Title: Epidemiologic and Sociodemographic Characterization of Traumatic Brain Injury at a Level I Trauma Center in New Orleans

Authors and affiliations: Tanner Hoole, Xavier Chapa-Dubocq, Patricia E. Molina.
Department of Physiology LSUHSC New Orleans

Background
Traumatic brain injury (TBI) is a leading cause of death and disability in the United States, with disproportionate burden in urban regions due to factors such as interpersonal violence, alcohol misuse, and motor vehicle collisions. In Louisiana, particularly in the New Orleans metropolitan area, these risk factors contribute to a unique and high-risk injury landscape. Despite this, there is no comprehensive epidemiologic profile of TBI cases treated at University Medical Center New Orleans (UMCNO), the region's primary Level I trauma center. This study aims to address this gap by identifying the epidemiologic, clinical, and sociodemographic features of TBI and identifying factors associated with outcomes, disparities, and care pathways.

Methods
This retrospective observational study utilized data from the UMCNO trauma registry from 2016 to 2025 to characterize epidemiologic trends in TBI. The study population included all patients presenting with TBI during the study period. Variables extracted included patient demographics (age, sex, race/ethnicity), injury characteristics (mechanism and injury type), toxicology data (ethanol and drug screening), and injury severity measures, including Glasgow Coma Scale (GCS) and Abbreviated Injury Scale (AIS). Descriptive statistical analyses were performed to summarize demographic distributions, substance use prevalence, injury mechanisms, and severity classifications. Temporal trends in TBI incidence were assessed across years, and data were used to generate visualizations and regional maps to highlight patterns within New Orleans and surrounding areas.

Results
Raw data from the UMCNO were used to generate maps and visualizations highlighting key epidemiological trends in TBI across New Orleans and surrounding regions. TBI cases increased from 2016 to 2019, followed by a decline in 2020, and subsequently plateaued from 2021 to 2025 at levels comparable to 2019. In total, 5,746 TBI cases were identified and analyzed. The cohort was 27.9% female and 72.1% male patients and predominantly non-Hispanic (92.7%), with 6.6% Hispanic and 0.7% not reported. Racial distribution included 51.6% White, 38.8% Black, 1.4% Asian, 0.2% Native Hawaiian/Pacific Islander, and 8.0% classified as other. Blunt injuries accounted for the majority of cases (89.1%), followed by penetrating injuries (10.7%) and thermal injuries (0.2%). Ethanol was detected in 22.3% of patients, while approximately 53% tested positive for drugs at the time of assessment, with 16.6% presenting with polysubstance exposure. TBI severity classification based on GCS scores indicated that 44.7% of cases were mild, 20.1% moderate, and 35.2% severe. Injury severity based on the AIS revealed that 1.3% were minor, 23.9% moderate, 45.3% serious, 13.8% severe, and 14.5% critical, with 1.2% unspecified.

Conclusions
This study provides a comprehensive epidemiologic characterization of TBI at a Level I trauma center in New Orleans, highlighting injury patterns, severity distribution, and the substantial burden of alcohol and polysubstance exposure in a high-risk urban population. These findings are consistent with prior reports emphasizing substance use as a major contributor to TBI, while also underscoring region-specific disparities that warrant targeted prevention and intervention strategies. Key learning points include the persistent impact of substance use on TBI presentation, the high proportion of moderate-to-severe injuries, and the value of detailed clinical datasets for identifying at-risk populations and informing trauma care. Importantly, these results provide a translational link to ongoing preclinical studies investigating alcohol-related mitochondrial dysfunction and injury mechanisms, supporting their clinical relevance. Next steps include longitudinal analyses of outcomes, integration of geospatial and socioeconomic factors, and development of predictive models. Future efforts will also focus on linking clinical data with mechanistic studies to advance targeted therapeutic and prevention strategies for substance-associated TBI.