

Scientists Find Common Brain Network for Substance Use Disorders

Study findings suggest this circuitry might be targeted in potential therapies for a variety of substance use disorders.

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Substance use disorders are complex, hard-to-treat conditions that affect a person's brain and behavior. Affected people are unable to control their use of substances such as alcohol, tobacco, or drugs, despite harmful consequences.

Scientists have used different imaging techniques to find brain areas that might be linked to various addictions. Such studies have often focused on just one particular substance. And they've used differing methods for analysis. This variability has made it hard to find commonalities between the brain networks involved in different substance use disorders.

To learn more, a multi-center research team used a technique called network mapping to create maps of affected brains and search for overlap. The team was led by Dr. Michael D. Fox of Brigham and Women's Hospital and Dr. Jacob L. Stubbs of the University of British Columbia.

The researchers compared data from 144 imaging studies that analyzed brain anomalies linked to different substance use disorders. The studies included more than 9,000 participants in total. A brain map of 1,000 healthy people was used as an "average wiring diagram" that allowed for study comparison. Results were published in [Nature Mental Health](#) on September 25, 2023.

The researchers first focused on a subset of 45 studies that were part of a recent meta-analysis of brain abnormalities and substance use disorders. They analyzed imaging data from nearly 3,800 participants who had evidence of addiction linked to brain atrophy, a loss of neurons and the connections between them. The analysis included addiction to substances such as alcohol, nicotine, cocaine, opioids, and cannabis.

The researchers found that 91% of the atrophy coordinates mapped to a common brain network. This network included brain regions such as the anterior cingulate, the insulae, prefrontal cortices, and the thalamus. These regions had previously been linked to human craving, emotion, and risky decision making. The network was different from that found for atrophy associated with normal aging and neurodegenerative disease.

The researchers then analyzed coordinates from 99 studies that used fMRI to assess more than 5,000 participants with substance use disorders. This analysis showed that over 80% of the neuroimaging abnormalities mapped to a similar brain network, regardless of the substance.

A final analysis of the combined data across substance use disorders identified a common brain network that is similar across imaging methods and substances.

“Our study found that different brain regions implicated in addiction are all a part of a common brain circuit,” Fox says. “Consistency across different studies means we now have a brain circuit to target addiction with treatments, rather than just a region.”

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