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**Abstracts**  
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**Objectives:** An estimated 7-23% of traumatic brain injury (TBI) patients have multiple TBIs, and its risk to outcomes after another acute moderate-to-severe (msTBI) is not well-understood. Associations between prior TBI history, in-hospital mortality, and outcomes across 12-months post-injury were examined in a prospective United States msTBI cohort.

**Methods:** Hospitalized subjects with ED arrival Glasgow Coma Scale score (GCS)=3-12 were extracted from the TRACK-TBI Study (2014-2018). Prior TBI was determined using the Ohio State University TBI Identification Method. Competing risk regressions adjusting for age, sex, psychiatric history, GCS, and injury severity examined associations between prior TBI and in-hospital mortality, with hospital discharge=alive as the competing risk. Adjusted hazard ratios (aHR; [95% confidence interval]) were reported. Multivariable regressions evaluated associations between prior TBI, mortality, and unfavorable/favorable outcome (Glasgow Outcome Scale-Extended (GOSE)=1-3/4-8) at 3-/6-/12-months after msTBI.

**Results:** In 411 subjects (no prior TBI=78.6%, yes prior TBI=21.4%), prior TBI was associated with male sex (87.5%/77.1%,  $p=0.037$ ) and psychiatric history (34.1%/21.1%,  $p=0.016$ ). Median length of stay was 14 days (IQR=6-24) and in-hospital mortality was 10.1%. Competing risk regressions indicated prior TBI was associated with greater risk of in-hospital mortality (aHR=1.98 [1.05-3.76],  $p=0.036$ ), but not with likelihood of hospital discharge=alive. Prior TBI was not significantly associated with mortality or unfavorable outcomes at 3-/6-/12-months post-injury.

**Conclusions:** Prior TBI is independently associated with risk of in-hospital mortality after acute msTBI. Sociodemographic and clinical factors specific to msTBI patients with prior TBI, and the burden of prior TBIs, constitute next-step investigations to improve our understanding of this elevated risk.

#### **DB12 - Investigating Sex-Related Multi-Scale Brain Structural Differences and Developing Templates for Studying Traumatic Brain Injury**

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Sex differences in brain structure significantly influence traumatic brain injury (TBI) onset and progression, yet this area is understudied. Herein, we developed sex-specific brain anatomical (macro-scale) and axonal tract (mesoscale) templates and explored the sex-variations at subject level using a set of T1-MRI (609 males, 721 females) and DTI images (506 males, 594 females). The FreeSurfer, ANTs, and DSI-Studio packages were used. We investigated overall/regional volumes, DTI metrics (including fractional anisotropy (FA), mean diffusivity, and radial diffusivity), and connectivity matrix across 23 brain regions. The brain connectome was derived

by multiplying the fiber tract counts and the FA values within the connecting tracts, quantifying the connection strength within each pair of regions. Our subject-wise analysis revealed significant sex-based differences (Mann-Whitney  $p$ -values  $< 0.05$ ) across most studied regions for all parameters. The largest sex differences in brain connections were observed in five regions: corpus callosum and right/left cortex and cerebral white matter, all stronger in females. Brain regions were typically larger in males, yet females had higher fractional volumes in the majority of regions except for CSF and ventricles, known for their cushioning effect during head impacts. Additionally, the sex-specific templates better represented their targeted sex compared to opposite or mixed-sex populations as evaluated by root-mean-square-errors when comparing the DTI metrics and connectivity from the DTI templates against the median of subjects and deformation field in registering the subjects to the T1-MRI templates. Our findings highlight the necessity of sex-specific templates in accurate brain modeling and TBI research. Funded by NSF-2138719.

#### **DB13 - Correlation Between Astrocyte Reactivity and Anxiety Level Changes Following Traumatic Brain Injury**

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Understanding the relationship between pathology, psychological, and behavioral changes offer crucial insights into traumatic brain injury (TBI) mechanisms. This study investigates the correlation between psychological parameters measured in open-field test and astrocyte reactivities within specific brain regions by employing a ferret TBI model (CHIMERA, Canada), chosen due to the similarity of ferret brain structure and astrocytic territory to humans. Animals were divided into repeated TBI ( $n=5$ , one  $\sim 15\text{m/s}$  plus three  $\sim 10\text{m/s}$  impacts, 10-minutes apart) and sham ( $n=3$ ) groups. Behavioral tests were performed at pre-TBI and at 6-hours, 1-day, 3-days, and 7-days post-TBI. Brains were sectioned at 2mm and GFAP stained at 7-days post-TBI, and analyzed for overall and regional astrocytic reactivity. Results revealed significant differences (Wilcoxon Signed-Ranks Test,  $p$ -value  $< 0.05$ ) in anxiety-associated parameters—maximum speed, average speed, and total distance traveled—especially at 3- and 7-days post-TBI, when the effects of medication and anesthesia had disappeared, indicating a delayed development of anxiety in TBI group compared to stability or decline of anxiety in Sham group. Moreover, significantly higher astrocyte activation was observed in TBI group compared to Sham group (Mann-Whitney test,  $p$ -value  $< 0.05$ ), especially in white matter region, which cause disruption in neural communication and synaptic balance, contributing to heightened anxiety. Spearman correlation analysis showed a strong link between the psychological changes and astrocytic reactivity in the TBI group, suggesting heightened TBI-induced astrocyte reactivity in white matter region correlate with more changes in anxiety levels, highlighting astrocytes' critical role in TBI response. Funded by UTSA-SwRI CONNECT program.

#### **DB14 - The mini SCAT symptom severity index and acute concussion identification: Findings from the NCAA-DoD Care Consortium**

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**Objective:** The purpose of this study is to A) rigorously evaluate the Sport Concussion Assessment Tool (SCAT) symptom list and improve the sensitivity and sensitivity by creating a mini-SCAT (mSCAT) and B) identify an added utility of doing additional tests/exams in addition to mSCAT. **Methods:** Cohort study of collegiate athletics and military service academies. 59,901 athletes and cadets were enrolled in the NCAA/DOD CARE consortium; 5,075 were diagnosed with a concussion. These analyses utilize the SCAT Symptoms and other concussion assessments in concussed versus non-concussed individuals. **Results:** Individual symptoms demonstrate a variety of Cohen's-d effect sizes, the smallest being