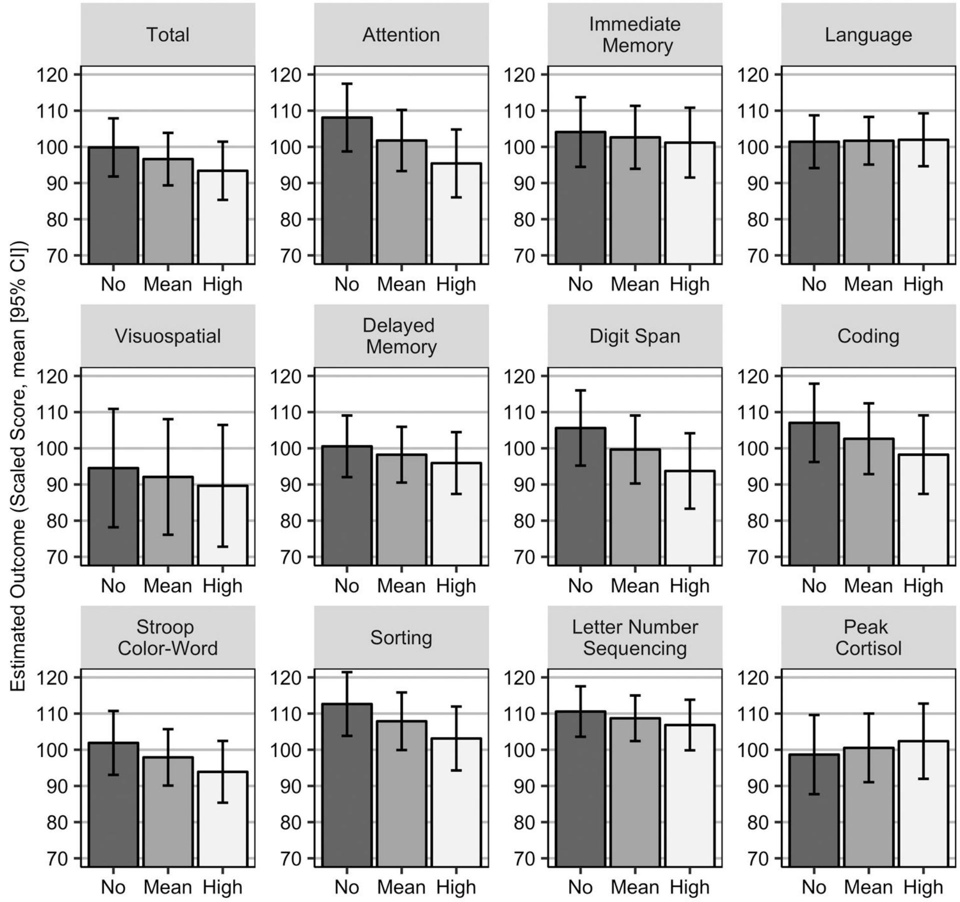

Figure 1.

Graph depicting the estimated performance, with 95% confidence interval, on cognitive tests and cortisol AUC by self-reported childhood trauma controlling for age, sex, education, health, GAD status, PTSD diagnosis, worry, and depressive symptoms.

[a] Participants were divided into three categories: no traumatic events (ETISR-SF = 0), mean number of traumatic events (ETISR-SF = 4) or high levels of traumatic events (+1 SD, ETISR-SF=8).

Table 1.

Descriptive statistics and comparisons between the health comparisons (N=19) and GAD (N=57) participants in the discovery sample and replication sample (N=48)

