Each year in the United States, there are 1.6-3.8 million cases of mild traumatic brain injury (mTBI) or concussion. 1 Cognitive deficits in memory, attention, and concentration are common in the acute phase of concussion, 2 and there is evidence for longitudinal effects on brain 3 and cognitive 4 function. Clinical imaging shows discrepancies in few cases, so concussion diagnosis depends on the judgment of trained clinicians. To aid in flagging and diagnosing potential cases, various computerized assessment tools using simple cognitive tasks have been developed. Although there is an urgent need for objective measures of function, concerns still remain about the validity and test-retest reliability of these commercial tools. Notre Dame Rec Sports purchased the Cogstate Cognigram, so we assessed its ability to identify and track recovery from mTBI.

Thus, our research focused on two questions:
1) Are there detectable effects of previous concussion on Cognigram or cognitive function in currently-healthy participants?
2) Is the Cognigram a reliable and valid tool for flagging concussion?

Experiment 1: Long-term effects of concussion on perception and working memory. Participants were surveyed on their concussion history and any current symptoms using a concussion history questionnaire and baseline symptomology report adapted from the SCAT5. After tournament bouts, all boxers were given clinical evaluations. They then completed the created for psychomotor function + attention and learning + working memory. From those four scores, composite scores were testing with al.

Experiment 2: Validity and reliability of Cogstate’s Cognigram in acute phases of mTBI. Male amateur boxers from Notre Dame’s Baraka Boxing program were sent online concussion history questionnaires and baseline symptomology report adapted from Zemek et al. and the SCAT5 before the season began. At the same time, they completed baseline testing with Cogstate’s Cognigrams. In the Cognigrams, participants complete four tasks in order to create both normative and individual baselines for psychomotor function, attention, learning, and working memory. From those four scores, composite scores were created for psychomotor function + attention + learning + working memory.

After tournament bouts, all boxers were given clinical evaluations. They then completed the Cognigram remotely within 24 h of the bout in order to flag for potential cognitive deficits. Concurrently, they completed questionnaires to report symptoms and suspected concussion.

In the first experiment, significant differences between the participants with and without a previous concussion were only seen in the OSPAN task, suggesting limited impact on long-term function of young adults. Additionally, little convergent validity was seen between Cognigram composite scores and separate WM and processing speed tasks. In the second experiment, the Cognigram showed limited test-retest reliability in both composite scores (r = .24 in PMFA, r = .57 in LWM) among healthy boxers. In suspected concussion, the PMFA score decreased significantly as expected, but the LWM score actually increased slightly. The small number of concussion cases was a limiting factor. Finally, the comparison for symptom scoring was severely limited by poor enrollment and attrition. However, data available suggest that self-reported symptoms are still a revealing measure of participant health. Future directions include: 1) examining testing environment and Cognigram performance and 2) studying reliability at multiple post-bout time points.

**References**
Dr. Joshua Koen, Dr. James Brockmole

**Acknowledgements**

**Table 1: Sample of SCAT5 symptom scoring used**