

Brain imaging shows kids' PTSD symptoms linked to poor hippocampus function

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Psychological trauma leaves a trail of damage in a child's brain, say scientists at the Stanford University School of Medicine and Lucile Packard Children's Hospital. Their new study gives the first direct evidence that children with symptoms of post-traumatic stress suffer poor function of the hippocampus, a brain structure that stores and retrieves memories. The research helps explain why traumatized children behave as they do and could improve treatments for these kids.

"The brain doesn't divide between biology and psychology," said Packard Children's child psychiatrist Victor Carrion, MD, the primary author of the new research. "We can use the knowledge we get from understanding [brain function](#) to improve the psychology of the individual and vice versa."

Extreme stressors such as experiencing abuse or witnessing violence can make children isolate themselves from family and friends, feel disconnected from reality, experience intrusive thoughts about the trauma and struggle in school. "[Post-traumatic stress](#) is not only about the traumatic memories; it really affects daily living," said Carrion, who is an associate professor of child and adolescent [psychiatry](#) at the School of Medicine and director of Stanford's early life stress research program. The research will be published online Dec. 8 in the *Journal of Pediatric Psychology*.

The findings could be an important step toward better monitoring of PTSD treatments, which include psychotherapy techniques such as

teaching relaxation exercises, helping children to construct a cohesive story about the traumatic event and helping them learn to cope with reminders of the trauma. Right now, psychologists assess such treatments by looking for improvements in symptoms, but that's a problem because the symptoms can fluctuate from day to day. "That method has the disadvantage that we don't know what's happening at the neural level," Carrion said.

To observe how kids' brains work after trauma, Carrion's team used functional magnetic resonance imaging to compare 16 young people who had PTSD symptoms with a control group of 11 normal youths. The scientists scanned the brains of the 10- to 17-year-old subjects during a simple test of verbal memory. Subjects read a list of words, then saw a similar list with new words added, and were asked which terms were present on the original list.

The hippocampus worked equally well in stressed and control subjects when the word list was first introduced. However, subjects with PTSD symptoms made more errors on the recall part of the test and showed less hippocampus activity than control subjects doing the same task.

Subjects with the worst hippocampus function were also most likely to experience a specific set of PTSD symptoms: Such impairment of the hippocampus was strongly correlated with "avoidance and numbing" symptoms of PTSD, including difficulty remembering the trauma, feeling cut off from others and lack of emotion.

Parents and other caregivers may find the new discoveries useful as they tend to traumatized children, Carrion said, particularly when children respond to trauma by withdrawing from people who are trying to help. Parents may sometimes misinterpret this behavior as a child's attempt to retaliate, when it actually represents an overload of the brain's normal mechanism for handling fear. "When parents understand that PTSD is

real, they don't take it as personally," he said. "They become more available to their kids. That's good because the kids need them."

In the future, physicians and scientists may be able to use fMRI scans of the hippocampus to identify children who are at high risk of PTSD after mass catastrophes, added Carrion, who has consulted on response teams for natural disasters such as Hurricane Katrina and the February 2009 wildfires in southeastern Australia. However, larger studies of brain activity in pediatric PTSD are still needed to give a more detailed understanding of the disorder.

It's already clear that untreated PTSD can interfere with a child's normal brain development and increase the risk of other psychiatric conditions such as depression and substance abuse, Carrion concluded. "Early intervention is critical for children with post-traumatic stress," he said.

More information: [DOI:10.1093/jpepsy/jsp112](https://doi.org/10.1093/jpepsy/jsp112)

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