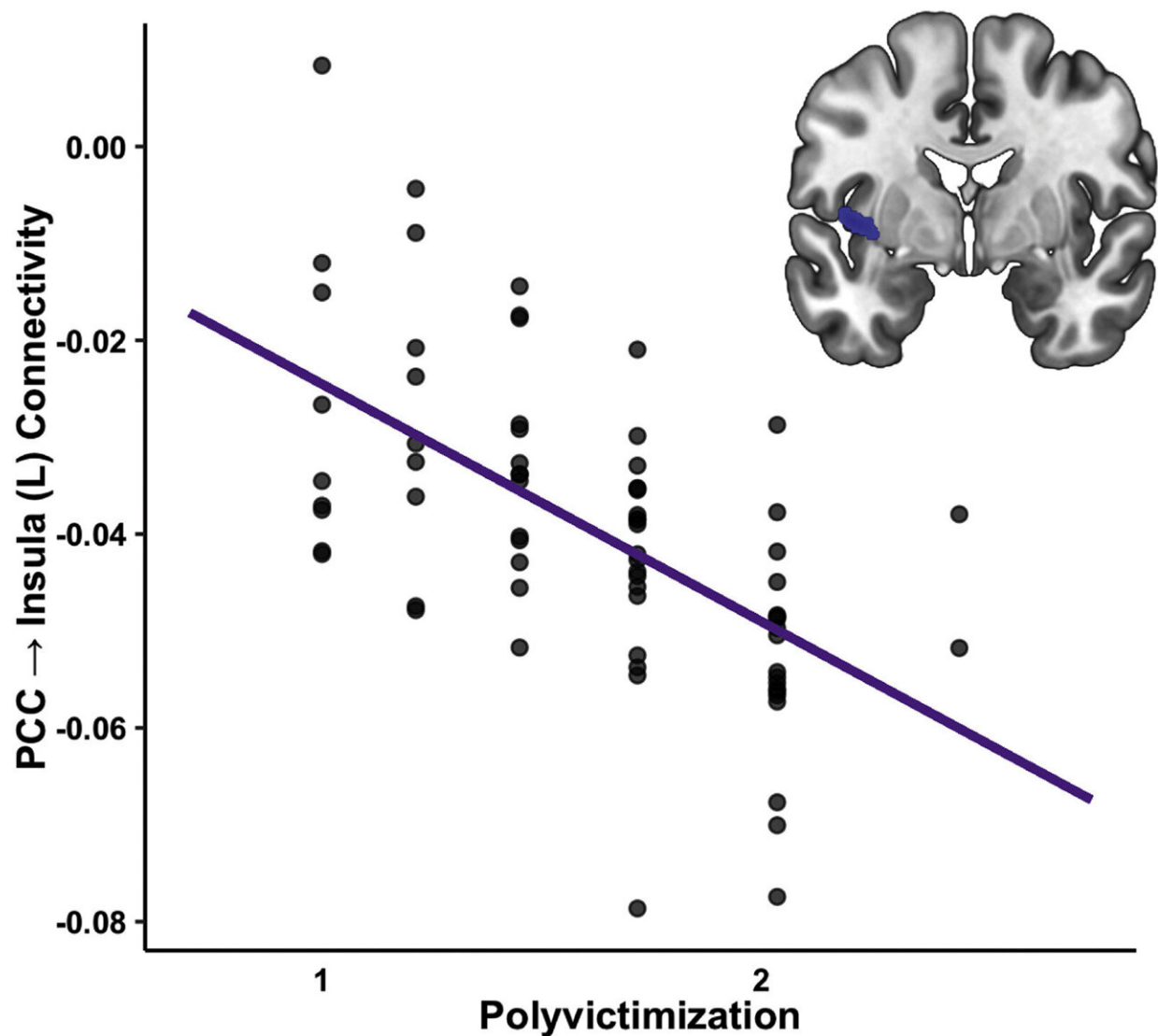


Effects of stress on adolescent brain's 'triple network'

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and a cluster containing the left (L) insula of the salience network (coronal slice $Z = 2$). Connectivity values displayed reflect adjustment of the polyvictimization variable for skew and are corrected for sex, age, medication use, and diagnosis. Credit: *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging* (2022). DOI: 10.1016/j.bpsc.2022.03.003

Stress and trauma during adolescence can lead to long-term health consequences such as psychiatric disorders, which may arise from neurodevelopmental effects on brain circuitry. A new study in *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, published by Elsevier, has used functional magnetic resonance imaging (fMRI) to examine the effects of acute stress and "polyvictimization," or repeated traumas, on three brain networks in adolescents.

"While negative health outcomes have been associated separately with early life victimization exposure, disrupted adolescent neurodevelopment, and aberrant neural network responses to [acute stress](#), no previous research had examined how these factors are related to each other," explained Rachel Corr, Ph.D., University of North Carolina at Chapel Hill, NC, U.S. and lead author of the study. "This study aimed to put together these pieces of the puzzle."

Dr. Corr and colleagues specifically wanted to explore "how acute stress influences functional connectivity of the brain's 'triple networks,'" referring to the [default mode network](#), the salience network, and the central executive network. Together, the three networks are critical for controlling cognition, emotion, perception, and social interaction. Aberrant activity in and between the triple networks has long been associated with psychiatric symptoms.

The researchers analyzed functional connectivity (FC) data previously

collected from 79 children aged 9 to 16, many with polyvictimization. To measure the effects of acute stress on brain connectivity, participants completed a task while undergoing fMRI scanning. In the control condition, subjects completed math problems at their own pace and were told their answers were not recorded; in the stress condition, participants had to do the math problems quickly during an allotted time and were given negative feedback about their performance throughout the test.

During the acute stress condition, participants showed altered functional connectivity between the three [brain networks](#). Specifically, the researchers saw increased FC between the default mode and central executive networks, and decreased FC between the salience network and the other two networks. The authors postulate that the insula, a brain region associated with inwardly directed attention, could mediate the changes they saw in FC.

The team also wanted to investigate how the neural network stress response was affected by polyvictimization, in which adolescents may experience multiple forms of victimization, including by parents, peers, or other adults. By studying polyvictimization, they could study the potential cumulative effects of repeated exposures on the brain. Subjects who experienced polyvictimization were more likely to show greater reductions in FC between the salience and default mode networks and the insula in particular. Together the findings suggest that the brain may have adapted to repeated traumas to make it less able to react to stressful experiences. A better understanding of the neurodevelopmental effects of trauma on the brain will help researchers to better address the resulting psychiatric outcomes.

Cameron Carter, MD, Editor of *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, said of the work, "This study shows how repeated trauma may lead to a maladaptive response to acute stress in important functional brain networks and reveals a potential

mechanism by which multiple early life stressors may lead to increased neural vulnerability to [stress](#) and the associated liability to future mental health problems."

More information: Rachel Corr et al, Triple Network Functional Connectivity During Acute Stress in Adolescents and the Influence of Polyvictimization, *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging* (2022). [DOI: 10.1016/j.bpsc.2022.03.003](https://doi.org/10.1016/j.bpsc.2022.03.003)

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