

control resources – were significantly higher when a distractor was present. Although there were no significant differences in behavioral distraction between groups, concussion patients trended towards higher levels of frontal lobe activity. Likewise, although not statistically significant, there was a trend towards a negative correlation for cases such that more attentional control resources (i.e., higher frontal lobe activity) was associated with less behavioral distraction (i.e., smaller capture index). This suggests that concussion patients may recruit more neural resources to produce comparable behavioral responses to healthy controls.

Categories: Concussion/Mild TBI (Child)

Keyword 1: concussion/ mild traumatic brain injury

Keyword 2: attention

Keyword 3: neuroimaging: functional

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64 Comparison of Post-Concussion Symptom Network Structure at Baseline and Post-Concussion

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Objective: Recent conceptualizations of concussion symptoms have begun to shift from a latent perspective (which suggests a common cause; i.e., head injury), to a network perspective (where symptoms influence and interact with each other throughout injury and recovery). Recent research has examined the network structure of the Post-Concussion Symptom Scale (PCSS) cross-sectionally at pre- and post-concussion, with the most important symptoms including dizziness, sadness, and feeling more emotional. However, within-subject comparisons between network structures at pre- and post-concussion have yet to be made. These analyses can provide invaluable information on whether concussion alters

symptom interactions. This study examined within-athlete changes in PCSS network connectivity and centrality (the importance of different symptoms within the networks) from baseline to post-concussion.

Participants and Methods: Participants were selected from a larger longitudinal database of high school athletes who completed the PCSS in English as part of their standard athletic training protocol (N=1,561). The PCSS is a 22-item self-report measure of common concussion symptoms (i.e., headache, vomiting, dizziness, etc.) in which individuals rate symptom severity on a 7-point Likert scale. Participants were excluded if they endorsed history of brain surgery, neurodevelopmental disorder, or treatment history for epilepsy, migraines, psychiatric disorders, or alcohol/substance use. Network analysis was conducted on PCSS ratings from a baseline and acute post-concussion (within 72-hours post-injury) assessment. In each network, the nodes represented individual symptoms, and the edges connecting them their partial correlations. Estimations of the regularized partial correlation networks were completed using the Gaussian graphical model, and the GLASSO algorithm was used for regularization. Each symptom's expected influence (the sum of its partial correlations with other symptoms) was calculated to identify the most central symptoms in each network. Recommended techniques from Epskamp et al. (2018) were completed for assessing the accuracy of the estimated symptom importance and relationships. Network Comparison Tests were conducted to observe changes in network connectivity, structure, and node influence.

Results: Both baseline and acute post-concussion networks contained negative and positive relationships. The expected influence of symptoms was stable in both networks, with difficulty concentrating having the greatest expected influence in both. The strongest edges in the networks were between symptoms within similar domains of functioning (e.g., sleeping less was associated with trouble falling asleep). Network connectivity was not significantly different between networks ($S=0.43$), suggesting the overall degree to which symptoms are related was not different at acute post-concussion. Network structure significantly differed at acute post-concussion ($M=0.305$), suggesting specific relationships in the acute post-concussion network were different than they were at baseline. In the acute post-

concussion network, vomiting was less central and sensitivity to noise and mentally foggy more central.

Conclusions: PCSS network structure at acute post-concussion is altered, suggesting concussion may disrupt symptom networks and certain symptoms' associations with the experience of others after sustaining a concussive injury. Future research should compare PCSS networks later in recovery to examine if similar structural changes remain or return to baseline structure, with the potential that observing PCSS network structure changes post-concussion could inform symptom resolution trajectories.

Categories: Concussion/Mild TBI (Child)

Keyword 1: concussion/ mild traumatic brain injury

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65 Examining Neuropsychological Outcomes Among Youth Concussion Patients With and Without Neurodevelopmental Learning Disorders

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Objective: The increasing incidence rates of concussive injuries, specifically among the youth age demographic, has led to the Center for Disease Control and Prevention to classify these injuries as a "silent epidemic." While symptoms from concussion typically remit within four weeks, many experience symptoms that persist beyond what is typically expected. For children, the persistence of symptoms can have damaging side-effects that impact daily functioning and the progression through developmental and educational milestones. Recent research highlights factors that modify the nature of outcomes after a concussive injury. For youth-aged individuals, one such factor is the presence of premorbid conditions. A growing body of research suggests children with learning disorders (LDs) may be more susceptible to negative symptom outcomes across neuropsychological domains. Therefore, the purpose of this study is to further examine the

influence of developmental learning disorders on concussion outcomes among youths.

Participants and Methods: Youths between 7 and 19 years of age that sought care at a concussion specialty clinic were screened for inclusion in the current study. The final sample of included 54 patients who reported having a neurodevelopmental LD between the ages of 8 and 17 and 54 patients without LDs matched on age, race/ethnicity, and gender to serve as paired case-controls. Measures of post-concussive physical symptoms (Modified Balance Error Scoring System; Quality of Life in Neurological Disorders: Neuro-QoL-SD, Neuro-QoL-F), emotional state (BAI, BDI), parent report measure of behavioral manifestations of cognitive functioning (Behavioral Rating Inventory of Executive Function), and select measures from the CogState automated test battery (i.e., One-Back, Two-Back, Groton Maze Learning, and Groton Maze Recall) were administered during the patient's first examination at the clinic. Patients were instructed by the provider to follow-up at the clinic between two-three weeks for a repeat examination. The current study examined concussion outcome variables via two (group: LD, control) by two (time: initial examination, follow-up examination) repeated measures ANCOVAs where time between injury and the first examination was included as a covariate to control for the duration of elapsed days since injury.

Results: Regarding cognitive symptoms, parent reported behaviors associated with executive functioning symptoms increased over time to reach clinically significant levels for the LD group, while symptoms decreased and remained within normal limits for the control group. Performance-based measures of cognition revealed no significant interactions or group/time differences. Additionally, the LD group showed more intense balance problems compared to the control group and symptom trends suggest LD participants may be more susceptible to prolonged, clinically significant, balance problems. With respect to sleep disturbances and fatigue, symptoms remained within normal limits across groups and time. Depression and anxiety symptoms remained within normal limits across groups and time as well.

Conclusions: Results highlight more intense balance problems and parent-reported executive dysfunction following concussion for youths with LDs compared to those without LDs. Additionally, though not significantly different