

msTBI. Finally, would controlling for either objective or subjective integration ratings enable neurocognitive assessments to better predict QoL post injury?

**Participants and Methods:** 41 older-adults ( $M=65.32$ ;  $SD=7.51$ ) with a history of msTBI were included ( $M=12.59$  years post-injury;  $SD=8.29$ ) for analysis. Subjective community integration was measured through the Participation Enfranchisement Survey. The Participation Assessment with Recombined Tools–Objective (PART-O) provided the objective measurement of participation. Quality of life was assessed through the Quality of Life after Brain Injury (QOLIBRI). An estimate of neurocognitive performance was created through the Brief Test of Adult Cognition by Telephone (BTACT), which includes six domains including: verbal-learning and memory (immediate and delayed recall), working memory (digit-span backwards), reasoning (number sequencing), semantic fluency (category fluency), and processing speed (backwards counting). Performance on the BTACT, PE ratings, and PART-O scores were included as the dependent variables in stepwise, linear regression models predicting QoL ratings to assess the differential contribution of the dependent variables and potential interaction effects.

**Results:** While both the PART-O ( $f(1,39)=5.52$ ;  $p=.024$ ,  $\eta^2=.124$ ) and the PE survey ( $f(1,39)=14.31$ ;  $p<.001$ ,  $\eta^2=.268$ ) significantly predicted QoL, the addition of PE in the PART-O model resulted in significant (20.9%) reduction in unaccounted variance. Further in the model controlling for PE, PART-O no longer provides a significant ( $p=.15$ ) contribution to the model estimating QoL ( $f(2,38)=8.41$ ;  $p=.001$ ). Performance on the BTACT correlated with PART-O ( $p<.0001$ ), but not PE ( $p=.13$ ) ratings. Finally, across two models controlling for BTACT performance, PE ( $p=.002$ , partial  $\eta^2=.23$ ), but not PART-O ( $p=.28$ , partial  $\eta^2=.031$ ) contributed significantly to QoL predictions. No significant interactions between PART-O, PE, and/or BTACT were observed when added to any model.

**Conclusions:** MsTBI impacts nearly every facet of an individual's life, and as such, improving QoL post-injury requires a broad, yet well-considered approach. The objective ratings of participation, subjective PE, BTACT performance, all independently predicted quality of life in this sample. However, after controlling

for neurocognitive assessment performance, PE was shown to independently contribute to quality of life, while the PART-O ratings no longer provided significant contribution. While community integration is a vital factor to consider for long-term rehabilitation, tailoring what "integration" means to the patient may hold significant potential to improve long-term quality of life.

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

**Keyword 1:** traumatic brain injury

**Keyword 2:** treatment outcome

**Keyword 3:** cognitive rehabilitation

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## 2 The Longitudinal Relationship Between Concussion History, Years of Football Participation, and Alcohol Use Among Former National Football League (NFL) Players: an NFL-LONG Study

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**Objective:** It has been posited that alcohol use may confound the association between greater concussion history and poorer neurobehavioral functioning. However, while greater alcohol use is positively correlated with neurobehavioral difficulties, the association between alcohol use

and concussion history is not well understood. Therefore, this study investigated the cross-sectional and longitudinal associations between cumulative concussion history, years of contact sport participation, and health-related/psychological factors with alcohol use in former professional football players across multiple decades.

**Participants and Methods:** Former professional American football players completed general health questionnaires in 2001 and 2019, including demographic information, football history, concussion/medical history, and health-related/psychological functioning. Alcohol use frequency and amount was reported for three timepoints: during professional career (collected retrospectively in 2001), 2001, and 2019. During professional career and 2001 alcohol use frequency included none, 1-2, 3-4, 5-7 days/week, while amount included none, 1-2, 3-5, 6-7, 8+ drinks/occasion. For 2019, frequency included never, monthly or less, 2-4 times/month, 2-3 times/week,  $\geq 4$  times/week, while amount included none, 1-2, 3-4, 5-6, 7-9, 10+ drinks/occasion. Scores on a screening measure for Alcohol Use Disorder (CAGE) were also available at during professional career and 2001 timepoints. Concussion history was recorded in 2001 and binned into five groups: 0, 1-2, 3-5, 6-9, 10+. Depression and pain interference were assessed via PROMIS measures at all timepoints. Sleep disturbance was assessed in 2001 via separate instrument and with PROMIS Sleep Disturbance in 2019. Spearman's rho correlations tested associations between concussion history and years of sport participation with alcohol use across timepoints, and whether poor health functioning (depression, pain interference, sleep disturbance) in 2001 and 2019 were associated with alcohol use both within and between timepoints.

**Results:** Among the 351 participants ( $M_{age}=47.86[SD=10.18]$  in 2001), there were no significant associations between concussion history or years of contact sport participation with CAGE scores or alcohol use frequency/amount during professional career, 2001, or 2019 ( $\rho$ s=-.072-.067,  $ps>.05$ ). In 2001, greater depressive symptomology and sleep disturbance were related to higher CAGE scores ( $\rho$ =.209,  $p<.001$ ;  $\rho$ =.176,  $p<.001$ , respectively), while greater depressive symptomology, pain interference, and sleep disturbance were related to higher alcohol use frequency ( $\rho$ =.176,  $p=.002$ ;  $\rho$ =.109,  $p=.045$ ;

$\rho$ =.132,  $p=.013$ , respectively) and amount/occasion ( $\rho$ =.215,  $p<.001$ ;  $\rho$ =.127,  $p=.020$ ;  $\rho$ =.153,  $p=.004$ , respectively). In 2019, depressive symptomology, pain interference, and sleep disturbance were not related to alcohol use ( $\rho$ s=-.047-.087,  $ps>.05$ ). Between timepoints, more sleep disturbance in 2001 was associated with higher alcohol amount/occasion in 2019 ( $\rho$ =.115,  $p=.036$ ).

**Conclusions:** Increased alcohol intake has been theorized to be a consequence of greater concussion history, and as such, thought to confound associations between concussion history and neurobehavioral function later in life. Our findings indicate concussion history and years of contact sport participation were not significantly associated with alcohol use cross-sectionally or longitudinally, regardless of alcohol use characterization. While higher levels of depression, pain interference, and sleep disturbance in 2001 were related to greater alcohol use in 2001, they were not associated cross-sectionally in 2019. Results support the need to concurrently address health-related and psychological factors in the implementation of alcohol use interventions for former NFL players, particularly earlier in the sport discontinuation timeline.

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

**Keyword 1:** traumatic brain injury

**Keyword 2:** alcohol

**Keyword 3:** sports-related neuropsychology

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### 3 Intensive Clinical Treatment and Rehabilitation for Veterans with Traumatic Brain Injury and Psychological Health Problems

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