	Discovery Sample *M* (SD) OR % (N)		Replication sample *M* (SD) or % (N) (N=48)	Omnibus F Or chi-square	Compare F GAD and Replication
	Comparison (N=19)	GAD (N=57)			
Age	75.32 (6.96)	71.75 (8.32)	72.33 (5.31)	1.27	0.17
Percent Women	78.90 (15)	68.40 (39)	64.60 (31)	1.30	0.17
Education (Years)	14.95 (2.55)	14.12 (2.64)	16.08 (2.70)	6.25*	14.10**
Childhood trauma full	2.68 (3.00)	4.61 (3.92)	5.51 (3.79)	7.33**	1.44
Childhood trauma general, physical, and sexual abuse	1.89 (1.91)	3.24 (2.60)	3.55 (2.59)	4.91*	0.39
Psychiatric and medical comorbidity					
PSWQ-A	12.63 (4.52)	26.18 (7.59)	25.52 (7.55)	23.26**	0.16
Hamilton Depression	1.37 (1.67)	11.12 (3.41)	…	143.20**	…
PROMIS Depression	…	…	18.08 (7.66)	…	…
CIRS-G	8.42 (2.80)	8.91 (3.95)	7.77 (3.17)	1.25	2.60
PTSD Diagnosis	0.0 (0)	3.50 (2)	4.30 (2)	0.80	0.04
Cognitive performance					
RBANS					
Total SS	97.37 (10.13)	94.25 (14.70)	…	0.74	…
Immediate Memory SS	103.11 (15.37)	97.60 (15.22)	…	1.86	…
Visuospatial Ability SS	91.21 (18.12)	83.16 (16.86)	…	3.13	…
Delayed Memory SS	97.95 (11.28)	94.72 (14.31)	…	2.13	…
Attention SS	102.42 (10.52)	101.33 (17.58)	…	0.07	…
Language SS	97.26 (8.98)	102.18 (13.68)	…	0.80	…
Coding SS	103.04 (14.56)	96.74 (19.09)	…	1.73	…
WAIS-III LN Sequencing SS	104.47 (11.77)	105.18 (11.30)	…	0.05	…
D-KEFS Sorting SS	114.21 (14.84)	111.05 (15.29)	…	0.62	…
Digit Span SS	101.11 (16.78)	101.73 (17.75)	92.88 (15.41)	5.67*	7.29**
Trenerry Stroop Interference SS	95.50 (14.90)	94.57 (14.95)	…	0.05	…
Digit Vigilance Time SS	…	…	95.31(13.26)	…	…
Digit Vigilance Errors SS	…	…	92.84 (18.90)	…	…
List Learning Immediate Recall (# words)	…	…	26.29 (7.77)	…	…
List Learning Delayed Recall (# words)	…	…	5.12 (2.94)	…	…
Paragraph 1 Immediate Recall (# words)	…	…	17.46 (6.15)	…	…
Paragraph 2 Immediate Recall (# words)	…	…	16.23 (5.66)	…	…
Paragraph 1 Delayed Recall (# words)	…	…	13.54 (6.63)	…	…
Paragraph 2 Delayed Recall (# words)	…	…	12.41 (5.56)	…	…
D-KEFS Stroop Color-Word SS	…	…	101.35 (18.27)	…	…
D-KEFS Verbal Fluency SS	…	…	101.25 (16.71)	…	…
Max Cortisol	3.16 (1.23)	5.23 (1.78)	4.99 (2.45)	6.21*	0.27

[a]Childhood trauma full = composite score of all subscales from the Early Trauma Inventory Self Report-Short Form (ETISR-SF)

[b]Childhood trauma general, physical, and sexual abuse = composite score of these subscales

[c]The symbol … represents not applicable

[d] * indicated $p < 0.05$

[e] ** indicates $p < 0.01$

Abbreviations: CIRS = Cumulative Illness Rating Scale-Geriatrics; D-KEFS = Delis-Kaplan Executive Function System; PSWQ-A = Penn State Worry Questionnaire- Abbreviated; SS = standard score; WAIS-III = Wechsler Adult Intelligence Scale version III

Table 2.

