Chapter 16
A Meta-Analysis of Cognitive Functioning in Older Adults with PTSD

Avee Champaneria and Kristin McArthur

Authors of the Original Article Sage Schuitevoerder, Jay W Rosen, Elizabeth W Twamley, Catherine R Ayers, Heather Sones, James B Lohr, Elizabeth M Goetter, Greg A Fonzo, Kathryn J Holloway, Steven R Thorp

Journal Publisher *Journal of Anxiety Disorders.*

Year of Publication 2013.

Type of Study Meta-analysis.

Funding Sources Clinical Science R&D Program of the Veterans Health Administration.

Objectives The investigators conducted a meta-analysis to examine cognitive functioning in older adults with PTSD and without PTSD, with the hypothesis that older adults with PTSD would exhibit poorer performance in the cognitive domains studied [1].

Methods The authors used established guidelines for systematic reviews of the evidence for public health issues [2]. They queried PubMed, PsycINFO, and PILOTS to find eligible articles by combining the terms "posttraumatic stress

A. Champaneria
Department of Psychiatry and Behavioral Sciences, Duke University Health System, Durham, NC, USA
e-mail: ac540@duke.edu

K. McArthur (✉)
Psychiatry, Durham VA Medical Center, Durham, NC, USA
e-mail: Kristin.mcarthur@va.gov

R. R. Tampi et al. (eds.), *Essential Reviews in Geriatric Psychiatry*,
https://doi.org/10.1007/978-3-030-94960-0_16

disorder" or "PTSD" with "neuropsychology," "neurocognitive," or "cognitive impairment." They used the following inclusion criteria: journal articles had to be peer-reviewed, had to be in the English language, and should have human subjects over the age of 65, and articles had to provide data from which an effect size could be calculated for at least one neuropsychological test. They used the following exclusion criteria: search engine results lacking an abstract (including letters to the editor), articles focused on maladaptive thinking patterns/cognitive distortions rather than cognitive deficits, and articles that did not include a discussion of the words "elderly," "aged," "older adults," or "senior," or did not make any statistical inferences about participants older than 60 years.

Investigators used a priori method to identify ten categories of cognitive domains to be studied: global cognitive functioning, premorbid intelligence, processing speed, attention and working memory, learning, memory, language, visuospatial abilities, executive functioning, and fine motor skills.

Established test interpretation guidelines and recommendations were used to identify the potential challenges in the interpretation of the cognitive status in older adults with PTSD. Potential confounds included age; premorbid cognitive functioning and education; ethnicity/culture; severity, chronicity, and onset of PTSD symptoms; psychiatric disorders other than PTSD; drug and alcohol use; sleep disorders and fatigue; pain; medical conditions; exercise; cigarette smoking; and medications. The investigators examined the statistical control of these variables in the articles.

Investigators examined three levels of trauma exposure: PTSD positive (PTSD+), trauma exposed but PTSD negative (PTSD−), and non-trauma-exposed healthy comparison (HC) samples.

Investigators calculated effect sizes for two comparisons: PTSD+ vs. PTSD− and PTSD+ vs. HC. Effect sizes were calculated using the standardized mean difference statistic (Hedges' g), and they subtracted the mean of the comparison group from the mean of the PTSD+ group; therefore, negative effect size (ES) suggests poorer cognitive performance. Investigators used a well-documented way of standardizing measures within each study and across the studies for each of the cognitive domains, in essence, making standardized composite scores based on relevant measures for each domain before calculating the mean effect size across studies, allowing for comparisons between measures that are otherwise on different scales. They used fixed-effects model to control for unobserved study-specific variation. They prevented for preferential weighing by averaging the effect sizes in studies which used data from various cognitive measures from the same group of participants.

Results Eleven articles met the criteria for the systematic review; 77 were excluded according to the exclusion criteria. Total sample sizes in the identified articles ranged from 25 to 114, and mean age range was 62–80 years. Six studies examined participants who identified as Jewish or Israeli and had experienced Holocaust-related trauma; and five studies included veterans from the United States with trauma from combat and captivity as POWs.

