

Teen cannabis users have poor long-term memory in adulthood

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Teens who were heavy marijuana users - smoking it daily for about three years—had an abnormally shaped hippocampus and performed poorly on long-term memory tasks, reports a new Northwestern Medicine study.

The hippocampus is important to long-term [memory](#) (also known as episodic memory), which is the ability to remember autobiographical or life events.

The brain abnormalities and memory problems were observed during the individuals' early twenties, two years after they stopped smoking [marijuana](#).

Young adults who abused cannabis as teens performed about 18 percent worse on long-term memory tests than [young adults](#) who never abused

cannabis.

"The memory processes that appear to be affected by cannabis are ones that we use every day to solve common problems and to sustain our relationships with friends and family," said senior author Dr. John Csernansky, the Lizzie Gilman professor and chair of psychiatry and behavioral sciences at Northwestern University Feinberg School of Medicine and Northwestern Memorial Hospital.

The study will be published March 12 in the journal *Hippocampus*.

The study is among the first to say the hippocampus is shaped differently in heavy marijuana smokers and the different looking shape is directly related to poor long-term memory performance. Previous studies of cannabis users have shown either the oddly shaped hippocampus or poor [long-term memory](#) but none have linked them.

Previous research by the same Northwestern team showed poor short-term and working memory performance and abnormal shapes of brain structures in the sub-cortex including the striatum, globus pallidus and thalamus.

"Both our recent studies link the chronic use of marijuana during adolescence to these differences in the shape of brain regions that are critical to memory and that appear to last for at least a few years after people stop using it," said lead study author Matthew Smith, assistant professor of psychiatry and behavioral sciences at the Feinberg School of Medicine.

The longer the individuals were chronically using marijuana, the more abnormal the shape of their hippocampus, the study reports. The findings suggest that these regions related to memory may be more susceptible to the effects of the drug the longer the abuse occurs.

The abnormal shape likely reflects damage to the hippocampus and could include the structure's neurons, axons or their supportive environments.

"Advanced brain mapping tools allowed us to examine detailed and sometimes subtle changes in small brain structures, including the hippocampus," said Lei Wang, also a senior study author and an assistant professor of psychiatry and [behavioral sciences](#) at Feinberg. The scientists used computerized programs they developed with collaborators that performed fine mappings between structural MRIs of different individuals' brains.

Subjects took a narrative memory test in which they listened to a series of stories for about one minute, then were asked to recall as much content as possible 20 to 30 minutes later. The test assessed their ability to encode, store, and recall details from the stories.

The groups in the study started using marijuana daily between 16 to 17 years of age for about three years. At the time of the study, they had been marijuana free for about two years. A total of 97 subjects participated, including matched groups of healthy controls, subjects with a marijuana use disorder, schizophrenia subjects with no history of substance use disorders, and schizophrenia subjects with a marijuana use disorder. The subjects who used marijuana did not abuse other drugs.

The study also found that young adults with schizophrenia who abused cannabis as teens performed about 26 percent more poorly on memory tests than young adults with schizophrenia who never abused cannabis.

In the U.S., marijuana is the most commonly used illicit drug, and young adults have the highest—and growing—prevalence of use.

Decriminalization of the drug may lead to greater use. Four states have legalized marijuana for recreational use, and 23 states plus Washington

D.C. have legalized it for medical use.

Because the study results examined one point in time, a longitudinal study is needed to definitively show if marijuana is responsible for the observed differences in the brain and memory impairment, Smith said.

"It is possible that the abnormal brain structures reveal a pre-existing vulnerability to marijuana abuse," Smith said. "But evidence that the longer the participants were abusing marijuana, the greater the differences in [hippocampus](#) shape suggests marijuana may be the cause."

Provided by Northwestern University

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