Items and frequency of endorsing each item from the Early Trauma Inventory Self Report- Short Form (ETISR-SF) between the healthy comparison (N=19) and GAD (N=57) participants in the discovery sample and replication sample (N=48)

Traumatic Event	Discovery		Replication
	Comparison % (n)	GAD % (n)	% (n)
General Trauma			
1. Exposed to life-threatening natural disaster?	5.3 (1)	1.8 (1)	20.8 (10)
2. Were you ever exposed to a life-threatening event due to war, terrorist attack, or political conflict?	0.0 (0)	1.8 (1)	10.4 (5)
3. Were you involved in a serious accident?	0.0 (0)	14.0 (8)	25.0 (12)
4. Did you ever suffer a serious personal injury or illness?	31.6 (6)	26.8 (15)	29.2 (14)
5. Did you ever experience the death or serious illness of a parent or a primary caretaker?	26.3 (5)	43.9 (25)	40.0 (19)
6. Did you experience the divorce or separation of your parents?	5.3 (1)	10.5 (6)	16.7 (8)
7. Did you experience the death or serious injury of a sibling?	10.5 (2)	12.3 (7)	16.7 (8)
8. Did you experience the death or serious injury of a friend?	15.8 (3)	38.6 (22)	31.3 (15)
9. Did you ever witness violence towards others, including family members?	15.8 (3)	26.3 (15)	27.1 (13)
10. Did anyone in your family ever suffer from mental or psychiatric illness or have a “breakdown”?	5.3 (1)	29.8 (17)	25.0 (12)
11. Did your parents or primary caretaker have a problem with alcoholism or drug abuse?	15.8 (3)	28.1 (16)	25.0 (12)
12. Did you ever see someone murdered?	0.0 (0)	1.8 (1)	0.0 (0)
Physical Punishment			
1. Were you ever slapped in the face with an open hand?	15.8 (3)	15.8 (9)	25.0 (12)
2. Were you ever burned with hot water, a cigarette or something else?	0.0 (0)	0.0 (0)	0.0 (0)
3. Were you ever punched or kicked?	0.0 (0)	7.0 (4)	16.7 (8)
4. Were you ever hit with an object that was thrown at you?	0.0 (0)	7.0 (4)	8.3 (4)
5. Were you ever pushed or shoved?	5.3 (1)	12.3 (7)	10.4 (5)
Emotional Abuse			
1. Were you often put down or ridiculed?	26.3 (5)	33.3 (19)	50.0 (24)
2. Were you often ignored or made to feel that you didn’t count?	10.5 (2)	26.3 (15)	43.8 (21)
3. Were you often told you were no good?	10.5 (2)	15.8 (9)	27.1 (13)
4. Most of the time were you treated in a cold, uncaring way or made to feel like you were not loved?	21.1 (4)	26.3 (15)	43.8 (21)
5. Did your parents or caretakers often fail to understand you or your needs?	10.5 (2)	35.1 (20)	43.8 (21)
Sexual Events			
1. Were you ever touched in an intimate or private part of your body (e.g. breasts, thighs, genitals) in a way that surprised you or made you feel uncomfortable?	15.8 (3)	19.3 (11)	22.9 (11)
2. Did you ever experience someone rubbing their genitals against you?	5.3 (1)	10.5 (6)	10.4 (5)
3. Were you ever forced or coerced to touch another person in an intimate or private part of their body?	5.3 (1)	5.3 (3)	2.1 (1)
4. Did anyone ever have genital sex with you against your will?	5.3 (1)	1.8 (1)	4.2 (2)
5. Were you ever forced or coerced to perform oral sex on someone against your will?	0.0 (0)	1.8 (1)	0.0 (0)
6. Were you ever forced or coerced to kiss someone in a sexual rather than an affectionate way?	5.3 (1)	0.0 (0)	4.2 (2)

Table 3.

Discovery sample results from the hierarchical linear regression examining number of traumatic events reported in relation to cognitive test performance and hierarchical linear regression examining number of general, physical, and sexual traumatic events reported in relation to cognitive test performance.

