

Functional Brain Connectivity Patterns in Childhood vs. Adulthood Trauma based on CT and AT Data-Driven Approaches

Studies have examined neurobiological markers associated with childhood trauma (CT) and adulthood trauma (AT) to better understand how the timing of trauma exposure may influence brain function and to identify therapeutic targets. Although prior research has yielded some promising findings, results have been inconsistent. There remains a need for data-driven approaches to clarify whether CT and AT are linked to distinct patterns of functional brain connectivity.

This study aimed to explore whether trauma experienced in childhood versus adulthood is associated with different functional brain connectivity profiles, using a data-driven clustering approach.

A total of 110 participants were included in the analysis, comprising four groups: individuals with childhood trauma only (CT, $n=19$), adulthood trauma only (AT, $n=46$), both CT and AT ($n=12$), and healthy controls (HC, $n=33$). Functional connectivity data were derived from T1-weighted functional MRI scans. K-means clustering was applied to identify distinct brain connectivity profiles across the sample. Cross-validation techniques were used to test the robustness and consistency of the identified clusters.

Two data-driven clusters were identified: one with 55 participants and the other with 57. The first cluster, with a higher proportion of participants reporting childhood trauma (36.4%, 20/55), was characterized by hyperconnectivity in the amygdala–nucleus accumbens (Amygdala-NAcc), the default mode network (DMN), and the nucleus accumbens–executive function (NAcc-EF) network. This cluster is referred to as the CT cluster. The second cluster had a higher proportion of participants with adulthood trauma (49.1%, 28/57), referred to as the AT cluster, and showed comparatively lower connectivity in the aforementioned networks. These connectivity patterns are consistent with previous findings implicating these brain regions in early-life trauma exposure and emotion regulation.