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A meta-analysis of cognitive functioning in older adults with PTSD☆

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ABSTRACT

A meta-analysis was conducted to summarize and integrate the literature on the cognitive functioning of older adults with posttraumatic stress disorder (PTSD). We hypothesized that those with PTSD would exhibit worse performance in each of the cognitive domains studied when compared to older adults without PTSD. Major databases were queried and eleven articles met criteria for review. As predicted, there was evidence of worse performance across cognitive measures in older adult samples with PTSD relative to older samples without PTSD. The strongest effect across samples was found for lower test scores in the broad domain of memory among older adults with PTSD, and there was evidence that trauma exposure is uniquely associated with worse performance on tests specific to learning. We outline factors thought to contribute to the interactions among PTSD, cognitive deficits, and the aging process. These findings highlight the need for thorough evaluation of cognitive functioning in older adults with PTSD, particularly in the areas of processing speed, learning, memory, and executive functioning.

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Posttraumatic stress disorder (PTSD) is often linked with deficits in processing speed and memory, and less often with an inability to divert attention from trauma-provoking stimuli (Qureshi et al., 2011; Twamley et al., 2009; Vasterling et al., 2002). Deficits such as these are known to increase the effects of psychosocial stressors related to physical health behaviors (Zen, Whooley, Zhao, & Cohen, 2011), academic and vocational productivity (Kessler & Frank, 1997; Murray & Lopez, 1997), and interpersonal relationships (Karney & Crown, 2007). Cognitive deficits are one of the most consistent predictors of chronic disability found among both younger and older people with psychiatric illness (Green, Kern, Braff, & Mintz, 2000; Heaton and Pendleton, 1981; Twamley et al., 2002).

The older segment of the population is rapidly growing (U.S. Census Bureau, 2010), demonstrates increased use of healthcare resources (Hartman, Catlin, Lassman, Cylus, & Heffler, 2008), and has a higher prevalence of cognitive functioning deficits compared to younger adults (e.g., Lindeboom & Weinstein, 2004). The relationship between cognitive functioning and PTSD in the elderly is not clear (Lapp, Agbokou, & Ferreri, 2011). For example, it has not been firmly established that older adults with PTSD perform more poorly on tests of cognitive functioning than older adults without PTSD.

Most research on cognitive performance among older survivors of trauma has focused on memory, learning, and attention deficits. For instance, the relationship between age and memory decline appears to be stronger for Holocaust survivors with PTSD than for trauma-exposed individuals without PTSD and non-trauma exposed comparison subjects (Golier et al., 2002; Yehuda, Golier, Halligan, & Harvey, 2004; Yehuda, Golier, Harvey, et al., 2005; Yehuda, Golier, Tischler, Stravitsky, & Harvey, 2005b). The poorer memory performance was linked to higher mean cortisol values (Yehuda, Golier, Harvey, et al., 2005). Existing studies have revealed learning deficits among older Veterans with PTSD, and memory deficits among both older and younger Veterans with PTSD. These results suggest that some PTSD-associated cognitive deficits may exist across the age spectrum, but other deficits, such as learning, may be the result of a more complex interaction between aging and PTSD. Attention and delayed recall deficits have been

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identified in Vietnam Veterans with PTSD (Vasterling et al., 2002), but it is unclear if the pattern of these results is unique to older adults (see Vasterling, Brailey, Constans, & Sutker, 1998).

There have been several excellent reviews of PTSD in the elderly, but there have been no meta-analyses regarding cognitive performance in this population. Furthermore, previous reviews have not classified neuropsychological tests according to their respective cognitive domains, thus preventing standardized comparison of effect sizes across studies. Additional analysis of late-life cognitive deficits among individuals with PTSD can enhance our knowledge of the neurobiological mechanisms involved in traumatic sequelae, and the effects of stress across the lifespan.

There are several challenges to be considered for research on cognitive performance and PTSD generally. Cognitive deficits have been explored bi-directionally as both a risk factor and consequence of PTSD (Vasterling & Brailey, 2005). Variations in type, frequency, duration, and severity of trauma exposure, age at exposure, and severity of PTSD may affect test performance (and some types of trauma, such as malnutrition in the context of the Holocaust, impact both psychological and physical health), but these factors are not always addressed in research (Qureshi et al., 2011; Twamley et al., 2009). Overall health status, level of education, cigarette use, exercise regimens, co-morbid psychiatric status, developmental disorders, and medication use may also challenge cognitive assessment of individuals with PTSD (Hart, Martelli, & Zasler, 2000; Hauri, 1997; Heyer et al., 2000; Marvel & Paradiso, 2004; Nation et al., 2011, 2012; Norman et al., 2011; Stanek & Gunstad, 2012).