Predictor: Childhood trauma full composite score	Step 1: Adjust for demographics and health (N=76)			Step 2: Adjust for depression and anxiety (N=76)			Step 3: Adjust for cortisol (N=57)		
Outcome:	Trauma β	95% CI	p	Trauma β	95% CI	p	Trauma β	95% CI	p
RBANS									
Total IS	**−0.99**	**−1.84 to −0.14**	**0.03**	−0.81	−1.67 to 0.06	0.07	−0.60	−1.65 to 0.44	0.25
Attention IS	**−1.70**	**−2.66 to −0.73**	**<0.01**	**−1.59**	**−2.59 to −0.58**	**<0.01**	**−1.55**	**−2.80 to −0.30**	**0.02**
Coding SS	**−1.33**	**−2.47 to −0.20**	**0.02**	−1.10	−2.27 to 0.07	0.06	−0.88	−2.34 to 0.59	0.23
Digit SS	**−1.53**	**−2.60 to −0.47**	**<0.01**	**−1.48**	**−2.60 to −0.36**	**0.01**	**−1.68**	**−3.13to −0.23**	**0.02**
Immediate Memory IS	−0.54	−1.55 to 0.47	0.29	−0.37	−1.40 to 0.67	0.48	0.03	−1.35to 1.41	0.97
Visuospatial Function IS	−0.74	−1.83 to 0.34	0.18	−0.61	−1.74 to 0.52	0.28	−0.69	−2.11 to 0.72	0.33
Delayed Memory IS	−0.61	−1.49 to 0.27	0.17	−0.58	−1.50 to 0.34	0.21	−0.32	−1.47 to 0.83	0.58
Language IS	−0.12	−0.90 to 0.66	0.76	0.06	−0.72 to 0.85	0.87	0.37	−0.64 to 1.38	0.46
Letter Number Sequencing SS	−0.62	−1.36 to 0.12	0.10	−0.47	−1.22 to 0.29	0.22	−0.22	−1.20 to 0.76	0.66
Confirmed Correct Sorts SS	**−1.14**	**−2.04 to −0.24**	**0.01**	**−1.19**	**−2.14 to −0.24**	**0.01**	**−1.11**	**−2.08 to −0.13**	**0.03**
Stroop Color-Word interference SS	**−1.00**	**−1.92 to −0.08**	**0.03**	**−1.00**	**−1.95 to −0.04**	**0.04**	**−1.61**	**−2.83 to −0.39**	**0.01**

Predictor: Childhood general, physical, and sexual trauma composite score	Step 1: Adjust for demographics and health (N=76)			Step 2: Adjust for depression and anxiety (N=76)			Step 3: Adjust for cortisol (N=57)		
Outcome:	Trauma β	95% CI	p	Trauma β	95% CI	p	Trauma β	95% CI	p
RBANS									
Total IS	**−1.50**	**−2.78 to −0.22**	**0.02**	−1.25	−2.54 to 0.03	0.06	−0.81	−2.39 to 0.76	0.30
Attention IS	**−2.31**	**−3.78 to −0.84**	**<0.01**	**−2.14**	**−3.66 to −0.62**	**<0.01**	−1.89	−3.80 to 0.02	0.053
Coding SS	**−1.82**	**−3.54 to −0.11**	**0.04**	−1.55	−3.30 to 0.18	0.08	−1.11	−3.32 to 1.09	0.32
Digit SS	**−2.39**	**−3.99 to −0.80**	**<0.01**	**−2.30**	**−3.96 to −0.64**	**<0.01**	**−2.45**	**−4.63 to −0.28**	**0.03**
Immediate Memory IS	−0.87	−2.40 to 0.64	0.25	−0.59	−2.14 to 0.95	0.45	−0.01	−2.08 to 2.06	0.99
Visuospatial Function IS	−0.96	2.60 to 0.67	0.24	−0.80	−2.49 to 0.88	0.35	−0.63	−2.77 to 1.50	0.53
Delayed Memory IS	−1.15	−2.46 to 0.16	0.08	−1.06	−2.42 to 0.30	0.12	−0.61	−2.33 to 1.10	0.48
Language IS	−0.22	−1.39 to 0.95	0.71	−0.05	−1.22 to 1.12	0.93	0.40	−1.12 to 1.92	0.60
Letter Number Sequencing SS	−0.93	−2.05 to 0.18	0.10	−0.68	−1.80 to 0.44	0.23	−0.09	1.56 to 1.39	0.91