All studies utilized PTSD-specific structured clinical interviews and self-report measures to assess for PTSD symptoms/diagnosis and trauma exposure. Ten studies included a trauma inventory—Trauma History Questionnaire, Combat Exposure Scale, Childhood Trauma Questionnaire, and Live Events Questionnaire. One study conducted a chart review of previously administered trauma inventories to assess for traumatic events. Nine studies used the Clinician Administered PTSD Scale to assess for current and lifetime PTSD symptoms. One of these studies administered a version of the CAPS that assessed symptoms in a 1-week period, rather than the 1 month required to meet diagnosis of PTSD. Two of the studies used self-report measures of PTSD—the Mississippi Scale for Combat-Related PTSD and the Post-traumatic Stress Diagnostic Scale.

The meta-analysis included 72 tests or subtests measuring cognitive functioning utilized in the studies. The potential confound of age was controlled in all studies using age-related test norms, evaluation of age-equivalency between groups with statistical tests, or matched comparison samples using methodological control. Ten studies (91%) accounted for the severity of PTSD, major comorbid psychiatric conditions, and the impact of medical, neurological, or cerebrovascular conditions. Nine studies (82%) assessed past drug or alcohol use. Education and medications were accounted for less consistently in the studies, 64% and 55%, respectively. Only 36% of the studies established statistical equivalency of ethnicities between comparison groups or the age of index trauma. The potential confounding factors of sleep disorder, cigarette smoking, exercise, pain, or impact of the effort on testing results were not accounted for in any of the studies.

All studies used means comparisons to evaluate the impact of trauma exposure or PTSD on neurocognition. Seven studies compared three groups: PTSD+, PTSD−, and HC. Three studies compared PTSD+ and PTSD− groups. One study compared two PTSD+ samples, with and without comorbid schizophrenia to a sample of HC. Almost all the studies used a cross-sectional design.

Five of the 11 studies utilized a shared sample of participants who were survivors of the Holocaust. Two of the studies reported data from the same cohort of combat veterans. Ultimately, six unique samples were considered in the calculations of effect size.

The investigators calculated effect sizes for each cognitive domain (refer to Table 16.1) and for comparison between Holocaust survivors and combat veterans as well (refer to Table 16.2). They tested for heterogeneity when determining the effect sizes and, when appropriate, made adjustments to correct for between and within study variances.

Conclusion Investigators found that older adults with PTSD exhibited poorer performance in all cognitive domains in comparison to trauma-exposed older adults without PTSD and healthy controls. Memory showed a large effect size when comparing the PTSD+ and PTSD− samples. Effect size was larger for the cognitive domain of learning in the PTSD+ vs. HC than with PTSD+ vs. PTSD− samples. When comparing the samples of PTSD+ to PTSD− and PTSD+ to HC, the effect sizes were moderate to large in the combat veteran samples. In the samples of the

Table 16.1 Cognitive domain ES for comparison samples PTSD+ vs. PTSD and PTSD+ vs. HC

Domain	Comparison sample	Mean effect size	95% CI for mean ES
All cognitive domains	PTSD+ vs. PTSD−	− 0.58	− 1.05, − 0.10
	PTSD+ vs. HC	− 0.72	− 0.90, − 0.54
Global cognitive functioning	PTSD+ vs. PTSD−	N/A (no measures provided)	N/A
	PTSD+ vs. HC	− 1.01	N/A
Premorbid intelligence	PTSD+ vs. PTSD−	− 0.71	− 1.47, 0.04
	PTSD+ vs. HC	− 0.98	− 1.15, − 0.82
Processing speed	PTSD+ vs. PTSD−	− 1.17	N/A
	PTSD+ vs. HC	− 0.87	N/A
Attention and working memory	PTSD+ vs. PTSD−	− 0.67	− 1.66, 0.88
	PTSD+ vs. HC	− 0.28	N/A
Learning	PTSD+ vs. PTSD−	− 0.40	− 0.54, − 0.26
	PTSD+ vs. HC	− 0.72	− 1.09, − 0.35
Memory	PTSD+ vs. PTSD−	− 0.97	− 1.83, 0.48
	PTSD+ vs. HC	− 0.73	− 1.02, − 0.44
Language	PTSD+ vs. PTSD−	− 0.34	− 0.86, 0.18
	PTSD+ vs. HC	N/A (no measures provided)	N/A
Visuospatial abilities	PTSD+ vs. PTSD−	− 0.61	− 0.81, − 0.42
	PTSD+ vs. HC	− 0.61	− 0.77, − 0.44
Executive functioning	PTSD+ vs. PTSD−	− 0.80	− 1.79, 1.04
	PTSD+ vs. HC	− 1.49	N/A
Fine motor skill	PTSD+ vs. PTSD−	N/A (no measures provided)	N/A
	PTSD+ vs. HC	− 0.47	N/A

