

# New insights into the circuitry of PTSD and mild traumatic brain injury

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Post-traumatic stress disorder (PTSD) and traumatic brain injury (TBI) can have devastating consequences. Both are associated with high rates of disability and suicide, and although they are separate conditions, they commonly co-occur. For example, a soldier who has developed PTSD as a result of a traumatic experience may have also sustained a brain injury during that experience.

Significant research has been conducted to understand the brain mechanisms underlying PTSD and TBI, but there has still been a lack of knowledge regarding exactly which brain networks are disturbed in these disorders.

To fill this gap, Dr. Jeffrey Spielberg and his colleagues at the VA Boston Healthcare System examined brain networks in veterans with trauma exposure using functional [magnetic resonance imaging](#) and graph theory tools. As the authors explain, graph theory is a sophisticated analysis that allows us to understand brain networks at a level of complexity that was previously impossible. It permits examination of the patterns of brain connections, as opposed to examining individual connections.

The researchers recruited 208 veterans of Operation Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn, all of whom had experienced a traumatic event. They found that veterans who had more severe PTSD re-experiencing symptoms (e.g., flashbacks or reliving the event) showed weaker connectivity in two networks.

The first altered network includes the hippocampus and prefrontal cortex, and is involved in providing contextual information. This suggests that perhaps the hippocampus may be overgeneralizing trauma-related memories, and therefore, fails to correctly classify non-threatening cues as "safe".

The second network, which was identified only in veterans with comorbid mild TBI, includes the basal ganglia and prefrontal cortex, and plays a role in working memory.

Because the veterans studied here had already experienced a traumatic event, this research cannot identify with certainty whether the observed brain network disturbances were present in these individuals before the trauma occurred, or whether they occurred as a result of the trauma exposure. Future research of at-risk individuals, perhaps examining soldiers before and after military deployment, will be necessary to clarify this point.

"It may never be possible to fully distinguish the role of the severity of stress, the capacity for resilience to stress effects, and the presence of mild TBI in PTSD-related distress and disability because these factors are so complex and intimately entwined," said Dr. John Krystal, Editor of Biological Psychiatry.

"However, this study suggests that there are subtle but important differences in [brain](#) circuit functional connectivity related to the impact of traumatic stress among individuals with and without TBI. These data provide additional evidence that TBI may complicate the capacity for recovery from traumatic stress-related symptoms."

**More information:** "Brain Network Disturbance Related to Posttraumatic Stress and Traumatic Brain Injury in Veterans." [DOI: 10.1016/j.biopsych.2015.02.013](https://doi.org/10.1016/j.biopsych.2015.02.013)

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