Confirmed Correct Sorts SS	**−1.99**	**−3.33 to −0.66**	**<0.01**	**−2.00**	**−3.39 to −0.60**	**<0.01**	**−1.79**	**−3.24 to −0.34**	**0.02**
Stroop Color-Word interference SS	**−1.68**	**−3.07 to −0.29**	**0.02**	**−1.72**	**−3.14 to 0.30**	**0.02**	**−2.73**	**−4.56 to −0.89**	**<0.01**

[a] Step 1 includes age, sex, years of education, cirs-g, PTSD and GAD status

[b] Step 2 adds PSWQ-A and HRSD to the model

[c] Step 3 adds max cortisol to the model

[d] Estimates below p <0.05 are bolded

Abbreviations: CI = Confidence interval; GAD= Generalized Anxiety Disorder; HRSD = Hamilton Rating Scale for Depression; PSWQ-A= Abbreviated Penn State Worry Questionnaire; PTSD = Posttraumatic Stress Disorder; RBANS = Repeatable Battery for the Assessment of Neuropsychological Status; IS=Index Score; SS= Standard Score; Trauma β = estimated effect of Early Trauma Inventory Self Report- Short Form score on cognitive performance.

Table 4.

Replication sample results from the hierarchical linear regression examining number of traumatic events reported in relation to cognitive test performance and hierarchical linear regression examining number of general, physical, and sexual traumatic events reported in relation to cognitive test performance in the replication sample (N =48).

	Childhood trauma full composite score			Childhood general, physical, and sexual trauma composite score		
Outcome	**Trauma β**	**95% CI**	**p**	**Trauma β**	**95% CI**	**p**
Attention						
Digit Span (SS)	**−1.40**	**−2.74 to −0.06**	**0.04**	**−2.68**	**−4.61 to −0.74**	**<0.01**
Digit Vigilance Time (SS)	−0.50	−1.78 to 0.80	0.44	−1.72	−3.61 to 0.17	0.07
Digit Vigilance Errors (SS)	−1.15	−2.96 to 0.66	0.21	−0.89	−3.69 to 1.91	0.53
Memory						
List Immediate. Recall (# words)	−0.46	−1.13 to 0.20	0.17	−0.92	−1.91 to 0.07	0.06
List Delay Recall (# words)	−0.18	−0.42 to 0.07	0.15	**−0.38**	**−0.74 to −0.02**	**0.04**
Paragraph 1 Imm. Recall (# pieces)	−0.16	−0.74 to 0.41	0.57	−0.38	−1.24 to 0.47	0.37
Paragraph 2 Imm. Recall (# pieces)	−0.25	−0.77 to 0.27	0.34	−0.36	−1.14 to 0.42	0.35
Paragraph 1 Delay Recall (# pieces)	−0.11	−0.70 to 0.48	0.72	−0.44	−1.32 to 0.43	0.32
Paragraph 2 Delay Recall (# pieces)	−0.29	−0.80 to 0.22	0.26	−0.47	−1.24 to 0.30	0.22
Executive Functioning						
Verbal Fluency Raw	**−1.68**	**−3.19 to −0.17**	**0.03**	**−2.69**	**−4.96 to −0.41**	**0.02**
Stroop Interference	**−1.87**	**−3.55 to −0.19**	**0.03**	**−3.30**	**−5.79 to −0.82**	**0.01**

[a]Both models include age, sex, years of education, cirs-g, PTSD diagnosis, GAD, PSWQ-A, and PROMIS Depression as covariates.

Abbreviations: CI = Confidence interval; GAD= Generalized Anxiety Disorder; PROMIS = Patient-Reported Outcomes Measurement Information System; PSWQ-A= Abbreviated Penn State Worry Questionnaire; PTSD = Posttraumatic Stress Disorder; RBANS = Repeatable Battery for the Assessment of Neuropsychological Status; SS= Standard Score; Trauma β = estimated effect of Early Trauma Inventory Self Report- Short Form score on cognitive performance.