Table 16.2 ES for comparison groups PTSD+ vs. PTSD- and PTSD+ vs. HC for Holocaust survivors and combat veterans

	Comparison sample	Effect size	95% CI for mean ES
Holocaust survivors	PTSD+ vs. PTSD−	− 0.47	N/A
	PTSD+ vs. HC	− 0.66	− 0.70, − 0.62
Combat veterans	PTSD+ vs. PTSD−	− 0.74	− 1.21, − 0.03
	PTSD+ vs. HC	− 0.91	N/A

Holocaust survivors, however, the effect sizes were small to moderate. This poses a question whether combat traumas impact the cognitive abilities differently in older adults and if there are combat-specific factors at play, or whether there are some protective factors in the Holocaust survivors, warranting further research. In the cognitive domain of learning, the effect size was about half the magnitude for PTSD+ vs. PTSD− comparison group as the PTSD+ vs. HC, suggesting that trauma exposure may be a contributing factor to poorer performance in learning. The largest

differences between older adults with PTSD and HC were in the areas of processing speed, learning, memory, and executive functioning; thus, cognitive training may be an appropriate intervention. Additional research is needed to examine the impact of cognitive deficits on treatment interventions in older adults with PTSD.

Strengths of the Study

- The investigators used a priori method to identify ten cognitive domains and classify the neuropsychological measures by sub-scales to facilitate systematic comparison.
- The investigators examined methodological challenges across the studies to inform future efforts in research.
- This meta-analysis highlights the scarcity of peer-reviewed empirical studies on cognitive functioning in older adults with PTSD.

Limitations of the Study

- Almost all the studies employed a cross-sectional design; therefore, the impact of course of PTSD and symptom fluctuation on cognitive status could not be assessed.
- Study samples were restricted to groups of Holocaust survivors and combat veterans, limiting its generalizability.
- The combat veteran samples comprised entirely of men, limiting generalizability.
- Cohort effects have been well established in psychological studies of intelligence and other cognitive structures [3, 4], which may also limit generalizability.
- Sample sizes were relatively small in many of the studies and may have provided insufficient statistical power.
- Many of the studies which examined memory deficits failed to account premorbid level of functioning or for the effects of attention/learning.
- The potential confounds like sleep disorder, exercise, pain, cigarette smoking, or the impact of effort on the test results were not accounted of controlled for in any of the studies.
- There was inconsistency in reporting of the neuropsychological test scores—raw, scaled, and standard formats—likely impacting indices of heterogeneity.
- There was infrequent reporting of premorbid IQ, which is an established risk factor for developing PTSD prior to trauma exposure in younger adult samples [5].

Take-Home Points

There is scarcity of peer-reviewed empirical research on cognitive function of older adults with PTSD. This meta-analysis provides evidence that older adults with PTSD perform more poorly on tests of memory in comparison with older adults without PTSD; however, the generalizability of these results is limited. Cognitive training could be an appropriate intervention to help improve processing speed, learning, memory, and executive functioning in older adults with PTSD.

Practical Applications of the Take-Home Points

Further empirical research is needed to assess for cognitive function in older adults with PTSD.

References

1. Schuitevoerder S, Rosen JW, Twamley EW, Ayers CR, Sones H, Lohr JB, Goetter EM, Fonzo GA, Holloway KJ, Thorp SR. A meta-analysis of cognitive functioning in older adults with PTSD. J Anxiety Disord. 2013;27(6):550–8.
2. Centre for Reviews and Dissemination. Systematic reviews: CRD's guidance for undertaking reviews in health care. 2009. Retrieved from: http://www.york.ac.uk/inst/crd/. Accessed January 25, 2021.
3. Gerstorf D, Ram N, Hoppmann C, Willis SL, Schaie KW. Cohort differences in cognitive aging and terminal decline in the Seattle longitudinal study. Dev Psychol. 2011;47(4):1026–41.
4. Schaie KW, Willis SL, Pennak S. An historical framework for cohort differences in intelligence. Res Hum Dev. 2005;2(1–2):43–67.
5. Weintraub D, Ruskin PE. Posttraumatic stress disorder in the elderly: a review. Harv Rev Psychiatry. 1999;7(3):144–52.