

Cognitive & Behavioral Assessment

Cognitive impairment among World Trade Center responders: Long-term implications of re-experiencing the 9/11 terrorist attacks

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Abstract

Introduction: During the World Trade Center (WTC) attacks, responders who helped in search, rescue, and recovery endured multiple traumatic and toxic exposures. One-fifth subsequently developed post-traumatic stress disorder (PTSD). PTSD has been linked to dementia in veterans. This study examined the association between WTC-related PTSD and cognitive impairment (CI) in WTC responders.

Methods: A one-third sample of responders ($N = 818$) reporting for annual monitoring visits were screened for cognitive impairment and dementia using the Montreal Cognitive Assessment from January 2014–April 2015. Concurrent diagnoses of PTSD and major depressive disorder (MDD), as well as serial PTSD and depressive symptom inventories, collected since 2002, were examined in relation to current CI.

Results: Approximately 12.8% and 1.2% of responders in this sample respectively had scores indicative of CI and possible dementia. Current PTSD and MDD were associated with CI. Longitudinal results revealed that re-experiencing symptoms were consistently associated with CI (aRR = 2.88, 95% confidence interval = 1.35–6.22), whereas longitudinal increases in other PTSD and depressive symptoms in the years before screening were evident only among those with CI.

Conclusions: Analyses replicated results from Veterans studies and further highlighted the importance of re-experiencing symptoms, a major component of PTSD that was consistently predictive of CI 14 years later. Clinicians should monitor CI when treating individuals with chronic PTSD.

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Keywords:

Epidemiology; World Trade Center; Disasters; Posttraumatic stress disorder; Cognitive impairment; Psychiatry

Dementia is a degenerative disease of the brain that is expected to affect as many as 40% of the U.S. population [1,2]. Although dementia is an uncommonly devastating disease, milder prodromal forms of cognitive impairment

(CI) are more common and also implicate substantial losses in cognitive functioning [3]. Risk factors for CI and dementia include age, smoking, alcohol intake, cardiovascular disease, education, diabetes, and depression [4]. Research suggests that post-traumatic stress disorder (PTSD) may also be associated with reduced cognitive functioning and increased risk of dementia [5,6]. PTSD involves complex memory, emotional, and behavioral processes [7],

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and encompasses distinct domains including re-experiencing, effortful avoidance, emotional numbing, and hyperarousal resulting from a traumatic event [8]. Exact mechanisms for this association remain understudied [9]. Theories suggest, on the one hand, that PTSD may be a unique part of the causal pathway leading to CI [10]. However, the association may be confounded by co-morbid features that are independently associated with PTSD and dementia, such as traumatic brain injury [11]. Finally, symptoms indicative of PTSD, which is commonly comorbid with major depressive disorder (MDD) [12], may be manifestations of CI and dementia [13]. It is thus unclear whether reported associations between PTSD and cognitive impairments and dementia are due to reverse causation.

1.1. Setting

Thousands of responders who helped in search, rescue, and cleanup efforts after the World Trade Center (WTC) were exposed to an extraordinary array of psychological traumas and toxic exposures. Although few were physically injured by their efforts, many responders witnessed the disaster or death and dismemberment of others, helped civilians flee, lost colleagues in the tower collapse, and dug through debris to search for survivors [14]. Since then, researchers examining WTC responders have found high rates of chronic PTSD. Yet, the potential effects of persistent mental health symptoms on CI have not been examined [15].

2. Hypotheses

Based on existing studies, we hypothesized that current WTC-PTSD will be associated with CI. Dementia researchers largely agree that CI is generally characterized as undergoing a period of accelerated decline before becoming diagnostic (Fig. 1A) [16,17]. We posited that such change might also be observed in noncognitive outcomes, such as via increasing depressive symptoms (dashed line), in a way similar to cognitive outcomes. Thus, longitudinal analyses of depressive and PTSD symptoms before cognitive screening may help interpret concurrent associations. Specifically, changes in related noncognitive factors could be used to help mark the course of the disease. If so, then reverse causation would be evident by significantly increasing symptoms before screening positive for CI. In contrast, risk factors may be those that, alternatively, precede the course of the disease and/or are not subject to such reverse causal effects.

3. Methods

3.1. Parent monitoring study

In July 2002, the Centers for Disease Control and Prevention initiated a monitoring and treatment program for WTC responders, spanning five clinical centers. Since then, more than 33,000 responders have enrolled in the WTC Health

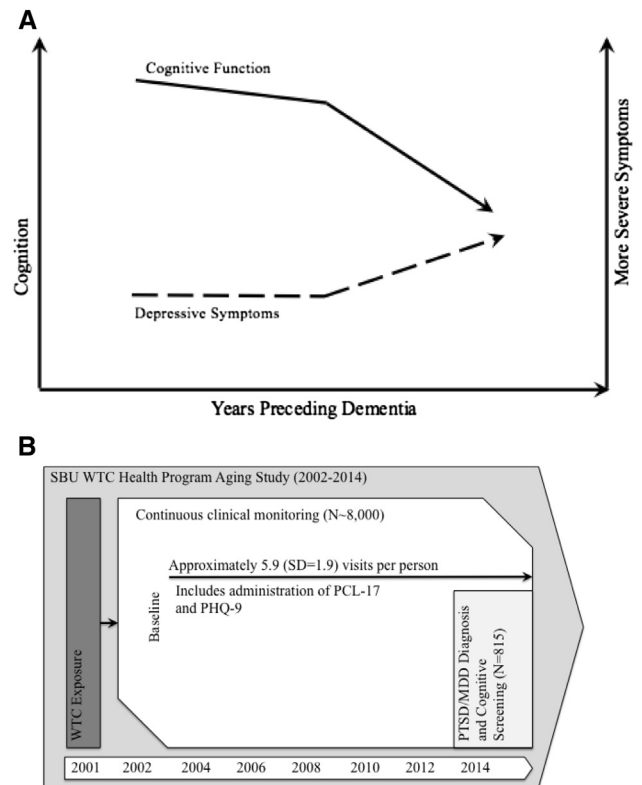


Fig. 1. Hypotheses and data structure for the Stony Brook University World Trade Center Aging Study 2002–2015. (A) Hypothesized progression of cognitive and non-cognitive changes. Solid lines, charted on the left y-axis, reflect changes in cognition whereas dashed lines, charted on the right y-axis, reflect changes in non-cognitive mental health symptoms. (B) Structure of the longitudinal PTSD sample and cross-sectional cognitive sample. Enrollment is open, and some patients have left. WTC exposures precede data collection, but mental health symptoms have been gathered since 2002, and diagnoses and cognitive screening were done concurrently in 2014–2015.

Program and form the WTC general responders cohort [14]. Stony Brook University (SBU) runs the second largest clinical center, monitoring >8000 responders residing on Long Island, NY. SBU's population had similar exposures to the general responder cohort and was similar in age on 9/11/2001 (38.7 in the WTC general responder cohort versus 38.4 at SBU) [14]. However, the SBU population includes relatively more law enforcement personnel and men and fewer individuals without a high-school degree. The SBU Institutional Review Board approved this study, and responders provided written informed consent; >95% of responders consented for data to be used for research purposes.

3.2. Sample

Trained clinicians screened responders for CI during monitoring visits at the SBU clinics starting in 2014. Of those approached, 89.8% completed the screening, 0.6% did not complete due to extenuating circumstances, 0.4% only finished part of the screening, and 8.7% refused to participate in this cognitive screening. Those who refused

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