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**Objective:** To examine neurocognitive correlates of oculomotor performance among U.S. military personnel with history of mild traumatic brain injury (mTBI).

**Participants and Methods:** A series of studies (total n=356) were conducted to examine saccadic eye movements and manual button presses collected in response to attention stimuli, and to compare these findings to the results of standardized neuropsychological tests. Study 1 included n=27 with remote mTBI and n=54 controls who completed the Bethesda Eye and Attention Measure (BEAM), an eye tracking task that was designed to measure visual attention and executive function. In Study 2, n=51 with chronic mTBI and n=33 controls completed the Fusion n-Back task, an eye tracking task that was designed to assess the impact of working memory load on visual attention performance. Study 3 examined psychometric characteristics of BEAM among n=191 military personnel with remote mTBI. In all studies, participants completed eye tracking tasks, a structured TBI diagnostic interview, and a brief battery of standardized neuropsychological tests.

**Results:** In Study 1, BEAM saccadic and manual metrics demonstrated strong reliability and high sensitivity to multiple cognitive cues designed to elicit spatial orienting, temporal alerting, executive interference, perceptual release (gap) and inhibition ( $\eta^2_p=.76$ ,  $p<.001$ ). However, corresponding saccadic and manual measurements were weakly related to each other, and only manual (not saccadic) measurements were related to estimated verbal intelligence or years of education. Standardized neuropsychological measures did not differ between groups, but mTBI participants were more likely to be impaired on saccadic metrics than controls.

In Study 2, Standardized cognitive measures and estimated premorbid intelligence were positively associated with all manual metrics from the Fusion n-Back test, but were not associated with mTBI history or with saccadic metrics. Fusion n-Back saccadic and manual metrics had strong reliability and complementary

sensitivity to chronic mTBI, with combined predictive power of PPV=.78, NPV=.72,  $r^2=.44$  for classification of remote mild TBI vs. controls on the more cognitively-challenging 1-back task condition.

In Study 3, BEAM metrics including manual RT latency and consistency, saccadic RT consistency, and saccadic inhibition errors showed consistent correlations with standardized measures of visual attention, processing speed, task switching, working memory, and executive functions. Hierarchical regressions showed that BEAM saccadic and manual metrics were independently predictive of cognitive test performance, above and beyond effects of demographic factors and clinical characteristics.

**Conclusions:** Results demonstrated some surprising findings related to neurocognitive influences on oculomotor performance. While both saccadic and manual performance were strongly and similarly influenced by attention cues, these two modalities were only weakly correlated to one another. Additionally, manual metrics were more strongly and consistently related to standardized cognitive test performance and premorbid intelligence than saccadic metrics. However, saccadic metrics demonstrated superior sensitivity to remote/chronic mTBI relative to manual metrics and standardized neuropsychological measures. Overall, these results suggest that saccadic eye tracking measures may provide unique value in assessment of mTBI and neurocognitive functions that is complementary with more common forms of assessment relying upon somatomotor response modalities.

#### Categories:

Assessment/Psychometrics/Methods (Adult)

**Keyword 1:** attention

**Keyword 2:** reaction time

**Keyword 3:** concussion/ mild traumatic brain injury

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## 2 Examining the Role of Symptom Attribution on Neurobehavioral and Neurocognitive Outcomes in Treatment-Seeking Veterans with Remote History of Traumatic Brain Injury

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**Objective:** Illness perception, or the ways in which individuals understand and cope with injury, has been extensively studied in the broader medical literature and has been found to have important associations with clinical outcomes across a wide range of medical conditions. However, there is a dearth of knowledge regarding how perceptions of traumatic brain injury (TBI) influence outcome and recovery following injury, especially in military populations. The purpose of this study was to examine relationships between illness perception, as measured via symptom attribution, and neurobehavioral and neurocognitive outcomes in Veterans with TBI history.

**Participants and Methods:** This cross-sectional study included 44 treatment-seeking Veterans (86.4% male, 65.9% white) with remote history of TBI (75.0% mild TBI). All Veterans were referred to the TBI Cognitive Rehabilitation Clinic at VA San Diego and completed a clinical interview, self-report questionnaires, and a neuropsychological assessment. A modified version of the Neurobehavioral Symptom Inventory (NSI) was administered to assess neurobehavioral symptom endorsement and symptom attribution. Symptom attribution was assessed by having participants rate whether they believe each NSI item was caused by TBI. A total symptom attribution score was computed, as well as the standard NSI total and symptom cluster scores (i.e., vestibular, somatic, cognitive, and affective symptom domains). Three cognitive composite scores (representing mean performance) were also computed, including memory, attention/processing speed, and executive functioning. Participants were excluded if they did not complete the NSI attribution questions or they failed performance validity testing.

**Results:** Results showed that the symptoms most frequently attributed to TBI included forgetfulness (82%), poor concentration (80%), and slowed thinking (77%). There was a significant positive association between symptom attribution and the NSI total score ( $r = 0.62, p < .001$ ), meaning that greater attribution of symptoms to TBI was significantly associated with greater symptom endorsement overall.

Symptom attribution was also significantly associated with all four NSI symptom domains ( $r$ 's = 0.47-0.66; all  $p$ 's < .001), with the strongest relationship emerging between symptom attribution and vestibular symptoms. Finally, linear regressions demonstrated that symptom attribution but not symptom endorsement was significantly associated with objective cognitive functioning. Specifically, greater attribution of symptoms to TBI was associated with worse memory ( $\beta = -0.33, p = .035$ ) and attention/processing speed ( $\beta = -0.40, p = .013$ ) performance.

**Conclusions:** Results showed significant associations between symptom attribution and (1) symptom endorsement and (2) objective cognitive performance in Veterans with a remote history of TBI. Taken together, findings suggest that Veterans who attribute neurobehavioral symptoms to their TBI are at greater risk of experiencing poor long-term outcomes. Although more research is needed to understand how illness perception influences outcomes in this population, results highlight the importance of early psychoeducation regarding the anticipated course of recovery following TBI.

**Categories:** Acquired Brain Injury  
(TBI/Cerebrovascular Injury & Disease - Adult)

**Keyword 1:** traumatic brain injury

**Keyword 2:** self-report

**Keyword 3:** neuropsychological assessment

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### 3 Optimizing Cognitive Rehabilitation of the Injured Warfighter

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