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Alcohol-Induced Alterations in Brain Functional Connectivity: Insights from Whole-Brain Data-Driven Analysis in Older Adults

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Background
Alcohol intake results in altered brain connectome patterns. Although previous studies reported alcohol intake-related brain functional connectivity (FC) changes, the consent has not been reached (e.g., hyper- vs. hypo-connections). To address this gap, we perform whole-brain data-driven network analysis to systematically investigate the impact of alcohol.

Methods
We focused on participants aged $\geq$ 40 from UK Biobank and compared the brain FC between two alcohol status groups: hazardous alcohol use (HAU, n =8,216, 46.82% female, mean age (SD) = 55.47(7.53)) and controls (n=7,730, 68.69% female, mean age (SD) = 57.78(7.29)). HAU was defined using the Alcohol Use Disorders Identification Test gating logic, International Classification of Disorders 10 and diagnosis codes for alcohol dependence and alcoholic fatty liver. We applied a data-driven network analysis to assess the effect of alcohol on whole-brain FC accounting for age, sex and head motions. The data-driven network analysis can mitigate the bias due to the subjective selection of seed voxels and networks of interest.

Results
We identified an organized HAU-related subnetwork (β= -0.013, $p<0.001$). The subnetwork exhibits a bipartite graph structure, showing systematically decreased connections between the nodes from the sensorimotor network, dorsal attention network, and ventral attention network (component 1) and nodes from default mode network (DMN) + central executive network (CEN) (component 2) in HAU participants.

Discussion
Alcohol intake in older adults systematically reduces FC between motor skill-related brain subnetworks and DMN+CEN, which reveals potential neurobiological mechanisms underlying alcohol-induced declines in motor planning, coordination, delayed reactions, diminished judgment and cognitive function.