Older adults have higher rates of medical co-morbidities and cognitive deficits, making diagnosis, case formulation, and treatment particularly challenging. There is notable symptom overlap between late-life cognitive disorders and PTSD (e.g., hypervigilance, anxiety, concentration difficulties). More variability is associated with older adults' performance on cognitive tests compared to younger adults (Christensen, 2001), and without the use of age-corrected norms or statistical co-variation for age, it is difficult to tease apart normal cognitive aging vs. PTSD (Hannay & Lezak, 2004). Many of the lower test scores associated with PTSD mirror declines that are a part of the normal cognitive aging process (Gatz, 1994; Lupien, Maheu, Tu, Fiocco, & Schramek, 2007; Owens, Baker, Kaskcow, Ciesla, & Mohamed, 2005).

The present systematic review and meta-analysis examines cognitive functioning in older adults with PTSD with aims to describe (a) populations studied, (b) assessment measures employed, and (c) methodological challenges that could affect interpretation of cognitive status. Based on the extant literature, we hypothesized that when compared to older adults without PTSD, older adults with PTSD would exhibit worse performance in each of the cognitive domains we have identified: global cognitive functioning, premorbid intelligence, processing speed, attention and working memory, learning, memory, language, visuospatial abilities, executive functioning, and fine motor skills.

1. Method

We adhered to the guidelines for systematic reviews in evaluating the effects of health interventions. The Centre for Reviews and Dissemination (2009) is part of the National Institute for Health Research that conducts systematic reviews of the evidence for public health issues. These established guidelines were utilized to ensure that methods were comprehensive for identifying research questions, undertaking the review, and synthesizing results. We queried electronic search engines PubMed, PsycINFO, and PILOTS to identify eligible articles. The terms "posttraumatic stress disorder" or "PTSD" were combined with words "neuropsychology," "neurocognitive," or "cognitive impairment" across the three search engines. Thus, a total of 18 search queries (six terms by three search engines) were conducted. Duplicate articles were removed. The reference sections of the identified journal articles were reviewed for any relevant articles that were not produced by the search engines.

Inclusion criteria restricted results to peer-reviewed, English-language articles that included human subjects aged 65 or older. We also required that articles provided data from which to calculate an effect size for the difference between older adults with and without PTSD on at least one neuropsychological test. We excluded (a) search engine results lacking an abstract (including letters to the editor); (b) articles focused on cognitive distortions or maladaptive thinking patterns rather than cognitive deficits; and (c) 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 whose average age was older than 60 years. Eligibility of articles based on these criteria was determined by a consensus of all authors.

1.1. Classification of neuropsychological tests and cognitive domains

Two of the co-authors with expertise in neuropsychology (E.W.T. and J.W.R.) independently categorized the neuropsychological measures examined in the selected articles. Neuropsychological measures were defined by objectively assessing a recognized cognitive domain. Ten categories of cognitive domains were identified: (a) global cognitive functioning; (b) premorbid intelligence; (c) processing speed; (d) attention and working memory; (e) learning; (f) memory; (g) language; (h) visuospatial abilities; (i) executive functioning; and (j) fine motor skills. Consensus was built through discussion and text reference (Strauss, Sherman, & Spreen, 2006). Classification of neuropsychological tests by cognitive domain can be seen in Table 1.

1.2. Potential confounds

We identified potential challenges to the interpretation of cognitive status in older adults with PTSD a priori through a review of test interpretation guidelines and recommendations from previous research (Duke & Vasterling, 2005; Hannay & Lezak, 2004; Yehuda, Golier, Harvey, et al., 2005). The categories of potential confounds included: (a) age; (b) premorbid cognitive functioning and education; (c) ethnicity/culture; (d) severity, chronicity, and onset of PTSD symptoms; (e) psychiatric disorders other than PTSD; (f) drug and alcohol use; (g) sleep disorders and fatigue; (h) pain; (i) medical conditions (e.g., traumatic brain injury, neurodegenerative disorders, stroke, endocrine disorders, cerebrovascular and allostatic risk factors); (j) exercise, (k) cigarette smoking, and (l) medications. Articles were examined for methodological or statistical control of these variables.

1.3. Categories of trauma exposure

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

1.4. Calculation of effect sizes

Effect sizes were calculated using the standardized mean difference statistic Hedges' g [(mean 1 − mean 2)/sd_p], where sd_p is the