

Brain training induces lasting brain, mental health gains for veterans, civilians with brain injury

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In the first study of its kind, veterans and civilians with traumatic brain injury showed improved cognitive performance and psychological and neural health following strategy-based cognitive training. The Department of Defense-funded study, published this week in *Neuropsychological Rehabilitation*, was conducted by an interdisciplinary team of cognitive neuroscientists, rehabilitation specialists, and neuroimaging experts from the Center for BrainHealth at The University of Texas at Dallas.

"Veterans and others who have sustained traumatic brain injuries often experience persistent cognitive and psychological difficulties, such as depression and/or [post traumatic stress disorder](#), which hinder day-to-day life activities," said Dr. Sandra Bond Chapman, founder and chief director of the Center for BrainHealth and principal investigator on the study. "This study shows that strategy-based cognitive training focusing on abstract and innovative thinking not only improves cognitive areas critical to everyday life success but also improves [brain blood flow](#) to key regions of the brain and lessens depressive and stress-related symptoms."

The study examined 60 individuals between the ages of 19 and 65 years of age who had sustained at least one traumatic [brain injury](#) previously. More than two-thirds of the participants had sustained a traumatic brain injury more than 10 years ago.

The participants were randomly assigned to either receive strategy-based brain training focused on complex abstraction and innovation or an educational, information-based program about how the brain works. Both programs offered 18 hours of training that was completed in 12 group sessions over an 8-week timeframe. All participants underwent extensive cognitive assessments and Magnetic Resonance Imaging (MRI). The researchers also measured symptoms of depression and symptoms of [post-traumatic stress disorder](#).

The group who received the strategy-based cognitive training improved complex abstraction scores by more than 20% and memory scores by more than 30%. Participants in the strategy-based cognitive training group also reported 60% reduction in depressive symptoms as well as almost 40% reduction in symptoms related to post traumatic stress disorder. Regional brain [blood flow](#) to the frontal lobe, anterior cingulate and precuneus was also found to increase significantly following the strategy-based training as compared to the active comparison group.

"Previously, reduction in precuneus blood flow has been linked to severity of [traumatic brain injury](#) and symptoms of PTSD," said Dr. Daniel Krawczyk, associate professor of cognitive neuroscience and cognitive psychology at the Center for BrainHealth and principal investigator on the study.

"Our results show that following the strategy-based training, blood flow increased more than 25% to this region, implying the brain is undergoing changes suggestive of improved neural health. Enhanced neural health of the frontal region has been associated with increased abstract thinking, the anterior cingulate to superior cognitive performance, and the precuneus to emotional regulation of stress and severity of brain injury symptoms," said Krawczyk, who holds the Debbie and Jim Francis chair at The University of Texas at Dallas.

Researchers suggest that the improved abstract thinking and improved executive functioning appear to help individuals to down-regulate emotional reactions, resulting in better mood and fewer stress symptoms.

"Our research suggests that interventions that improve frontal lobe reasoning, induces positive brain changes that support higher-order thinking and down-regulation of negative emotion. The converging patterns identified biological validity for the cognitive and mental health improvement," said Chapman, who holds the Dee Wyly Distinguished University Chair at The University of Texas at Dallas. "The cognitive, psychological and brain blood flow benefits continued to be realized three to four months following training, suggesting that participants continued to improve after the training ended."

She continued, "The benefits of the strategy based [training](#) were experienced months and years after injury suggesting that [brain](#) injuries should be treated more like a chronic health condition rather than a single short-term event."

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